ANEXO 2-1
DOCUMENTOS DEL REPRESENTANTE LEGAL

ZONA REGISTRAL IX - SEDE LIMA
Oficina Registral LIMA

Código N° 75965721
Solicitud N° 649803
03/02/2020 10:17:49

REGISTRO DE PERSONAS JURIDICAS
LIBRO DE SOCIEDADES ANONIMAS

CERTIFICADO DE VIGENCIA

El funcionario que suscribe, **CERTIFICA**:

Que, en la partida electrónica N° 11532703 del Registro de Personas Jurídicas de la Oficina Registral de LIMA, consta registrado y vigente el poder a favor de EZIO MARTINO BUSELLI CANEPA, identificado con DNI 07801032 cuyos datos se precisan a continuación:

DENOMINACIÓN O RAZÓN SOCIAL: MINERA CHINALCO PERU S.A.
LIBRO: SOCIEDADES ANONIMAS
ASIENTO: C00032
CARGO: APODERADO

FACULTADES:
Se acuerdan:
(…)
1º La ratificación de los poderes otorgados a las siguientes personas, quienes ejercerán las facultades conferidas dentro de los límites previstos en el numeral 8.2 del artículo 8º de la escritura de constitución (pacto social) de la Sociedad, como se indica más adelante:

4. Apoderado: EZIO MARTINO BUSELLI CANEPA
Documento de Identidad: D.N.I. Nº 07801032
Facultades: Todas las incluidas en la sección 8.1 del artículo 8º de la escritura de constitución (pacto social) de la Sociedad
Asiento de Inscripción: C00023

Los límites aplicables al ejercicio de las facultades otorgadas a las personas antes mencionadas, serán los siguientes:
i) Para el ejercicio de las facultades comprendidas en los literales c), f), g), h), i), j), k), l), m) del régimen detallado en la sección 8.1 del artículo 8º de la escritura de constitución (pacto social) de la Sociedad, y en general, de cualquier facultad que habilite al apoderado a comprometer recursos de la Sociedad, se requerirá de la firma de uno o más apoderados, según el monto involucrado, como se detalla a continuación:

i.1. Para la celebración de contratos, órdenes de compra, convenios u otro tipo de acuerdo, sin importar su denominación, de cualquier naturaleza, incluyendo pero sin limitarse a actos de naturaleza civil, laboral, financiera, y en general para la celebración de cualquier acuerdo que involucre o pueda involucrar el desembolso de sumas menores o iguales a US$ 5,000.00 (cinco mil y 00/100 Dólares de los Estados Unidos de América), se requerirá la firma de un apoderado de la Sociedad que cuente con las facultades que correspondan del régimen detallado en la sección 8.1 del artículo 8º de la escritura de constitución (pacto social) de la Sociedad.

i.2 Para la celebración de contratos, órdenes de compra, convenios u otro tipo de acuerdo, sin importar su denominación, de cualquier naturaleza, incluyendo pero sin limitarse a actos de naturaleza civil, laboral, financiera, y en general para la celebración de cualquier acuerdo que involucre o pueda involucrar el desembolso de sumas

- LOS CERTIFICADOS QUE EXTIENDEN LAS OFICINAS REGISTRALES ACREDITAN LA EXISTENCIA O INEXISTENCIA DE INSCRIPCIONES O ANOTACIONES EN EL REGISTRO AL TIEMPO DE SU EXPEDICIÓN (ART. 140° DEL T.U.O DEL REGLAMENTO GENERAL DE LOS REGISTROS PÚBLICOS APROBADO POR RESOLUCIÓN N° 126-2012-SUNARP-SN).
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mayores a US$ 5,000.00 (cinco mil y 00/100 Dólares de los Estados Unidos de América) hasta US$ 100,000.00 (cien mil y 00/100 Dólares de los Estados Unidos de América), se requerirá de la firma en conjunto de dos apoderados de la Sociedad que cuenten con las facultades que correspondan del régimen detallado en la sección 8.1 del artículo 8º de la escritura de constitución (pacto social) de la Sociedad.

i.3 Para la celebración de contratos, órdenes de compra, convenios u otro tipo de acuerdo, sin importar su denominación, de cualquier naturaleza, incluyendo pero sin limitarse a actos de naturaleza civil, laboral, financiera, y en general para la celebración de cualquier acuerdo que involucre o pueda involucrar el desembolso de sumas mayores a US$ 100,000.00 (cien mil y 00/100 Dólares de los Estados Unidos de América) hasta US$ 50'000,000.00 (cincuenta millones y 00/100 Dólares de los Estados Unidos de América), se requerirá de la firma en conjunto del Gerente General de la Sociedad con otro apoderado que cuente con las facultades que correspondan del régimen detallado en la sección 8.1 del artículo 8º de la escritura de constitución (pacto social) de la Sociedad.

i.4 Para la celebración de contratos, órdenes de compra, convenios u otro tipo de acuerdo, sin importar su denominación, de cualquier naturaleza, incluyendo pero sin limitarse a actos de naturaleza civil, laboral, financiera, y en general para la celebración de cualquier acuerdo que involucre o pueda involucrar el desembolso de sumas mayores a US$ 50'000,000.00 (cincuenta millones y 00/100 Dólares de los Estados Unidos de América), se requerirá de la aprobación previa y expresa del Directorio de la Sociedad, debiendo designar éste a la(s) persona(s) facultada(s) para suscribir los documentos en mención. La aprobación del Directorio deberá ser adoptada con el voto favorable de no menos de dos tercios de sus miembros.

ii) Las facultades comprendidas en los literales a), b), d), e), n), o) y p) del régimen de facultades de la Sociedad, podrán ser ejercidas de manera individual por cualquier apoderado de la Sociedad que cuente con dichas facultades.

iii) Para la venta, disposición -a título gratuito u oneroso-, afectación con cargas o gravámenes, arrendamiento, dación en uso, otorgamiento de derecho de superficie o, en general tratándose de cualquier acto que implique la transferencia actual o potencial a favor de terceros de toda o parte de la posesión o de la propiedad de activos fijos de la Sociedad, tales como concesiones mineras, terrenos, propiedad intelectual, otros bienes muebles e inmuebles que constituyan activo fijo de propiedad directa o indirecta de la Sociedad, se requerirá de la aprobación previa y expresa del Directorio, con prescindencia del valor que dicho contrato pudiera involucrar, debiendo designar el Directorio a la(s) persona(s) facultada(s) para suscribir los documentos necesarios. La aprobación del Directorio deberá ser adoptada con el voto favorable de no menos de dos tercios de sus miembros. Queda entendido que esta autorización no será necesaria para la transferencia de activo corriente o no fijo de la Sociedad como, sin que la mención resulte limitativa, inventarios de concentrado o de minerales en general de propiedad de la Sociedad, cuya comercialización constituya precisamente el negocio de la Sociedad.

iv) Para la celebración de contratos, órdenes de compra, convenios u otro tipo de acuerdo, sin importar su denominación, de cualquier naturaleza, en particular financiera, pero no limitado sólo a ésta, que pudieran acarrear para la Sociedad el riesgo de incurrir en potencial responsabilidad, contingencia y, en general, en cualquier costo no previsto, mayor a los US$ 50'000,000.00 (cincuenta millones y 00/100 Dólares de los Estados Unidos de América), se requerirá de la aprobación previa y expresa del Directorio, debiendo designar éste a la(s) persona(s) facultada(s) para suscribir los documentos en mención. La aprobación del Directorio deberá ser adoptada con el voto favorable de no menos de dos tercios de sus miembros.

v) Para la realización de cualquier tipo de operaciones relacionadas al mercado de futuros, incluyendo el hedging, o suscripción de contratos de futuros, sin ser limitativo, relacionados a instrumentos financieros, índices, commodities, monedas o productos derivados de cualquier índole, tales como opciones, warrants y swaps, entre otros; así como la emisión, suscripción, adquisición, cesión o transferencia de bonos, instrumentos de corto plazo o papeles comerciales, se requerirá de la aprobación previa y expresa del Directorio, debiendo designar éste a la(s) persona(s) facultada(s) para suscribir los documentos en mención. La aprobación del Directorio deberá ser adoptada con el voto favorable de no menos de dos tercios de sus miembros.

- LOS CERTIFICADOS QUE EXTIENDEN LAS OFICINAS REGISTRALES ACREDITAN LA EXISTENCIA O INEXISTENCIA DE INSCRIPCIONES O ANOTACIONES EN EL REGISTRO AL TIEMPO DE SU EXPEDICIÓN (ART. 140° DEL T.U.O DEL REGLAMENTO GENERAL DE LOS REGISTROS PÚBLICOS APROBADO POR RESOLUCIÓN N° 126-2012-SUNARP-SN).
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Se deja constancia que en el Asiento B0005 consta registrada y vigente la ESCRITURA PÚBLICA DEL 24-03-2010 OTORGADA ANTE NOTARIO DE LIMA RICARDO FERNANDINI BARREDA Y EL ACTA DE JUNTA GENERAL DEL 20-01-2010 DONDE SE ACORDO
LA MODIFICACIÓN DEL ARTICULO 8° DE LA ESCRITURA DE CONSTITUCIÓN DE LA SOCIEDAD, QUE CONTIENE EL RÉGIMEN DE FACULTADES EN LOS TÉRMINOS SIGUIENTES:
OCTAVO: LAS PARTES ACUERDAN OTORGAR EL SIGUIENTE RÉGIMEN DE FACULTADES, LAS CUALES SERÁN EJERCIDAS POR LOS REPRESENTANTES DE LA SOCIEDAD,. SEGÚN LES SEAN OTORGADAS, CON LAS LIMITACIONES QUE SE INDICAN MÁS ADELANTE:
8.1 FACULTADES:
A) ORGANIZAR EL RÉGIMEN INTERNO DE LA SOCIEDAD Y DIRIGIR LAS OPERACIONES DE ÉSTA DE CONFORMIDAD CON EL ESTATUTO, LOS ACUERDOS DE JUNTA GENERAL DE ACCIONISTAS Y LOS DEL DIRECTORIO.
B) REPRESENTAR A LA SOCIEDAD ANTE TODA CLASE DE AUTORIDADES JUDICIALES, POLÍTICAS, ADMINISTRATIVAS, CONSULARES, MUNICIPALES, POLICIALES Y DE CUALQUIER OTRA ÍNDOLE EN TODA CLASE DE PROCESOS, SEAN ESTOS JUDICIALES, ADMINISTRATIVOS U OTROS Y SEA CUAL FUERE LA NORMA QUE LOS REGULE.
PARA TAL EFECTO, GOZARÁ DE LAS ATRIBUCIONES Y POTESTADES GENERALES QUE CORRESPONDEN EN LOS PROCESOS A LA SOCIEDAD, PARA SU TRAMITACIÓN EN SU INTEGRIDAD, INCLUSO PARA LA EJECUCIÓN DE LA SENTENCIA Y OTRAS RESOLUCIONES Y EL COBRO DE COSTAS Y COSTOS, LEGITIMANDO SU INTERVENCIÓN EN EL PROCESO Y TODOS LOS! ACTOS DEL MISMO CONFORME A LOS ARTÍCULOS 74 Y 75 DEL CÓDIGO PROCESAL CIVIL EL ARTÍCULO 53° DE LA LEY DE PROCEDIMIENTO ADMINISTRATIVO GENERAL Y DEMÁS NORMAS APLICABLES SEGÚN FUERA EL CASO.
ASIMISMO, GOZARÁN DE LAS FACULTADES ESPECIALES REQUERIDAS PARA REALIZAR EN LOS PROCESOS TODOS LOS ACTOS DE DISPOSICIÓN DE DERECHOS SUSTANTIVOS; DEMANDAR, INTERPONER DENUNCIAS PENALES Y DE CUALQUIER OTRA NATURALEZA, PRESENTAR SOLICITUDES, RECURSOS Y MEDIOS IMPUGNATORIOS; RATIFICARSE EN DENUNCIAS PENALES; RECONVENIR; CONTESTAR CONTRADICCIONES, DEMANDAS Y RECONVENCIONES; DESISTIRSE DE LAS DEMANDAS, DE LOS PROCESOS, DE LAS PRETENSIONES, DE LAS DENUNCIAS PENALES U OTRAS DENUNCIAS, DE LAS SOLICITUDES, DE LOS RECURSOS Y MEDIOS IMPUGNATORIOS Y DE CUALQUIER OTRO ACTO; FORMULAR TODO TIPO DE OPOSICIONES Y CONTRADICCIONES; ALLANARSE A LA PRETENSIÓN; INTERVENIR EN LAS AUDIENCIAS DE SANEAMIENTO, CONCILIATORIA, DE FIJACIÓN DE PUNTOS CONTROVERTIDOS, DE PRUEBAS, DE SENTENCIAS, DE ACTUACIÓN DE DECLARACIÓN JUDICIAL Y CUALQUIER OTRA AUDIENCIA; PRESTAR CONFESIÓN Y JURAMENTO DECISORIO Y DEFERIR AL DEL CONTRARIO; PRESTAR DECLARACIONES DE PARTE; ABSÓLVER POSICIONES; RECONOCER DOCUMENTOS; CONCILIAR; TRANSIGIR; SOMETER A ARBITRAJE LAS PRETENSIONES CONTROVERTIDAS EN EL PROCESO Y FUERA DE ÉSTE; CELEBRAR CONVENIOS ARBITRALES; SOLICITAR MEDIDAS CAUTELARES Y OFRECER GONTRACAUTELAS PARA MEDIDAS CAUTELARES, INCLUSIVE CAUCIÓN JURATORIA; EFECTUAR PAGOS Y CONSIGNACIONES, DIRECTAMENTE 0 MEDIANTE CONSIGNACIÓN U OFRECIMIENTOS DE PAGO JUDICIAL 0 EXTRAJUDICIAL; RETIRAR CONSIGNACIONES; SOLICITAR DECLARACIONES DE INSOLVENCIA; PRESENTARSE A JUNTAS DE ACREEDORES Y A PROCEDIMIENTOS DE LIQUIDACIÓN, REESTRUCTURACIÓN Y QUIEBRA DE EMPRESAS Y PROCEDIMIENTOS SIMILARES; SUSTITUIR 0 DELEGAR LA REPRESENTACIÓN PROCESAL; Y. OTORGAR PODERES ESPECIALES EN PROCESOS ADMINISTRATIVOS
C) SIN QUE ELLO IMPORTE LIMITACIÓN A LO SEÑALADO EN EL LITERAL ANTERIOR REPRESENTAR A LA SOCIEDAD ANTE LAS AUTORIDADES ADMINISTRATIVAS Y JUDICIALES DE TRABAJO Y ANTE LOS TRABAJADORES DE LA SOCIEDAD, CON OCASIÓN DE LOS PROCESOS QUE PUDIERA INICIAR LA SOCIEDAD 0 CONTRA ELLA INICIEN SUS TRABAJADORES, ASI COMO EN NEGOCIACIONES COLECTIVAS DE TRABAJO, GOZANDO DE LAS FACULTADES MENCIONADAS EN EL LITERAL., ANTERIOR, ASÍ COMO LAS DE RECIBIR Y NEGOCIAR !PLIEGOS DE RECLAMOS, CELEBRAR-CONVENIOS COLECTIVOS, MODIFICAR LOS CONVENIOS COLECTIVOS EXISTENTES Y, EN-GENERAL REALIZAR TODOS LOS ACTOS A QUE ALUDEN LOS ARTÍCULOS 46°, 48°, 49° Y 61 ° DEL D.L N° 25593 Y SU TEXTO ÚNICO ORDENADO, DECRETO SUPREMO N° 10-2003-TR, EL ARTICULO 37° DEL DS. N° 011-92-TR, LOS ARTÍCULOS 8° Y 21° DE LA- LEY N° 26636, EL DECRETO

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LEGISLATIVO N° 910 Y EL D.S. N° 020-2001-TR, 0 LOS DISPOSITIVOS QUE EN SU OPORTUNIDAD PUDIERAN SUSTITUIRLOS, SIN RESERVA NI LIMITACIÓN ALGUNA.

D) IGUALMENTE, SIN QUE ELLO IMPORTE LIMITACIÓN A LO INDICADO EN LOS LITERALES B) Y C) ANTERIORES, REPRESENTARA LA SOCIEDAD ANTE LAS AUTORIDADES MINERAS, POLÍTICAS Y; ADMINISTRATIVAS, NACIONALES, REGIONALES 0 LOCALES Y ANTE EL CONSEJO DE MINERÍA, CON LAS FACULTADES DE FORMULAR PETITORIOS, SOLICITAR AUTORIZACIONES Y PERMISOS MINEROS Y DE CUALQUIER OTRO TIPO; SOLICITAR EL OTORGAMIENTO DE CONCESIONES DE, CUALQUIER CLASE; SOLICITAR LA REDUCCIÓN DEL AREA/Y/O EL FRACCIONAMIENTO DEN DENUNCIOS, PETITORIOS Y CONCESIONES; SOLICITAR LA ACUMULACIÓN Y TRANSFORMACIÓN DE DENUNCIOS, PETITORIOS 0 CONCESIONES 0 EL CAMBIO DE LA NATURALEZA DE LAS\ SUSTANCIAS; OPONERSE A DENUNCIOS IY PETITORIOS DE TERCEROS, IMPUGNAR JUDICIALMENTE CONCESIONES DE TERCEROS Y FORMULAR DENUNCIAS; INTERPONER TODA CLASE DE RECURSOS Y MEDIOS IMPUGNATORIOS; DESISTIRSE DE LOS RECURSOS Y SOLICITUDES QUE FORMULE LA SOCIEDAD; SOLICITAR LA APROBACIÓN DE UNIDADES ECONÓMICO ADMINISTRATIVAS; PRESENTAR DECLARACIONES; SOLICITAR EL OTORGAMIENTO DE BENEFICIOS A LOS QUE LA SOCIEDAD PUDIERA TENER DERECHO; Y, EN GENERAL, REPRESENTAR A LA SOCIEDAD CON LAS MAS AMPLIAS FACULTADES, SUSCRIBIENDO TODOS LOS ESCRITOS, RECURSOS Y DOCUMENTOS QUE PUDIERAN REQUERIRSE, INCLUYENDO LOS DE NULIDAD,

E) DELEGAR LAS FACULTADES MENCIONADAS EN LOS ACÁPITES B), C) Y D) ANTERIORES A FAVOR DE TERCERAS PERSONAS, FUNCIONARIOS O NO DE LA SOCIEDAD, Y REVOCAR TALES DELEGACIONES.

F) ABRIR Y CERRAR CUENTAS DE TODO TIPO, EN MONEDA NACIONAL 0 EXTRANJERA, EN-INSTITUCIONES BANCARIAS Y FINANCIERAS DEL PAÍS 0 DEL EXTERIOR; ABRIR CARTAS DES CRÉDITO, CONO SIN GARANTÍAS Y, ENDOSAR CONOCIMIENTOS DE EMBARQUE

G) GIRAR, ENDOSAR Y PROTESTAR CHEQUES, DEPOSITAR Y RETIRAR DINER0.

H) GIRAR, ACEPTAR Y SUSCRIBIR, ENDOSAR Y PROTESTAR LETRAS, VALES, PAGARÉS Y OTROS TÍTULOS VALORES ORIGINADOS EN OPERACIONES COMERCIALES; RECIBIR, OBTENER Y ENDOSAR CERTIFICADOS DE DEPOSITO Y WARRANTS; SOLICITAR CARTAS FIANZA, REALIZAR OPERACIONES DE FACTORING, CELEBRAR, ACORDAR Y VERIFICAR TODO TIPO DE OPERACIONES? DE CRÉDITO Y SUSCRIBIR LOS DOCUMENTOS Y TÍTULOS VALORES QUE SE REQUIERA PARA ELLO; CELEBRAR CONTRATOS DE ARRENDAMIENTO FINANCIERO Y, EN GENERAL, EFECTUAR TODA CLASE DE OPERACIONES BANCARIAS Y FINANCIERAS. .

I) CELEBRAR LOS CONTRATOS Y COMPROMISOS QUE RESULTEN NECESARIOS 0 CONVENIENTES PARA EL CUMPLIMIENTO DEL OBJETO SOCIAL; EN ESPECIAL Y SIN QUE LA SIGUIENTE ENUNCIACIÓN SEA LIMITATIVA SINO MERAMENTE ENUNCIATIVA, TRATAR SOBRE TODA CLASE DE NEGOCIOS; CELEBRAR TRANSACCIONES; SOMETER LAS DISPUTAS A ARBITRAJE; DESIGNAR ÁRBITROS; ADQUIRIR, ENAJENAR A TÍTULO ONEROSO 0 GRATUITO; GRAVAR, ARRENDAR 0 SUBARRENDAR, COMO ARRENDADOR, SUBARRENDADOR, ARRENDATARIO 0 SUBARRENDATARIO, ACTIVA 0 PASIVAMENTE, TODA CLASE DE BIENES MUEBLES O INMUEBLES; OTORGAR GARANTÍAS CELEBRAR CONTRATOS DE CESIÓN Y DE OPCIÓN RESPECTO DE DERECHOS MINEROS DE) TERCEROS, CELEBRAR CONTRATOS DE SOCIEDAD, ASOCIACIÓN EN PARTICIPACIÓN 0 JOINT VENTURE ASÍ COMO CUALQUIER CONTRATO DE SOCIEDAD 0 ASOCIACIÓÑ SEA DE NATURALEZA CIVIL 0 MERCANTIL, NOMINADO 0 INNOMINADO Y, EN GENERAL, HACER TODO CUANTO ESTIME CONVENIENTE 0 NECESARIO PARA EL CUMPLIMIENTO DE LOS FINES SOCIALES

J) NOMBRAR Y REMOVER A LOS EMPLEADOS Y OPERARIOS DE LOS QUE REQUIERA LA SOCIEDAD, NACIONALES 0 EXTRANJEROS, FIJANDO SUS ATRIBUCIONES, FUNCIONES Y RETRIBUCIÓN Y SUSCRIBIENDO LOS CONTRATOS DE TRABAJO Y DEMÁS DOCUMENTOS, ASÍ COMO LOS ESCRITOS, SOLICITUDES Y RECURSOSJANTE LA AUTORIDAD DE TRABAJO Y ANTE LA AUTORIDAD MIGRATORIA QUE FUERAN NECESARIOS 0 CONVENIENTES, INCLUYENDO EL OTORGAMIENTO DE LAS GARANTÍAS QUE SE REQUIERAN CONFORME A LEY PARA EL INGRESO 0 PERMANENCIA EN EL PAÍS DE LOS TRABAJADORES EXTRANJEROS DE LA SOCIEDAD

K) CON RELACIÓN A ELEMENTOS DE LA PROPIEDAD INDUSTRIAL 0 INTELECTUAL, REGISTRAR, ADQUIRIR, TRANSFERIR; Y CELEBRAR CONTRATOS DE LICENCIA Y SUBLICENCIA.

L) PARTICIPAR EN LICITACIONES 0 CONCURSO DE PRECIOS, PÚBLICOS 0 PRIVADOS QUEDANDO AL. EFECTO FACULTADOS PARA PROPONER GESTIONAR YIO SUSCRIBIR LAS RESPECTIVAS OFERTAS Y LOS

- LOS CERTIFICADOS QUE EXTIENDEN LAS OFICINAS REGISTRALES ACREDITAN LA EXISTENCIA O INEXISTENCIA DE INSCRIPCIONES O ANOTACIONES EN EL REGISTRO AL TIEMPO DE SU EXPEDICIÓN (ART. 140° DEL T.U.O DEL REGLAMENTO GENERAL DE LOS REGISTROS PÚBLICOS APROBADO POR RESOLUCIÓN N° 126-2012-SUNARP-SN).
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CONTRATOS QUE SE DERIVEN DE ELLOS ASÍ CÓMO CUALESQUIERA DOCUMENTOS PÚBLICOS 0 PRIVADOS, INCLUSO DE TÍTULOS VALORES SIN RESERVA NI LIMITACIÓN,
M) ORDENAR COBRANZAS Y OTORGAR RECIBOS Y CANCELACIONES.
N) LLEVAR LA CORRESPONDENCIA DE LA SOCIEDAD.
O) SOLICITAR Y CELEBRA CONTRATOS DE ESTABILIDAD JURÍDICA CON EL ESTADO AL AMPARO DE LAS NORMAS LEGALES APLICABLES
P) FORMALIZAR E INSCRIBIR, A FALTA DE APODERADO EXPRESO, Y CUANDO ELLO SEA NECESARIO LOS ACUERDOS ADOPTADOS POR LA SOCIEDAD EN SESIONES DE DIRECTORIO 0 JUNTA GENERAL DE ACCIONISTAS.*******

DOCUMENTO QUE DIO MÉRITO A LA INSCRIPCIÓN:
POR COPIA CERTIFICADA EL 09.03.10 POR NOTARIO PÚBLICO FERNANDINI BARREDA EN MERITO AL ACTA JUNTA GENERAL DE ACCIONISTAS DE FECHA 22.01.2010

II. ANOTACIONES EN EL REGISTRO PERSONAL O EN EL RUBRO OTROS
Ninguno

III. TÍTULOS PENDIENTES
Ninguno

IV. DATOS ADICIONALES DE RELEVANCIA PARA CONOCIMIENTO DE TERCEROS
Ninguno

Nº de Fojas del Certificado: 5 N° Cuenta: MPCOPPER001
Derechos Pagados:S/.26.00
Mayor Derecho: S/.0.00
Total de Derechos: S/.26.00

Verificado y expedido por EVELYN VANESSA ROCA BADARACO, ABOGADO CERTIFICADOR de la Oficina Registral de LIMA, a las 13:12:36 horas del 6 de Febrero del 2020

EVELYN VANESSA ROCA BADARACO
ABOGADO CERTIFICADOR
Zona Registral Nº IX - Sede Lima

- LOS CERTIFICADOS QUE EXTIENDEN LAS OFICINAS REGISTRALES ACREDITAN LA EXISTENCIA O INEXISTENCIA DE INSCRIPCIONES O ANOTACIONES EN EL REGISTRO AL TIEMPO DE SU EXPEDICIÓN (ART. 140° DEL T.U.O DEL REGLAMENTO GENERAL DE LOS REGISTROS PÚBLICOS APROBADO POR RESOLUCIÓN N° 126-2012-SUNARP-SN).
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Ezio Martino Buselli Canepa
DNI Nº 07801032

ANEXO 2-2
RESERVA DE AGUA

Que, el Informe Nº 001-2006-INRENA-IRH-DIRHI-MAN/ACF de la Dirección de Recursos Hídricos de la Intendencia de Recursos Hídricos del Instituto Nacional de Recursos Naturales - INRENA, concluye que en la cuenca del río Ocoña existen la disponibilidad hídrica para atender la solicitud de prórroga de la reserva de agua solicitada por el Gobierno Regional de Arequipa para el Proyecto de Irrigación Pampa Colorada;

Que de conformidad con el inciso a) del Artículo 7º de la Ley General de Aguas, dada por Decreto Ley Nº 17752 e inciso a) del Artículo 10º del Reglamento de sus Títulos I, II y III, aprobado por Decreto Supremo Nº 261-69-AP, las reservas de agua que establezca el Estado tienen vigencia de dos (2) años renovables, cuando exista razones técnicas o planes específicos que así lo justifiquen, quedando la Administración Técnica respectiva encargada de su cumplimiento;

Que, es necesario prorrogar la reserva de agua a favor del Proyecto de Irrigación Pampa Colorada, a fin de garantizar el recurso hídrico para la ejecución de las actividades programadas en el ámbito de ese Proyecto, previa regularización del período sin reserva sobreviviente al vencimiento del plazo otorgado por Decreto Supremo Nº 023-2004-AG;

En uso de las atribuciones conferidas en el inciso 8) del artículo 118º de la Constitución Política del Perú;

DECRETA:

Artículo 1º.- Renovar, en vía de regularización, hasta la fecha de dación de este Decreto Supremo, la reserva de agua prorrogada por Decreto Supremo Nº 023-2004-AG.

Artículo 2º.- Prorrogar la reserva de agua de la cuenca del río Ocoña a favor del Proyecto de Irrigación Pampa Colorada del Gobierno Regional de Arequipa, por el período de dos años (2) contados a partir de la fecha de publicación del presente Decreto Supremo, por un volumen anual de 177.32 MMC, distribuido de la siguiente manera:

Mes	MMC
Enero	20.28
Febrero	17.54
Marzo	17.32
Abril	15.33
Mayo	11.68
Junio	9.95
Julio	10.75
Agosto	12.98
Setiembre	14.04
Octubre	11.53
Noviembre	14.49
Diciembre	21.43
Total	177.32

Artículo 3º.- La Administración Técnica del Distrito de Riego Ocoña - Pausa queda encargada del cumplimiento de la reserva de agua.

Artículo 4º.- El presente Decreto Supremo será refrendado por el Ministro de Agricultura.

Dado en la Casa de Gobierno, en Lima, a los seis días del mes de mayo del año dos mil seis.

DAVID WAISMAN RJAVINSTHI
Segundo Vicepresidente de la República
Encargado del Despacho de la
Presidencia de la República

MANUEL MANRIQUE UGARTE
Ministro de Agricultura

08795

Reservan aguas subterráneas del acuífero de las subcuencas Rumichaca, Huascacocha y Pucará de la cuenca del río Mantaro a favor del Proyecto Minero Toromocho de la empresa CENTROMIN

DECRETO SUPREMO
Nº 027-2006-AG

EL PRESIDENTE DE LA REPÚBLICA

CONSIDERANDO:

Que, el Ministerio de Energía y Minas ha solicitado reserva de aguas para el Proyecto Minero Toromocho por el plazo de dos años, por 34.7 millones de metros cúbicos anuales de las aguas subterráneas que se encuentran en el acuífero de las subcuencas Huascacocha, Pucará y Rumichaca, de la cuenca del río Mantaro, para fines minero y poblacional; por tratarse de un Proyecto de interés nacional y de utilidad pública de acuerdo con lo dispuesto en el Decreto Legislativo Nº 674 - Ley de Promoción de la Inversión Privada en las Empresas del Estado, el Decreto Legislativo Nº 708 - Ley de Promoción de la Inversión Privada en el Sector Minero y el Texto Único Ordenado de la Ley General de Minería, aprobado por Decreto Supremo Nº 014-92-EM; se señala que ese Proyecto, ubicado en concesiones mineras de propiedad de la empresa Minera del Centro del Perú S.A.-CENTROMIN, fue materia de un proceso de promoción de inversión privada bajo el régimen del Decreto Legislativo Nº 674, resultando adjudicataria de la buena pro la empresa MINERA PERÚ COOPER S.A., la que tiene por obligación realizar determinadas inversiones y desarrollar un estudio orientado a definir la viabilidad y dimensión definitiva del Proyecto, por lo que se requiere la reserva de aguas subterráneas materia de petición, acompañándose al efecto el Estudio Hidrológico e Hidrogeológico para obtener la Reserva de Agua y Licencia de Uso de Agua para el Proyecto Toromocho;

Que, el artículo 7º, inciso a), de la Ley General de Aguas, dada por Decreto Ley Nº 17752, prescribe que el Poder Ejecutivo podrá reservar aguas para cualquier finalidad de interés público y el artículo 1º, inciso a), del Reglamento de los Títulos I, II y III de la Ley General de Aguas, aprobado por Decreto Supremo Nº 261-69-AP, establece que el Ministerio de Agricultura mediante decreto supremo podrá reservar aguas para cualquier finalidad de interés público por un plazo de dos (2) años, renovable, cuando existan razones técnicas o planes específicos que así lo justifiquen, quedando la Administración Técnica respectiva encargada de su cumplimiento bajo responsabilidad;

Que, igualmente, el artículo 5º del Reglamento de Aguas Subterráneas de la Ley General de Aguas, aprobado por Decreto Supremo Nº 274-69-AP/DGA, dispone que el Ministerio de Agricultura por propia iniciativa o a solicitud de otras entidades públicas o municipales, podrá reservar aguas subterráneas por un plazo de dos años renovables, para cualquier finalidad de interés social o público, cuando existan razones técnicas o planes específicos que lo justifiquen;

Que, la Intendencia de Recursos Hídricos del INRENA ha analizado el Estudio Hidrológico e Hidrogeológico que sustenta la solicitud de reserva de aguas, concluyendo, a través del Informe Nº 014-2006-INRENA-IRH-DIRHI-MAN/ACF/MPCH, en que los recursos hídricos disponibles y aprovechables para satisfacer la demanda hídrica del Proyecto Minero Toromocho, lo constituyen las aguas subterráneas que se encuentran en los acuíferos kársticos localizados en las subcuencas Huascacocha, Rumichaca y Pucará, evidenciadas a través de las descargas que son drenadas por las galerías de la actividad minera y por el Túnel Kingsmill a un caudal promedio de 1.25 m3/s equivalente a un volumen anual de 39 MMC, el cual es superior a la demanda del proyecto de 1.10 m3/s equivalente a un volumen anual de 34.69 MMC., de lo que infiere que

existen los recursos hídricos subterráneos necesarios para atender la solicitud de la reserva de agua subterránea a favor del Proyecto Minero Toromocho de propiedad de la empresa Minera del Centro del Perú S.A. - CENTROMIN, a fin de garantizar el requerimiento de agua con fines minero y poblacional, recomendando otorgar la reserva de aguas solicitada por la empresa Minera del Centro del Perú S.A. - CENTROMIN;

Que, el Decreto Supremo N° 044-2001-AG, precisa, a través de su artículo 1°, que las reservas de agua a favor de las entidades del Estado no faculta al uso, aprovechamiento o explotación de las fuentes de aguas reservadas, no estando obligadas dichas entidades al pago de la tarifa por uso de agua;

Que, de otro lado, las Leyes N°s. 28082 y 28608 declaran en emergencia ambiental la cuenca del río Mantaro y disponen que el Gobierno Regional de Junín dedique esfuerzos y recursos de manera preferente para descontaminar las aguas del Túnel Kingsmill, siendo el Proyecto Toromocho, a través del aprovechamiento de aguas subterráneas planteadas, un mecanismo que puede contribuir a remediar la contaminación de los ríos afluentes al Mantaro, pues la captación de dichas aguas conllevará a una importante disminución de las descargas de aguas ácidas del túnel Kingsmill hacia el río Yauli y de éste hacia el río Mantaro;

En uso de las atribuciones conferidas por el artículo 118°, inciso 8), de la Constitución Política del Perú;

DECRETA:

Artículo 1°.- Reservar las aguas subterráneas del acuífero de las subcuencas Rumichaca, Huascacocha y Pucará del sistema hidrográfico de la cuenca del río Mantaro a favor del Proyecto Minero Toromocho de propiedad de la empresa Minera del Centro del Perú S.A. - CENTROMIN, por un período de dos (2) años, para fines minero y poblacional, por un volumen anual de hasta 34.69 MMC (1.10 m3/s).

Artículo 2°.- La Administración Técnica del Distrito de Riego Mantaro, queda encargada del cumplimiento de la reserva de aguas que se otorga por este Decreto Supremo.

Artículo 3°.- El presente Decreto Supremo será refrendado por el Ministro de Agricultura y entrará en vigencia al día siguiente de su publicación en el Diario Oficial El Peruano.

Dado en la Casa de Gobierno, en Lima, a los dieciséis días del mes de mayo del año dos mil seis.

DAVID WAISMAN RJAVINSTHI
Segundo Vicepresidente de la República
Encargado del Despacho de la Presidencia de la República

MANUEL MANRIQUE UGARTE
Ministro de Agricultura

08796

Renuevan reserva de agua prorrogada por D.S. N° 022-2004-AG y prorrogan reserva de agua de cuencas de los ríos Colca y Apurímac a favor del Proyecto Especial Majes-Siguas

DECRETO SUPREMO
N° 028-2006-AG

EL PRESIDENTE DE LA REPÚBLICA

CONSIDERANDO:

Que, por Decreto Supremo N° 022-2004-AG, se prorrogó hasta el 13 de agosto del 2004, a favor del Proyecto Especial Majes-Siguas, la reserva de agua procedente de la cuenca del río Colca y de la cuenca alta del río Apurímac, hasta por un volumen anual total de 914.16 MMC (28.99 m3/seg.), correspondiéndole a cada una de las cuencas un volumen anual de 566.16 MMC (17.95 m3/seg.) y 348 MMC (11.04 m3/seg.) respectivamente;

Que, con Oficio N° 198-2005-GRA-AUTODEMA-2.1/2.6, la Gerencia General del Proyecto Especial Majes-Siguas, solicita nueva prórroga de la reserva de agua de la cuenca del río Colca y la Cuenca alta el río Apurímac, con fines poblaciones, agrícolas, energéticos y otros usos a favor del Proyecto Especial Majes-Siguas del Gobierno Regional de Arequipa;

Que, el Informe N° 008-2006-INRENA-IRH-DIRHI-MAN/ACF, de la Dirección de Recursos Hídricos de la Intendencia de Recursos Hídricos del Instituto Nacional de Recursos Naturales - INRENA, concluye en que existe disponibilidad hídrica para prorrogar la reserva de agua de la cuenca del río Colca y la cuenca alta del río Apurímac, para atender las demandas hídricas futuras del Proyecto Especial Majes-Siguas, siendo la disponibilidad hídrica anual para los usos agrícolas y poblaciones de 702.45 MMC (22.27 m3/seg.) y para los usos energéticos de: 536.19 MMC (17.00 m3/seg.) para la central hidroeléctrica de Lluta I; 1072.30 MMC (34 m3/seg.) para la central hidroeléctrica de Lluta II y 1072.30 MMC (34 m3/seg.) para la central hidroeléctrica de Llucllа; señalando que para posteriores solicitudes de reserva o derecho de uso de agua se debe acreditar la correspondiente viabilidad económica y social del proyecto, así como la viabilidad ambiental aprobada por la autoridad competente;

Que, de conformidad con el inciso a) del Artículo 7° de la Ley General de Aguas Decreto, dada por Decreto Ley N° 17752 e inciso a) del Artículo 10° del Reglamento de sus Títulos I, II y III, aprobado por Decreto Supremo N° 261-69-AP, las reservas de agua que establezca el Estado tienen vigencia de dos (2) años renovables, cuando exista razones técnicas o planes específicos que así lo justifiquen, quedando la Administración Técnica respectiva encargada de su cumplimiento;

Que, es necesario prorrogar la reserva de agua a favor del Proyecto Especial Majes - Siguas, a fin de garantizar el recurso hídrico para las actividades agrícolas, poblacionales y energéticas previstas en la ejecución de la Primera y Segunda Etapa del referido proyecto, previa regularización del período sin reserva sobreviviente al vencimiento del plazo otorgado por Decreto Supremo N° 022-2004-AG;

En uso de las atribuciones conferidas en el inciso 8) del artículo 118° de la Constitución Política del Perú;

DECRETA:

Artículo 1°.- Renovar, en vía de regularización, hasta la fecha de dación de este Decreto Supremo, la reserva de agua prorrogada por Decreto Supremo N° 022-2004-AG.

Artículo 2°.- Prorrogar la reserva de agua procedente de la cuenca del río Colca y de la cuenca alta del río Apurímac a favor del Proyecto Especial Majes-Siguas, por el período de dos años (2) a partir de la fecha de publicación del presente Decreto Supremo, distribuido de la siguiente manera:

Usos agrícolas y poblacionales

- Por un volumen anual de hasta 702.45 MMC (22.27 m3/seg.), correspondiendo 354.45 MMC (11.24 m3/seg.) a las aguas de la cuenca del río Colca y 348 MMC (11.04 m3/seg.) a las aguas de la cuenca alta el río Apurímac.

Usos Energéticos:

- Para la central hidroeléctrica de Lluta I, por un volumen anual de hasta 536.19 MMC (17.00 m3/seg.), correspondiendo 188.19 MMC a la cuenca del río Colca y 348 MMC a la cuenca alta del río Apurímac, teniendo como punto de captación de agua la cota 3,532 m.s.n.m. ubicada en la coordenada Norte 8, 238,500 y sur 813,156 (desembocadura del túnel terminal en la Quebrada

Descargado desde www.elperuano.com.pe

CALIFICACIÓN DE ORGANISMOS PÚBLICOS		
27	Instituto Nacional de Innovación Agraria - INIA	Ejecutor
28	Instituto Nacional de Radio y Televisión del Perú - IRTP	Ejecutor
29	Instituto Nacional de Salud - INS	Ejecutor
30	Instituto Nacional Penitenciario - INPE	Ejecutor
31	Instituto Peruano de Energía Nuclear -IPEN	Ejecutor
32	Instituto Peruano del Deporte - IPD	Ejecutor
33	Instituto Tecnológico Pesquero - ITP	Ejecutor
34	Organismo de Formalización de la Propiedad Informal - COFOPRI	Ejecutor
35	Seguro Integral de Salud - SIS	Ejecutor
36	Servicio Aerofotográfico Nacional - SAN	Ejecutor
37	Servicio Nacional de Meteorología e Hidrología del Perú - SENAMHI	Ejecutor
38	Servicio Nacional de Sanidad Agraria -SENASA	Ejecutor
39	Sierra Exportadora	Ejecutor
40	Superintendencia Nacional de Bienes Estatales	Ejecutor
41	Superintendencia Nacional de Administración Tributaria - SUNAT	Ejecutor
42	Organismo Supervisor de la Inversión en Infraestructura de Transporte de Uso Público OSITRAN	Regulador
43	Organismo Supervisor de la Inversión en Energía y Minería - OSINERGMIN	Regulador
44	Organismo Supervisor de la Inversión Privada en Telecomunicaciones - OSIPTEL	Regulador
45	Superintendencia Nacional de Servicios de saneamiento - SUNASS	Regulador
46	Autoridad Nacional del Agua - ANA	Técnico especializado
47	Autoridad Portuaria Nacional - APN	Técnico especializado
48	Centro Nacional de Planeamiento Estratégico - CEPLAN	Técnico especializado
49	Comisión Nacional Supervisora de Empresas y Valores - CONASEV	Técnico especializado
50	Consejo Nacional del Ambiente - CONAM	Técnico especializado
51	Consejo Superior del Empleo Público - COSEP	Técnico especializado
52	Instituto del Mar del Perú - IMARPE	Técnico especializado
53	Instituto Geológico Minero y Metalúrgico - INGEMMET	Técnico especializado
54	Instituto Nacional de Defensa de la Competencia y Protección de la Propiedad Intelectual - INDECOPI	Técnico especializado
55	Instituto Nacional de Estadística e Informática - INEI	Técnico especializado
56	Instituto Nacional de Recursos Naturales - INRENA	Técnico especializado
57	Oficina de Normalización Previsional - ONP	Técnico especializado
58	Superintendencia de Entidades Prestadoras de Salud - SEPS	Técnico especializado
59	Superintendencia Nacional de Registros Públicos - SUNARP	Técnico especializado

196542-2

AGRICULTURA

Prorrogan la Reserva de Agua otorgada al Proyecto Minero Toromocho de propiedad de la empresa estatal Activos Mineros S.A.C.

DECRETO SUPREMO
Nº 010-2008-AG

EL PRESIDENTE DE LA REPÚBLICA

CONSIDERANDO:

Que, según el inciso a) del Artículo 7º de la Ley General de Aguas, aprobada mediante Decreto Ley Nº 17752, el Poder Ejecutivo podrá reservar aguas para cualquier finalidad de interés público;

Que, el Artículo 9º de la citada norma declara de necesidad y utilidad pública conservar, preservar e incrementar los recursos hídricos, regularizar el régimen de las aguas para obtener una racional, eficiente, económica y múltiple utilización de los recursos hídricos; promover, financiar y realizar las investigaciones, estudios y obras necesarias para tales fines;

Que, el inciso a) del Artículo 10º del Reglamento de los Títulos I, II y III de la Ley General de Aguas, aprobado por Decreto Supremo Nº 261-69-AP, señala que las reservas de agua que establezca el Estado tendrán un plazo de dos (2) años, renovables, cuando existan razones técnicas o planes específicos que así lo justifiquen;

Que, mediante Decreto Supremo Nº 027-2006-AG, se reservaron las aguas subterráneas del acuífero de las subcuencas Rumichaca, Huascacocha y Pucará del sistema hidrográfico de la cuenca del río Mantaro a favor del Proyecto Minero Toromocho de propiedad de la empresa Minera del Centro del Perú S.A. - CENTROMIN, por un período de dos (2) años, para fines minero y poblacional, por un volumen anual de hasta 34.69 MMC (1.10 m3/s);

Que, mediante Oficio Nº 523-2008-MEM/DM el Ministro de Energía y Minas, solicita la extensión de la prórroga de la reserva de agua señalada en el considerando precedente;

Que, con Informe Nº 202-2008-INRENA-IRH-DIRHI/JAH/EZT-ACF, la Dirección de Recursos Hídricos de la Intendencia de Recursos Hídricos del Instituto Nacional de Recursos Naturales concluye que las aguas subterráneas de los acuíferos cársticos localizados en las unidades hidrográficas Huascacocha, Rumichaca y Pucará pertenecientes a la unidad hidrográfica del río Yauli de la cuenca del río Mantaro son recursos de libre disponibilidad y potencialmente aprovechables para satisfacer la demanda hídrica del Proyecto Minero Toromocho los mismos que no han sufrido reducción alguna durante la vigencia de la reserva de agua otorgada a través del Decreto Supremo

Nº 027-2006-AG, razón por la cual recomienda su prórroga por dos años más;

Que, según Informe Nº 358-2008-MEM-AAM/RC de la Dirección General de Asuntos Ambientales Mineros del Ministerio de Energía y Minas, el Proyecto Minero Toromocho es de propiedad de la empresa estatal ACTIVOS MINEROS S.A.C., la misma que se ha subrogado en todos los derechos y obligaciones que anteriormente eran de CENTROMIN;

Que, en consecuencia, resulta necesario prorrogar por dos años la reserva de agua otorgada mediante Decreto Supremo Nº 027-2006-AG, a favor del Proyecto Minero Toromocho de propiedad de la empresa estatal ACTIVOS MINEROS S.A.C., así como adoptar las medidas necesarias para viabilizar la reserva y futuros otorgamientos derechos de uso de agua con cargo a dicha reserva; y,

En uso de las atribuciones conferidas en el inciso 8) del Artículo 118° de la Constitución Política del Perú;

DECRETA:

Artículo 1°.- De la Prórroga de Reserva de Agua

Prorróguese, por dos (2) años adicionales, la Reserva de Agua otorgada mediante Decreto Supremo Nº 027-2006-AG a favor del Proyecto Minero Toromocho de propiedad de la empresa estatal ACTIVOS MINEROS S.A.C., de las aguas subterráneas de libre disponibilidad, provenientes del acuífero de las subcuencas Rumichaca, Huascacocha y Pucará del sistema hidrográfico de la cuenca del río Mantaro, por un volumen anual de hasta 34.69 MMC (1.10m3/s) para fines mineros y poblacional.

Artículo 2°.- Responsables de la Reserva de Agua

La Intendencia de Recursos Hídricos del INRENA y la Administración Técnica del Distrito de Riego Mantaro son responsables de cautelar el cumplimiento de la reserva de agua que se está prorrogando mediante el presente Decreto Supremo.

Artículo 3°.- Refrendo

El presente Decreto Supremo será refrendado por el Ministro de Agricultura y entrará en vigencia al día siguiente de su publicación en el Diario Oficial El Peruano.

Dado en la Casa de Gobierno, en Lima, a los cinco días del mes de mayo del año dos mil ocho.

ALAN GARCÍA PÉREZ
Presidente Constitucional de la República

ISMAEL BENAVIDES FERREYROS
Ministro de Agricultura

196543-3

Declaran concluido proceso de efectivización de transferencia de funciones en materia agraria a los Gobiernos Regionales de Amazonas, Cajamarca, Huánuco, Piura y Huancavelica

RESOLUCIÓN MINISTERIAL
Nº 323-2008-AG

Lima, 30 de abril de 2008

CONSIDERANDO:

Que, de conformidad con el artículo 51° de la Ley Nº 27867 – Ley Orgánica de los Gobiernos Regionales, se establece que las funciones en materia agraria, entre otras, que corresponden a los Gobiernos Regionales se desarrollan en base a las políticas regionales y en concordancia con la política nacional;

Que, mediante el Decreto Supremo N° 052-2005-PCM, se aprobó el Plan Anual de Transferencia de Competencias

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CURSOS

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control

Del 06 al 27 de mayo
Control de Gestión de Gobiernos Locales

Del 07 al 21 de mayo
Auditoría de Obras Públicas

Normas de Control Interno

Determinación de Áreas Críticas en Auditoría Gubernamental

Introducción al Control Gubernamental: Ley 27785

Del 19 al 23 de mayo
Sistema de Auditoría Gubernamental - SAGU

Del 26 de mayo al 06 de junio
Planeamiento de la Auditoría Gubernamental

Determinación de Responsabilidades de los Servidores Públicos

Grafotecnia y Fraude Documentario: Básico

gestión pública

Del 05 al 09 de mayo
Sistema Integrado de Administración Financiera - SIAF

Del 06 al 27 de mayo
Contrataciones y Adquisiciones del Estado: Ley 26850

Planeamiento Estratégico para el Sector Público

Del 26 de mayo al 06 de junio
Procedimiento Administrativo General: Ley 27444

desarrollo de competencias

Del 20 de mayo al 05 de junio
Redacción y Ortografía

Del 26 de mayo al 06 de junio
MS Project para Auditores

cursos virtuales

Del 12 de mayo al 05 de julio
Contrataciones y Adquisiciones del Estado

CIERRE DE INSCRIPCIONES UN DÍA ANTES DEL INICIO INDEFECTIBLEMENTE
PREPARAMOS PROGRAMAS DE CAPACITACIÓN A LA MEDIDA DE SU ENTIDAD
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la Ministra de Economía y Finanzas y por el Ministro de Transportes y Comunicaciones.

Regístrese, comuníquese y publíquese.

ALAN GARCÍA PÉREZ
Presidente Constitucional de la República

JAVIER VELASQUEZ QUESQUÉN
Presidente del Consejo de Ministros

MERCEDES ARÁOZ FERNÁNDEZ
Ministra de Economía y Finanzas

ENRIQUE CORNEJO RAMÍREZ
Ministro de Transportes y Comunicaciones

490255-7

AGRICULTURA

Prorrogan reserva de aguas subterráneas a favor de Minera Chinalco Perú S.A. y para el desarrollo del proyecto minero Toromocho

RESOLUCIÓN JEFATURAL
Nº 276-2010-ANA

Lima, 4 de mayo de 2010

VISTA:

La Carta VPALC-133-2010, mediante la cual la empresa "MINERA CHINALCO PERÚ S.A.", solicita la prórroga de la reserva de agua a favor del proyecto minero Toromocho y,

CONSIDERANDO:

Que, según el artículo 103º de la Ley de Recursos Hídricos, Ley Nº 29338, mediante resolución de la Autoridad Nacional se puede reservar un volumen de agua para el desarrollo de proyectos, asimismo el numeral 5º del artículo 15º de la misma Ley, señala que es función de la Autoridad Nacional, aprobar previo estudio técnico, reservas de agua por un tiempo determinado cuando así lo requiera el interés de la nación;

Que, el numeral 208.1 del artículo 208º, concordante con el numeral 206.3 del artículo 206º del Reglamento de la Ley de Recursos Hídricos, aprobado por Decreto Supremo Nº 001-2010-AG, señala que la reserva de recursos hídricos se otorga por un periodo máximo de dos años prorrogables mientras subsistan las causas que la motivan. Esta reserva no faculta el uso del agua;

Que, por Decreto Supremo Nº 027-2006-AG, se reservó las aguas subterráneas del acuífero de las subcuencas Rumichaca, Huascacocha y Pucará del sistema hidrográfico de la cuenca del río Mantaro a favor del proyecto minero Toromocho de propiedad de la empresa Minera del Centro del Perú S.A.-CENTROMIN, por un período de dos (2) años, para fines minero y poblacional, por un volumen anual de hasta 34.69 MMC (1.10 m³/s);

Que, por Decreto Supremo Nº 010-2008-AG, se prorrogó la citada reserva de agua por dos (02) años adicionales, a favor del mismo proyecto de propiedad de la empresa estatal ACTIVOS MINEROS S.A.C.;

Que, mediante Escritura Pública de fecha 02.04.2008, "MINERA CHINALCO PERÚ S.A." y ACTIVOS MINEROS S.A.C, suscribieron contrato con el objeto que esta última transfiera la titularidad de las concesiones y la propiedad de los terrenos, así como las edificaciones, derechos de agua obtenidos para el desarrollo del proyecto Minero Toromocho e información documentaria;

Que, con el Informe Técnico Nº 023-2010-ANA-DCPRH/ASUB/EZT, la Dirección de Conservación y Planeamiento de Recursos Hídricos, concluye que es factible otorgar la prórroga de las reservas de aguas subterráneas, basado en la justificación presentada por los interesados, que es la descontaminación de las aguas ácidas del túnel Kingsmill, lo que conllevará a la disminución de las descargas de aguas ácidas hacía el río Yauli y de éste al río Mantaro; y,

Estando a lo opinado por la Oficina de Asesoría Jurídica, con los vistos de la Dirección de Conservación y Planeamiento de Recursos Hídricos y de la Secretaría General, y de conformidad con lo establecido por la Ley de Recursos Hídricos, Ley Nº 29338 y el artículo 206º del Reglamento de la citada Ley, aprobado por Decreto Supremo Nº 001-2010-AG.

SE RESUELVE:

Artículo 1º.- De la Prórroga de la Reserva de Agua
Prorróguese, a favor de "MINERA CHINALCO PERÚ S.A. y para el desarrollo del proyecto minero Toromocho, por dos (02) años adicionales, contados a partir del 07.05.2010, la reserva de las aguas subterráneas de los acuíferos Kársticos localizados en las unidades hidrográficas Rumichaca, Huascacocha y Pucará, pertenecientes a la unidad hidrográfica del río Yauli de la cuenca del río Mantaro, por un volumen anual de hasta 34.69 MMC (1.10 m³/s).

Artículo 2º.- De la supervisión de la Reserva de Agua
La Administración Local de Agua Mantaro es responsable de supervisar el cumplimiento de lo dispuesto mediante la presente Resolución Jefatural, debiendo informar periódicamente a la Dirección de Conservación y Planeamiento de Recursos Hídricos.

Regístrese, comuníquese y publíquese.

FRANCISCO PALOMINO GARCÍA
Jefe
Autoridad Nacional del Agua

490252-1

COMERCIO EXTERIOR Y TURISMO

Autorizan viaje de representantes del Ministerio a Bélgica para participar en reunión de revisión legal del texto final del Acuerdo Comercial entre la UE y las Repúblicas de Colombia y Perú

RESOLUCIÓN SUPREMA
Nº 065-2010-MINCETUR

Lima, 5 de mayo de 2010

CONSIDERANDO:

Que, las delegaciones que participaron en el cierre de las negociaciones para un Acuerdo Comercial entre la Unión Europea y las Repúblicas de Colombia y Perú, realizado en la ciudad de Bruselas, Reino de Bélgica, del 22 y el 26 de febrero de 2010, han iniciado la etapa de revisión legal del texto final de dicho Acuerdo;

Que, la segunda reunión de revisión legal se llevará a cabo en la ciudad de Bruselas, del 11 al 15 de mayo de 2010, por lo cual el Viceministro de Comercio Exterior ha solicitado que se autorice el viaje del equipo de profesionales que participará en dicha reunión, en representación del Ministerio de Comercio Exterior y Turismo - MINCETUR;

Que, el MINCETUR es el organismo público competente para definir, dirigir, ejecutar, coordinar y supervisar la política de comercio exterior y de turismo; responsable en materia de negociaciones comerciales internacionales, en coordinación con los demás sectores del Gobierno en el ámbito de sus respectivas competencias;

Que, la Ley N° 29465, Ley de Presupuesto del Sector Público para el Año Fiscal 2010, prohíbe los viajes al exterior con cargo a recursos públicos, salvo los casos

aprueban la Constitución de la "Mancomunidad Municipal Lima Centro", en el Registro de Mancomunidades Municipales.

Artículo 4°.- Publicación
Disponer la publicación de la presente Resolución de Secretaría de Descentralización en el Diario Oficial El Peruano, y en la página web de la Presidencia del Consejo de Ministros: http://www.descentralizacion.gob.pe.

Artículo 5°.- Vigencia
La presente Resolución rige a partir del día siguiente de su publicación en el Diario Oficial El Peruano.

Regístrese, comuníquese y publíquese.

ALBERTO MUÑOZ-NAJAR FRIEDRICH
Secretario de Descentralización

797522-6

Modifican Requisitos Específicos Mínimos para la transferencia de Funciones Sectoriales en materia de Micro y Pequeña Empresa - MYPE, propuestos por el Ministerio de la Producción, a la Municipalidad Metropolitana de Lima

RESOLUCIÓN DE SECRETARÍA DE DESCENTRALIZACIÓN N° 035-2012-PCM/SD

Lima, 29 de mayo de 2012

VISTOS:

El Oficio N° 0255-2011-PRODUCE/DVMYPE y el Informe N° 006-2012-PCM/SD-LENC;

CONSIDERANDO:

Que, por Resolución de la Secretaría de Descentralización N° 032-2007-PCM/SD, se aprobó la Directiva N° 007-2007-PCM/SD, "Normas para la Ejecución de la Transferencia del año 2007 al Régimen Especial de Lima Metropolitana, de las Funciones Sectoriales incluidas en los Planes Anuales de Transferencia", modificada mediante la Resolución de Secretaría de Descentralización N° 399-2011-PCM/SD;

Que, el numeral 5.2.4 de la Directiva N° 007-2007-PCM/SD, establece que los Sectores del Gobierno Nacional propondrán a la Secretaría de Descentralización, los Requisitos Específicos que serán solicitados a la Municipalidad Metropolitana de Lima para la transferencia de las funciones sectoriales; asimismo se señala que la aprobación de estos requisitos debe realizarse en el plazo de diez días, contados a partir de la publicación de la directiva en mención;

Que, mediante la Resolución de Secretaría de Descentralización N° 046-2007/PCM/SD se aprobaron los Requisitos Específicos Mínimos propuestos por los sectores para su aplicación en la etapa de certificación de todas las funciones sectoriales que serán transferidas a la Municipalidad Metropolitana de Lima, comprendidas en el "Plan Anual de Transferencia de Competencias Sectoriales a los Gobiernos Regionales y Locales del año 2007";

Que, por Resolución de Secretaría de Descentralización N° 052-2009-PCM/SD, se modificó el plazo establecido en el numeral 5.2.4 de la Directiva N° 007-2007-PCM/SD, instituyéndose que los plazos para el cumplimiento de las etapas del proceso de transferencia de funciones específicas por materias, para todos los grupos, se establecerán en los planes de acción sectoriales;

Que, conforme a lo dispuesto en el numeral 5.2.4 de la indicada Directiva N° 007-2007-PCM/SD, la Secretaría de Descentralización ha recibido del Ministerio de la Producción la propuesta de requisitos específicos mínimos para la transferencia de las funciones sectoriales en materia de MYPE, que serán solicitados a la Municipalidad Metropolitana de Lima;

Que, mediante Decreto Supremo N° 103-2011-PCM, del 31 de diciembre de 2011, se decreta que el proceso de transferencia de las Funciones, Fondos, Programas, Proyectos, Empresas, Activos y otros organismos del gobierno nacional a los gobiernos regionales y locales, programados en los Planes Anuales de Transferencia aprobados hasta el año 2010, que se encuentren pendientes, continuará hasta su formalización, de conformidad a lo dispuesto en la Quinta Disposición Transitoria de la Ley de Bases de la Descentralización y las directivas aprobadas por la Secretaría de Descentralización de la Presidencia del Consejo de Ministros;

Que acorde al informe de vistos, corresponde aprobar los requisitos específicos mínimos en materia de Micro y Pequeña Empresa - MYPE, remitidos oficialmente por el Ministerio de la Producción;

De conformidad con las Leyes N° 27783, 27867, 27972, 28273, sus normas modificatorias y complementarias; Decretos Supremos N° 007-2007-PCM; N° 103-2011-PCM y en uso de las atribuciones contenidas en el Decreto Supremo N° 063-2007-PCM;

SE RESUELVE:

Artículo 1°.- Modificar los Requisitos Específicos Mínimos para la transferencia de Funciones Sectoriales en materia de Micro y Pequeña Empresa - MYPE, propuestos por el sector Produce para su aplicación en la certificación de las funciones sectoriales que serán transferidas a la Municipalidad Metropolitana de Lima, aprobados por la Resolución de Secretaría de Descentralización N° 046-2007/PCM/SD.

Modifíquense los requisitos específicos mínimos propuestos por el Ministerio de la Producción, para su aplicación en la etapa de certificación de las funciones sectoriales en la materia de MYPE, del Art. 48° de la Ley Orgánica de Gobiernos Regionales, que serán transferidas a la Municipalidad Metropolitana de Lima aprobados con la Resolución de Secretaría de Descentralización N° 046-2007/PCM/SD, los mismos que en Anexo forman parte de la presente Resolución.

Artículo 2°.- Publicación
Disponer la publicación de la presente Resolución Secretarial y de su anexo en el Diario Oficial El Peruano y en la página web de la Secretaría de Descentralización: www.pcm.gob.pe/sd.

Regístrese, comuníquese y publíquese.

ALBERTO MUÑOZ – NAJAR FRIEDRICH
Secretario de Descentralización

797522-4

AGRICULTURA

Renuevan prórroga de reserva de agua otorgada a favor de Minera Chinalco Perú S.A. mediante R.J. N° 276-2010-ANA

RESOLUCIÓN JEFATURAL N° 223-2012-ANA

Lima, 1 de junio de 2012

VISTA:

La Carta VPAL-065-2012, mediante el cual la empresa Minera Chinalco Perú S.A., solicita la prórroga de la reserva de agua a favor del Proyecto Minero Toromocho; y,

CONSIDERANDO:

Que, según el numeral 5 del artículo 15° de la Ley N° 29338, Ley de Recursos Hídricos, es función de la Autoridad Nacional del Agua, aprobar previo estudio técnico, reservas de agua por un tiempo determinado cuando así lo requiera el interés de la Nación;

Que, asimismo, el artículo 103° de la Ley de Recursos Hídricos, concordado con el artículo 206° de su Reglamento, establece que la reserva de recursos hídricos es un derecho especial intransferible, consistente en separar un determinado volumen de agua de libre disponibilidad de una fuente natural de agua superficial o subterránea, por un plazo determinado, con la finalidad de garantizar la atención de las demandas de un proyecto declarado de interés regional o nacional;

Que, por Decreto Supremo N° 027-2006-AG, se reservó las aguas subterráneas del acuífero de las subcuencas Rumichaca, Huascacocha y Pucará del sistema hidrográfico de la cuenca del río Mantaro a favor del Proyecto Minero Toromocho de propiedad de la empresa Minera del Centro del Perú S.A. – CENTROMIN, por un periodo de dos (02) años, para fines minero y poblacional, por un volumen anual de hasta 34.69 MMC (1.10 m^3/s);

Que, mediante Decreto Supremo N° 010-2008-AG y Resolución Jefatural N° 276-2010-ANA, se prorrogó la reserva de agua señalada en el considerando precedente por dos (02) años adicionales, a favor del mismo proyecto, actualmente de propiedad de Minera Chinalco Perú S.A., hasta el 07.05.2012;

Que, la Dirección de Conservación y Planeamiento de Recursos Hídricos, con Informe Técnico N° 011-2012-ANA-DCPRH-ERH-SUB/JQO, señala que es procedente la ampliación del plazo de la reserva de recursos hídricos para la ejecución y desarrollo del Proyecto Minero Toromocho;

Que, la prórroga de la reserva de recursos hídricos otorgada mediante Resolución Jefatural N° 276-2010-ANA, venció el 07.05.2012 y la solicitud de prórroga fue presentada por la empresa Minera Chinalco Perú S.A. con fecha 17.04.2012, por lo que de acuerdo con el considerando precedente, en forma previa a otorgar una prórroga de la reserva de agua, debe disponerse su renovación, en vías de regularización, desde la fecha de su vencimiento hasta la fecha de la presente resolución;

Que, en consecuencia, corresponde renovar y prorrogar la reserva de recursos hídricos dispuesta mediante Decreto Supremo N° 027-2006-AG y prorrogada mediante Decreto Supremo N° 010-2008-AG y Resolución Jefatural N° 276-2010-ANA;

Estando a lo opinado por la Dirección de Conservación y Planeamiento de Recursos Hídricos, con los vistos de la Oficina de Asesoría Jurídica y de la Secretaría General, y de conformidad con lo establecido en el artículo 103° de la Ley de Recursos Hídricos y 206° de su Reglamento.

SE RESUELVE:

Artículo 1°.- Renovación de la Reserva de Recursos Hídricos

Renovar, en vía de regularización, hasta la fecha de dación de la presente Resolución Jefatural, la prórroga de la reserva de agua otorgada a favor de Minera Chinalco Perú S.A., mediante Resolución Jefatural N° 276-2010-ANA, para el Proyecto Minero Toromocho.

Artículo 2°.- Prórroga de la Reserva de Recursos Hídricos

Prorróguese, a favor de Minera Chinalco Perú S.A. y para el desarrollo del Proyecto Minero Toromocho, por el plazo de dos (02) años adicionales, desde la fecha de dación de la presente resolución, la reserva de las aguas subterráneas de los acuíferos Kársticos localizados en las unidades hidrográficas Rumichaca, Huascacocha y Pucará, pertenecientes a la unidad hidrográfica del río Yauli de la cuenca del río Mantaro, por un volumen anual de hasta 34.69 MMC (1.10 m3/s).

Artículo 3°.- De la supervisión de la reserva de recursos hídricos

La Administración Local de Agua Mantaro es responsable de supervisar el cumplimiento de lo dispuesto mediante la presente Resolución Jefatural, debiendo informar periódicamente a la Dirección de Conservación y Planeamiento de Recursos Hídricos.

Regístrese, comuníquese y publíquese.

HUGO EDUARDO JARA FACUNDO
Jefe
Autoridad Nacional del Agua

797714-1

Encargan funciones de las Administraciones Locales de Agua de Chancay - Lambayeque, Moche - Virú - Chao y Chicama

RESOLUCIÓN JEFATURAL
N° 228-2012-ANA

Lima, 5 de junio de 2012

CONSIDERANDO:

Que, conforme al Reglamento de Organización y Funciones (ROF) de la Autoridad Nacional del Agua, aprobado por Decreto Supremo N° 006-2010-AG, las Administraciones Locales del Agua son unidades orgánicas que administran las aguas de uso agrario y no agrario en sus respectivos ámbitos territoriales;

Que, mediante Resoluciones Jefaturales Nros. 190-2010-ANA, 612-2011-ANA y 868-2011-ANA, se encargaron las funciones de las Administraciones Locales de Agua Chancay - Lambayeque, Moche-Virú-Chao y Chicama, esta última en adición a las funciones del Contrato Administrativo de Servicios N°0600-ANA-2010, correspondiente al señor Jorge Luis Tarifeño Rojas;

Que, se ha visto por conveniente, dar por concluidas las encargaturas a que se refiere el considerando precedente y consecuentemente encargar a los nuevos profesionales que asuman las funciones de las referidas Administraciones Locales de Agua; continuando el señor Jorge Luis Tarifeño Rojas ejerciendo las funciones según Contrato Administrativo de Servicios N°0600-ANA-2010;

Que, conforme a lo establecido en la Primera Disposición Complementaria Transitoria del Reglamento de Organización y Funciones de la Autoridad Nacional del Agua, aprobado con Decreto Supremo N° 006-2010-AG, la Jefatura de la entidad está facultada transitoriamente, para encargar mediante Resolución Jefatural las funciones de las Administraciones Locales de Agua;

De conformidad con lo dispuesto en la Ley N° 27594, Ley que Regula la Participación del Poder Ejecutivo en el Nombramiento y Designación de Funcionarios Públicos y el Reglamento de Organización y Funciones (ROF) de la Autoridad Nacional del Agua, aprobado por Decreto Supremo N° 006-2010-AG.

SE RESUELVE:

Artículo Primero.- Dar por concluidas, a partir del día 08 de Junio de 2012, las encargaturas de funciones en las Administraciones Locales de Agua, que fueron otorgadas a los profesionales que se indican a continuación, dándosele las gracias por los servicios prestados:

ADMINISTRACIÓN LOCAL DE AGUA	PROFESIONAL ENCARGADO	RESOLUCIÓN DE ENCARGATURA
Chancay - Lambayeque	Carlos Wildor Olano Fernández	R.J. N° 190-2010-ANA
Moche – Virú - Chao	Kathy Zulema Negron Tunjar de Sifuentes	R.J.N° 612-2011-ANA
Chicama	Jorge Luis Tarifeño Rojas	R.J. N° 868-2011-ANA

Artículo Segundo.- Encargar, a partir del día 08 de Junio de 2012, las funciones de las Administraciones Locales de Agua, a los profesionales siguientes:

ADMINISTRACIÓN LOCAL DE AGUA	PROFESIONAL ENCARGADO
Chancay - Lambayeque	Luis Fernando Biffi Martin
Moche – Virú - Chao	Jorge Damián Albujar Peche
Chicama	Kathy Zulema Negron Tunjar de Sifuentes

Regístrese, comuníquese y publíquese.

HUGO EDUARDO JARA FACUNDO
Jefe
Autoridad Nacional del Agua

797738-1

002135

CUT: 54876

ANA
AUTORIDAD NACIONAL DEL AGUA
El fedatario que suscribe certifica que el presente documento que ha tenido a la vista es COPIA FIEL DEL ORIGINAL, y al que me remito en caso necesario de lo que doy fe.
Lima, 20 JUN. 2014
RAFAEL M. VELASQUEZ PELAEZ
FEDATARIO

REPUBLICA DEL PERU

MINERA CHINALCO PERU S.A.
RECEPCION
24 JUN. 2014
RECIBIDO

Expediente : CUT - 54876 - 2014
Materia : Reserva de recursos hídricos
Solicitante : Minera Chinalco Perú S.A

RESOLUCIÓN JEFATURAL Nº 192 -2014-ANA

Lima, 13 JUN 2014

VISTA:

La Carta VPAL-073-2014 mediante la cual Minera Chinalco Perú S.A, solicita prórroga de la reserva de recursos hídricos otorgada a favor del Proyecto Minero Toromocho; y,

CONSIDERANDO:

Que, conforme lo previsto en el numeral 5 del artículo 15º de la Ley Nº 29338, Ley de Recursos Hídricos, la Autoridad Nacional del Agua tiene como función, entre otros, aprobar previo estudio técnico, reservas de agua por un tiempo determinado cuando así lo requiera el interés de La Nación;

Que, el articulo 208º numeral 208.1 del Reglamento de la Ley de Recursos Hídricos, aprobado por Decreto Supremo N° 01-2010-AG, dispone que la reserva de recursos hídricos se otorga por un período de dos años prorrogables, mientras subsistan las causas que la motiven;

Que, mediante Decreto Supremo Nº 027-2006-AG se reservó, por el plazo de dos (2) años, el recurso hídrico proveniente del acuífero de las subcuencas Rumichaca, Huascacocha y Pucará del Sistema Hidrográfico de la cuenca del río Mantaro, a favor del Proyecto Minero Toromocho de la empresa Minera del Centro del Perú S.A, CENTROMIN, con fines mineros y poblacionales, por un volumen anual de 34.69 MMC (1 10m³/s);

Que, mediante Decreto Supremo Nº 010-2008-AG y Resoluciones Jefaturales Nº 276-2010-ANA y 223-2012-ANA, se prorrogó la reserva de recursos hídricos señalada en el considerando precedente, a favor del mismo proyecto actualmente de propiedad de Minera Chinalco Perú S.A, por el plazo de dos (02) años, hasta 01.06.2012;

Que, la Dirección de Conservación y Planeamiento de Recursos Hídricos con Informe Técnico N° 024-2014-ANA-DCPRH-ERH-SUP/ERO refiere que:

a) La reserva de aguas subterráneas otorgada mediante Decreto Supremo Nº 027-2006-AG, fue otorgada por un volumen anual de 34.69 MMC (equivalente a 1.10 m³/s), para fines mineros y poblacionales.
b) Mediante Resolución Administrativa Nº 268-2010-ANA-ALA MANTARO, la Administración Local de Agua Mantaro otorgó a Minera Chinalco Perú S.A, licencia de uso de agua subterránea, con fines industriales, para el aprovechamiento de hasta 50 l/s, lo cual equivale a una masa anual de 1 576 800 m³, con cargo al volumen de la reserva de agua.
c) Minera Chinalco Perú S.A se encuentra culminando la construcción de la infraestructura para la operación del Proyecto Minero Toromocho, razón por la cual resulta necesario prorrogar la reserva de aguas subterráneas de los acuíferos de las subcuencas Rumichaca, Huacacocha y Pucará pertenecientes a la unidad hidrográfica del río Yaulí de la cuenca del río Mantaro, para los fines mineros y poblacionales, por un nuevo volumen anual de hasta 33 113 200 m³ (1.05 m³/s) y en las mismas condiciones otorgadas por el Decreto Supremo N° 027-2006-AG.

Que, en este sentido, el citado informe concluye que es procedente prorrogar la reserva de recursos hídricos, otorgada a favor de Proyecto Minero Toromocho, por un volumen anual de 33 113 200 m³, descontando el volumen de agua que con cargo a la reserva de recursos hídricos, se han otorgado en licencia de uso de agua;

Que, si bien la solicitud de prórroga de la reserva de recursos hídricos fue presentada por la recurrente el 12.05.2014, no obstante, la prórroga otorgada por Resolución Jefatural Nº 223-2012-ANA, estuvo vigente hasta el 01.06.2014, por lo que corresponde otorgar la prórroga de la vigencia, desde la fecha de su vencimiento hasta la dación de la presente resolución;

Que, por lo expuesto, corresponde prorrogar la reserva de recursos hídricos, en las mismas condiciones establecidas en el Decreto Supremo Nº 027-2006-AG, a favor del Proyecto Minero Toromocho de propiedad de Minera Chinalco del Perú S.A;

Estando a lo opinado por la Dirección de Conservación y Planeamiento de Recursos Hídricos, con el visto de Secretaría General y la Oficina de Asesoría Jurídica, así como de conformidad con lo establecido en el artículo 103° de la Ley de Recursos Hídricos, y el artículo 206° de su Reglamento;

AUTORIDAD NACIONAL DEL AGUA Abg. Yury Pinto Ortiz Secretario General Secretaría General

SE RESUELVE:

ARTÍCULO 1º.- De la prórroga de la vigencia de la reserva de recursos hídricos

Prorróguese, con eficacia anticipada al 02.06.2014, la vigencia de la reserva de recursos hídricos otorgada mediante Decreto Supremo Nº 027-2006-AG y prorrogada por Resoluciones Jefaturales N° 276-2010-ANA y N° 223-2012-ANA, a favor de Minera Chinalco del Perú S.A, para el desarrollo del Proyecto Minero Toromocho, por un volumen anual de 33 113 200 m³, por el plazo de dos (2) años.

AUTORIDAD NACIONAL DEL AGUA Abg. Mirco N. Miranda Sctil (Directorate) Oficina de Asesoría Jurídica

ARTÍCULO 3°.- De la supervisión de la reserva de recursos hídricos

La Autoridad Administrativa del Agua Mantaro y la Administración Local de Agua Mantaro son responsables de supervisar el cumplimiento de lo dispuesto mediante la presente resolución, debiendo informar periódicamente a la Dirección de Conservación y Planeamiento de Recursos Hídricos.

AUTORIDAD NACIONAL DEL AGUA V°B EUSEBIO INGA BLANCO Director Dirección de Conservación y Planeamiento de Recursos Hídricos

Regístrese, comuníquese y publíquese,

MINISTERIO DE AGRICULTURA Y RIEGO REPÚBLICA DEL PERÚ AUTORIDAD NACIONAL DEL AGUA

JUAN CARLOS SEVILLA GILDEMEISTER
Jefe
Autoridad Nacional del Agua

ANA
AUTORIDAD NACIONAL DEL AGUA
El fedatario que suscribe certifica que el presente documento que ha tenido a la vista es COPIA FIEL DEL ORIGINAL y al que me remito en caso necesario de lo que doy fe.

Lima, 20 JUN. 2014

RAFAEL M. VELASQUEZ PELAEZ
FEDATARIO

002137

NOTIFICACION CARGO

PERÚ | Ministerio de Agricultura y Riego | Autoridad Nacional del Agua

115620-2016 EXP:

ACTA DE NOTIFICACIÓN Nº 168 -2016-ANA-OA-UATD 10-08-2016

En la ciudad de: Provincia: Dpto.:

se procedió a notificar la Resolución Jefatural Nº 201 -2016-ANA 05-08-2016

a : **PROYECTO MINERO TOROMOCHO - MINERA CHINALCO DEL PERU S.A.**

domiciliado en: Av. El Derby Nº 250, piso 8 Santiago de Surco

PERSONA NATURAL

Nombres y Apellidos

Firma

DNI

Relación con el Administrado: (de ser el caso)

Fecha:

Hora:

PERSONA JURÍDICA

SELLO DE RECEPCION

MINERA CHINALCO PERU S.A.
RECEPCION - LIMA
12 AGO 2016

identificacion de la Persona que atiende la diligencia

fecha:

Hora:

☐ Se negó a firmar
☐ Se negó a recibir

se procede a describir las características externas del inmueble:

N° pisos_____ Puertas _____ Ventanas _____

Color de paredes _____ Suministro Electrico N° _____

Otros_____

Nombre del notificador:

DNI

fecha:

Hora

Firma/sello

OFICINA DE ADMINISTRACION - UATD
V°B°
Lic. WALTER JESUS SALAS PAZ
Subdirector
ANA

1/1

11601946121
AUTORIDAD NACIONAL DEL
LIC (2) Folios:1
PROYECTO MINERO TOROMOCHO-
AV EL DERBY 250 CB AV EL POLO SANTIAG
DE SURCO
Doc Ext:115620-2016
(LIMA)
O/S:16/0194262 - 11/08/16

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CUT: 115620

AUTORIDAD NACIONAL DEL AGUA
El fedatario que suscribe certifica que el presente documento que ha tenido a la vista es COPIA FIEL DEL ORIGINAL, y al que me remito en caso necesario de lo que doy fe.
10 AGO. 2016
Lima,
EDWIN ABELARDO VASQUEZ HERRERA
FEDATARIO

REPUBLICA DEL PERU

MINERA CHINALCO PERÚ S.A.
RECEPCIÓN
12 AGO 2016

RESOLUCIÓN JEFATURAL Nº 201 -2016-ANA

Lima, 05 AGO. 2016

VISTA:

La Carta VPAL-058-2016 de fecha 30 de mayo del 2016 mediante la cual Minera Chinalco Perú S.A, solicita prórroga de la reserva de recursos hídricos otorgada a favor del Proyecto Minero Toromocho; y,

CONSIDERANDO:

Que, el artículo 15º numeral 5 de la Ley Nº 29338, Ley de Recursos Hídricos, establece que es función de la Autoridad Nacional del Agua, aprobar previo estudio técnico, reservas de agua por un tiempo determinado cuando así lo requiera el interés de la Nación;

Que, según el artículo 208º inciso 208.1 del Reglamento de la Ley de Recursos Hídricos, aprobado por Decreto Supremo N° 01-2010-AG, la reserva de recursos hídricos se otorga por un período de dos años prorrogables, mientras subsistan las causas que la motiven;

Que, mediante Decreto Supremo Nº 027-2006-AG se reservó, por el plazo de dos (2) años, el recurso hídrico proveniente del acuífero de las subcuencas Rumichaca, Huascacocha y Pucará del Sistema Hidrográfico de la cuenca del río Mantaro, a favor del Proyecto Minero Toromocho de la empresa Minera del Centro del Perú S.A, CENTROMIN, con fines mineros y poblacionales, por un volumen anual de 34.69 MMC (1 10m³/s);

Que, la reserva de recursos hídricos otorgada para el desarrollo del Proyecto Toromocho fue prorrogada mediante Decreto Supremo Nº 010-2008-AG a favor de CENTROMIN, y posteriormente con Resoluciones Jefaturales Nº 276-2010-ANA, 223-2012-ANA y 192-2014-ANA, a favor de Minera Chinalco, habiendo vencido está última el 02 de junio del 2016;

Que, mediante Carta del visto, Minera Chinalco Perú S.A, solicita se prorrogue la reserva de recursos hídricos, indicando que se encuentra en plena operación la Unidad Minera Toromocho, y que por Ley N° 28608, se declaró en emergencia ambiental la cuenca del río Mantaro y se dispuso que el Gobierno Regional de Junín, dedique esfuerzos y recursos de manera preferente a la descontaminación del Túnel Kingsmill, por lo que la captación de las aguas aunada a la operación de la Planta de Tratamiento de Agua del Túnel Kingsmill por parte de Chinalco, conllevará a una mejora de la calidad del agua en la zona del Túnel y por ende en la cuenca del río Mantaro, cumpliéndose el objetivo trazado en la Ley N° 28608;

Que, la Dirección de Conservación y Planeamiento de Recursos Hídricos con Informe Técnico N° 047-2016-ANA-DCPRH-ERH-SUB/CZME refiere que:

a) La reserva inicial de agua subterránea otorgada al Proyecto Minero Toromocho proveniente del acuífero de las subcuencas Rumichaca, Huascacocha y Pucará del sistema hidrográfico de la cuenca del río Mantaro, fue de 34 690 000 m³.

AUTORIDAD NACIONAL DEL AGUA Ing. ABELARDO DE LA TORRE VILLANUEVA JEFE JEFATURA

AUTORIDAD NACIONAL DEL AGUA Abg. Yury Pinto Ortiz Secretario General Secretaría General

AUTORIDAD NACIONAL DEL AGUA Abg. José A. Ramírez Carro DIRECTOR Oficina de Asesoría Jurídica

AUTORIDAD NACIONAL DEL AGUA V°B° WILFREDO J. ECHEVARRIA SUAREZ Director Dirección de Conservación y Planeamiento de Recursos Hídricos

AUTORIDAD NACIONAL DEL AGUA
El fedatario que suscribe certifica que el presente documento que ha tenido a la vista es COPIA FIEL DEL ORIGINAL, y al que me remito en caso necesario de lo que doy fe.
Lima, 10 AGO. 2016
EDWIN ABELARDO VASQUEZ HERRERA
FEDATARIO

b) A medida que se implementa el proyecto minero Toromocho, la empresa Minera Chinalco fue solicitando licencias de uso de agua con fines mineros, de origen subterráneo del acuífero mencionado anteriormente, y que en la actualidad ascienden a 16 664 883.84 m³, equivalente a 528.44 l/s de promedio anual.
c) Existe un volumen que aún no cuenta con licencia comprendido en la reserva de agua del Proyecto Toromocho por 18 025 116.16 m³, con un caudal medio anual de 0.57 m³/s, sobre el cual Minera Chinalco viene solicitando prórroga de reserva de agua.

Que, asimismo, el citado informe concluye que es procedente prorrogar la reserva de recursos hídricos por un volumen anual de 18 025 116.16 m³ con un caudal medio anual de 0.57 m³/s, para el desarrollo del Proyecto Minero Toromocho, descontando el volumen de agua que con cargo a la reserva de recursos hídricos se ha otorgado mediante licencias de uso de agua;

Que, la solicitud de prórroga de la reserva de recursos hídricos fue presentada por la recurrente el 31 de mayo del 2016, no obstante, el plazo de vigencia de la reserva prorrogada mediante Resolución Jefatural Nº 192-2014-ANA, venció el 02 de junio del 2016, por lo que corresponde se otorgue con eficacia anticipada, la prórroga de la reserva de recursos hídricos a favor del Proyecto Minero Toromocho de propiedad de Minera Chinalco del Perú S.A;

Estando a lo opinado por la Dirección de Conservación y Planeamiento de Recursos Hídricos, con el visto de Secretaría General y la Oficina de Asesoría Jurídica, así como de conformidad con lo establecido en el artículo 103° de la Ley de Recursos Hídricos y el artículo 206° de su Reglamento;

AUTORIDAD NACIONAL DEL AGUA Abg. Kury Pinto Ortiz Secretario General Secretaría General

AUTORIDAD NACIONAL DEL AGUA José A. Ramírez Garro DIRECTOR Oficina de Asesoría Jurídica

AUTORIDAD NACIONAL DEL AGUA V°B° WILFREDO J. ECHEVARRIA ALVAREZ Director Dirección de Conservación y Planeamiento de Recursos Hídricos

SE RESUELVE:

ARTÍCULO 1°.- De la prórroga de la reserva de recursos hídricos

Prorróguese, con eficacia anticipada al 03.06.2016, la reserva de recursos hídricos proveniente del acuífero de las subcuencas Rumichaca, Huascacocha y Pucará del Sistema Hidrográfico de la cuenca del río Mantaro, otorgada por Decreto Supremo Nº 027-2006-AG y prorrogada mediante Resoluciones Jefaturales N° 276-2010-ANA, 223-2012-ANA y 192-2014-ANA, para el desarrollo del Proyecto Minero Toromocho, de la empresa Minera Chinalco del Perú S.A, por un volumen anual de 18 025 116.16 m3, por el plazo de dos (2) años.

ARTÍCULO 2°.- De la supervisión de la reserva de recursos hídricos

La Autoridad Administrativa del Agua Mantaro y la Administración Local de Agua Mantaro son responsables de supervisar el cumplimiento de lo dispuesto mediante la presente resolución, debiendo informar periódicamente a la Dirección de Conservación y Planeamiento de Recursos Hídricos.

Regístrese, comuníquese y publíquese,

MINISTERIO DE AGRICULTURA Y RIEGO REPÚBLICA DEL PERÚ AUTORIDAD NACIONAL DEL AGUA

ABELARDO DE LA TORRE VILLANUEVA
Jefe
Autoridad Nacional del Agua

PODER LEGISLATIVO

CONGRESO DE LA REPUBLICA

LEY Nº 30778

EL PRESIDENTE DEL CONGRESO
DE LA REPÚBLICA

POR CUANTO:

EL CONGRESO DE LA REPÚBLICA;

Ha dado la Ley siguiente:

LEY QUE DECLARA DE INTERÉS NACIONAL Y NECESIDAD PÚBLICA LA CREACIÓN DEL DISTRITO DE SAN JOAQUÍN, EN LA PROVINCIA DE ICA, DEL DEPARTAMENTO DE ICA

Artículo único. Declaración de interés nacional
Declárase de interés nacional y necesidad pública la creación del distrito de San Joaquín, en la provincia de Ica, del departamento de Ica.

POR TANTO:

Habiendo sido reconsiderada la Ley por el Congreso de la República, insistiendo en el texto aprobado en sesión del Pleno realizada el día nueve de enero de dos mil dieciocho, de conformidad con lo dispuesto por el artículo 108 de la Constitución Política del Perú, ordeno que se publique y cumpla.

En Lima, al primer día del mes de junio de dos mil dieciocho.

LUIS GALARRETA VELARDE
Presidente del Congreso de la República

RICHARD ACUÑA NÚÑEZ
Segundo Vicepresidente del Congreso de la República

1655394-1

PODER EJECUTIVO

AGRICULTURA Y RIEGO

Designan Jefe de la Autoridad Nacional del Agua - ANA

RESOLUCIÓN SUPREMA
Nº 007-2018-MINAGRI

Lima, 1 de junio de 2018

CONSIDERANDO:

Que, mediante el artículo 2 de la Resolución Suprema Nª 005-2016-MINAGRI, de fecha 30 de julio de 2016, publicada en el Diario Oficial El Peruano con fecha 31 de julio de 2016, se designó al señor Abelardo Amador De La Torre Villanueva, en el cargo de Jefe de la Autoridad Nacional del Agua – ANA, Organismo Público adscrito al Ministerio de Agricultura y Riego;

Que, el citado funcionario ha formulado renuncia al cargo señalado en el considerando precedente, la que resulta pertinente aceptar;

De conformidad con lo dispuesto por la Ley Nº 29158, Ley Orgánica del Poder Ejecutivo; la Ley Nº 27594, Ley que regula la participación del Poder Ejecutivo en el Nombramiento y Designación de Funcionarios Públicos; el Decreto Legislativo Nº 997, Decreto Legislativo que aprueba la Ley de Organización y Funciones del Ministerio de Agricultura, actualmente Ministerio de Agricultura y Riego, modificado por la Ley Nº 30048; y su Reglamento de Organización y Funciones, aprobado por Decreto Supremo Nº 008-2014-MINAGRI, y sus modificatorias; y,

Estando a lo acordado:

SE RESUELVE:

Artículo 1.- Aceptar la renuncia presentada por el señor Abelardo Amador De La Torre Villanueva, al cargo de Jefe de la Autoridad Nacional del Agua – ANA, Organismo Público adscrito al Ministerio de Agricultura y Riego, dándosele las gracias por los servicios prestados.

Artículo 2.- Designar al señor Walter Obando Licera en el cargo de Jefe de la Autoridad Nacional del Agua – ANA, Organismo Público adscrito al Ministerio de Agricultura y Riego.

Regístrese, comuníquese y publíquese.

MARTÍN ALBERTO VIZCARRA CORNEJO
Presidente de la República

GUSTAVO EDUARDO MOSTAJO OCOLA
Ministro de Agricultura y Riego

1655394-5

Designan Director Ejecutivo del Proyecto Especial Binacional Puyango Tumbes

RESOLUCIÓN MINISTERIAL
Nº 239-2018-MINAGRI

Lima, 1 de junio de 2018

CONSIDERANDO:

Que, mediante el artículo 2 de la Resolución Ministerial Nº 232-2018-MINAGRI, de fecha 29 de mayo de 2018, publicada en el Diario Oficial El Peruano con fecha 30 de mayo de 2018, se designó al señor Enrique Antonio Maceda Nicolini, en el cargo de Director Ejecutivo del Proyecto Especial Binacional Puyango Tumbes - Unidad Ejecutora del Ministerio de Agricultura y Riego;

Que, se ha estimado conveniente dejar sin efecto la designación a que se refiere el considerando precedente;

Con los respectivos visados del Despacho Viceministerial de Desarrollo e Infraestructura Agraria y Riego, Secretaría General, Oficina General de Gestión de Recursos Humanos y Oficina General de Asesoría Jurídica;

De conformidad con lo dispuesto por la Ley Nº 29158, Ley Orgánica del Poder Ejecutivo; la Ley Nº 27594, Ley que regula la participación del Poder Ejecutivo en el nombramiento y designación de funcionarios públicos; el Decreto Legislativo Nº 997, Decreto Legislativo que aprueba la Ley de Organización y Funciones del Ministerio de Agricultura y Riego, modificada por la Ley Nº 30048; y su Reglamento de Organización y Funciones, aprobado por Decreto Supremo Nº 008-2014-MINAGRI, y sus modificatorias;

SE RESUELVE:

Artículo 1.- Dejar sin efecto, a partir de la fecha, la designación efectuada mediante Resolución Ministerial Nº 232-2018-MINAGRI.

Artículo 2.- Designar, a partir de la fecha, al señor Manuel Trinidad Leiva Castillo, en el cargo de Director Ejecutivo del Proyecto Especial Binacional Puyango Tumbes del Ministerio de Agricultura y Riego.

Regístrese, comuníquese y publíquese.

GUSTAVO EDUARDO MOSTAJO OCOLA
Ministro de Agricultura y Riego

1655375-1

Prorrogan reserva de recursos hídricos provenientes de los acuíferos de las subcuencas Rumichaca, Huascacocha y Pucará del Sistema Hidrográfico de la cuenca del río Mantaro, para el desarrollo del Proyecto Minero Toromocho de la empresa Minera Chinalco Perú S.A.

RESOLUCIÓN JEFATURAL
Nº 161-2018-ANA

Lima, 1 de junio de 2018

VISTA:

La Carta ECA-VP-032-2018, de fecha 26 de abril de 2018, mediante la cual la empresa MINERA CHINALCO PERÚ S.A., solicita prórroga de la reserva de recursos hídricos otorgada al Proyecto Minero Toromocho; y,

CONSIDERANDO:

Que, según el numeral 5 del artículo 15° de la Ley Nº 29338, Ley de Recursos Hídricos, es función de la Autoridad Nacional del Agua, aprobar previo estudio técnico, reservas de agua por un tiempo determinado cuando así lo requiera el interés de la Nación;

Que, el inciso 208.1 del artículo 208° del Reglamento de la Ley de Recursos Hídricos, aprobado por Decreto Supremo N° 001-2010-AG, establece que la reserva de recursos hídricos se otorga por un período máximo de dos (02) años prorrogables, mientras subsistan las causas que la motivan;

Que, mediante Decreto Supremo N° 027-2006-AG, publicado el 17 de mayo de 2006, se otorgó la reserva de recursos hídricos proveniente del acuífero de las subcuencas Rumichaca, Huascacocha y Pucará del Sistema Hidrográfico de la cuenca del río Mantaro, a favor del Proyecto Minero Toromocho, de propiedad de la empresa CENTROMIN, para fines mineros y poblacionales;

Que, la reserva de recursos hídricos otorgada para el desarrollo del Proyecto Toromocho fue prorrogada mediante Decreto Supremo N° 010-2008-AG, a favor de la empresa CENTROMIN, y por Resoluciones Jefaturales N° 276-2010-ANA, 223-2012-ANA, 192-2014-ANA y 201-2016-ANA, a favor de la empresa MINERA CHINALCO PERÚ S.A., esta última desde el 03 de junio de 2016, por un plazo de dos (02) años y por un volumen anual de 18´025,116.16 m³ (0.57 m³/s de caudal);

Que, mediante carta del visto, la empresa MINERA CHINALCO PERÚ S.A., solicita se prorrogue la reserva del recurso hídrico, con el mismo volumen otorgado mediante la Resolución Jefatural N° 201-2016-ANA;

Que, mediante Resolución Directoral N° 0186-2017-MEM/DGM, de fecha 16 de febrero de 2017, la Dirección General de Minería, aprobó la segunda modificación al Cronograma de Inversión del proyecto Toromocho, ascendente a la suma de US$ 5,832´481,496 (Cinco mil ochocientos treinta y dos millones cuatrocientos ochenta y un mil cuatrocientos noventa y seis con 00/100 Dólares de Estados Unidos de América); monto total comprometido por la empresa MINERA CHINALCO PERÚ S.A., cuyo plazo de ejecución vence en diciembre de 2020;

Que, mediante Memorando N° 973-2018-ANA-DCERH, de fecha 07 de mayo de 2018, la Dirección de Calidad y Evaluación de Recursos Hídricos, remitió el Informe Técnico N° 153-2018-ANA-DCERH-AESFRH, en el que concluye que es procedente otorgar a la empresa MINERA CHINALCO PERÚ S.A., prórroga de reserva de agua subterránea por un volumen anual de 18´025,116.16 m³, (0.57 m³/s de caudal), cuyas aguas provienen de los acuíferos de las subcuencas Rumichaca, Huascacocha y Pucará del Sistema Hidrográfico de la cuenca del río Mantaro, para el desarrollo del Proyecto Minero Toromocho, por un plazo de dos (02) años;

Que, de conformidad con lo previsto en la Resolución Ministerial N° 184-2009-MEM/DM, de fecha 20 de abril de 2009, que resuelve calificar de interés nacional la ejecución del Proyecto Minero Toromocho, ubicado en el distrito Morococha, provincia Yauli, región Junín, corresponde otorgar la prórroga de la reserva de recursos hídricos;

Estando a lo opinado por la Dirección de Calidad y Evaluación de Recursos Hídricos, con el visto de la Gerencia General y la Oficina de Asesoría Jurídica, de conformidad con lo establecido en el artículo 103° de la Ley de Recursos Hídricos y el artículo 206° de su Reglamento, aprobado por Decreto Supremo N° 001-2010-AG;

SE RESUELVE:

Artículo 1°.- Prórroga de reserva de recursos hídricos

Prorróguese, la reserva de recursos hídricos proveniente de los acuíferos de las subcuencas Rumichaca, Huascacocha y Pucará del Sistema Hidrográfico de la cuenca del río Mantaro, otorgada por Decreto Supremo N° 027-2006-AG, cuya última prórroga fue otorgada por Resolución Jefatural N° 201-2016-ANA, para el desarrollo del Proyecto Minero Toromocho, de la empresa MINERA CHINALCO PERÚ S.A., por un plazo de dos (02) años prorrogables, contados desde el 04 de junio de 2018, por un volumen anual de 18´025,116.16 m³, equivalente a un caudal de 0.57 m³/s., con fines mineros y poblacionales.

Artículo 2°.- Supervisión de la reserva de recursos hídricos

La Autoridad Administrativa del Agua Mantaro y la Administración Local de Agua Mantaro, son responsables de supervisar el cumplimiento de lo dispuesto en la presente resolución, debiendo informar periódicamente a la Dirección de Calidad y Evaluación de Recursos Hídricos.

Regístrese, comuníquese y publíquese,

ABELARDO DE LA TORRE VILLANUEVA
Jefe
Autoridad Nacional del Agua

1655265-1

AMBIENTE

Autorizan viaje de servidor del Instituto de Investigaciones de la Amazonía Peruana - IIAP, a Brasil, en comisión de servicios

RESOLUCIÓN MINISTERIAL
N° 217-2018-MINAM

Lima, 31 de mayo de 2018

VISTOS; el Oficio N° 120-2018-IIAP-P de la Presidencia del Instituto de Investigaciones de la Amazonía Peruana–IIAP; el Informe N° 340-2018-MINAM/SG/OGAJ de la Oficina General de Asesoría Jurídica; la Solicitud de Autorización de Viaje al Exterior; y,

CONSIDERANDO:

Que, mediante Decreto Legislativo N° 1013 se crea el Ministerio del Ambiente como organismo del Poder Ejecutivo, con personería jurídica de derecho público, cuya función general es diseñar, establecer y supervisar la política nacional y sectorial ambiental, asumiendo la rectoría con respecto a ella;

Que, de conformidad con lo dispuesto en el artículo 18 del Decreto Legislativo N° 1013, en concordancia con la Sexta Disposición Complementaria Final de la misma norma, el Instituto de Investigaciones de la Amazonía Peruana es un organismo público ejecutor con personería de derecho público interno adscrito al Ministerio del Ambiente;

Que, mediante documento s/n de fecha 16 de marzo de 2018, la Sociedad de Amparo al Desarrollo Tecnológico

ANEXO 2-3
COORDENADAS DE ÁREA EFECTIVA

VERTICES DEL ÁREA DE ACTIVIDAD MINERA

ACTIVIDAD MINERA			
Código	Vertice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
AM-TO-01	1	376265	8717688
AM-TO-01	2	376272	8717654
AM-TO-01	3	376287	8717604
AM-TO-01	4	376311	8717555
AM-TO-01	5	376366	8717497
AM-TO-01	6	376387	8717481
AM-TO-01	7	376401	8717468
AM-TO-01	8	376430	8717432
AM-TO-01	9	376442	8717405
AM-TO-01	10	376457	8717366
AM-TO-01	11	376469	8717348
AM-TO-01	12	376498	8717309
AM-TO-01	13	376511	8717290
AM-TO-01	14	376535	8717241
AM-TO-01	15	376545	8717215
AM-TO-01	16	376564	8717154
AM-TO-01	17	376581	8717101
AM-TO-01	18	376594	8717055
AM-TO-01	19	376605	8717013
AM-TO-01	20	376614	8716973
AM-TO-01	21	376619	8716935
AM-TO-01	22	376623	8716891
AM-TO-01	23	376628	8716811
AM-TO-01	24	376627	8716737
AM-TO-01	25	376625	8716701
AM-TO-01	26	376616	8716626
AM-TO-01	27	376610	8716586
AM-TO-01	28	376590	8716500
AM-TO-01	29	376573	8716432
AM-TO-01	30	376553	8716356
AM-TO-01	31	376532	8716274
AM-TO-01	32	376511	8716193
AM-TO-01	33	376494	8716115
AM-TO-01	34	376483	8716047
AM-TO-01	35	376478	8715985
AM-TO-01	36	376472	8715825
AM-TO-01	37	376461	8715790
AM-TO-01	38	376451	8715773
AM-TO-01	39	376417	8715709
AM-TO-01	40	376401	8715653
AM-TO-01	41	376387	8715612
AM-TO-01	42	376355	8715564
AM-TO-01	43	376333	8715542
AM-TO-01	44	376281	8715505
AM-TO-01	45	376251	8715491
AM-TO-01	46	376219	8715481
AM-TO-01	47	376185	8715476
AM-TO-01	48	376159	8715480
AM-TO-01	49	376087	8715461

ACTIVIDAD MINERA			
Código	Vertice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
AM-TO-01	50	376047	8715432
AM-TO-01	51	376045	8715431
AM-TO-01	52	376017	8715394
AM-TO-01	53	375745	8715311
AM-TO-01	54	375663	8715294
AM-TO-01	55	375599	8715282
AM-TO-01	56	375505	8715269
AM-TO-01	57	375437	8715261
AM-TO-01	58	375410	8715251
AM-TO-01	59	375332	8715217
AM-TO-01	60	375223	8715189
AM-TO-01	61	375151	8715191
AM-TO-01	62	375078	8715214
AM-TO-01	63	375039	8715235
AM-TO-01	64	374999	8715263
AM-TO-01	65	374906	8715345
AM-TO-01	66	374838	8715405
AM-TO-01	67	374782	8715454
AM-TO-01	68	374722	8715507
AM-TO-01	69	374643	8715577
AM-TO-01	70	374623	8715592
AM-TO-01	71	374590	8715608
AM-TO-01	72	374549	8715604
AM-TO-01	73	374522	8715594
AM-TO-01	74	374488	8715561
AM-TO-01	75	374460	8715518
AM-TO-01	76	374440	8715499
AM-TO-01	77	374427	8715495
AM-TO-01	78	374410	8715506
AM-TO-01	79	374390	8715522
AM-TO-01	80	374364	8715550
AM-TO-01	81	374350	8715581
AM-TO-01	82	374312	8715617
AM-TO-01	83	374278	8715635
AM-TO-01	84	374267	8715658
AM-TO-01	85	374268	8715659
AM-TO-01	86	374235	8715710
AM-TO-01	87	374228	8715725
AM-TO-01	88	374198	8715782
AM-TO-01	89	374183	8715813
AM-TO-01	90	374171	8715835
AM-TO-01	91	374159	8715883
AM-TO-01	92	374161	8715937
AM-TO-01	93	374173	8715995
AM-TO-01	94	374192	8716057
AM-TO-01	95	374205	8716089
AM-TO-01	96	374218	8716121
AM-TO-01	97	374238	8716211
AM-TO-01	98	374145	8716415

VERTICES DEL ÁREA DE ACTIVIDAD MINERA

ACTIVIDAD MINERA			
Código	Vertice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
AM-TO-01	99	374144	8716454
AM-TO-01	100	374142	8716489
AM-TO-01	101	374189	8716593
AM-TO-01	102	374189	8716609
AM-TO-01	103	374199	8716655
AM-TO-01	104	374205	8716688
AM-TO-01	105	374221	8716714
AM-TO-01	106	374234	8716744
AM-TO-01	107	374253	8716748
AM-TO-01	108	374262	8716768
AM-TO-01	109	374272	8716771
AM-TO-01	110	374289	8716807
AM-TO-01	111	374299	8716811
AM-TO-01	112	374316	8716839
AM-TO-01	113	374325	8716840
AM-TO-01	114	374342	8716865
AM-TO-01	115	374373	8716864
AM-TO-01	116	374380	8716873
AM-TO-01	117	374396	8716881
AM-TO-01	118	374408	8716897
AM-TO-01	119	374423	8716903
AM-TO-01	120	374429	8716910
AM-TO-01	121	374502	8716976
AM-TO-01	122	374509	8716985
AM-TO-01	123	374519	8716986
AM-TO-01	124	374527	8717000
AM-TO-01	125	374536	8717012
AM-TO-01	126	374543	8717022
AM-TO-01	127	374552	8717021
AM-TO-01	128	374562	8717036
AM-TO-01	129	374592	8717062
AM-TO-01	130	374606	8717070
AM-TO-01	131	374630	8717081
AM-TO-01	132	374658	8717096
AM-TO-01	133	374707	8717124
AM-TO-01	134	374743	8717128
AM-TO-01	135	374768	8717132
AM-TO-01	136	374863	8717157
AM-TO-01	137	374889	8717166
AM-TO-01	138	374920	8717184
AM-TO-01	139	374948	8717203
AM-TO-01	140	374989	8717241
AM-TO-01	141	375020	8717276
AM-TO-01	142	375046	8717309
AM-TO-01	143	375069	8717343
AM-TO-01	144	375090	8717380
AM-TO-01	145	375107	8717419
AM-TO-01	146	375121	8717453
AM-TO-01	147	375134	8717483

ACTIVIDAD MINERA			
Código	Vertice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
AM-TO-01	148	375150	8717512
AM-TO-01	149	375179	8717560
AM-TO-01	150	375187	8717577
AM-TO-01	151	375195	8717592
AM-TO-01	152	375223	8717628
AM-TO-01	153	375236	8717640
AM-TO-01	154	375264	8717661
AM-TO-01	155	375293	8717679
AM-TO-01	156	375324	8717690
AM-TO-01	157	375359	8717696
AM-TO-01	158	375398	8717700
AM-TO-01	159	375444	8717706
AM-TO-01	160	375490	8717710
AM-TO-01	161	375524	8717732
AM-TO-01	162	375550	8717767
AM-TO-01	163	375560	8717788
AM-TO-01	164	375588	8717879
AM-TO-01	165	375605	8717957
AM-TO-01	166	375616	8718003
AM-TO-01	167	375625	8718026
AM-TO-01	168	375635	8718037
AM-TO-01	169	375655	8718047
AM-TO-01	170	375727	8718069
AM-TO-01	171	375807	8718079
AM-TO-01	172	375824	8718077
AM-TO-01	173	375832	8718072
AM-TO-01	174	375872	8718046
AM-TO-01	175	375907	8718023
AM-TO-01	176	375944	8717999
AM-TO-01	177	375983	8717968
AM-TO-01	178	376015	8717942
AM-TO-01	179	376090	8717884
AM-TO-01	180	376111	8717867
AM-TO-01	181	376157	8717831
AM-TO-01	182	376185	8717809
AM-TO-01	183	376226	8717776
AM-TO-01	184	376244	8717758
AM-TO-01	185	376252	8717747
AM-TO-01	186	376259	8717726
AM-TO-02	1	375367	8715194
AM-TO-02	2	375367	8715195
AM-TO-02	3	375367	8715196
AM-TO-02	4	375358	8715228
AM-TO-02	5	375410	8715251
AM-TO-02	6	375437	8715261
AM-TO-02	7	375505	8715269
AM-TO-02	8	375599	8715282
AM-TO-02	9	375663	8715294
AM-TO-02	10	375696	8715301

VERTICES DEL ÁREA DE ACTIVIDAD MINERA

ACTIVIDAD MINERA			
Código	Vertice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
AM-TO-02	11	375733	8715308
AM-TO-02	12	375745	8715311
AM-TO-02	13	375854	8715344
AM-TO-02	14	375876	8715351
AM-TO-02	15	376017	8715394
AM-TO-02	16	376012	8715365
AM-TO-02	17	376010	8715345
AM-TO-02	18	376006	8715287
AM-TO-02	19	376063	8715145
AM-TO-02	20	376013	8715072
AM-TO-02	21	375830	8715089
AM-TO-02	22	375794	8715078
AM-TO-02	23	375733	8714990
AM-TO-02	24	375721	8714960
AM-TO-02	25	375645	8714948
AM-TO-02	26	375806	8713950
AM-TO-02	27	376037	8713997
AM-TO-02	28	376250	8714041
AM-TO-02	29	376385	8714081
AM-TO-02	30	376550	8714102
AM-TO-02	31	376670	8714127
AM-TO-02	32	376740	8714003
AM-TO-02	33	376732	8713859
AM-TO-02	34	376722	8713705
AM-TO-02	35	377029	8713720
AM-TO-02	36	377158	8713662
AM-TO-02	37	377327	8713389
AM-TO-02	38	377320	8713215
AM-TO-02	39	377401	8713073
AM-TO-02	40	377438	8712932
AM-TO-02	41	377532	8712842
AM-TO-02	42	377619	8712697
AM-TO-02	43	377652	8712602
AM-TO-02	44	377711	8712458
AM-TO-02	45	377757	8712303
AM-TO-02	46	377648	8712208
AM-TO-02	47	377694	8712066
AM-TO-02	48	377606	8711933
AM-TO-02	49	377741	8711606
AM-TO-02	50	377747	8711505
AM-TO-02	51	377789	8711303
AM-TO-02	52	377903	8711135
AM-TO-02	53	377994	8710992
AM-TO-02	54	378150	8710833
AM-TO-02	55	378154	8710673
AM-TO-02	56	378048	8710122
AM-TO-02	57	377713	8709819
AM-TO-02	58	377562	8709709
AM-TO-02	59	377589	8709571

VERTICES DEL ÁREA DE ACTIVIDAD MINERA

ACTIVIDAD MINERA			
Código	Vertice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
AM-TO-02	60	376855	8708829
AM-TO-02	61	376454	8708424
AM-TO-02	62	376451	8708425
AM-TO-02	63	376389	8708460
AM-TO-02	64	376233	8708589
AM-TO-02	65	376185	8708677
AM-TO-02	66	376102	8708761
AM-TO-02	67	376042	8708796
AM-TO-02	68	375872	8709048
AM-TO-02	69	375822	8709088
AM-TO-02	70	375667	8709149
AM-TO-02	71	375640	8709229
AM-TO-02	72	375590	8709270
AM-TO-02	73	375527	8709371
AM-TO-02	74	375455	8709405
AM-TO-02	75	375329	8709438
AM-TO-02	76	375301	8709408
AM-TO-02	77	375211	8709439
AM-TO-02	78	375116	8709499
AM-TO-02	79	374912	8709607
AM-TO-02	80	374866	8709682
AM-TO-02	81	374791	8709755
AM-TO-02	82	374592	8709889
AM-TO-02	83	374628	8710041
AM-TO-02	84	374900	8710969
AM-TO-02	85	374844	8711190
AM-TO-02	86	374889	8711383
AM-TO-02	87	374791	8711541
AM-TO-02	88	374802	8711653
AM-TO-02	89	375244	8712106
AM-TO-02	90	375189	8712265
AM-TO-02	91	375221	8712442
AM-TO-02	92	375240	8712552
AM-TO-02	93	375344	8712738
AM-TO-02	94	375362	8712843
AM-TO-02	95	375533	8713065
AM-TO-02	96	375448	8713475
AM-TO-02	97	375443	8713653
AM-TO-02	98	375536	8713781
AM-TO-02	99	375536	8713781
AM-TO-02	100	375405	8714566
AM-TO-02	101	375372	8715158
AM-TO-02	102	375371	8715180

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-01	1	374837	8721695
UM-TO-01	2	375653	8721274
UM-TO-01	3	376005	8721298
UM-TO-01	4	377112	8720594
UM-TO-01	5	377160	8719897
UM-TO-01	6	376994	8719524
UM-TO-01	7	376880	8719401
UM-TO-01	8	376716	8719386
UM-TO-01	9	376588	8719410
UM-TO-01	10	376013	8719893
UM-TO-01	11	375445	8720320
UM-TO-01	12	375133	8720491
UM-TO-01	13	375026	8720424
UM-TO-01	14	375054	8719938
UM-TO-01	15	375103	8719697
UM-TO-01	16	375216	8719361
UM-TO-01	17	375371	8719084
UM-TO-01	18	375618	8718686
UM-TO-01	19	375427	8718494
UM-TO-01	20	375125	8718394
UM-TO-01	21	374781	8719062
UM-TO-01	22	374227	8719296
UM-TO-01	23	374191	8719306
UM-TO-01	24	374125	8719328
UM-TO-01	25	374004	8719319
UM-TO-01	26	373903	8719323
UM-TO-01	27	373847	8719339
UM-TO-01	28	373717	8719455
UM-TO-01	29	373666	8719472
UM-TO-01	30	373608	8719472
UM-TO-01	31	373443	8719432
UM-TO-01	32	373352	8719420
UM-TO-01	33	373308	8719417
UM-TO-01	34	373279	8719423
UM-TO-01	35	373082	8719319
UM-TO-01	36	372992	8719366
UM-TO-01	37	372966	8719360
UM-TO-01	38	372923	8719321
UM-TO-01	39	372788	8719282
UM-TO-01	40	372684	8719262
UM-TO-01	41	372580	8719270
UM-TO-01	42	372502	8719297
UM-TO-01	43	372477	8719370
UM-TO-01	44	372412	8720971
UM-TO-01	45	372905	8721319
UM-TO-01	46	373534	8721516
UM-TO-01	47	374164	8721292
UM-TO-02	1	383556	8720296
UM-TO-02	2	384848	8719077
UM-TO-02	3	384852	8718945

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-02	4	384852	8718935
UM-TO-02	5	384841	8718912
UM-TO-02	6	384841	8718911
UM-TO-02	7	384831	8718893
UM-TO-02	8	384830	8718887
UM-TO-02	9	384828	8718911
UM-TO-02	10	384826	8718918
UM-TO-02	11	384823	8718922
UM-TO-02	12	384819	8718925
UM-TO-02	13	384815	8718928
UM-TO-02	14	384811	8718930
UM-TO-02	15	384806	8718930
UM-TO-02	16	384801	8718929
UM-TO-02	17	384796	8718928
UM-TO-02	18	384772	8718915
UM-TO-02	19	384763	8718912
UM-TO-02	20	384758	8718910
UM-TO-02	21	384752	8718909
UM-TO-02	22	384746	8718909
UM-TO-02	23	384740	8718909
UM-TO-02	24	384577	8718928
UM-TO-02	25	384569	8718929
UM-TO-02	26	384563	8718928
UM-TO-02	27	384469	8718919
UM-TO-02	28	384444	8718940
UM-TO-02	29	384449	8718988
UM-TO-02	30	384450	8719000
UM-TO-02	31	384449	8719006
UM-TO-02	32	384448	8719012
UM-TO-02	33	384447	8719018
UM-TO-02	34	384445	8719023
UM-TO-02	35	384443	8719029
UM-TO-02	36	384441	8719035
UM-TO-02	37	384438	8719040
UM-TO-02	38	384435	8719045
UM-TO-02	39	384407	8719086
UM-TO-02	40	384400	8719094
UM-TO-02	41	384396	8719099
UM-TO-02	42	384391	8719103
UM-TO-02	43	384387	8719106
UM-TO-02	44	384382	8719110
UM-TO-02	45	384376	8719113
UM-TO-02	46	384371	8719115
UM-TO-02	47	384365	8719118
UM-TO-02	48	384145	8719197
UM-TO-02	49	384140	8719200
UM-TO-02	50	384137	8719203
UM-TO-02	51	384055	8719281
UM-TO-02	52	384050	8719285
UM-TO-02	53	384044	8719288

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-02	54	384039	8719291
UM-TO-02	55	384033	8719293
UM-TO-02	56	384027	8719294
UM-TO-02	57	384021	8719294
UM-TO-02	58	384015	8719294
UM-TO-02	59	383970	8719290
UM-TO-02	60	383961	8719289
UM-TO-02	61	383955	8719290
UM-TO-02	62	383949	8719291
UM-TO-02	63	383943	8719292
UM-TO-02	64	383938	8719294
UM-TO-02	65	383932	8719296
UM-TO-02	66	383927	8719299
UM-TO-02	67	383922	8719302
UM-TO-02	68	383906	8719312
UM-TO-02	69	383900	8719316
UM-TO-02	70	383894	8719318
UM-TO-02	71	383889	8719319
UM-TO-02	72	383883	8719320
UM-TO-02	73	383877	8719320
UM-TO-02	74	383871	8719319
UM-TO-02	75	383777	8719303
UM-TO-02	76	383769	8719302
UM-TO-02	77	383763	8719302
UM-TO-02	78	383757	8719303
UM-TO-02	79	383752	8719304
UM-TO-02	80	383667	8719329
UM-TO-02	81	383636	8719337
UM-TO-02	82	383622	8719339
UM-TO-02	83	383575	8719343
UM-TO-02	84	383569	8719348
UM-TO-02	85	383562	8719355
UM-TO-02	86	383559	8719358
UM-TO-02	87	383499	8719315
UM-TO-02	88	383481	8719340
UM-TO-02	89	383462	8719366
UM-TO-02	90	383414	8719429
UM-TO-02	91	383410	8719435
UM-TO-02	92	383401	8719447
UM-TO-02	93	383378	8719482
UM-TO-02	94	383362	8719507
UM-TO-02	95	383346	8719529
UM-TO-02	96	383335	8719542
UM-TO-02	97	383292	8719586
UM-TO-02	98	383278	8719598
UM-TO-02	99	383253	8719609
UM-TO-02	100	383245	8719614
UM-TO-02	101	383239	8719620
UM-TO-02	102	383226	8719643
UM-TO-02	103	383157	8719710

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-02	104	383084	8719644
UM-TO-02	105	382989	8719768
UM-TO-02	106	383266	8720021
UM-TO-02	107	383315	8720065
UM-TO-02	108	383395	8720136
UM-TO-03	1	377207	8718221
UM-TO-03	2	377274	8718125
UM-TO-03	3	377951	8718125
UM-TO-03	4	377888	8717778
UM-TO-03	5	379369	8717393
UM-TO-03	6	379351	8717388
UM-TO-03	7	379325	8717380
UM-TO-03	8	379294	8717375
UM-TO-03	9	379262	8717372
UM-TO-03	10	379201	8717369
UM-TO-03	11	379157	8717365
UM-TO-03	12	379083	8717360
UM-TO-03	13	379056	8717360
UM-TO-03	14	379029	8717363
UM-TO-03	15	378964	8717392
UM-TO-03	16	378895	8717424
UM-TO-03	17	378822	8717458
UM-TO-03	18	378746	8717488
UM-TO-03	19	378684	8717510
UM-TO-03	20	378640	8717523
UM-TO-03	21	378612	8717526
UM-TO-03	22	378576	8717528
UM-TO-03	23	378514	8717521
UM-TO-03	24	378472	8717515
UM-TO-03	25	378435	8717511
UM-TO-03	26	378413	8717501
UM-TO-03	27	378390	8717484
UM-TO-03	28	378359	8717456
UM-TO-03	29	378323	8717428
UM-TO-03	30	378295	8717404
UM-TO-03	31	378256	8717378
UM-TO-03	32	378205	8717351
UM-TO-03	33	378169	8717328
UM-TO-03	34	378129	8717305
UM-TO-03	35	378086	8717283
UM-TO-03	36	378055	8717268
UM-TO-03	37	378011	8717261
UM-TO-03	38	377954	8717258
UM-TO-03	39	377916	8717247
UM-TO-03	40	377888	8717228
UM-TO-03	41	377845	8717192
UM-TO-03	42	377823	8717171
UM-TO-03	43	377785	8717141
UM-TO-03	44	377753	8717127
UM-TO-03	45	377720	8717125

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-03	46	377663	8717132
UM-TO-03	47	377610	8717140
UM-TO-03	48	377553	8717150
UM-TO-03	49	377503	8717159
UM-TO-03	50	377455	8717170
UM-TO-03	51	377416	8717173
UM-TO-03	52	377392	8717167
UM-TO-03	53	377358	8717158
UM-TO-03	54	377324	8717156
UM-TO-03	55	377287	8717167
UM-TO-03	56	377250	8717183
UM-TO-03	57	377204	8717203
UM-TO-03	58	377162	8717222
UM-TO-03	59	377135	8717243
UM-TO-03	60	377114	8717275
UM-TO-03	61	377099	8717296
UM-TO-03	62	377080	8717314
UM-TO-03	63	377034	8717334
UM-TO-03	64	376975	8717361
UM-TO-03	65	376936	8717375
UM-TO-03	66	376910	8717378
UM-TO-03	67	376884	8717375
UM-TO-03	68	376864	8717379
UM-TO-03	69	376848	8717392
UM-TO-03	70	376848	8717408
UM-TO-03	71	376871	8717438
UM-TO-03	72	376948	8717473
UM-TO-03	73	377021	8717495
UM-TO-03	74	377170	8717540
UM-TO-03	75	377226	8717561
UM-TO-03	76	377246	8717581
UM-TO-03	77	377252	8717596
UM-TO-03	78	377246	8717620
UM-TO-03	79	377197	8717671
UM-TO-03	80	377150	8717743
UM-TO-03	81	377148	8717806
UM-TO-03	82	377146	8717888
UM-TO-03	83	377082	8717933
UM-TO-03	84	377014	8717992
UM-TO-03	85	377014	8718021
UM-TO-03	86	377078	8718092
UM-TO-03	87	377117	8718177
UM-TO-04	1	375332	8715217
UM-TO-04	2	375358	8715228
UM-TO-04	3	375367	8715196
UM-TO-04	4	375367	8715195
UM-TO-04	5	375371	8715180
UM-TO-04	6	375405	8714566
UM-TO-04	7	375536	8713781
UM-TO-04	8	375291	8713977

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-04	9	374897	8714558
UM-TO-04	10	374893	8714565
UM-TO-04	11	374890	8714568
UM-TO-04	12	374890	8714568
UM-TO-04	13	374890	8714568
UM-TO-04	14	374804	8714560
UM-TO-04	15	374608	8714540
UM-TO-04	16	374356	8714516
UM-TO-04	17	374015	8714482
UM-TO-04	18	374015	8714482
UM-TO-04	19	373917	8714673
UM-TO-04	20	373885	8714734
UM-TO-04	21	373795	8714910
UM-TO-04	22	373174	8715447
UM-TO-04	23	373078	8715499
UM-TO-04	24	372734	8715687
UM-TO-04	25	372469	8715709
UM-TO-04	26	372467	8715709
UM-TO-04	27	372224	8715730
UM-TO-04	28	372218	8715730
UM-TO-04	29	372198	8715729
UM-TO-04	30	371950	8715722
UM-TO-04	31	371961	8715785
UM-TO-04	32	372014	8715818
UM-TO-04	33	372039	8715860
UM-TO-04	34	372113	8715926
UM-TO-04	35	372115	8715970
UM-TO-04	36	372134	8716006
UM-TO-04	37	372137	8716046
UM-TO-04	38	372132	8716078
UM-TO-04	39	372137	8716105
UM-TO-04	40	372169	8716165
UM-TO-04	41	372224	8716200
UM-TO-04	42	372267	8716296
UM-TO-04	43	372315	8716364
UM-TO-04	44	372345	8716440
UM-TO-04	45	372356	8716515
UM-TO-04	46	372375	8716618
UM-TO-04	47	372384	8716656
UM-TO-04	48	372397	8716700
UM-TO-04	49	372403	8716709
UM-TO-04	50	372408	8716746
UM-TO-04	51	372420	8716787
UM-TO-04	52	372499	8717145
UM-TO-04	53	372566	8717431
UM-TO-04	54	372635	8717425
UM-TO-04	55	372743	8717405
UM-TO-04	56	372874	8717383
UM-TO-04	57	373086	8717365
UM-TO-04	58	373274	8717364

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-04	59	373334	8717368
UM-TO-04	60	373443	8717390
UM-TO-04	61	373512	8717392
UM-TO-04	62	373587	8717412
UM-TO-04	63	373635	8717406
UM-TO-04	64	373705	8717405
UM-TO-04	65	373753	8717419
UM-TO-04	66	373795	8717452
UM-TO-04	67	373845	8717494
UM-TO-04	68	373882	8717543
UM-TO-04	69	373901	8717625
UM-TO-04	70	373906	8717642
UM-TO-04	71	373953	8717670
UM-TO-04	72	374034	8717734
UM-TO-04	73	374070	8717751
UM-TO-04	74	374093	8717744
UM-TO-04	75	374120	8717726
UM-TO-04	76	374164	8717697
UM-TO-04	77	374230	8717645
UM-TO-04	78	374239	8717632
UM-TO-04	79	374244	8717614
UM-TO-04	80	374243	8717593
UM-TO-04	81	374233	8717568
UM-TO-04	82	374222	8717545
UM-TO-04	83	374214	8717517
UM-TO-04	84	374218	8717488
UM-TO-04	85	374230	8717452
UM-TO-04	86	374253	8717383
UM-TO-04	87	374296	8717310
UM-TO-04	88	374340	8717252
UM-TO-04	89	374368	8717231
UM-TO-04	90	374389	8717223
UM-TO-04	91	374423	8717219
UM-TO-04	92	374499	8717218
UM-TO-04	93	374594	8717220
UM-TO-04	94	374711	8717226
UM-TO-04	95	374755	8717225
UM-TO-04	96	374789	8717232
UM-TO-04	97	374828	8717248
UM-TO-04	98	374892	8717279
UM-TO-04	99	374926	8717314
UM-TO-04	100	374946	8717346
UM-TO-04	101	374965	8717377
UM-TO-04	102	374976	8717388
UM-TO-04	103	375010	8717452
UM-TO-04	104	375032	8717512
UM-TO-04	105	375055	8717550
UM-TO-04	106	375097	8717604
UM-TO-04	107	375109	8717638
UM-TO-04	108	375115	8717681

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-04	109	375118	8717695
UM-TO-04	110	375129	8717711
UM-TO-04	111	375169	8717732
UM-TO-04	112	375260	8717771
UM-TO-04	113	375357	8717796
UM-TO-04	114	375396	8717796
UM-TO-04	115	375449	8717806
UM-TO-04	116	375469	8717816
UM-TO-04	117	375493	8717885
UM-TO-04	118	375520	8718023
UM-TO-04	119	375527	8718069
UM-TO-04	120	375534	8718093
UM-TO-04	121	375547	8718117
UM-TO-04	122	375603	8718182
UM-TO-04	123	375649	8718237
UM-TO-04	124	375675	8718278
UM-TO-04	125	375689	8718291
UM-TO-04	126	375707	8718292
UM-TO-04	127	375723	8718285
UM-TO-04	128	375737	8718268
UM-TO-04	129	375767	8718220
UM-TO-04	130	375780	8718210
UM-TO-04	131	375823	8718189
UM-TO-04	132	375921	8718126
UM-TO-04	133	375971	8718094
UM-TO-04	134	376022	8718062
UM-TO-04	135	376083	8718015
UM-TO-04	136	376158	8717965
UM-TO-04	137	376227	8717921
UM-TO-04	138	376259	8717903
UM-TO-04	139	376305	8717870
UM-TO-04	140	376323	8717844
UM-TO-04	141	376336	8717819
UM-TO-04	142	376355	8717750
UM-TO-04	143	376370	8717682
UM-TO-04	144	376377	8717642
UM-TO-04	145	376395	8717601
UM-TO-04	146	376429	8717568
UM-TO-04	147	376482	8717535
UM-TO-04	148	376517	8717507
UM-TO-04	149	376525	8717493
UM-TO-04	150	376541	8717437
UM-TO-04	151	376549	8717411
UM-TO-04	152	376563	8717384
UM-TO-04	153	376582	8717354
UM-TO-04	154	376595	8717340
UM-TO-04	155	376593	8717305
UM-TO-04	156	376593	8717270
UM-TO-04	157	376589	8717227
UM-TO-04	158	376584	8717174

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-04	159	376587	8717125
UM-TO-04	160	376596	8717072
UM-TO-04	161	376622	8716981
UM-TO-04	162	376643	8716922
UM-TO-04	163	376700	8716862
UM-TO-04	164	376722	8716834
UM-TO-04	165	376730	8716810
UM-TO-04	166	376721	8716740
UM-TO-04	167	376748	8716735
UM-TO-04	168	376746	8716721
UM-TO-04	169	376737	8716691
UM-TO-04	170	376797	8716671
UM-TO-04	171	376797	8716671
UM-TO-04	172	376812	8716693
UM-TO-04	173	376816	8716699
UM-TO-04	174	376819	8716708
UM-TO-04	175	376821	8716721
UM-TO-04	176	376820	8716740
UM-TO-04	177	376827	8716741
UM-TO-04	178	376828	8716757
UM-TO-04	179	376827	8716764
UM-TO-04	180	376827	8716771
UM-TO-04	181	376826	8716774
UM-TO-04	182	376820	8716774
UM-TO-04	183	376816	8716773
UM-TO-04	184	376802	8716770
UM-TO-04	185	376799	8716766
UM-TO-04	186	376797	8716762
UM-TO-04	187	376787	8716759
UM-TO-04	188	376773	8716757
UM-TO-04	189	376771	8716745
UM-TO-04	190	376755	8716746
UM-TO-04	191	376735	8716750
UM-TO-04	192	376745	8716811
UM-TO-04	193	376738	8716832
UM-TO-04	194	376729	8716853
UM-TO-04	195	376673	8716916
UM-TO-04	196	376651	8716940
UM-TO-04	197	376609	8717084
UM-TO-04	198	376600	8717131
UM-TO-04	199	376597	8717187
UM-TO-04	200	376606	8717294
UM-TO-04	201	376610	8717329
UM-TO-04	202	376629	8717321
UM-TO-04	203	376656	8717315
UM-TO-04	204	376680	8717311
UM-TO-04	205	376686	8717291
UM-TO-04	206	376686	8717291
UM-TO-04	207	376735	8717299
UM-TO-04	208	376797	8717314

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-04	209	376853	8717322
UM-TO-04	210	376886	8717327
UM-TO-04	211	376903	8717325
UM-TO-04	212	376933	8717313
UM-TO-04	213	377018	8717264
UM-TO-04	214	377042	8717248
UM-TO-04	215	377086	8717210
UM-TO-04	216	377150	8717170
UM-TO-04	217	377257	8717116
UM-TO-04	218	377284	8717105
UM-TO-04	219	377328	8717097
UM-TO-04	220	377351	8717100
UM-TO-04	221	377387	8717113
UM-TO-04	222	377422	8717119
UM-TO-04	223	377445	8717119
UM-TO-04	224	377473	8717113
UM-TO-04	225	377534	8717001
UM-TO-04	226	377490	8716704
UM-TO-04	227	377530	8716645
UM-TO-04	228	377651	8716624
UM-TO-04	229	377688	8716667
UM-TO-04	230	377783	8716855
UM-TO-04	231	377721	8716868
UM-TO-04	232	377709	8716974
UM-TO-04	233	377739	8717049
UM-TO-04	234	377752	8717117
UM-TO-04	235	377762	8717122
UM-TO-04	236	377786	8717118
UM-TO-04	237	377875	8717188
UM-TO-04	238	377920	8717219
UM-TO-04	239	377951	8717224
UM-TO-04	240	377994	8717212
UM-TO-04	241	378142	8717249
UM-TO-04	242	378182	8717267
UM-TO-04	243	378213	8717287
UM-TO-04	244	378237	8717306
UM-TO-04	245	378300	8717372
UM-TO-04	246	378317	8717385
UM-TO-04	247	378342	8717400
UM-TO-04	248	378478	8717450
UM-TO-04	249	378534	8717464
UM-TO-04	250	378612	8717472
UM-TO-04	251	379017	8717317
UM-TO-04	252	379157	8717311
UM-TO-04	253	379244	8717323
UM-TO-04	254	379330	8717344
UM-TO-04	255	379382	8717359
UM-TO-04	256	379456	8717168
UM-TO-04	257	379528	8716982
UM-TO-04	258	379479	8716985

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-04	259	379580	8716388
UM-TO-04	260	379781	8716420
UM-TO-04	261	379921	8716393
UM-TO-04	262	380018	8717016
UM-TO-04	263	379808	8717089
UM-TO-04	264	379736	8717276
UM-TO-04	265	379663	8717459
UM-TO-04	266	379833	8717521
UM-TO-04	267	379976	8717531
UM-TO-04	268	380031	8717544
UM-TO-04	269	380093	8717576
UM-TO-04	270	380461	8716798
UM-TO-04	271	381092	8715985
UM-TO-04	272	380569	8715432
UM-TO-04	273	380511	8715371
UM-TO-04	274	379640	8714451
UM-TO-04	275	378243	8714446
UM-TO-04	276	377866	8714441
UM-TO-04	277	377586	8714344
UM-TO-04	278	376670	8714127
UM-TO-04	279	376559	8714104
UM-TO-04	280	376550	8714102
UM-TO-04	281	376385	8714081
UM-TO-04	282	376250	8714041
UM-TO-04	283	376037	8713997
UM-TO-04	284	375806	8713950
UM-TO-04	285	375645	8714948
UM-TO-04	286	375721	8714960
UM-TO-04	287	375733	8714990
UM-TO-04	288	375794	8715078
UM-TO-04	289	375830	8715089
UM-TO-04	290	376013	8715072
UM-TO-04	291	376063	8715145
UM-TO-04	292	376006	8715287
UM-TO-04	293	376012	8715365
UM-TO-04	294	376017	8715394
UM-TO-04	295	376045	8715431
UM-TO-04	296	376047	8715432
UM-TO-04	297	376087	8715461
UM-TO-04	298	376159	8715480
UM-TO-04	299	376185	8715476
UM-TO-04	300	376219	8715481
UM-TO-04	301	376251	8715491
UM-TO-04	302	376281	8715505
UM-TO-04	303	376333	8715542
UM-TO-04	304	376355	8715564
UM-TO-04	305	376387	8715612
UM-TO-04	306	376401	8715653
UM-TO-04	307	376417	8715709
UM-TO-04	308	376451	8715773

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-04	309	376461	8715790
UM-TO-04	310	376472	8715825
UM-TO-04	311	376478	8715985
UM-TO-04	312	376483	8716047
UM-TO-04	313	376494	8716115
UM-TO-04	314	376511	8716193
UM-TO-04	315	376532	8716274
UM-TO-04	316	376553	8716356
UM-TO-04	317	376573	8716432
UM-TO-04	318	376590	8716500
UM-TO-04	319	376610	8716586
UM-TO-04	320	376616	8716626
UM-TO-04	321	376625	8716701
UM-TO-04	322	376627	8716737
UM-TO-04	323	376628	8716811
UM-TO-04	324	376623	8716891
UM-TO-04	325	376619	8716935
UM-TO-04	326	376614	8716973
UM-TO-04	327	376605	8717013
UM-TO-04	328	376594	8717055
UM-TO-04	329	376581	8717101
UM-TO-04	330	376564	8717154
UM-TO-04	331	376545	8717215
UM-TO-04	332	376535	8717241
UM-TO-04	333	376511	8717290
UM-TO-04	334	376498	8717309
UM-TO-04	335	376469	8717348
UM-TO-04	336	376457	8717366
UM-TO-04	337	376442	8717405
UM-TO-04	338	376430	8717432
UM-TO-04	339	376401	8717468
UM-TO-04	340	376387	8717481
UM-TO-04	341	376366	8717497
UM-TO-04	342	376311	8717555
UM-TO-04	343	376287	8717604
UM-TO-04	344	376272	8717654
UM-TO-04	345	376265	8717688
UM-TO-04	346	376259	8717726
UM-TO-04	347	376252	8717747
UM-TO-04	348	376244	8717758
UM-TO-04	349	376226	8717776
UM-TO-04	350	376185	8717809
UM-TO-04	351	376157	8717831
UM-TO-04	352	376111	8717867
UM-TO-04	353	376090	8717884
UM-TO-04	354	376015	8717942
UM-TO-04	355	375983	8717968
UM-TO-04	356	375944	8717999
UM-TO-04	357	375907	8718023
UM-TO-04	358	375872	8718046

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-04	359	375832	8718072
UM-TO-04	360	375824	8718077
UM-TO-04	361	375807	8718079
UM-TO-04	362	375727	8718069
UM-TO-04	363	375655	8718047
UM-TO-04	364	375635	8718037
UM-TO-04	365	375625	8718026
UM-TO-04	366	375616	8718003
UM-TO-04	367	375605	8717957
UM-TO-04	368	375588	8717879
UM-TO-04	369	375560	8717788
UM-TO-04	370	375550	8717767
UM-TO-04	371	375524	8717732
UM-TO-04	372	375490	8717710
UM-TO-04	373	375444	8717706
UM-TO-04	374	375398	8717700
UM-TO-04	375	375359	8717696
UM-TO-04	376	375324	8717690
UM-TO-04	377	375293	8717679
UM-TO-04	378	375264	8717661
UM-TO-04	379	375236	8717640
UM-TO-04	380	375223	8717628
UM-TO-04	381	375195	8717592
UM-TO-04	382	375187	8717577
UM-TO-04	383	375179	8717560
UM-TO-04	384	375150	8717512
UM-TO-04	385	375134	8717483
UM-TO-04	386	375121	8717453
UM-TO-04	387	375107	8717419
UM-TO-04	388	375090	8717380
UM-TO-04	389	375069	8717343
UM-TO-04	390	375046	8717309
UM-TO-04	391	375020	8717276
UM-TO-04	392	374989	8717241
UM-TO-04	393	374948	8717203
UM-TO-04	394	374920	8717184
UM-TO-04	395	374889	8717166
UM-TO-04	396	374863	8717157
UM-TO-04	397	374768	8717132
UM-TO-04	398	374743	8717128
UM-TO-04	399	374707	8717124
UM-TO-04	400	374658	8717096
UM-TO-04	401	374630	8717081
UM-TO-04	402	374606	8717070
UM-TO-04	403	374592	8717062
UM-TO-04	404	374562	8717036
UM-TO-04	405	374552	8717021
UM-TO-04	406	374543	8717022
UM-TO-04	407	374536	8717012
UM-TO-04	408	374527	8717000

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-04	409	374519	8716986
UM-TO-04	410	374509	8716985
UM-TO-04	411	374502	8716976
UM-TO-04	412	374429	8716910
UM-TO-04	413	374423	8716903
UM-TO-04	414	374408	8716897
UM-TO-04	415	374396	8716881
UM-TO-04	416	374380	8716873
UM-TO-04	417	374373	8716864
UM-TO-04	418	374342	8716865
UM-TO-04	419	374325	8716840
UM-TO-04	420	374316	8716839
UM-TO-04	421	374299	8716811
UM-TO-04	422	374289	8716807
UM-TO-04	423	374272	8716771
UM-TO-04	424	374262	8716768
UM-TO-04	425	374253	8716748
UM-TO-04	426	374234	8716744
UM-TO-04	427	374221	8716714
UM-TO-04	428	374205	8716688
UM-TO-04	429	374199	8716655
UM-TO-04	430	374189	8716609
UM-TO-04	431	374189	8716593
UM-TO-04	432	374142	8716489
UM-TO-04	433	374144	8716454
UM-TO-04	434	374145	8716415
UM-TO-04	435	374238	8716211
UM-TO-04	436	374218	8716121
UM-TO-04	437	374205	8716089
UM-TO-04	438	374192	8716057
UM-TO-04	439	374173	8715995
UM-TO-04	440	374161	8715937
UM-TO-04	441	374159	8715883
UM-TO-04	442	374171	8715835
UM-TO-04	443	374183	8715813
UM-TO-04	444	374198	8715782
UM-TO-04	445	374228	8715725
UM-TO-04	446	374235	8715710
UM-TO-04	447	374268	8715659
UM-TO-04	448	374267	8715658
UM-TO-04	449	374278	8715635
UM-TO-04	450	374312	8715617
UM-TO-04	451	374350	8715581
UM-TO-04	452	374364	8715550
UM-TO-04	453	374390	8715522
UM-TO-04	454	374410	8715506
UM-TO-04	455	374427	8715495
UM-TO-04	456	374440	8715499
UM-TO-04	457	374460	8715518
UM-TO-04	458	374488	8715561

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-04	459	374522	8715594
UM-TO-04	460	374549	8715604
UM-TO-04	461	374590	8715608
UM-TO-04	462	374623	8715592
UM-TO-04	463	374643	8715577
UM-TO-04	464	374722	8715507
UM-TO-04	465	374782	8715454
UM-TO-04	466	374838	8715405
UM-TO-04	467	374906	8715345
UM-TO-04	468	374999	8715263
UM-TO-04	469	375039	8715235
UM-TO-04	470	375078	8715214
UM-TO-04	471	375151	8715191
UM-TO-04	472	375223	8715189
UM-TO-05	1	389207	8715828
UM-TO-05	2	389349	8715782
UM-TO-05	3	389539	8715718
UM-TO-05	4	389579	8715713
UM-TO-05	5	389655	8715710
UM-TO-05	6	389716	8715710
UM-TO-05	7	389745	8715703
UM-TO-05	8	389776	8715691
UM-TO-05	9	389831	8715666
UM-TO-05	10	389852	8715660
UM-TO-05	11	389867	8715657
UM-TO-05	12	389912	8715656
UM-TO-05	13	389973	8715659
UM-TO-05	14	390002	8715654
UM-TO-05	15	390039	8715645
UM-TO-05	16	390077	8715629
UM-TO-05	17	390146	8715596
UM-TO-05	18	390211	8715567
UM-TO-05	19	390242	8715558
UM-TO-05	20	390269	8715554
UM-TO-05	21	390302	8715549
UM-TO-05	22	390358	8715542
UM-TO-05	23	390414	8715526
UM-TO-05	24	390514	8715488
UM-TO-05	25	390543	8715477
UM-TO-05	26	390603	8715457
UM-TO-05	27	390669	8715437
UM-TO-05	28	390648	8715299
UM-TO-05	29	390903	8714987
UM-TO-05	30	390093	8715099
UM-TO-05	31	390097	8715304
UM-TO-05	32	389900	8715463
UM-TO-05	33	389648	8715569
UM-TO-05	34	389316	8715650
UM-TO-05	35	389258	8715214
UM-TO-05	36	389125	8715232

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-06	1	377982	8706946
UM-TO-06	2	378046	8706888
UM-TO-06	3	378067	8706870
UM-TO-06	4	378098	8706837
UM-TO-06	5	378148	8706791
UM-TO-06	6	378157	8706782
UM-TO-06	7	378172	8706767
UM-TO-06	8	378253	8706725
UM-TO-06	9	378294	8706695
UM-TO-06	10	378347	8706637
UM-TO-06	11	378368	8706622
UM-TO-06	12	378381	8706614
UM-TO-06	13	378412	8706609
UM-TO-06	14	378533	8706613
UM-TO-06	15	378570	8706616
UM-TO-06	16	378596	8706616
UM-TO-06	17	378648	8706601
UM-TO-06	18	378689	8706597
UM-TO-06	19	378718	8706603
UM-TO-06	20	378756	8706623
UM-TO-06	21	378771	8706640
UM-TO-06	22	378784	8706663
UM-TO-06	23	378864	8706776
UM-TO-06	24	378878	8706795
UM-TO-06	25	378895	8706827
UM-TO-06	26	378902	8706846
UM-TO-06	27	378906	8706872
UM-TO-06	28	378909	8706938
UM-TO-06	29	378908	8707000
UM-TO-06	30	378913	8707033
UM-TO-06	31	378924	8707065
UM-TO-06	32	378947	8707102
UM-TO-06	33	378963	8707120
UM-TO-06	34	378984	8707154
UM-TO-06	35	379008	8707199
UM-TO-06	36	379005	8707210
UM-TO-06	37	379019	8707229
UM-TO-06	38	379026	8707261
UM-TO-06	39	379044	8707286
UM-TO-06	40	379026	8707300
UM-TO-06	41	379094	8707388
UM-TO-06	42	379093	8707444
UM-TO-06	43	379096	8707523
UM-TO-06	44	379087	8707547
UM-TO-06	45	379127	8707541
UM-TO-06	46	379138	8707508
UM-TO-06	47	379111	8707355
UM-TO-06	48	379134	8707385
UM-TO-06	49	379148	8707411
UM-TO-06	50	379153	8707438

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-06	51	379159	8707458
UM-TO-06	52	379183	8707493
UM-TO-06	53	379191	8707504
UM-TO-06	54	379201	8707515
UM-TO-06	55	379238	8707549
UM-TO-06	56	379252	8707565
UM-TO-06	57	379288	8707599
UM-TO-06	58	379321	8707645
UM-TO-06	59	379359	8707727
UM-TO-06	60	379367	8707740
UM-TO-06	61	379383	8707761
UM-TO-06	62	379402	8707776
UM-TO-06	63	379420	8707787
UM-TO-06	64	379435	8707794
UM-TO-06	65	379454	8707801
UM-TO-06	66	379476	8707805
UM-TO-06	67	379528	8707809
UM-TO-06	68	379562	8707814
UM-TO-06	69	379590	8707825
UM-TO-06	70	379613	8707837
UM-TO-06	71	379635	8707855
UM-TO-06	72	379653	8707875
UM-TO-06	73	379672	8707910
UM-TO-06	74	379695	8707954
UM-TO-06	75	379706	8707968
UM-TO-06	76	379722	8707981
UM-TO-06	77	379749	8707998
UM-TO-06	78	379773	8708005
UM-TO-06	79	379806	8708008
UM-TO-06	80	379846	8708015
UM-TO-06	81	379883	8708030
UM-TO-06	82	379909	8708043
UM-TO-06	83	379939	8708064
UM-TO-06	84	379955	8708079
UM-TO-06	85	379968	8708093
UM-TO-06	86	379975	8708103
UM-TO-06	87	380000	8708151
UM-TO-06	88	380013	8708181
UM-TO-06	89	380030	8708220
UM-TO-06	90	380042	8708249
UM-TO-06	91	380048	8708259
UM-TO-06	92	380068	8708284
UM-TO-06	93	380092	8708300
UM-TO-06	94	380128	8708313
UM-TO-06	95	380195	8708322
UM-TO-06	96	380237	8708331
UM-TO-06	97	380266	8708345
UM-TO-06	98	380284	8708358
UM-TO-06	99	380299	8708373
UM-TO-06	100	380320	8708403

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-06	101	380351	8708459
UM-TO-06	102	380368	8708484
UM-TO-06	103	380447	8708574
UM-TO-06	104	380457	8708588
UM-TO-06	105	380477	8708623
UM-TO-06	106	380488	8708652
UM-TO-06	107	380503	8708715
UM-TO-06	108	380508	8708730
UM-TO-06	109	380522	8708766
UM-TO-06	110	380536	8708791
UM-TO-06	111	380545	8708804
UM-TO-06	112	380600	8708865
UM-TO-06	113	380617	8708890
UM-TO-06	114	380659	8709003
UM-TO-06	115	380691	8709101
UM-TO-06	116	380713	8709149
UM-TO-06	117	380723	8709166
UM-TO-06	118	380740	8709183
UM-TO-06	119	380791	8709228
UM-TO-06	120	380801	8709241
UM-TO-06	121	380818	8709272
UM-TO-06	122	380839	8709307
UM-TO-06	123	380859	8709333
UM-TO-06	124	380895	8709377
UM-TO-06	125	380932	8709418
UM-TO-06	126	380982	8709481
UM-TO-06	127	381025	8709527
UM-TO-06	128	381043	8709552
UM-TO-06	129	381074	8709600
UM-TO-06	130	381089	8709627
UM-TO-06	131	381116	8709690
UM-TO-06	132	381148	8709744
UM-TO-06	133	381179	8709817
UM-TO-06	134	381203	8709875
UM-TO-06	135	381220	8709910
UM-TO-06	136	381256	8709962
UM-TO-06	137	381288	8710003
UM-TO-06	138	381324	8710052
UM-TO-06	139	381444	8710174
UM-TO-06	140	381466	8710200
UM-TO-06	141	381485	8710218
UM-TO-06	142	381572	8710292
UM-TO-06	143	381596	8710309
UM-TO-06	144	381624	8710325
UM-TO-06	145	381791	8710414
UM-TO-06	146	381814	8710428
UM-TO-06	147	381838	8710448
UM-TO-06	148	381908	8710533
UM-TO-06	149	381930	8710554
UM-TO-06	150	381962	8710578

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-06	151	382085	8710645
UM-TO-06	152	382122	8710669
UM-TO-06	153	382150	8710691
UM-TO-06	154	382183	8710723
UM-TO-06	155	382218	8710761
UM-TO-06	156	382335	8710899
UM-TO-06	157	382419	8710996
UM-TO-06	158	382424	8711005
UM-TO-06	159	382581	8711190
UM-TO-06	160	382601	8711211
UM-TO-06	161	382630	8711233
UM-TO-06	162	382654	8711246
UM-TO-06	163	382668	8711252
UM-TO-06	164	382690	8711260
UM-TO-06	165	382760	8711278
UM-TO-06	166	382776	8711284
UM-TO-06	167	382797	8711297
UM-TO-06	168	382826	8711324
UM-TO-06	169	382870	8711382
UM-TO-06	170	382905	8711422
UM-TO-06	171	382925	8711449
UM-TO-06	172	382946	8711481
UM-TO-06	173	382996	8711564
UM-TO-06	174	383026	8711611
UM-TO-06	175	383041	8711638
UM-TO-06	176	383067	8711692
UM-TO-06	177	383078	8711713
UM-TO-06	178	383093	8711733
UM-TO-06	179	383146	8711786
UM-TO-06	180	383171	8711814
UM-TO-06	181	383186	8711838
UM-TO-06	182	383198	8711864
UM-TO-06	183	383204	8711880
UM-TO-06	184	383209	8711897
UM-TO-06	185	383248	8711988
UM-TO-06	186	383267	8712047
UM-TO-06	187	383274	8712087
UM-TO-06	188	383284	8712212
UM-TO-06	189	383287	8712228
UM-TO-06	190	383292	8712244
UM-TO-06	191	383325	8712325
UM-TO-06	192	383343	8712358
UM-TO-06	193	383348	8712371
UM-TO-06	194	383359	8712418
UM-TO-06	195	383383	8712505
UM-TO-06	196	383440	8712650
UM-TO-06	197	383472	8712724
UM-TO-06	198	383487	8712764
UM-TO-06	199	383501	8712814
UM-TO-06	200	383507	8712836

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-06	201	383515	8712854
UM-TO-06	202	383601	8712988
UM-TO-06	203	383619	8713013
UM-TO-06	204	383640	8713036
UM-TO-06	205	383663	8713055
UM-TO-06	206	383698	8713079
UM-TO-06	207	383825	8713170
UM-TO-06	208	383989	8713260
UM-TO-06	209	383993	8713254
UM-TO-06	210	384003	8713260
UM-TO-06	211	384486	8713563
UM-TO-06	212	384510	8713579
UM-TO-06	213	384534	8713596
UM-TO-06	214	384867	8713864
UM-TO-06	215	384877	8713850
UM-TO-06	216	384896	8713865
UM-TO-06	217	384916	8713842
UM-TO-06	218	384907	8713829
UM-TO-06	219	384914	8713824
UM-TO-06	220	384923	8713829
UM-TO-06	221	384928	8713833
UM-TO-06	222	384934	8713835
UM-TO-06	223	384943	8713843
UM-TO-06	224	384961	8713865
UM-TO-06	225	384960	8713867
UM-TO-06	226	384981	8713886
UM-TO-06	227	384984	8713885
UM-TO-06	228	384996	8713873
UM-TO-06	229	384980	8713858
UM-TO-06	230	384986	8713850
UM-TO-06	231	384969	8713836
UM-TO-06	232	384964	8713842
UM-TO-06	233	384947	8713831
UM-TO-06	234	384944	8713835
UM-TO-06	235	384938	8713830
UM-TO-06	236	384930	8713829
UM-TO-06	237	384925	8713825
UM-TO-06	238	384913	8713818
UM-TO-06	239	384904	8713825
UM-TO-06	240	384901	8713821
UM-TO-06	241	384895	8713816
UM-TO-06	242	384871	8713845
UM-TO-06	243	384874	8713847
UM-TO-06	244	384866	8713857
UM-TO-06	245	384537	8713592
UM-TO-06	246	384513	8713575
UM-TO-06	247	384489	8713559
UM-TO-06	248	384006	8713255
UM-TO-06	249	383991	8713247
UM-TO-06	250	383987	8713254

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-06	251	383828	8713166
UM-TO-06	252	383701	8713074
UM-TO-06	253	383666	8713051
UM-TO-06	254	383643	8713032
UM-TO-06	255	383623	8713010
UM-TO-06	256	383605	8712986
UM-TO-06	257	383520	8712852
UM-TO-06	258	383505	8712812
UM-TO-06	259	383492	8712763
UM-TO-06	260	383477	8712722
UM-TO-06	261	383444	8712648
UM-TO-06	262	383390	8712506
UM-TO-06	263	383364	8712416
UM-TO-06	264	383353	8712370
UM-TO-06	265	383348	8712356
UM-TO-06	266	383331	8712322
UM-TO-06	267	383296	8712242
UM-TO-06	268	383291	8712227
UM-TO-06	269	383289	8712212
UM-TO-06	270	383278	8712078
UM-TO-06	271	383272	8712046
UM-TO-06	272	383255	8711990
UM-TO-06	273	383214	8711895
UM-TO-06	274	383209	8711878
UM-TO-06	275	383203	8711862
UM-TO-06	276	383191	8711836
UM-TO-06	277	383175	8711811
UM-TO-06	278	383150	8711782
UM-TO-06	279	383101	8711735
UM-TO-06	280	383094	8711727
UM-TO-06	281	383082	8711710
UM-TO-06	282	383071	8711690
UM-TO-06	283	383045	8711636
UM-TO-06	284	383033	8711611
UM-TO-06	285	383000	8711561
UM-TO-06	286	382950	8711478
UM-TO-06	287	382929	8711446
UM-TO-06	288	382909	8711419
UM-TO-06	289	382874	8711379
UM-TO-06	290	382830	8711321
UM-TO-06	291	382818	8711308
UM-TO-06	292	382800	8711293
UM-TO-06	293	382782	8711281
UM-TO-06	294	382761	8711273
UM-TO-06	295	382678	8711249
UM-TO-06	296	382643	8711234
UM-TO-06	297	382617	8711217
UM-TO-06	298	382595	8711196
UM-TO-06	299	382428	8711002
UM-TO-06	300	382423	8710993

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-06	301	382339	8710896
UM-TO-06	302	382222	8710758
UM-TO-06	303	382172	8710705
UM-TO-06	304	382147	8710682
UM-TO-06	305	382125	8710665
UM-TO-06	306	382101	8710649
UM-TO-06	307	382076	8710635
UM-TO-06	308	381965	8710574
UM-TO-06	309	381937	8710554
UM-TO-06	310	381912	8710530
UM-TO-06	311	381840	8710442
UM-TO-06	312	381817	8710424
UM-TO-06	313	381794	8710409
UM-TO-06	314	381626	8710321
UM-TO-06	315	381604	8710308
UM-TO-06	316	381575	8710288
UM-TO-06	317	381477	8710203
UM-TO-06	318	381448	8710170
UM-TO-06	319	381334	8710055
UM-TO-06	320	381292	8710000
UM-TO-06	321	381260	8709959
UM-TO-06	322	381223	8709904
UM-TO-06	323	381207	8709873
UM-TO-06	324	381173	8709788
UM-TO-06	325	381153	8709741
UM-TO-06	326	381143	8709724
UM-TO-06	327	381120	8709688
UM-TO-06	328	381096	8709629
UM-TO-06	329	381078	8709597
UM-TO-06	330	381048	8709548
UM-TO-06	331	381029	8709524
UM-TO-06	332	380981	8709472
UM-TO-06	333	380936	8709415
UM-TO-06	334	380899	8709374
UM-TO-06	335	380863	8709330
UM-TO-06	336	380839	8709298
UM-TO-06	337	380813	8709250
UM-TO-06	338	380801	8709231
UM-TO-06	339	380734	8709169
UM-TO-06	340	380715	8709139
UM-TO-06	341	380693	8709091
UM-TO-06	342	380663	8709001
UM-TO-06	343	380627	8708902
UM-TO-06	344	380619	8708884
UM-TO-06	345	380605	8708861
UM-TO-06	346	380549	8708801
UM-TO-06	347	380540	8708788
UM-TO-06	348	380527	8708765
UM-TO-06	349	380513	8708728
UM-TO-06	350	380508	8708714

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-06	351	380492	8708647
UM-TO-06	352	380482	8708620
UM-TO-06	353	380461	8708586
UM-TO-06	354	380451	8708571
UM-TO-06	355	380371	8708479
UM-TO-06	356	380356	8708457
UM-TO-06	357	380324	8708401
UM-TO-06	358	380303	8708370
UM-TO-06	359	380288	8708354
UM-TO-06	360	380269	8708341
UM-TO-06	361	380241	8708327
UM-TO-06	362	380203	8708316
UM-TO-06	363	380127	8708306
UM-TO-06	364	380102	8708297
UM-TO-06	365	380077	8708282
UM-TO-06	366	380061	8708267
UM-TO-06	367	380047	8708248
UM-TO-06	368	380035	8708218
UM-TO-06	369	380026	8708197
UM-TO-06	370	380001	8708140
UM-TO-06	371	379979	8708101
UM-TO-06	372	379972	8708090
UM-TO-06	373	379958	8708075
UM-TO-06	374	379942	8708060
UM-TO-06	375	379923	8708046
UM-TO-06	376	379898	8708031
UM-TO-06	377	379874	8708020
UM-TO-06	378	379847	8708010
UM-TO-06	379	379807	8708003
UM-TO-06	380	379774	8708000
UM-TO-06	381	379750	8707992
UM-TO-06	382	379724	8707976
UM-TO-06	383	379710	8707965
UM-TO-06	384	379699	8707952
UM-TO-06	385	379664	8707883
UM-TO-06	386	379657	8707872
UM-TO-06	387	379638	8707852
UM-TO-06	388	379625	8707840
UM-TO-06	389	379611	8707830
UM-TO-06	390	379581	8707814
UM-TO-06	391	379559	8707808
UM-TO-06	392	379533	8707804
UM-TO-06	393	379472	8707799
UM-TO-06	394	379442	8707791
UM-TO-06	395	379417	8707778
UM-TO-06	396	379388	8707757
UM-TO-06	397	379378	8707747
UM-TO-06	398	379363	8707724
UM-TO-06	399	379328	8707646
UM-TO-06	400	379310	8707619

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-06	401	379291	8707593
UM-TO-06	402	379256	8707561
UM-TO-06	403	379240	8707543
UM-TO-06	404	379205	8707512
UM-TO-06	405	379195	8707501
UM-TO-06	406	379187	8707490
UM-TO-06	407	379162	8707453
UM-TO-06	408	379158	8707437
UM-TO-06	409	379152	8707409
UM-TO-06	410	379138	8707381
UM-TO-06	411	379089	8707314
UM-TO-06	412	379054	8707261
UM-TO-06	413	379018	8707213
UM-TO-06	414	379016	8707211
UM-TO-06	415	379014	8707213
UM-TO-06	416	379010	8707208
UM-TO-06	417	379013	8707198
UM-TO-06	418	378988	8707150
UM-TO-06	419	378968	8707117
UM-TO-06	420	378953	8707101
UM-TO-06	421	378929	8707063
UM-TO-06	422	378918	8707032
UM-TO-06	423	378914	8706992
UM-TO-06	424	378914	8706938
UM-TO-06	425	378912	8706872
UM-TO-06	426	378908	8706843
UM-TO-06	427	378901	8706823
UM-TO-06	428	378885	8706791
UM-TO-06	429	378868	8706772
UM-TO-06	430	378821	8706705
UM-TO-06	431	378787	8706657
UM-TO-06	432	378776	8706636
UM-TO-06	433	378769	8706625
UM-TO-06	434	378757	8706614
UM-TO-06	435	378728	8706598
UM-TO-06	436	378696	8706590
UM-TO-06	437	378661	8706590
UM-TO-06	438	378624	8706600
UM-TO-06	439	378596	8706608
UM-TO-06	440	378571	8706610
UM-TO-06	441	378534	8706605
UM-TO-06	442	378409	8706600
UM-TO-06	443	378378	8706606
UM-TO-06	444	378342	8706632
UM-TO-06	445	378289	8706689
UM-TO-06	446	378249	8706719
UM-TO-06	447	378168	8706762
UM-TO-06	448	378151	8706778
UM-TO-06	449	378144	8706788
UM-TO-06	450	378100	8706828

COORDENADAS DE LOS VERTICES DEL ÁREA DE USO MINERO

USO MINERO			
Código	Vértice	Coordenadas UTM WGS84 Zona 18S	
		Este	Norte
UM-TO-06	451	378067	8706862
UM-TO-06	452	378045	8706881
UM-TO-06	453	377979	8706942
UM-TO-06	454	377866	8707031
UM-TO-06	455	377838	8707020
UM-TO-06	456	377751	8707084
UM-TO-06	457	377735	8707157
UM-TO-06	458	377669	8707340
UM-TO-06	459	377418	8707571
UM-TO-06	460	377217	8707793
UM-TO-06	461	377184	8707883
UM-TO-06	462	377044	8708142
UM-TO-06	463	376881	8708247
UM-TO-06	464	376703	8708093
UM-TO-06	465	376439	8708413
UM-TO-06	466	376451	8708425
UM-TO-06	467	376454	8708424
UM-TO-06	468	376855	8708829
UM-TO-06	469	377138	8708495
UM-TO-06	470	377002	8708349
UM-TO-06	471	377102	8708199
UM-TO-06	472	377195	8708057
UM-TO-06	473	377269	8707909
UM-TO-06	474	377277	8707883
UM-TO-06	475	377276	8707858
UM-TO-06	476	377275	8707848
UM-TO-06	477	377651	8707440
UM-TO-06	478	377668	8707427
UM-TO-06	479	377685	8707415
UM-TO-06	480	377718	8707368
UM-TO-06	481	377899	8707043
UM-TO-06	482	377872	8707033
UM-TO-06	483	377933	8706985

ANEXO 2-4
MAPAS ÁREA DE IMPACTO DIRECTO POR COMPONENTE AMBIENTAL

Aníbal Marcos Ordóñez Porras
CGP N° 139

M.Sc. Qco. Julia Velarde Yllanes
Químico
CQP 0480

COMPONENTES MODIFICATORIA EIA

N°	Nombre	Actividad Principal
1	Tajo	Reconfiguración
2	Depósito de Desmonte Oeste	
3	Depósito de Desmonte Este	
4	Depósito de Mineral de Baja Ley Este	
5	Depósito de Mineral de Baja Ley Oeste	
6	Grifo Mina	Nuevo componente
7	Polvorín	Nuevo componente
8	Nuevo Acceso Principal	Nuevo componente
9	Nueva Chancadora Primaria	Nuevo componente
10	Depósito de Suelo Orgánico N° 4	Nuevo componente
11	Sistema de Suministro de Agua Tratada	Repotenciar
12	Planta Concentradora	Incorporación de equipos
13	Depósito de Desmonte Valle Norte (Cantera)	Reconfiguración
14	Depósito de Relaves	Reconfiguración

ÁREA DE IMPACTO DIRECTO

Componente Aire

COMPONENTES U.M. TOROMOCHO

- Componentes Proyectados
- Huella de la U.M. Toromocho (2019)
- Huella Final de la U.M. Toromocho

LEYENDA

Capital de Distrito	Curva Secundaria
Centro Poblado	Área Poblada
Vía Asfaltada	Laguna
Vía Afirmada	Bofedal
Trocha Carrozable	Área Afectada por Terceros
Vía Férrea	Límite Distrital
Río	Límite Provincial
Quebrada	Límite Departamental
Nevados	Área de Influencia Ambiental Directa
Curva Primaria	

MODIFICACIÓN DEL ESTUDIO DE IMPACTO AMBIENTAL PARA EL PROYECTO DE EXPANSIÓN DE LA UNIDAD MINERA TOROMOCHO A 170 000 TPD

TÍTULO :

MAPA DE ÁREA DE IMPACTO DIRECTO COMPONENTE AIRE

DEPARTAMENTO:	PROVINCIA:	DISTRITO:
JUNIN	YAULI	YAULI, MOROCOCHA

ESCALA: 1:25,000

1,250 625 0 1,250 2,500 m

Datum: WGS84 UTM - Zona 18 Sur

CLIENTE: CHINALCO

ELABORADO POR:	PROYECTO:	FECHA:	MAPA:
Walsh Perú ecology and environment, inc.	MIN-1711	Junio, 2020	AI-01

FUENTE: Instituto Nacional de Estadística e Informática (INEI), Instituto Geográfico Nacional (IGN)
Ministerio de transportes y Comunicaciones (MTC)

Aníbal Marcos Ordóñez Porras
CGP N° 139

M.Sc. Qco. Julia Velarde Yllanes
Químico
CQP 0480

COMPONENTES MODIFICATORIA EIA

N°	Nombre	Actividad Principal
1	Tajo	Reconfiguración
2	Depósito de Desmonte Oeste	
3	Depósito de Desmonte Este	
4	Depósito de Mineral de Baja Ley Este	
5	Depósito de Mineral de Baja Ley Oeste	
6	Grifo Mina	Nuevo componente
7	Polvorín	Nuevo componente
8	Nuevo Acceso Principal	Nuevo componente
9	Nueva Chancadora Primaria	Nuevo componente
10	Depósito de Suelo Orgánico N° 4	Nuevo componente
11	Sistema de Suministro de Agua Tratada	Repotenciar
12	Planta Concentradora	Incorporación de equipos
13	Depósito de Desmonte Valle Norte (Cantera)	Reconfiguración
14	Depósito de Relaves	Reconfiguración

ÁREA DE IMPACTO INDIRECTO

Componente Aire

COMPONENTES U.M. TOROMOCHO

Componentes Proyectados
Huella de la U.M. Toromocho (2019)
Huella Final de la U.M. Toromocho

LEYENDA

Capital de Distrito	Curva Secundaria
Centro Poblado	Área Poblada
Vía Asfaltada	Laguna
Vía Afirmada	Bofedal
Trocha Carrozable	Área Afectada por Terceros
Vía Férrea	Límite Distrital
Río	Límite Provincial
Quebrada	Límite Departamental
Nevados	Área de Influencia Ambiental Directa
Curva Primaria	Área de Influencia Ambiental Indirecta

MODIFICACIÓN DEL ESTUDIO DE IMPACTO AMBIENTAL PARA EL PROYECTO DE EXPANSIÓN DE LA UNIDAD MINERA TOROMOCHO A 170 000 TPD

TÍTULO :

MAPA DE ÁREA DE IMPACTO INDIRECTO COMPONENTE AIRE

DEPARTAMENTO:	PROVINCIA:	DISTRITO:
JUNIN	YAULI	YAULI, MOROCOCHA

ESCALA: 1:25,000
1,250 625 0 1,250 2,500 m
Datum: WGS84 UTM - Zona 18 Sur

CLIENTE: CHINALCO

ELABORADO POR:	PROYECTO:	FECHA:	MAPA:
Walsh Perú ecology and environment, inc.	MIN-1711	Junio, 2020	AI-02

FUENTE: Instituto Nacional de Estadística e Informática (INEI), Instituto Geográfico Nacional (IGN)
Ministerio de transportes y Comunicaciones (MTC)

Aníbal Marcos Ordóñez Porras
CGP N° 139

M.Sc. Qco. Julia Velarde Yllanes
Químico
CQP 0480

COMPONENTES MODIFICATORIA EIA

N°	Nombre	Actividad Principal
1	Tajo	Reconfiguración
2	Depósito de Desmonte Oeste	
3	Depósito de Desmonte Este	
4	Depósito de Mineral de Baja Ley Este	
5	Depósito de Mineral de Baja Ley Oeste	
6	Grifo Mina	Nuevo componente
7	Polvorín	Nuevo componente
8	Nuevo Acceso Principal	Nuevo componente
9	Nueva Chancadora Primaria	Nuevo componente
10	Depósito de Suelo Orgánico N° 4	Nuevo componente
11	Sistema de Suministro de Agua Tratada	Repotenciar
12	Planta Concentradora	Incorporación de equipos
13	Depósito de Desmonte Valle Norte (Cantera)	Reconfiguración
14	Depósito de Relaves	Reconfiguración

ÁREA DE IMPACTO DIRECTO

Componente Ruido

COMPONENTES U.M. TOROMOCHO

Componentes Proyectados
Huella de la U.M. Toromocho (2019)
Huella Final de la U.M. Toromocho

LEYENDA

Capital de Distrito
Centro Poblado
Vía Asfaltada
Vía Afirmada
Trocha Carrozable
Vía Férrea
Río
Quebrada
Nevados
Curva Primaria
Curva Secundaria
Área Poblada
Laguna
Bofedal
Área Afectada por Terceros
Límite Distrital
Límite Provincial
Límite Departamental
Área de Influencia Ambiental Directa

MODIFICACIÓN DEL ESTUDIO DE IMPACTO AMBIENTAL PARA EL PROYECTO DE EXPANSIÓN DE LA UNIDAD MINERA TOROMOCHO A 170 000 TPD

TÍTULO :

MAPA DE ÁREA DE IMPACTO DIRECTO COMPONENTE RUIDO

DEPARTAMENTO:	PROVINCIA:	DISTRITO:
JUNIN	YAULI	YAULI, MOROCOCHA

ESCALA: 1:25,000

1,250 625 0 1,250 2,500 m

Datum: WGS84 UTM - Zona 18 Sur

CLIENTE: CHINALCO

ELABORADO POR:	PROYECTO:	FECHA:	MAPA:
Walsh Perú ecology and environment, inc.	MIN-1711	Junio, 2020	AI-03

FUENTE: Instituto Nacional de Estadística e Informática (INEI), Instituto Geográfico Nacional (IGN)
Ministerio de transportes y Comunicaciones (MTC)

Aníbal Marcos Ordóñez Porras
CGP Nº 139

M.Sc. Qco. Julia Velarde Yllanes
Químico
CQP 0480

COMPONENTES MODIFICATORIA EIA		
Nº	Nombre	Actividad Principal
1	Tajo	Reconfiguración
2	Depósito de Desmonte Oeste	
3	Depósito de Desmonte Este	
4	Depósito de Mineral de Baja Ley Este	
5	Depósito de Mineral de Baja Ley Oeste	
6	Grifo Mina	Nuevo componente
7	Polvorín	Nuevo componente
8	Nuevo Acceso Principal	Nuevo componente
9	Nueva Chancadora Primaria	Nuevo componente
10	Depósito de Suelo Orgánico Nº 4	Nuevo componente
11	Sistema de Suministro de Agua Tratada	Repotenciar
12	Planta Concentradora	Incorporación de equipos
13	Depósito de Desmonte Valle Norte (Cantera)	Reconfiguración
14	Depósito de Relaves	Reconfiguración

ÁREA DE IMPACTO INDIRECTO

Componente Ruido

COMPONENTES U.M. TOROMOCHO

Componentes Proyectados
Huella de la U.M. Toromocho (2019)
Huella Final de la U.M. Toromocho

LEYENDA

Capital de Distrito	Curva Secundaria
Centro Poblado	Área Poblada
Vía Asfaltada	Laguna
Vía Afirmada	Bofedal
Trocha Carrozable	Área Afectada por Terceros
Vía Férrea	Límite Distrital
Río	Límite Provincial
Quebrada	Límite Departamental
Nevados	Área de Influencia Ambiental Directa
Curva Primaria	Área de Influencia Ambiental Indirecta

MODIFICACIÓN DEL ESTUDIO DE IMPACTO AMBIENTAL PARA EL PROYECTO DE EXPANSIÓN DE LA UNIDAD MINERA TOROMOCHO A 170 000 TPD

TÍTULO :

MAPA DE ÁREA DE IMPACTO INDIRECTO COMPONENTE RUIDO

DEPARTAMENTO:	PROVINCIA:	DISTRITO:
JUNIN	YAULI	YAULI, MOROCOCHA

ESCALA: 1:25,000

1,250 625 0 1,250 2,500 m

Datum: WGS84 UTM - Zona 18 Sur

CLIENTE: CHINALCO

ELABORADO POR:	PROYECTO:	FECHA:	MAPA:
Walsh Perú ecology and environment, inc.	MIN-1711	Junio, 2020	AI-04

FUENTE: Instituto Nacional de Estadística e Informática (INEI), Instituto Geográfico Nacional (IGN)
Ministerio de transportes y Comunicaciones (MTC)

Aníbal Marcos Ordóñez Porras
CGP Nº 139

M.Sc. Qco. Julia Velarde Yllanes
Químico
CQP 0480

COMPONENTES MODIFICATORIA EIA

Nº	Nombre	Actividad Principal
1	Tajo	Reconfiguración
2	Depósito de Desmonte Oeste	
3	Depósito de Desmonte Este	
4	Depósito de Mineral de Baja Ley Este	
5	Depósito de Mineral de Baja Ley Oeste	
6	Grifo Mina	Nuevo componente
7	Polvorín	Nuevo componente
8	Nuevo Acceso Principal	Nuevo componente
9	Nueva Chancadora Primaria	Nuevo componente
10	Depósito de Suelo Orgánico Nº 4	Nuevo componente
11	Sistema de Suministro de Agua Tratada	Repotenciar
12	Planta Concentradora	Incorporación de equipos
13	Depósito de Desmonte Valle Norte (Cantera)	Reconfiguración
14	Depósito de Relaves	Reconfiguración

ÁREA DE IMPACTO DIRECTO

- Efluentes y Zona de Mezcla
- Componente Agua Superficial

COMPONENTES U.M. TOROMOCHO

- Componentes Proyectados
- Huella de la U.M. Toromocho (2019)
- Huella Final de la U.M. Toromocho

LEYENDA

- Capital de Distrito
- Centro Poblado
- Vía Asfaltada
- Vía Afirmada
- Trocha Carrozable
- Vía Férrea
- Río
- Quebrada
- Nevados
- Curva Primaria
- Curva Secundaria
- Área Poblada
- Laguna
- Bofedal
- Área Afectada por Terceros
- Límite Distrital
- Límite Provincial
- Límite Departamental
- Área de Influencia Ambiental Directa

MODIFICACIÓN DEL ESTUDIO DE IMPACTO AMBIENTAL PARA EL PROYECTO DE EXPANSIÓN DE LA UNIDAD MINERA TOROMOCHO A 170 000 TPD

TÍTULO :

MAPA DE ÁREA DE IMPACTO DIRECTO COMPONENTE AGUA SUPERFICIAL

DEPARTAMENTO:	PROVINCIA:	DISTRITO:
JUNIN	YAULI	YAULI, MOROCOCHA

ESCALA: 1:25,000

1,250 625 0 1,250 2,500 m

Datum: WGS84 UTM - Zona 18 Sur

CLIENTE: CHINALCO

ELABORADO POR:	PROYECTO:	FECHA:	MAPA:
Walsh Perú ecology and environment, inc.	MIN-1711	Junio, 2020	AI-05

FUENTE: Instituto Nacional de Estadística e Informática (INEI), Instituto Geográfico Nacional (IGN)
Ministerio de transportes y Comunicaciones (MTC)

COMPONENTES MODIFICATORIA EIA		
N°	Nombre	Actividad Principal
1	Tajo	Reconfiguración
2	Depósito de Desmonte Oeste	
3	Depósito de Desmonte Este	
4	Depósito de Mineral de Baja Ley Este	
5	Depósito de Mineral de Baja Ley Oeste	
6	Grifo Mina	Nuevo componente
7	Polvorín	Nuevo componente
8	Nuevo Acceso Principal	Nuevo componente
9	Nueva Chancadora Primaria	Nuevo componente
10	Depósito de Suelo Orgánico N° 4	Nuevo componente
11	Sistema de Suministro de Agua Tratada	Repotenciar
12	Planta Concentradora	Incorporación de equipos
13	Depósito de Desmonte Valle Norte (Cantera)	Reconfiguración
14	Depósito de Relaves	Reconfiguración

ÁREA DE IMPACTO INDIRECTO

COMPONENTES U.M. TOROMOCHO

- Componentes Proyectados
- Huella de la U.M. Toromocho (2019)
- Huella Final de la U.M. Toromocho

LEYENDA

- Capital de Distrito
- Centro Poblado
- Vía Asfaltada
- Vía Afirmada
- Trocha Carrozable
- Vía Férrea
- Río
- Quebrada
- Nevados
- Curva Primaria
- Curva Secundaria
- Área Poblada
- Laguna
- Bofedal
- Área Afectada por Terceros
- Límite Distrital
- Límite Provincial
- Límite Departamental
- Área de Influencia Ambiental Directa
- Área de Influencia Ambiental Indirecta

MODIFICACIÓN DEL ESTUDIO DE IMPACTO AMBIENTAL PARA EL PROYECTO DE EXPANSIÓN DE LA UNIDAD MINERA TOROMOCHO A 170 000 TPD

TÍTULO :

MAPA DE ÁREA DE IMPACTO INDIRECTO COMPONENTE AGUA SUPERFICIAL

DEPARTAMENTO:	PROVINCIA:	DISTRITO:
JUNIN	YAULI	YAULI, MOROCOCHA

ESCALA: 1:25,000

1,250 625 0 1,250 2,500 m

Datum: WGS84 UTM - Zona 18 Sur

CLIENTE: CHINALCO

ELABORADO POR:	PROYECTO:	FECHA:	MAPA:
Walsh Perú ecology and environment, inc.	MIN-1711	Junio, 2020	AI-06

FUENTE: Instituto Nacional de Estadística e Informática (INEI), Instituto Geográfico Nacional (IGN)
Ministerio de transportes y Comunicaciones (MTC)

COMPONENTES MODIFICATORIA EIA

N°	Nombre	Actividad Principal
1	Tajo	Reconfiguración
2	Depósito de Desmonte Oeste	
3	Depósito de Desmonte Este	
4	Depósito de Mineral de Baja Ley Este	
5	Depósito de Mineral de Baja Ley Oeste	
6	Grifo Mina	Nuevo componente
7	Polvorín	Nuevo componente
8	Nuevo Acceso Principal	Nuevo componente
9	Nueva Chancadora Primaria	Nuevo componente
10	Depósito de Suelo Orgánico N° 4	Nuevo componente
11	Sistema de Suministro de Agua Tratada	Repotenciar
12	Planta Concentradora	Incorporación de equipos
13	Depósito de Desmonte Valle Norte (Cantera)	Reconfiguración
14	Depósito de Relaves	Reconfiguración

ÁREA DE IMPACTO DIRECTO

Componente agua Subterránea (Modelo Piezométrico)

COMPONENTES U.M. TOROMOCHO

Componentes Proyectados
Huella de la U.M. Toromocho (2019)
Huella Final de la U.M. Toromocho

LEYENDA

Capital de Distrito
Centro Poblado
Vía Asfaltada
Vía Afirmada
Trocha Carrozable
Vía Férrea
Río
Quebrada
Nevados
Curva Primaria
Curva Secundaria
Área Poblada
Laguna
Bofedal
Área Afectada por Terceros
Límite Distrital
Límite Provincial
Límite Departamental
Área de Influencia Ambiental Directa

MODIFICACIÓN DEL ESTUDIO DE IMPACTO AMBIENTAL PARA EL PROYECTO DE EXPANSIÓN DE LA UNIDAD MINERA TOROMOCHO A 170 000 TPD

TÍTULO :

MAPA DE ÁREA DE IMPACTO DIRECTO COMPONENTE AGUA SUBTERRÁNEA

DEPARTAMENTO:	PROVINCIA:	DISTRITO:
JUNIN	YAULI	YAULI, MOROCOCHA

ESCALA: 1:25,000

1,250 625 0 1,250 2,500 m

Datum: WGS84 UTM - Zona 18 Sur

CLIENTE: CHINALCO

ELABORADO POR:	PROYECTO:	FECHA:	MAPA:
Walsh Perú ecology and environment, inc.	MIN-1711	Junio, 2020	AI-07

FUENTE: Instituto Nacional de Estadística e Informática (INEI), Instituto Geográfico Nacional (IGN)
Ministerio de transportes y Comunicaciones (MTC), Estudio Hidrológico e Hidrogeológico Definitivos (Proyecto Toromocho).

Aníbal Marcos Ordóñez Porras
CGP N° 139

M.Sc. Qco. Julia Velarde Yllanes
Químico
CQP 0480

COMPONENTES MODIFICATORIA EIA

N°	Nombre	Actividad Principal
1	Tajo	Reconfiguración
2	Depósito de Desmonte Oeste	
3	Depósito de Desmonte Este	
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6	Grifo Mina	Nuevo componente
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10	Depósito de Suelo Orgánico N° 4	Nuevo componente
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12	Planta Concentradora	Incorporación de equipos
13	Depósito de Desmonte Valle Norte (Cantera)	Reconfiguración
14	Depósito de Relaves	Reconfiguración

ÁREA DE IMPACTO INDIRECTO

Componente agua Subterránea (Área de Acuífero por Karstificación)

COMPONENTES U.M. TOROMOCHO

Componentes Proyectados
Huella de la U.M. Toromocho (2019)
Huella Final de la U.M. Toromocho

LEYENDA

Capital de Distrito	Curva Secundaria
Centro Poblado	Área Poblada
Vía Asfaltada	Laguna
Vía Afirmada	Bofedal
Trocha Carrozable	Área Afectada por Terceros
Vía Férrea	Límite Distrital
Río	Límite Provincial
Quebrada	Límite Departamental
Nevados	Área de Influencia Ambiental Directa
Curva Primaria	Área de Influencia Ambiental Indirecta

MODIFICACIÓN DEL ESTUDIO DE IMPACTO AMBIENTAL PARA EL PROYECTO DE EXPANSIÓN DE LA UNIDAD MINERA TOROMOCHO A 170 000 TPD

TÍTULO :

MAPA DE ÁREA DE IMPACTO INDIRECTO COMPONENTE AGUA SUBTERRÁNEA

DEPARTAMENTO:	PROVINCIA:	DISTRITO:
JUNIN	YAULI	YAULI, MOROCOCHA

ESCALA: 1:25,000
1,250 625 0 1,250 2,500 m
Datum: WGS84 UTM - Zona 18 Sur

CLIENTE: CHINALCO

ELABORADO POR:	PROYECTO:	FECHA:	MAPA:
Walsh Perú ecology and environment, inc.	MIN-1711	Junio, 2020	AI-08

FUENTE: Instituto Nacional de Estadística e Informática (INEI), Instituto Geográfico Nacional (IGN)
Ministerio de transportes y Comunicaciones (MTC), Estudio Hidrológico e Hidrogeológico Definitivos (Proyecto Toromocho).

LEYENDA

Zonas	Símbolo
Áreas antrópicas	An
Unidades de Vegetación	**Símbolo**
Pajonal y matorral altoandino	Pma
Pajonal altoandino	Pa
Césped altoandino	Cp
Bofedales (Ecosistemas Frágiles)	Bo
Vegetación geliturbada	Vg
Vegetación asociada a pedregales	Vap

IRAYDA SALINAS HIJAR
BIÓLOGA
COLBIOP Nº 6571

Anibal Marcos Ordóñez Porras
CGP Nº 139

COMPONENTES MODIFICATORIA EIA

Nº	Nombre	Actividad Principal
1	Tajo	Reconfiguración
2	Depósito de Desmonte Oeste	
3	Depósito de Desmonte Este	
4	Depósito de Mineral de Baja Ley Este	
5	Depósito de Mineral de Baja Ley Oeste	
6	Grifo Mina	Nuevo componente
7	Polvorín	Nuevo componente
8	Nuevo Acceso Principal	Nuevo componente
9	Nueva Chancadora Primaria	Nuevo componente
10	Depósito de Suelo Orgánico Nº 4	Nuevo componente
11	Sistema de Suministro de Agua Tratada	Repotenciar
12	Planta Concentradora	Incorporación de equipos
13	Depósito de Desmonte Valle Norte (Cantera)	Reconfiguración
14	Depósito de Relaves	Reconfiguración

COMPONENTES U.M. TOROMOCHO

- Componentes Proyectados
- Huella de la U.M. Toromocho (2019)
- Huella Final de la U.M. Toromocho

LEYENDA

Capital de Distrito	Curva Secundaria
Centro Poblado	Área Poblada
Vía Asfaltada	Laguna
Vía Afirmada	Bofedal
Trocha Carrozable	Área Afectada por Terceros
Vía Férrea	Límite Distrital
Río	Límite Provincial
Quebrada	Límite Departamental
Nevados	Área de Influencia Ambiental Directa
Curva Primaria	

MODIFICACIÓN DEL ESTUDIO DE IMPACTO AMBIENTAL PARA EL PROYECTO DE EXPANSIÓN DE LA UNIDAD MINERA TOROMOCHO A 170 000 TPD

TÍTULO :

MAPA DE ÁREA DE IMPACTO DIRECTO COMPONENTE ECOSISTEMAS

DEPARTAMENTO:	PROVINCIA:	DISTRITO:
JUNIN	YAULI	YAULI, MOROCOCHA

ESCALA: 1:25,000

1,250 625 0 1,250 2,500 m

Datum: WGS84 UTM - Zona 18 Sur

CLIENTE: CHINALCO

ELABORADO POR:	PROYECTO:	FECHA:	MAPA:
Walsh Perú ecology and environment, inc.	MIN-1711	Junio, 2020	AI-09

FUENTE: Instituto Nacional de Estadística e Informática (INEI), Instituto Geográfico Nacional (IGN)
Ministerio de transportes y Comunicaciones (MTC)

LEYENDA

Zonas	Símbolo
Áreas antrópicas	An
Unidades de Vegetación	**Símbolo**
Pajonal y matorral altoandino	Pma
Pajonal altoandino	Pa
Césped altoandino	Cp
Bofedales (Ecosistemas Frágiles)	Bo
Vegetación geliturbada	Vg
Vegetación asociada a pedregales	Vap

IRAYDA SALINAS HIJAR
BIÓLOGA
COLBIOP Nº 6571

Aníbal Marcos Ordóñez Porras
CGP Nº 139

COMPONENTES MODIFICATORIA EIA

Nº	Nombre	Actividad Principal
1	Tajo	Reconfiguración
2	Depósito de Desmonte Oeste	
3	Depósito de Desmonte Este	
4	Depósito de Mineral de Baja Ley Este	
5	Depósito de Mineral de Baja Ley Oeste	
6	Grifo Mina	Nuevo componente
7	Polvorín	Nuevo componente
8	Nuevo Acceso Principal	Nuevo componente
9	Nueva Chancadora Primaria	Nuevo componente
10	Depósito de Suelo Orgánico Nº 4	Nuevo componente
11	Sistema de Suministro de Agua Tratada	Repotenciar
12	Planta Concentradora	Incorporación de equipos
13	Depósito de Desmonte Valle Norte (Cantera)	Reconfiguración
14	Depósito de Relaves	Reconfiguración

COMPONENTES U.M. TOROMOCHO

- Componentes Proyectados
- Huella de la U.M. Toromocho (2019)
- Huella Final de la U.M. Toromocho

LEYENDA

- Capital de Distrito
- Centro Poblado
- Vía Asfaltada
- Vía Afirmada
- Trocha Carrozable
- Vía Férrea
- Río
- Quebrada
- Nevados
- Curva Primaria
- Curva Secundaria
- Área Poblada
- Laguna
- Bofedal
- Área Afectada por Terceros
- Límite Distrital
- Límite Provincial
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- Área de Influencia Ambiental Directa
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ÁREA DE IMPACTO DIRECTO

Componente Impacto Visual

COMPONENTES U.M. TOROMOCHO

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MAPA DE ÁREA DE IMPACTO DIRECTO COMPONENTE IMPACTO VISUAL

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ELABORADO POR:	PROYECTO:	FECHA:	MAPA:
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ÁREA DE IMPACTO INDIRECTO

Componente Impacto Visual

COMPONENTES U.M. TOROMOCHO

Componentes Proyectados
Huella de la U.M. Toromocho (2019)
Huella Final de la U.M. Toromocho

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Capital de Distrito
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Ministerio de transportes y Comunicaciones (MTC)

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CGP N° 139

VIRGINIA ÑAHUI SEGURA
INGENIERA AGRÓNOMA
Reg. CIP N° 125589

COMPONENTES MODIFICATORIA EIA

N°	Nombre	Actividad Principal
1	Tajo	Reconfiguración
2	Depósito de Desmonte Oeste	
3	Depósito de Desmonte Este	
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12	Planta Concentradora	Incorporación de equipos
13	Depósito de Desmonte Valle Norte (Cantera)	Reconfiguración
14	Depósito de Relaves	Reconfiguración

ÁREA DE IMPACTO DIRECTO

Componente Recurso Suelo

COMPONENTES U.M. TOROMOCHO

Componentes Proyectados
Huella de la U.M. Toromocho (2019)
Huella Final de la U.M. Toromocho

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Capital de Distrito
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TÍTULO :

MAPA DE ÁREA DE IMPACTO DIRECTO COMPONENTE RECURSO SUELO

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Ministerio de transportes y Comunicaciones (MTC), Estudio Hidrológico e Hidrogeológico Definitivos (Proyecto Toromocho).

ANEXO 2-5
ESTIMACIÓN DE RESERVAS

Tetra Tech Chiles S.A. | Complex World, Clear Solutions
Evaristo Lillo N° 78, piso 5°, Las Condes | Santiago, Chile
www.tetratech.com | www.tetratech.cl

REVISIÓN ESTIMACIÓN DE RESERVAS MINERALES Y PLAN DE VIDA DE MINA TOROMOCHO 2019 – CHINALCO PERÚ

M1903700 / CONTRATO MC00752CON

INFORME FINAL

ESTIMACIÓN DE RESERVAS MINERALES DE LA MINA TOROMOCHO

Persona Competente Jefe de Proyecto Raúl Contreras G.	Ing. Especialista Minería José Luis Contreras	Plan Estratégico MCP	Plan Minero MCP

Nº Páginas	Nº Documento	REV.	Fecha
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TETRA TECH

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Glosario de Términos y Unidades

Fue utilizado el sistema métrico en este informe, a menos que se indique lo contrario. Los dólares son dólares americanos. Las toneladas declaradas son toneladas métricas secas de 1,000 kilógramos. Las libras declaradas son libras del sistema inglés que equivalen a aproximadamente 0.4536 kg/lb. Las leyes de cobre se reportan en porcentaje de cobre total, soluble o recuperable.

Abreviación	Unidad o Término
MCP	Minera Chinalco Perú
JORC	Reservas Minerales
ASCII	de Información
Cu	Cobre
Ag	Plata
Mo	Molibdeno
As	Arsénico
Zn	Zinc
MgO	Magnésio
F	Fluor
TCu	Cobre total
US$	US dolar(es)
KUS$	Miles de dolares
US$/lb	US dolares por libra
US$/t	US dolares por tonelada
US$/tm	US dolares por toneladamétricas
US$/oz	US dolares por onza
US$/t. ore	Dólares por toneladas de mineral
US$/t. waste	Dólares por toneladas de lastre
US$/dmt	Dólares por toneladas métricas secas
US$/wmt	Dólares por toneladas metricas humedas
US¢/t-km	Centavo de dólar por tonelada kilómetro
t, tm	Tonelada(s) métrica(s)
Mt	Millones de toneladas
Mtpa	Millones de toneladas por año
kt	Miles de toneladas
kth	Miles de toneladas húmedas
t/d	Toneladas por día
t/h or tph	Toneladas por hora
t/m^3	Toneladas por metro cúbico
t/m^2	Toneladas por metro cuadrado
t/a	Toneladas por año
t/ h efect.	Toneladas por hora efectiva
th/ h efect.	Toneladas humedas por hora efectiva
g/t	Gramo por tonelada
ktms	Miles de toneladas métricas secas

Abreviación	Unidad o Término
l/s	Litros por segundo
CNI	Call & Nicholas Inc.
kg	Kilógramo(s)
g	Gramo (s)
lb	Libra(s)
km	Kilómetro(s)
m	Metros
m^3	Metro cúbico
yd^3	Yardas cúbicas
ktpd	Miles de toneladas por día
cut-off	Ley de corte
MG	Ley Media
LG	Baja Ley
%	Porcentaje
km/h	Kilómetro por hora
m/h efect.	Metros por hora efectiva
th/m	Tonalada humeda por metro
gln/h	Galones por hora
tc	Toneladas cortas
G&A	Generales y Administrativos
A-T	Actinolita-Tremolita
SM	Serpentina-Magnetita
INP	Income Net of Process
ktpd	Miles de toneladas por día
LOM	Life of Mina
CAPEX	Gastos de capital
OPEX	Gastos de operación
IP	Insumo producto
TC/RC	Costo de tratamiento y costo de refinación
Conc.	Concentrado
ppm	Partes por millón
IRA	Ángulo interrampa
BFA	Ángulo de cara de banco
OSA	Ángulo global
NPV o VAN	Valor presente neto
NSR	Net Smelter Return
MCAF	Factor de ajuste de capital minero

1 RESUMEN EJECUTIVO

1.1 Introducción

El presente documento ha sido preparado por Tetra Tech Chile S.A. (Tetra Tech) a solicitud de Minera Chinalco Perú, para el Proyecto Toromocho, denominado “Revisión Estimación de Reservas Minerales y Plan de Vida de Mina” actualizado al 31 de diciembre de 2019.

El yacimiento Toromocho se encuentra a más de 4,500 metros de altura, en el distrito de Morococha, provincia de Yauli, departamento de Junín, adyacente a la Mina Morocha.

El yacimiento cuenta con una posición geográfica privilegiada, con conectividad a la Carretera Central, acceso al Ferrocarril Central, con disponibilidad de agua, energía eléctrica y en la zona existe mano de obra especializada en minería.

Minera Chinalco Perú (MCP) cuenta en la actualidad con una estimación de reservas basada en la información reportada en el Estudio de Factibilidad, de noviembre 2007, y la Estimación de Reservas Minerales y Plan de Vida de la Mina Toromocho, de octubre 2017; las cuales fueron realizadas y visadas por personas calificadas de empresas consultoras de acuerdo con el código JORC.

La información y datos en este informe relativos a la Estimación de las Reservas Minerales han sido compilados, analizados y desarrollados por Raúl Contreras Guzmán, Ingeniero Civil de Minas (36 años de experiencia, Miembro de la Comisión Calificadora de Competencias en Recursos y Reservas Mineras, de Chile, registro público # 0128.

La persona anteriormente mencionada tiene suficiente experiencia, la cual es relevante al estilo de la mineralización, al tipo de depósito bajo consideración, y al tipo de actividad desarrollada, la cual los acredita como personas competentes para la certificación de Reservas Mineras.

Los aspectos legales y ambientales de Toromocho son de responsabilidad de las respectivas entidades competentes de minera Chinalco Perú. Tetra Tech tomó conocimiento de la existencia de las resoluciones de permisos ambientales y sectoriales presentadas a la fecha.

Tanto la persona competente como el ingeniero especialista en minería, que desarrollaron la presente estimación de reservas minerales, cuenta con el conocimiento de la faena minera por visitas realizadas en los años 2016 y 2017.

Las definiciones de los recursos y reservas mineras, que se utilizaron para preparar el reporte técnico, y que están definidas en el código JORC para reportar resultados de exploración, recursos y reservas minerales del año 2012, son las siguientes:

Recurso Mineral

Un “Recurso Mineral” es una concentración u ocurrencia de material de interés económico intrínseco en o sobre la corteza de la Tierra en forma y cantidad en que haya probabilidades razonables de una eventual extracción económica. La ubicación, cantidad, ley, características geológicas y continuidad de un Recurso Mineral son conocidas, estimadas o interpretadas a partir de evidencia y conocimientos específicos geológicos. Los Recursos Minerales se subdividen, en orden de confianza geológica ascendente, en categorías de Inferidos, Indicados y Medidos.

Reserva Mineral

Una “Reserva Mineral” es la parte económicamente explotable de un Recurso Mineral Medido o Indicado. Incluye dilución de materiales y tolerancias por pérdidas que se puedan producir cuando se extraiga el material. Se han realizado las evaluaciones apropiadas, que pueden incluir estudios de factibilidad e incluyen la consideración de y modificación por factores razonablemente asumidos de extracción, metalúrgicos, económicos, de mercados, legales, ambientales, sociales y gubernamentales. Estas evaluaciones demuestran en la fecha en que se reporta que podría justificarse razonablemente la extracción. Las Reservas de Mena se subdividen en orden creciente de confianza en Reservas Probables Minerales D30 y Reservas Probadas Minerales.

1.2 Objetivo y Alcances

La presente estimación de Reservas Minerales se sustenta en el diseño del pit final de la mina, en la planificación minera estratégica y operacional realizada por MCP, cuyo desarrollo aborda las etapas de revisiones y validaciones siguientes:

- Información base.
- Determinación de pit óptimo económico.
- Diseño de fases y análisis de secuencia minera.
- Diseño de Depósito de Desmontes y Stocks
- Definición de Ley de Corte
- Plan minero Estratégico
- Plan Minero Operacional
- Estimación de Flota minera requerida por el Plan Operativo
- Estimación de Gasto en inversión en equipos mineros
- Estimación de Costos Operacionales.
- Declaración de Reservas Minerales.

1.3 Modelo de Recursos

El Modelo de Recursos fue desarrollado y actualizado por la empresa consultora Golder Associates en el año 2019. Este modelo es utilizado para el estudio de reservas y corresponde al archivo digital denominado **"toromocho_2019_rbk.asc"** de octubre del año 2019, en formato ascii. Dicho archivo es cargado en el software minero MineSight ®, con la información que lo sustenta como son de leyes de minerales, categorías, densidad, dureza, alteración, entre otras.

1.4 Determinación del Pit Económico

La determinación y optimización del pit, se realiza con el software optimizador Whittle®, ampliamente utilizado en la industria minera, cuyo resultado considera los parámetros técnicos-económicos definidos por MCP. Los resultados indican que para un precio del Cu de 2.74 US$/lb, Mo de 11.30 US$/lb y Ag de 16.78 US$/oz, se obtiene el pit 71 con aproximadamente 2,154 Mt de material, de los cuales 1,405 Mt corresponde a mineral procesable con una ley media de 0.43 % de TCu y ratio estéril/mineral de 0.53.

Los Recursos Medidos e Indicados fueron valorizados como mineral para alimentar la planta de proceso. Los Recursos Inferidos fueron considerados como lastre, con destino al Depósito de Desmonte, como también aquellos minerales sin valor económico producto de sus penalizaciones.

Se seleccionó el pit 71 como pit final debido a:

- Presenta el pit al precio de largo plazo de 2.74 US$/lb de Cu (Revenue Factor igual a 1).
- El pit 71 maximiza las reservas para el plan de expansión (170 ktpd), permitiendo una duración de 22.8 años, con las actuales reservas, sin considerar stocks.
- Disminuye la cantidad de Lastre a las consideradas en el estudio de factibilidad.

En la Tabla 1-1, se muestra el resumen de la optimización del pit, destacando la selección que presenta mayor beneficio (RF) = 1 correspondiendo al pit 71, el cual se representa en la Figura 1-1.

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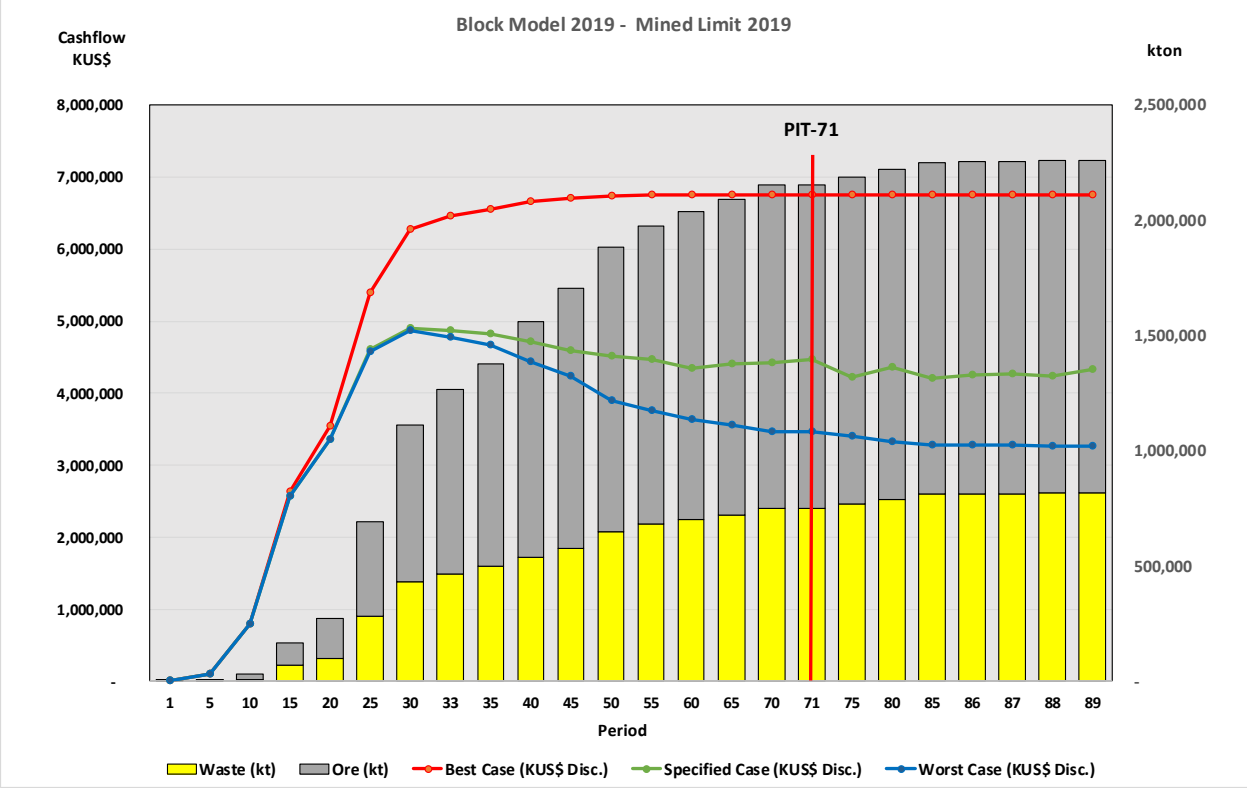
Tabla 1-1: Resumen Resultado Optimización

Pit	Revenue Factor	Copper Price	Total (kt)	Waste (kt)	Ore (kt)	Strip Ratio	Max Bench	Min Bench	Cu (%)	Mo (%)	As Conc (%)	Ag (g/t)	Best	Specified	Worst
1	0.30	0.82	181	56	125	0.45	70	37	1.49	0.016	0.124	8.6	7,737	7,737	7,737
5	0.34	0.93	2,892	658	2,234	0.29	70	34	1.13	0.023	0.149	6.3	99,381	99,381	99,381
10	0.39	1.07	33,732	7,856	25,876	0.30	70	32	0.83	0.032	0.216	5.9	801,188	801,188	801,188
15	0.44	1.21	166,047	68,986	97,061	0.71	70	26	0.78	0.026	0.300	6.5	2,634,946	2,568,185	2,568,185
20	0.49	1.34	272,162	97,516	174,646	0.56	74	23	0.69	0.024	0.378	6.3	3,547,601	3,354,759	3,352,177
25	0.54	1.48	694,275	284,187	410,088	0.69	74	23	0.60	0.021	0.506	6.6	5,388,142	4,614,542	4,576,885
30	0.59	1.62	1,113,607	430,248	683,359	0.63	74	20	0.55	0.019	0.567	6.3	6,278,251	4,904,505	4,868,923
35	0.64	1.75	1,377,355	501,550	875,805	0.57	74	19	0.51	0.018	0.596	6.1	6,549,201	4,824,449	4,676,364
40	0.69	1.89	1,562,259	538,576	1,023,683	0.53	75	18	0.49	0.017	0.617	5.9	6,658,619	4,708,659	4,440,371
45	0.74	2.03	1,703,277	578,202	1,125,075	0.51	75	18	0.47	0.017	0.631	5.8	6,705,114	4,597,834	4,243,264
50	0.79	2.16	1,884,089	651,189	1,232,900	0.53	75	17	0.46	0.016	0.651	5.7	6,743,377	4,515,177	3,905,050
55	0.84	2.30	1,974,509	681,232	1,293,277	0.53	75	17	0.45	0.016	0.661	5.7	6,753,494	4,473,594	3,758,165
60	0.89	2.44	2,039,649	702,097	1,337,552	0.52	75	17	0.44	0.016	0.667	5.6	6,757,635	4,342,590	3,642,871
65	0.94	2.58	2,093,108	720,178	1,372,930	0.52	75	17	0.44	0.015	0.671	5.6	6,758,551	4,402,596	3,563,677
70	0.99	2.71	2,153,384	750,414	1,402,970	0.53	75	17	0.44	0.015	0.673	5.6	6,757,653	4,424,705	3,460,575
71	1.00	2.74	2,154,591	749,679	1,404,912	0.53	75	17	0.43	0.015	0.673	5.5	6,757,618	4,463,340	3,459,270
75	1.04	2.85	2,188,223	768,715	1,419,508	0.54	75	17	0.43	0.015	0.674	5.5	6,756,269	4,221,434	3,397,070
80	1.09	2.99	2,220,731	789,838	1,430,893	0.55	75	17	0.43	0.015	0.675	5.5	6,754,457	4,362,448	3,333,309
85	1.14	3.12	2,252,082	811,774	1,440,308	0.56	75	17	0.43	0.015	0.676	5.5	6,752,032	4,207,354	3,281,610
86	1.15	3.15	2,253,195	812,483	1,440,712	0.56	75	17	0.43	0.015	0.676	5.5	6,751,937	4,249,985	3,280,263
87	1.16	3.18	2,255,422	814,025	1,441,397	0.56	75	17	0.43	0.015	0.676	5.5	6,751,744	4,263,545	3,277,190
88	1.17	3.21	2,258,289	815,746	1,442,543	0.57	75	17	0.43	0.015	0.676	5.5	6,751,444	4,231,991	3,272,796
89	1.18	3.23	2,258,940	816,146	1,442,794	0.57	75	17	0.43	0.015	0.676	5.5	6,751,380	4,329,410	3,272,138

Figura 1-1: Resultados Análisis Milawa



En las siguientes Tablas se muestra parámetros técnico-económicos utilizados en la optimización del pit.

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Tabla 1-2: Costos de Proceso, Costos de Productos y Pagables

Minera Chinalco Peru - Toromocho Project Optimization Parameters Whittle 2020		
		ING 2020
Mine Cost		
Ore Waste MCAF	US/tore US/twaste (per bench) (Bench Base 4725)	Base 1.1211 x MCAF + Sust. Capital * Equation
Process Cost		
Mill	US/tm	5.7546 + Sust Capital+ Kingsmill
G&A	US/tm	0.4627 + Sust Capital
Minimun Cu Grade	%	0.15
Throughtput	ton Ore	** Equation
Commodities Price		
Cu	US/lb	2.74
Mo	US/lb	11.3
Ag	US/t.oz	16.78
Payable		
Cu (ore)	%	Cu Conc -1%
Mo (Ore)	%	100
Ag (ore)	%	90
Sustaining Capital		
Mine Sustaining Capital	US$/ton Mined	0.312
Process Sustaining Capital	US$/tons processed	0.356
General & Admin Sustaining Capital	US$/tons processed	0.039
Concentrate Moisture		
Concentrate Moisture		9%
Fixed Cost		
Fixed Administrative Cost	US/tm	0.822
Insurance	US/tm	0.139
Royalties	US/tm	0.159
Kingsmill Cost	US/tm	0.094

* (0.00000031*WBENCH**4-0.00002964*WBENCH**3+ 0.00073297*WBENCH**2-0.0287439*WBENCH**1+2.58100786)

* (0.00000064*WBENCH**4-0.0001173*WBENCH**3+0.00761221*WBENCH**2-0.22955765*WBENCH**1+4.37619922)

** (100320-1685*HARD+1572*FE-609*MGO+38471*RTOX+5482*SKR_ACT_TREM/100-11359*HORN/100)

La ecuación de throughput (**) fue referencial ya que la alimentación considera el ramp-up definido por la planta ajustado a una tasa fija de 170 ktpd.

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Tabla 1-3: Costos de Venta

Minera Chinalco Peru - Toromocho Project Optimization Parameters Whittle 2020		
Selling Cost	**Unit**	**Values**
a) Treatment charges (TC) Cu		
CIQ Compliance As in Conc < =0.5%	US$/dtm	82.530
0.5% < = As in Conc, high F > 1000 ppm	US$/dtm	91.720
0.5% < = As in Conc ≤ 1%	US$/dtm	110.720
1% < As in Conc ≤ 1.5%	US$/dtm	115.720
1.5 % < As in Conc	US$/dtm	135.720
b) Refining charges (RC) Cu		
CIQ Compliance As in Conc < =0.5%	US$/dtm	37.299
0.5% < As in Conc, high F > 1000 ppm	US$/dtm	41.453
0.5% < As in Conc ≤ 1%	US$/dtm	50.040
1% < As in Conc ≤ 1.5%	US$/dtm	52.299
1.5 % ≤ As in Conc	US$/dtm	61.338
c) Refining charges (RC) Ag		
CIQ Compliance As in Conc <= 0.5%	US$/oz payable	0.50
0.5% < As in Conc, high F > 1000 ppm	US$/oz payable	0.50
0.5% < As in Conc ≤ 1%	US$/oz payable	0.50
1% < As in Conc ≤ 1.5%	US$/oz payable	0.50
1.5 % ≤ As in Conc	US$/oz payable	0.50
		0.50
d) Cu Selling Cost		
Rail Transport - Mine to Warehouse Callao	USD/wmt	23.50
Bulk International Cargo Transportation	USD/wmt	38.07
Storage	USD/wmt	14.50
Warehouse operations	USD/wmt	3.17
Conveyor Belt	USD/wmt	8.50
Bulk Customs Agency	USD/wmt	0.10
Reception Concentrate Supervision	USD/wmt	0.30
Dispatch Concentrate Supervision	USD/wmt	0.35
Sample Analysis at Reception	USD/wmt	0.70
Dispatch Sample Analysis	USD/wmt	0.45
Destination supervision, Part analysis and resolutions.	USD/wmt	1.50
		91.14
e) Mo Selling Cost		
Laboratory	US$/dtm MoO3	10
Logistics	US$/dtm MoO4	75
Freight	US$/dtm MoO5	15
Logistics in Destiny	US$/dtm MoO6	50
		150

Para la penalización o cargo por posibles contaminantes, el concentrado de cobre se ha clasificado en cinco tipos:

- La calidad 1 o CIQ Compliance (China Inspection and Quarantine), es el concentrado de cobre con ley de As menor a 0.5% y Flúor en el concentrado bajo los 1000 ppm.
- La calidad 2 corresponde al concentrado de cobre con ley de As menor a 0.5% y Flúor en el concentrado sobre 1000 ppm.
- La calidad 3 corresponde al concentrado de cobre con ley de As entre 0.5% y 1%.
- La calidad 4 corresponde al concentrado de cobre con ley de As entre 1.0% y 1.5%.
- La calidad 5 es el concentrado de cobre cuya ley de As es mayor a 1.5%.

La Tabla 1-4, resume los criterios de penalización incorporados en el modelo económico para la determinación del pit final y el diseño minero.

Tabla 1-4: Penalidades

Minera Chinalco Peru - Toromocho Project Optimization Parameters Whittle 2020		
Penalties		
As and Zn penalization model		
As		
0.20 % < As in Conc ≤ 1.0%	US$/dmt conc	4 * (per each 0.1 %)
1.0 % < As in Conc	US$/dmt conc	8 * (per each 0.1 %)
Zn		
3% ≤ Zn in Conc	US$/dmt conc	3 * (per each 1.00 %)
MgO		
1% ≤ MgO in Conc	US$/dmt conc	3 * (per each 1.0 %)
F		
400 ppm < F in Conc ≤ 1000 ppm	US$/dmt conc	2.0 * (per each 100 ppm)
1000 ppm < F in Conc	US$/dmt conc	3.0 * (per each 100 ppm)

Las funciones de recuperación metalúrgica fueron incorporadas al modelo de optimización de acuerdo con las expresiones indicadas en la Tabla 1-5.

Tabla 1-5: Recuperaciones Metalúrgica

Metallurgical Recovery		Expression
Rec Cu (%)	=	(95.95-0.02498*(UINTA+UINTB)-0.1607*USKSM-1.237*RATOX-0.056*(FE/CU)+0.486*MGO + 0.001726*USKSM*USKSM + 0.001732*(UINTA+UINTB)*USKSM+0.0296*RATOX*(FE/CU)-0.0669*(FE/CU)*MGO)
Rec Ag (%)	=	72%
Rec Mo (%)	=	66%
Rec MOO3 (%)	=	93%
Rec As (%)	=	ASCC*TCC/(ton*AS)*100
Rec Zn (%)	=	ZNCC*TCC/(ton*ZN)*100
Rec F (%)	=	FCC*TCC/(ton*F)*100
Rec MgO (%)	=	MGOCC*TCC/(ton*MGO)*100

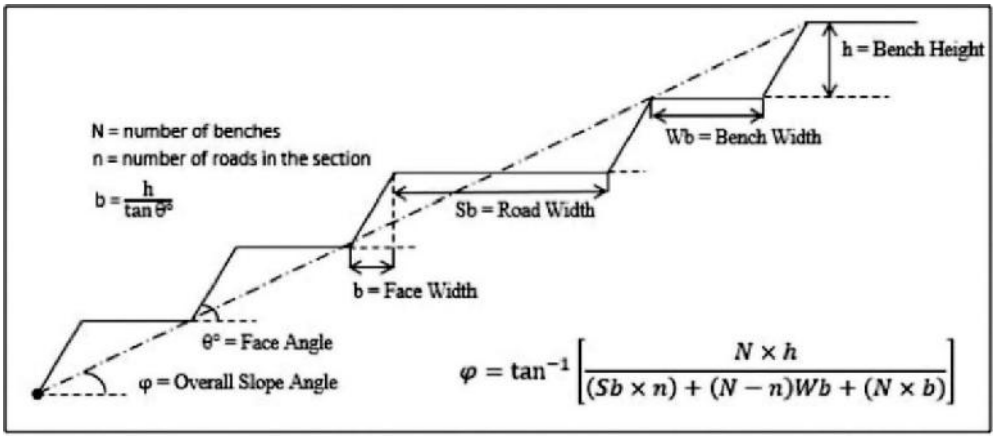
Concentrade Grades Estimation	Unit	Expression
Cu Conc	%	24%
Ag Conc	g/t	ton*AG*RAG/TCC
Mo Conc	%	19%
MOO3C	%	66%
As Conc	%	(0.6906-1.4405*TCU+0.03947*AG+24.54*AS-0.502*RATOX/100)
Zn Conc	%	(2.491-4.057*TCU+0.0622*AG+26.497*ZN)
F Conc	%	(67+559.8*TCU-44.03*AG-15.46*MGO+0.1819*FL-205.9*USKSM/100+475*UHONR/100-2499*TALC/100)
MgO Conc	%	(0.286+0.0155*MGO+3.626*TCU+0.000436*FL-12.48*TALC/100-1.904*USKSM/100+4.271*UHONR/100-0.2780*AG)

Los parámetros geotécnicos incorporados al modelo son los indicados en la Tabla 1-6.

Tabla 1-6: Parámetros Geotécnicos Mina Toromocho

CODE	IRA	BFA	Berm (m)	N° Benches Uncoupling	Uncoupling Width (m)	Ramp (m)	Overall Slope
1	38	60	10.54	8	30.00	40.00	33
2	44	73	10.95	8	30.00	40.00	38
3	40	64	10.56	8	30.00	40.00	35
4	49	80	10.39	8	30.00	40.00	42
5	49	80	10.39	8	30.00	40.00	42
6	44	73	10.95	8	30.00	40.00	38
7	42	69	10.90	8	30.00	40.00	36
8	49	80	10.39	8	30.00	40.00	42
9	40	64	10.56	8	30.00	40.00	35
10	49	80	10.39	8	30.00	40.00	42
11	44	75	11.51	8	30.00	40.00	38
12	49	80	10.39	8	30.00	40.00	42
13	37	63	12.26	8	30.00	40.00	33
14	19	38	24.36	8	30.00	40.00	18
15	49	80	10.39	8	30.00	40.00	42
16	44	72	10.66	8	30.00	40.00	38
17	40	64	10.56	8	30.00	40.00	35
18	49	80	10.39	8	30.00	40.00	42
19	40	66	11.20	8	30.00	40.00	35
20	44	75	11.51	8	30.00	40.00	38
21	22	43	21.04	8	30.00	40.00	21
22	44	75	11.51	8	30.00	40.00	38
23	44	75	11.51	8	30.00	40.00	38
24	40	64	10.56	8	30.00	40.00	35
Tailing (25)	14	27	30.72	8	30.00	40.00	14
100	23	37	15.00	8	30.00	40.00	22

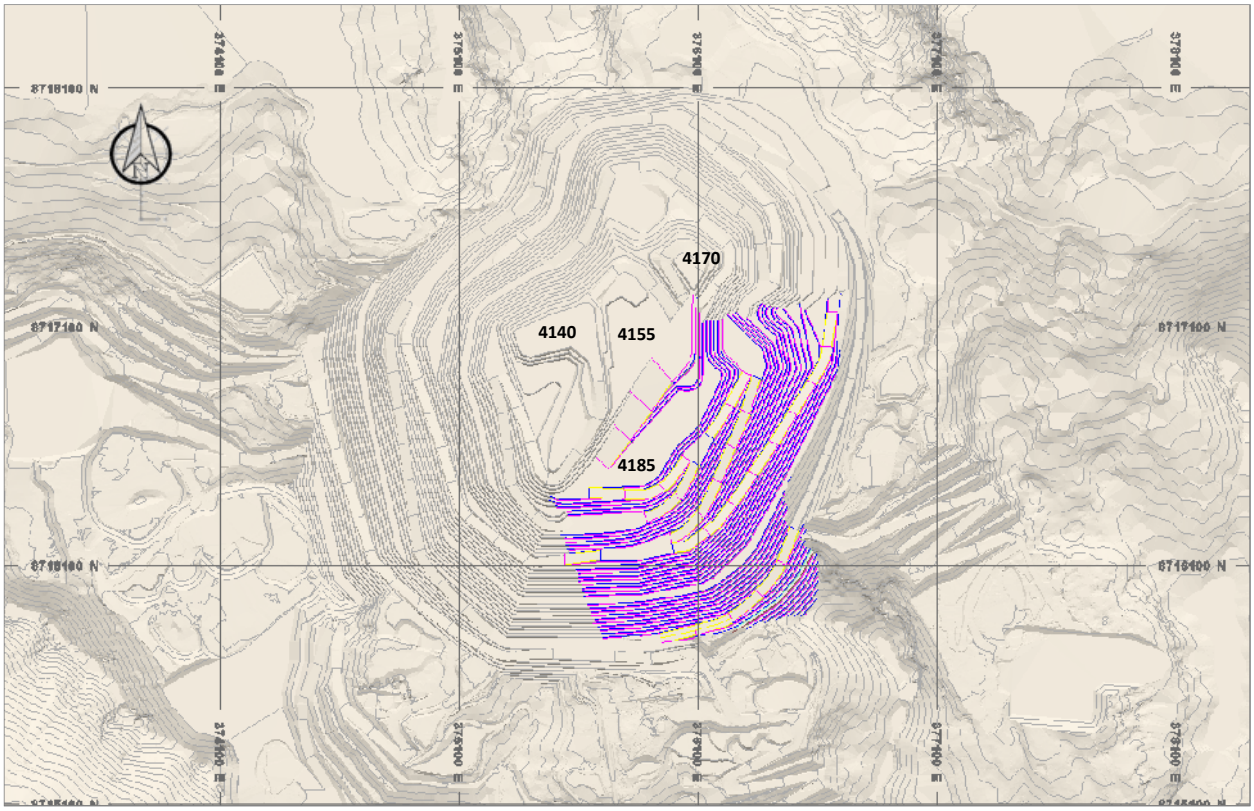
El cálculo del ángulo global está en función de la altura de desacople y longitud de la berma, como lo muestra la siguiente expresión:



1.5 Diseño del Pit Final

Una vez seleccionado el Pit Final (Pit 71), se efectúa el diseño operacional de fases siguiendo la dirección de la secuencia de los pits anidados. Las fases se diseñan con dimensiones (anchos y largos) adecuadas para la operación de equipos de alto tonelaje. El diseño del Pit Final se muestra en la Figura 1-2.

Figura 1-2: Diseño de la Fase-9 y Pit Final



1.6 Secuencia y Cubicación de Fases

La secuencia de las fases diseñadas se muestra en la Figura 1-3. La Tabla 1-7, muestra la cubicación de las fases generadas a partir de la topografía del 31 de diciembre de 2019. El mineral se define a partir de los recursos medidos e indicados, con ley de corte económica de acuerdo con el INP mayor a 1.62 US$/t, con el propósito de cuantificar el mineral en forma referencial.

Figura 1-3: Precedencia de Fases

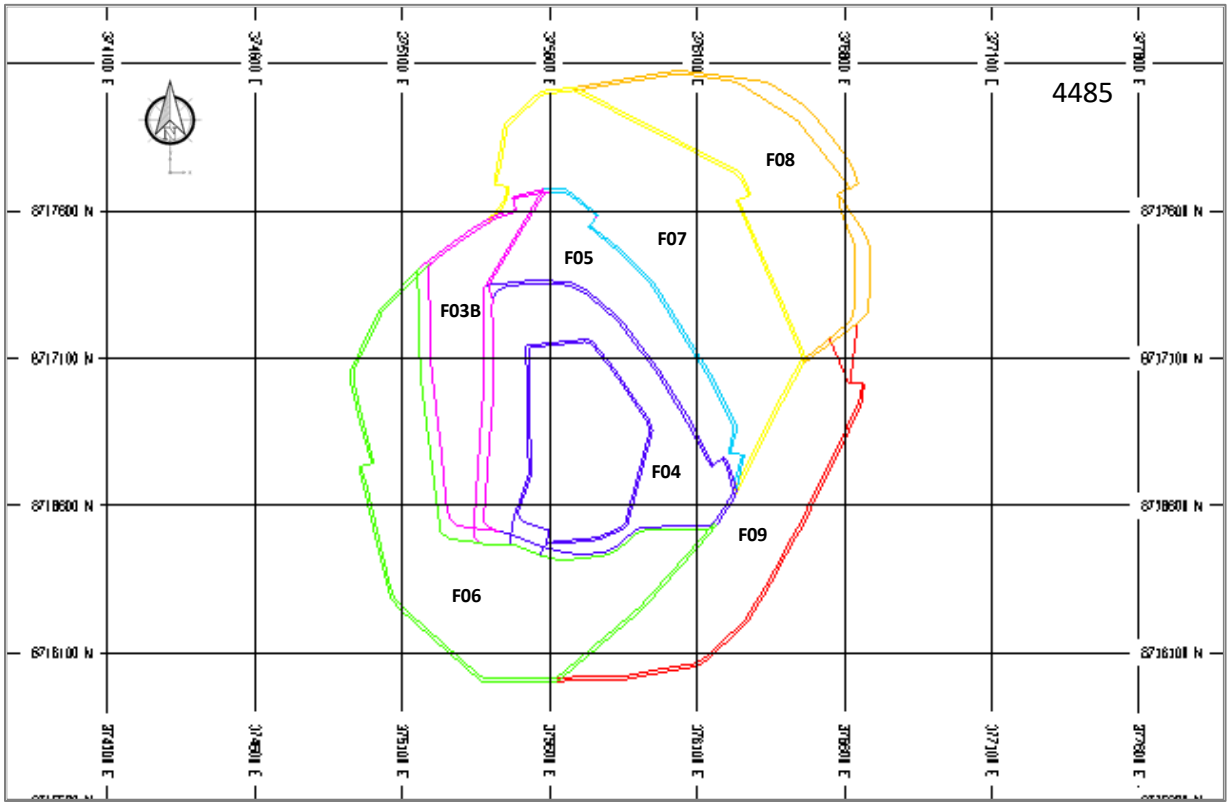


Figura 1-4: Precedencia de Fases en Perfil Longitudinal

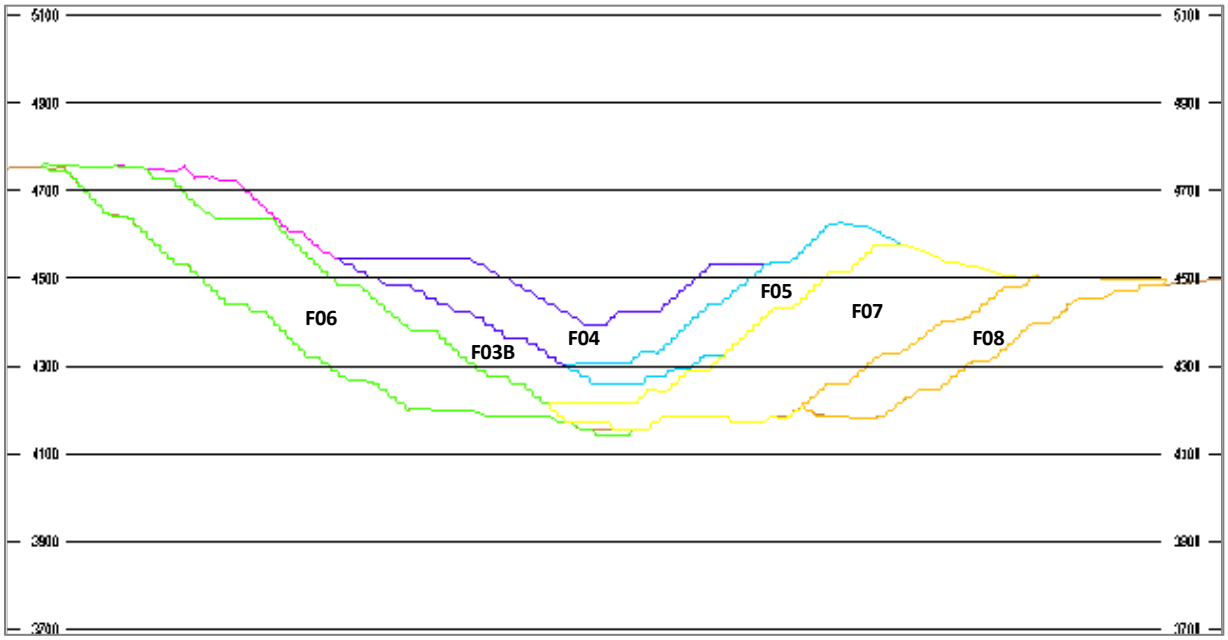


Tabla 1-7: Cubicación de Fases

Phases	Ore (Cutoff > 1.62 US$/t INP)				Waste	Total	W/O	GI
	kt	(%) TCu	(%) Mo	(g/t) Ag	kt	kt		
F02	26,695	0.519	0.025	4.82	112	26,807	0.00	0.52
F03AD	34,277	0.509	0.013	7.10	11,834	46,111	0.35	0.38
F03B	187,461	0.492	0.016	6.77	70,957	258,417	0.38	0.36
F04D	191,256	0.520	0.017	4.79	8,691	199,947	0.05	0.50
F05	121,759	0.463	0.011	5.28	17,076	138,835	0.14	0.41
F06	434,668	0.391	0.018	5.50	389,088	823,756	0.90	0.21
F07	229,338	0.433	0.012	5.78	102,994	332,332	0.45	0.30
F08	58,189	0.476	0.008	5.42	102,982	161,171	1.77	0.17
F09	165,646	0.352	0.013	4.64	140,948	306,594	0.85	0.19
TOTAL	**1,449,289**	**0.438**	**0.015**	**5.52**	**844,682**	**2,293,971**	**0.58**	**0.28**

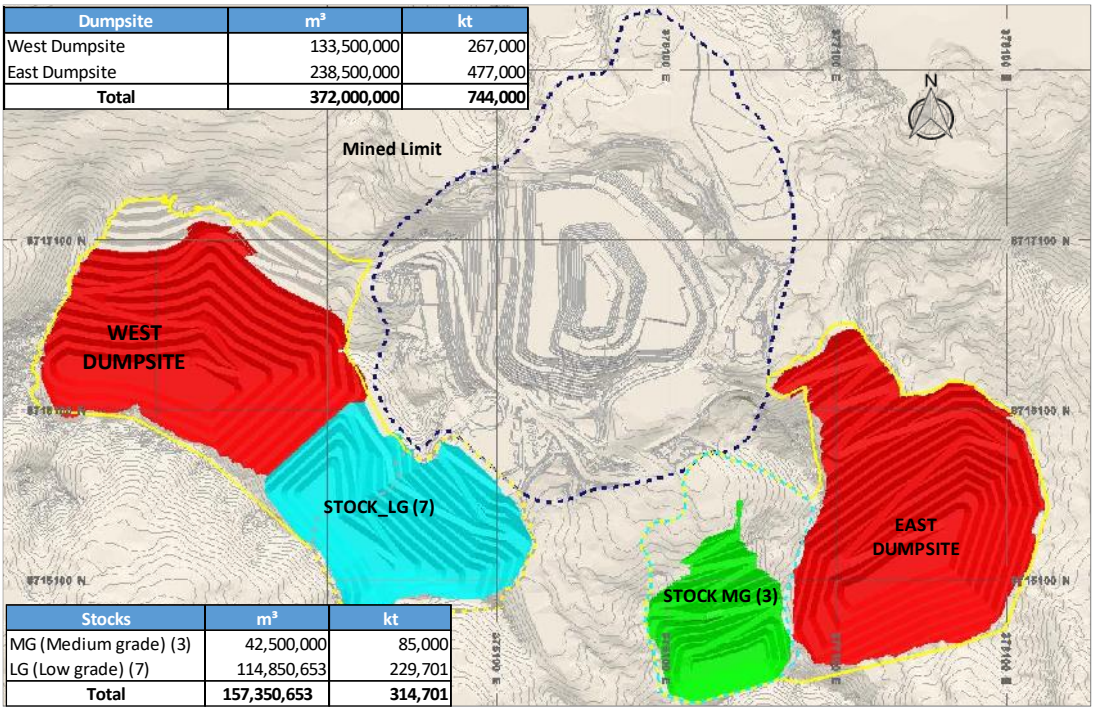
Measured and Indicated

1.7 Diseño Depósito de Desmontes y Stocks

En la Figura 1-5 se muestra el diseño inicial de los desmontes de lastre y stocks propuestos por MCP, de acuerdo con los requerimientos del plan minero de largo plazo. Existen dos desmontes de lastre de gran capacidad y dos stocks para el remanejo de los minerales. El área que ocupa el Stock MG (Stock-3, ubicado en el sector Este) debe quedar disponible, para acopiar lastre, a partir del año 2033. El Stock LG (Stock-7, ubicado en el sector Oeste), está diseñado de forma auto soportada (separado del botadero de lastre), debido a que es necesario ocupar este stock para envió de minerales en forma simultánea, a medida que avanza el botadero de lastre. De esta forma se evita contaminar el mineral con estéril.

En la Figura 1-6 se muestra la disposición final de los desmontes de estéril, diseñados para el actual plan LOM. Estos se ubican en el sector Este de la mina “Desmonte Este” (que incorpora el espacio que deja el stock MG (3) a partir del periodo 2033) y el sector Oeste (“Desmonte Oeste”), sector en el cual se aprecia que el Stock LG (7) fue extraído totalmente dejando la topografía natural. A su vez, esta configuración de desmontes muestra que existe una capacidad superior a 350 Mt., que podría ser utilizado como desmonte en una eventual ampliación de reservas mineras, o bien un mejoramiento del negocio al tener la posibilidad de mantener la política de ley de corte variable por un mayor período de tiempo, procesando los minerales de menor ley hacia finales del plan LOM.

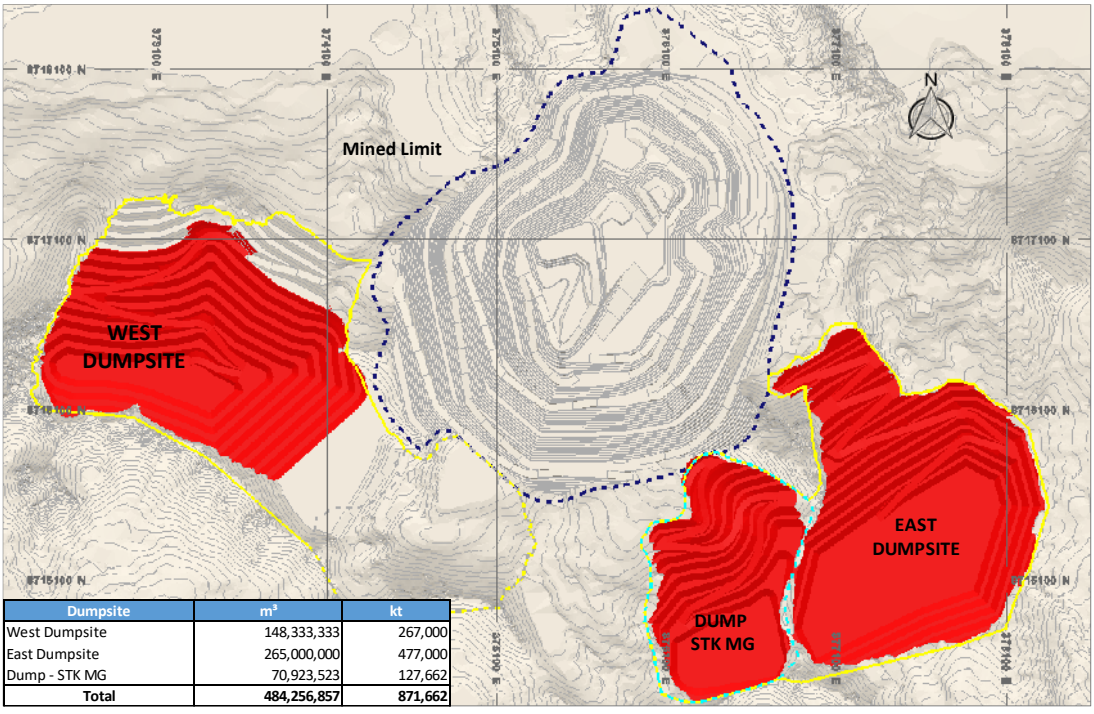
Figura 1-5: Diseños Depósitos de Desmonte y Stocks Iniciales



Dumpsite	m³	kt
West Dumpsite	133,500,000	267,000
East Dumpsite	238,500,000	477,000
Total	**372,000,000**	**744,000**

Stocks	m³	kt
MG (Medium grade) (3)	42,500,000	85,000
LG (Low grade) (7)	114,850,653	229,701
Total	**157,350,653**	**314,701**

Figura 1-6: Diseños Depósitos de Desmontes (Acopios de Estéril)



Dumpsite	m³	kt
West Dumpsite	148,333,333	267,000
East Dumpsite	265,000,000	477,000
Dump - STK MG	70,923,523	127,662
Total	**484,256,857**	**871,662**

La Tabla 1-8 muestra las capacidades de los desmontes que se indican en la Figura anterior. La capacidad total del Desmonte de lastre es de aproximadamente 872 Mt. Esta capacidad está distribuida en 267 Mt en el Desmonte Oeste, 477 Mt en el Desmonte Este y 128 Mt en el espacio que dejó el Stock MG. Esta capacidad es suficiente para cubrir el requerimiento del plan minero, el cual es de 844 Mt de Lastre a partir de enero del año 2020. La densidad base para el cálculo del tonelaje es 1.8 t/m^3.

Tabla 1-8: Capacidad de Desmontes

Dumpsite	m³	kt
West Dumpsite	148,333,333	267,000
East Dumpsite	265,000,000	477,000
Dump - STK MG	70,923,523	127,662
Total	**484,256,857**	**871,662**

La Tabla 1-9, muestra la capacidad de 315 Mt, diseñada para el acopio de minerales, distribuidas en dos posiciones principales, donde el Stock MG (minerales de mediana ley), con capacidad de 85 Mt y el Stock LG (minerales de baja ley), con capacidad de 230 Mt. El plan minero requiere 229 Mt de baja ley por tanto la capacidad de stock es suficiente. La capacidad es calculada en base a una densidad de 2.0 t/m^3, humedad de 2.5% y un esponjamiento de 30%.

Tabla 1-9: Capacidad de Stocks

Stocks	m³	kt
MG (Medium grade) (3)	42,500,000	85,000
LG (Low grade) (7)	114,850,653	229,701
Total	**157,350,653**	**314,701**

La densidad estimada para los stocks considera un grado de compactación debido al continuo tránsito de camiones de alto tonelaje durante la operación de acopio.

Además, en la actualidad se cuenta con 130 Mt de mineral en stock, por tanto, el plan minero LOM, mueve 358 Mt de remanejo.

1.8 Definición de Ley de Corte

Para la construcción del plan minero estratégico y operativo, la definición de ley de corte se basa en el concepto Income Net of Process (INP), de acuerdo con los siguientes valores:

- El marginal cut-off grade para los minerales, alimentados al chancador directamente desde la mina, sería de INP = 1.62 US$/t. Este valor está basado en el costo del G&A.

- El marginal cut-off grade para los minerales que se deben enviar a stock, y posteriormente pagar el remanejo, sería de INP = 2.32 US$/t. Este valor está basado en el costo de G&A de 1.62 US$/t y un costo de remanejo de 0.7 US$/t.

La Tabla 1-10, muestra el perfil de ley de corte para el plan minero operativo por tipo de mineral. En el plan se realiza la separación de los materiales Hornfels, Skarn Serpentina-Magnetita (SM), Actinolita-Tremolita (AT) y el resto de los otros tipos de minerales, con el objeto de realizar la mezcla por periodos y así cumplir con las restricciones impuestas para estos tipos de minerales. Sin embargo, en la construcción del plan minero las leyes de corte fueron las mismas para todos los tipos de material por periodo, de acuerdo con la operación actual de la mina.

Tabla 1-10: Perfil de Ley de Corte, Basada en INP según tipo de Mineral

Periodo		Clasificación de Mineral	
Per.Inicial	Per.Final	Mg	Lg
2021	2021	13.5	11
2022	2022	11.5	9
2023	2023	11	9
2024	2024	11	9
2025	2025	8.5	8
2026	2026	12	11
2027	2027	8.5	8.5
2028	2044	1.62	1.62

La ley de corte por INP considerada para el plan minero LOM el envío de minerales al chancado y al stock de Baja Ley, ya que comienza el periodo de reclamación de los stocks de mediana ley desde el año 2022 hasta el año 2030. Posteriormente se reclama el stock de baja ley.

1.9 Plan Minero Estratégico

En el presente capítulo, se exponen los resultados de la planificación estratégica realizada por MCP, que consiste en diseñar 6 set de fases, con las cuales se realizan diferentes planes mineros optimizados, mediante el módulo MPSO (software MineSight de Hexagon), con el objetivo de:

- Maximizar el NPV,
- Maximizar la ley de alimentación en los primeros 10 años,
- Maximizar el movimiento y hacerlo en forma uniforme por el máximo de periodos,
- Optimizar la capacidad de stockpiles y desmontes,
- Mantener las restricciones de alimentación a planta, y
- Aplicar las nuevas ecuaciones metalúrgicas al bloque y al plan de minado.

En la Tabla 1-11, se muestra el set de casos realizados, con la precedencia de fases diseñadas. Cada uno de los planes de minado realizados con el módulo MPSO, es operativizado mediante el software de planificación SP2, obteniendo las siguientes comparaciones:

Tabla 1-11: Casos Estratégicos Evaluados

Cases	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
	PH04	PH03	PH05	PH06*	PH07*	PH08	PH9	PH10	
SET-1	PH3A	PH3B	PH4	PH3C	PH5	PH6	PH7	PH8	PH9
SET-A	PH3A	PH3B	PH4	PH5	PH3C	PH6	PH7	PH8	PH9
SET-B	PH3A	PH4	PH5	PH3B	PH7	PH8	PH6	PH9	
SET-C	PH4	PH5	PH3B	PH7	PH8	PH6	PH9		
SET-D	PH4	PH5	PH3B	PH7	PH8	PH6	PH9		
SET-E	PH4	PH5	PH3B	PH7	PH8	PH6	PH9		
SET-F	PH4	PH5	PH3B	PH7	PH8	PH6	PH9		

Las siguientes figuras, muestran las comparaciones entre los casos para los primeros 5 años, 10 años y para el LOM total.

Figura 1-7: Comparación de Casos 5 y 10 Años

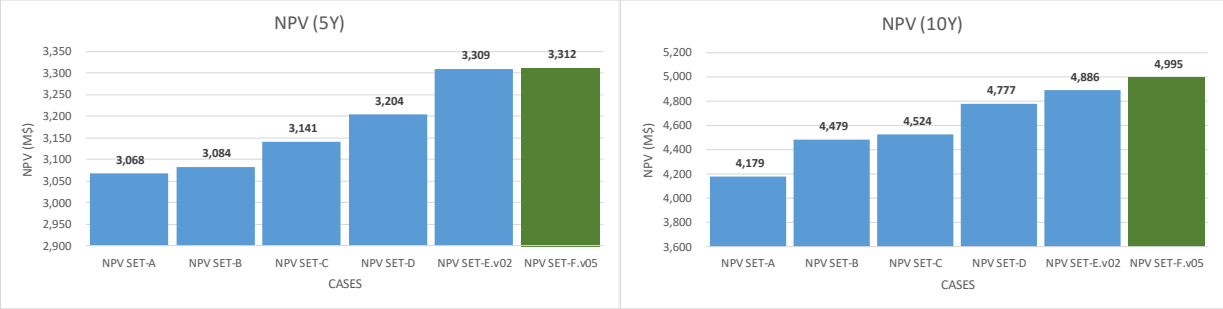
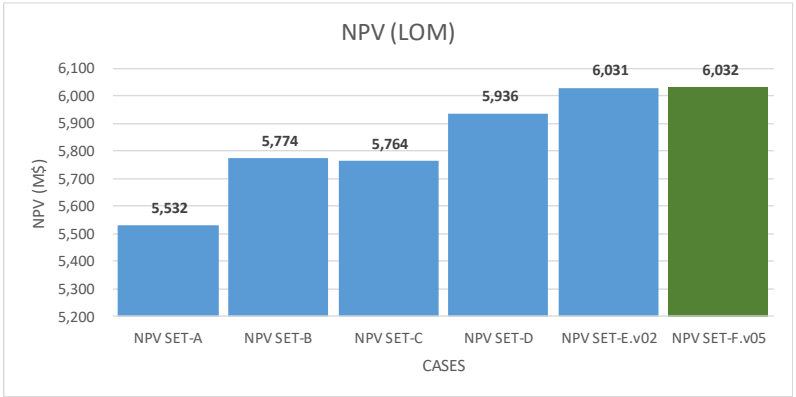


Figura 1-8: Comparación de Casos LOM



El plan estratégico seleccionado corresponde al que presenta mayor NPV que, de acuerdo con las comparaciones anteriores, es el plan con los diseños de las fases del SET F. En la Tabla 1-12 y Tabla 1-13, se detalla los movimientos del plan estratégico desglosado en los movimientos de la mina a proceso, de stocks a proceso, total enviado de alimentación a planta, los remanejos, la cantidad de estéril y los totales para la extracción y para el movimiento desde el año 2021 hasta agotar las reservas el año 2044.

Tabla 1-12: Resumen Movimientos Plan de Minado Estratégico SET F

	Unit	Total	Year											
			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Ore to Process														
Total	**kt**	**1,097,523**	**54,032**	**56,673**	**59,659**	**60,663**	**62,050**	**62,050**	**62,050**	**45,343**	**28,203**	**19,839**	**9,190**	**23,114**
TCu	%	0.465	0.621	0.603	0.575	0.604	0.573	0.599	0.529	0.466	0.457	0.422	0.351	0.309
Mo	%	0.017	0.020	0.018	0.017	0.018	0.016	0.020	0.015	0.022	0.009	0.014	0.004	0.004
Ag	g/t	5.710	5.168	5.768	6.960	7.750	7.071	6.052	6.090	6.057	5.292	4.608	5.091	5.319
Ore to Stocks														
Total	**kt**	**228,587**	**42,624**	**41,135**	**47,077**	**25,428**	**19,871**	**42,650**	**9,802**	**-**	**-**	**-**	**-**	**-**
TCu	%	0.298	0.328	0.283	0.275	0.295	0.294	0.324	0.254	-	-	-	-	-
Mo	%	0.007	0.007	0.009	0.005	0.006	0.008	0.007	0.005	-	-	-	-	-
Ag	g/t	4.43	4.199	4.050	5.255	5.169	3.972	4.146	3.347	-	-	-	-	-
Stock to Process														
Total	**kt**	**374,143**	**285**	**1,906**	**2,391**	**1,557**	**-**	**-**	**-**	**16,877**	**33,847**	**42,211**	**52,860**	**39,106**
TCu	%	0.342	0.420	0.420	0.420	0.375	-	-	-	0.417	0.393	0.386	0.369	0.345
Mo	%	0.017	0.010	0.010	0.010	0.010	-	-	-	0.012	0.012	0.011	0.044	0.040
Ag	g/t	4.94	6.210	6.210	6.210	4.535	-	-	-	6.328	5.575	5.614	4.927	4.636
Total to process														
Total	**kt**	**1,471,666**	**54,317**	**58,579**	**62,050**	**62,220**	**62,050**	**62,050**	**62,050**	**62,220**	**62,050**	**62,050**	**62,050**	**62,220**
TCu	%	0.433	0.620	0.597	0.569	0.598	0.573	0.599	0.529	0.453	0.422	0.398	0.366	0.331
Mo	%	0.015	0.020	0.018	0.017	0.018	0.016	0.020	0.015	0.019	0.011	0.012	0.009	0.007
Ag	g/t	5.55	5.174	5.783	6.931	7.669	7.071	6.052	6.090	6.130	5.447	5.293	5.407	5.209
Rehandling	kt	55,652	2,716	2,929	3,103	3,111	3,103	3,103	3,103	2,267	1,410	999	714	1,331
Waste														
Total	kt	**824,124**	28,511	25,708	17,769	38,593	41,746	25,884	58,559	68,573	68,239	68,377	62,764	53,888
Total	**kt**	**2,150,233**	**125,167**	**123,517**	**124,504**	**124,684**	**123,667**	**130,583**	**130,411**	**113,916**	**96,442**	**88,216**	**71,954**	**77,003**
Total	**kt**	**2,580,029**	**128,168**	**128,351**	**129,998**	**129,352**	**126,770**	**133,686**	**133,513**	**133,060**	**131,699**	**131,426**	**125,528**	**117,439**

	Unit	Total	Year											
			2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Ore to Process														
Total	**kt**	**1,097,523**	**15,667**	**19,742**	**35,602**	**44,443**	**61,760**	**62,050**	**62,050**	**62,220**	**44,322**	**51,413**	**54,959**	**40,428**
TCu	%	0.465	0.306	0.331	0.345	0.363	0.391	0.375	0.404	0.443	0.403	0.379	0.357	0.399
Mo	%	0.017	0.006	0.005	0.007	0.009	0.012	0.016	0.020	0.022	0.019	0.022	0.025	0.028
Ag	g/t	5.71	5.337	6.117	6.309	6.003	5.949	5.469	5.165	4.921	4.143	3.817	4.286	6.275
Ore to Stocks														
Total	**kt**	**228,587**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
TCu	%	0.298	-	-	-	-	-	-	-	-	-	-	-	-
Mo	%	0.007	-	-	-	-	-	-	-	-	-	-	-	-
Ag	g/t	4.43	-	-	-	-	-	-	-	-	-	-	-	-
Stock to Process														
Total	**kt**	**374,143**	**46,383**	**42,308**	**26,448**	**17,777**	**290**	**-**	**-**	**-**	**17,728**	**10,637**	**7,091**	**14,441**
TCu	%	0.342	0.306	0.305	0.305	0.305	0.360	-	-	-	0.305	0.305	0.305	0.305
Mo	%	0.017	0.008	0.006	0.006	0.006	0.010	-	-	-	0.006	0.006	0.006	0.006
Ag	g/t	4.94	4.569	4.590	4.596	4.596	3.990	-	-	-	4.596	4.596	4.596	4.596
Total to process														
Total	**kt**	**1,471,666**	**62,050**	**62,050**	**62,050**	**62,220**	**62,050**	**62,050**	**62,050**	**62,220**	**62,050**	**62,050**	**62,050**	**54,870**
TCu	%	0.433	0.306	0.313	0.328	0.346	0.391	0.375	0.404	0.443	0.375	0.366	0.351	0.374
Mo	%	0.015	0.006	0.006	0.006	0.008	0.012	0.016	0.020	0.022	0.015	0.019	0.023	0.022
Ag	g/t	5.55	4.793	5.082	5.579	5.601	5.940	5.469	5.165	4.921	4.273	3.950	4.321	5.833
Rehandling	kt	55,652	798	991	1,780	2,222	3,103	3,103	3,103	3,111	2,216	2,571	2,748	2,021
Waste														
Total	kt	**824,124**	22,461	21,590	23,529	16,135	23,528	22,357	20,517	20,419	20,878	21,929	22,316	29,853
Total	**kt**	**2,150,233**	**38,129**	**41,331**	**59,130**	**60,578**	**85,289**	**84,407**	**82,567**	**82,639**	**65,200**	**73,342**	**77,275**	**70,281**
Total	**kt**	**2,580,029**	**85,310**	**84,630**	**87,359**	**80,577**	**88,681**	**87,510**	**85,669**	**85,750**	**85,144**	**86,550**	**87,114**	**86,744**

TETRA TECH

Tabla 1-13: Resumen Plan Estratégico Mineral a Proceso

ORE TO CRUSHER	Units	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
TONNAGE	Ton	54,317,410	58,579,052	62,050,005	62,219,812	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	62,220,000
Cu	%	0.620	0.597	0.569	0.598	0.573	0.599	0.529	0.453	0.422	0.398	0.366	0.331
Ag	g/t	5.174	5.783	6.931	7.669	7.071	6.052	6.090	6.130	5.447	5.293	5.407	5.209
Mo	%	0.020	0.018	0.017	0.018	0.016	0.020	0.015	0.019	0.011	0.012	0.009	0.007
ORE CONTAMINANTS													
As	%	0.017	0.018	0.021	0.014	0.025	0.018	0.013	0.019	0.017	0.019	0.021	0.021
Zn	%	0.124	0.155	0.152	0.314	0.259	0.152	0.096	0.138	0.138	0.123	0.211	0.291
F	ppm	2,176	1,788	1,838	2,242	2,077	2,085	1,726	1,798	1,720	1,718	1,696	1,497
MgO	%	8.371	8.593	6.813	10.983	11.080	8.212	6.483	6.664	7.563	6.420	8.281	8.684
As in Conc	%	0.384	0.471	0.621	0.448	0.726	0.473	0.481	0.722	0.687	0.760	0.833	0.890
Zn in Conc	%	3.584	4.528	4.649	8.669	7.457	4.485	3.290	4.701	4.768	4.459	6.936	9.183
F in Conc	ppm	401	296	297	285	233	309	287	232	208	243	200	200
MgO in Conc	%	2.050	1.503	1.394	1.411	1.200	1.391	1.358	1.120	1.024	1.131	1.035	1.048
ADITIONAL INFORMATION													
Hardness	ratio	2.636	2.649	2.652	2.556	2.565	2.656	2.817	2.722	2.727	2.821	2.696	2.626
Blastability Index	ratio	18.164	19.381	19.587	17.528	17.991	18.773	21.355	18.718	19.178	20.498	19.070	18.282
XRD TALC	%	3.532	2.555	1.888	4.395	4.456	2.891	0.824	1.980	2.065	1.679	2.181	2.171
Ratox	%	8.904	8.908	7.276	6.448	8.041	6.867	5.076	5.799	7.594	7.886	9.759	10.245
Fe	%	7.788	9.276	9.390	9.066	10.915	9.437	6.135	7.988	7.999	6.346	6.611	7.073
Recovery Cu	%	82.508	82.298	83.151	82.406	82.079	83.584	86.796	84.033	82.113	83.143	82.136	82.359
Recovery Ag	%	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	1,157,077	1,199,672	1,221,900	1,279,514	1,214,976	1,291,485	1,187,193	987,659	895,946	855,250	777,880	721,972
Cu in Concentrate	%	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000
Ag in Conc	g/t	176.351	212.906	267.357	289.886	262.391	218.787	236.249	286.599	282.094	283.211	312.039	322.961
Mo in Conc	%	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000
INP	$/ton	23.195	21.925	21.207	22.944	19.998	22.581	19.832	16.843	14.158	13.505	11.386	9.307
ALTERATION													
INTRUSIVE A	%	33%	36%	39%	18%	20%	38%	61%	59%	57%	71%	49%	31%
INTRUSIVE B	%	4%	9%	16%	9%	9%	9%	5%	9%	13%	12%	20%	23%
HORNFELS	%	14%	5%	5%	14%	10%	6%	4%	4%	4%	5%	9%	14%
SKARN ACTINOLITE TREMOLITE	%	32%	29%	24%	31%	32%	22%	16%	17%	11%	4%	9%	12%
SKARN SERPENTINE MAGNETITE	%	17%	21%	16%	28%	29%	25%	14%	11%	15%	8%	13%	19%
ANHYDRITE	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

ORE TO CRUSHER	Units	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
TONNAGE	Ton	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	54,869,718
Cu	%	0.306	0.313	0.328	0.346	0.391	0.375	0.404	0.443	0.375	0.366	0.351	0.374
Ag	g/t	4.793	5.082	5.579	5.601	5.940	5.469	5.165	4.921	4.273	3.950	4.321	5.833
Mo	%	0.006	0.006	0.006	0.008	0.012	0.016	0.020	0.022	0.015	0.019	0.023	0.022
ORE CONTAMINANTS													
As	%	0.020	0.020	0.019	0.019	0.017	0.014	0.010	0.013	0.015	0.016	0.011	0.012
Zn	%	0.221	0.209	0.223	0.228	0.267	0.165	0.148	0.141	0.105	0.081	0.085	0.100
F	ppm	1,479	1,488	1,479	1,516	1,488	1,509	1,769	2,133	1,759	1,704	1,618	1,619
MgO	%	8.614	8.652	8.975	9.013	9.007	8.034	8.244	8.666	6.803	5.340	4.483	4.825
As in Conc	%	0.866	0.869	0.867	0.842	0.730	0.659	0.513	0.526	0.650	0.681	0.597	0.645
Zn in Conc	%	7.408	7.072	7.420	7.472	8.352	5.688	5.087	4.748	4.017	3.399	3.596	3.974
F in Conc	ppm	200	205	200	200	200	202	230	229	240	269	272	275
MgO in Conc	%	1.207	1.244	1.207	1.111	1.002	1.025	1.108	1.018	1.006	1.083	1.125	1.179
ADITIONAL INFORMATION													
Hardness	ratio	2.662	2.657	2.616	2.616	2.627	2.632	2.651	2.585	2.655	2.719	2.849	2.795
Blastability Index	ratio	18.794	18.615	17.899	17.274	17.010	17.589	18.332	17.992	19.241	20.020	21.087	20.086
XRD TALC	%	2.285	2.188	2.203	2.425	3.009	2.015	2.105	3.147	2.280	1.843	1.171	0.979
Ratox	%	10.421	10.311	9.024	9.118	9.863	7.625	6.297	6.984	8.239	6.821	4.802	5.470
Fe	%	7.461	7.324	6.895	7.005	7.637	6.651	7.154	9.351	7.780	6.857	5.130	5.479
Recovery Cu	%	82.239	82.265	82.381	82.282	82.769	82.733	82.613	82.507	82.479	84.014	87.020	86.424
Recovery Ag	%	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	698,787	715,041	753,262	738,563	835,277	803,608	869,395	952,855	846,930	794,463	790,027	781,341
Cu in Concentrate	%	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000
Ag in Conc	g/t	303.817	314.831	335.424	348.241	337.061	309.266	275.494	239.546	236.925	228.962	255.080	303.321
Mo in Conc	%	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000
INP	$/ton	7.834	8.257	9.226	10.247	12.623	12.653	14.563	16.026	12.251	12.457	12.962	14.332
ALTERATION													
INTRUSIVE A	%	28%	27%	24%	28%	26%	29%	28%	29%	44%	56%	65%	58%
INTRUSIVE B	%	18%	18%	21%	21%	22%	20%	19%	12%	15%	14%	14%	14%
HORNFELS	%	17%	18%	19%	15%	7%	13%	10%	0%	5%	3%	2%	6%
SKARN ACTINOLITE TREMOLITE	%	21%	22%	19%	16%	11%	16%	23%	27%	17%	13%	7%	12%
SKARN SERPENTINE MAGNETITE	%	16%	15%	17%	22%	34%	23%	19%	31%	19%	12%	10%	9%
ANHYDRITE	%	0%	0%	0%	0%	0%	1%	0%	0%	1%	2%	1%	1%

Nota: MCP desarrolló el Plan Minero Estratégico a partir de la topografía a fin de diciembre del 2020 en periodos anuales.

1.10 Plan Minero Operativo

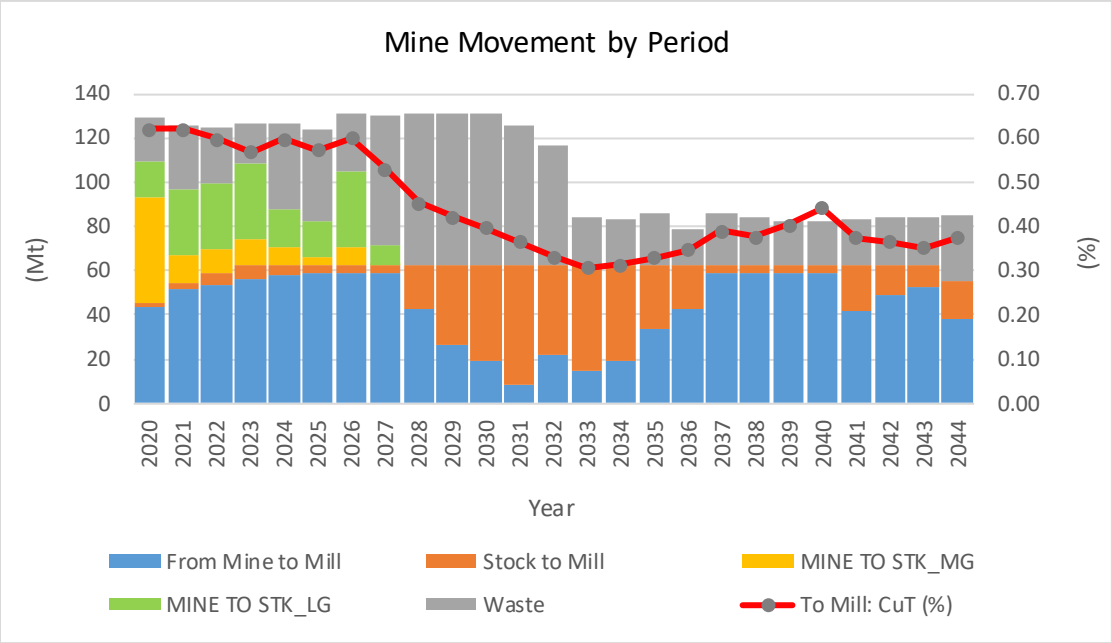
El plan minero operativo corresponde al mejor caso seleccionado en la planificación estratégica realizada por MCP, desarrollando la opción del Set F de fases o pushbacks; las que tienen por finalidad, mejorar el perfil de ley de alimentación los primeros 10 años, acercarse al pit RF1 optimizado con el software Whittle, y buscando entre todos los requerimientos no perder mineral, ni aumentar la cantidad de desmonte y mantener las definiciones dadas por la planificación estratégica (en relación con el perfil de ley de corte y movimientos por fases). Se realizó el plan minero operativo, mediante el software secuenciador *SP2,* el que permite programar en base a los equipos de carguío dispuestos en cada fase con sus correspondientes indicadores de gestión. El objetivo fue dar cumplimiento a los requerimientos de la planta, en cuanto a cantidad y calidad.

Los criterios considerados en el plan minero operativo son similares a los del plan estratégico, que se resume en lo siguiente:

- La topografía de inicio es al 31 de diciembre del 2020.
- La planificación se desarrolla a nivel de fase-banco, para todos los periodos con el siguiente desglose:
    - Asignación de equipos de carguío de acuerdo con el sinking rate definido en el estratégico, en base a rendimientos históricos promedio.
    - Períodos anuales, desde el 2021 hasta el fin de la vida de la mina.
- Seguir los lineamientos entregados por el plan estratégico desarrollado por MCP (MPSO de MineSight®), en cuanto a estrategia de ley de corte, secuencia minera y capacidad de mina.
- La estrategia del manejo de stock se mantiene respecto al plan estratégico, desarrollando un stock de alta ley y otro de mediana ley de cobre y se consumen los minerales desde stocks en forma anticipada, para dejar los espacios disponibles para acopiar material estéril.
- Incorpora al reporte el plan minero operativo del periodo 2020 realizado por MCP.

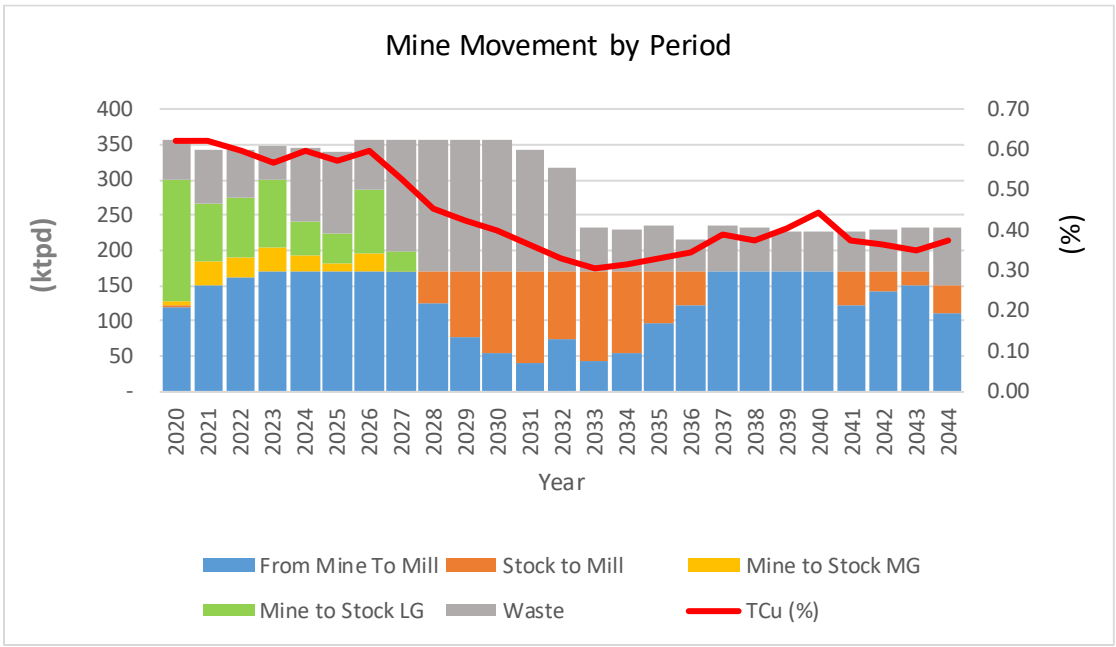
La Figura 1-9, muestra el resultado del movimiento de materiales programado para la mina Toromocho, señalando el desglose de los materiales desde mina, de stock, remanejo y movimiento de estéril.

Figura 1-9: Movimiento de Materiales para LOM Operativo



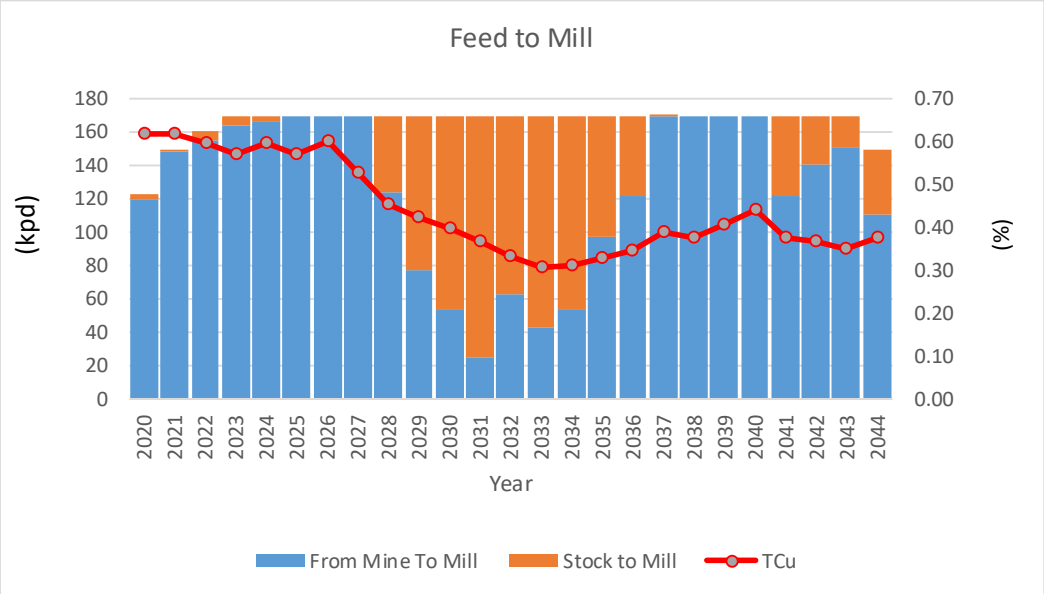
La Figura 1-10, muestra la tasa de minado por periodos anuales, expresados en ktpd, representando los minerales alimentados directamente desde mina, desde stock, los minerales enviados a stock y el movimiento de estéril.

Figura 1-10: Perfil de Capacidad de Mina en ktpd



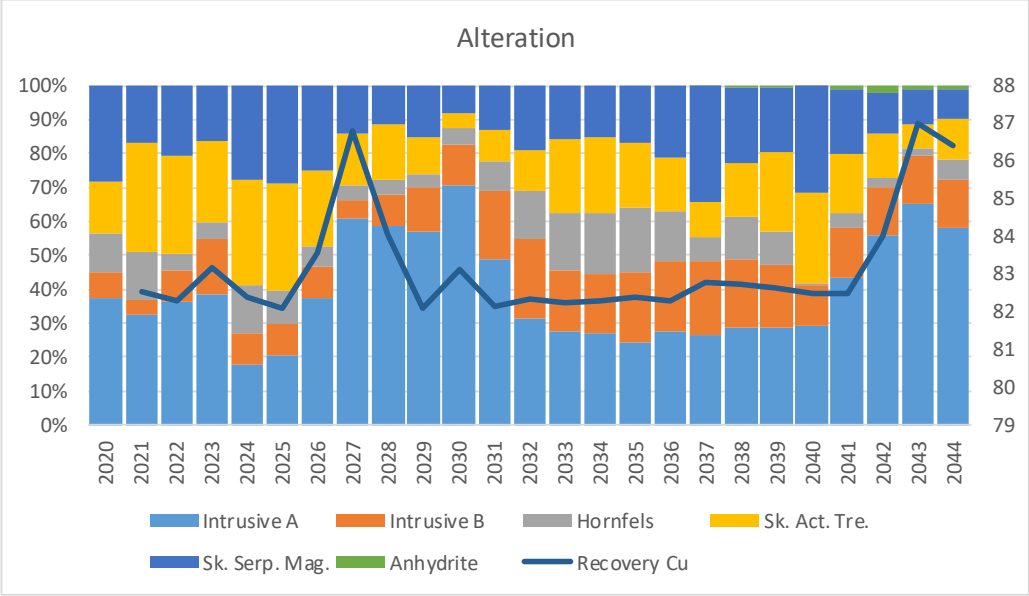
La alimentación programada en el plan operativo considera minerales enviados directamente desde la mina, y minerales remanejados desde stock, como se muestra en la Figura 1-11.

Figura 1-11: Alimentación de Mineral a la Concentradora por Promedio Diario



La Figura 1-12, muestra la distribución de los minerales por tipos de alteración, alimentados a la concentradora y la recuperación del Cu en periodos anuales, que cumple con las restricciones máximas para los tipos Skarn AT, Skarn SM y Hornfels.

Figura 1-12: Distribución de Minerales a Proceso



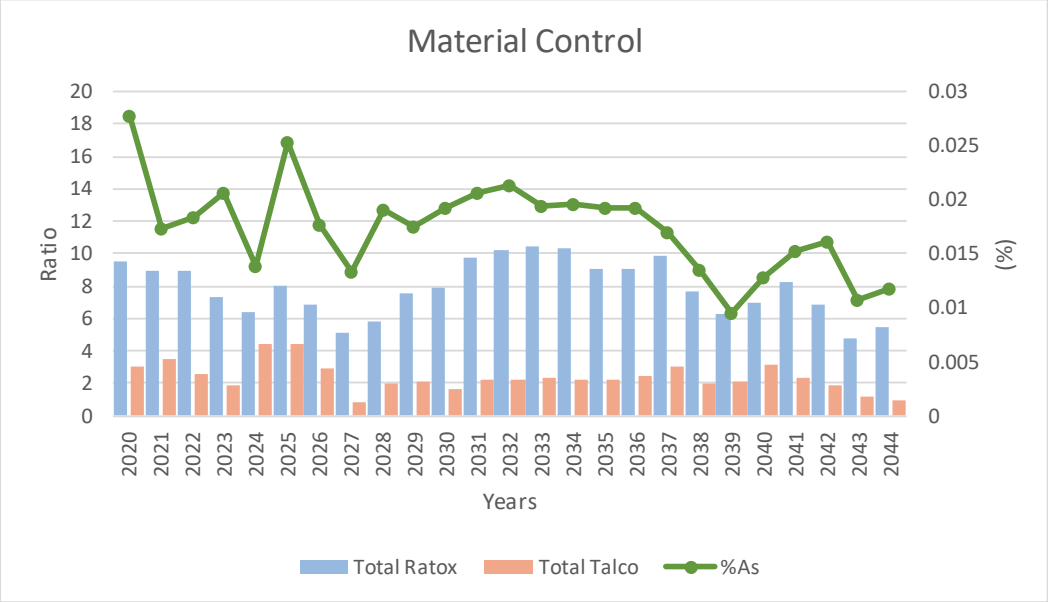
La Figura 1-13 y Figura 1-14 muestra el cumplimiento de las restricciones máximas para los minerales tipo Hornfels; Skarn SM y AT; Ratox; Talco y As. Hay valores que sobrepasan las restricciones en los periodos finales al incorporar los materiales desde los stocks en forma masiva.

Figura 1-13: Cumplimiento de Restricciones de Hornfels, Skarn SM y AT

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Tonnage	54,317,410	58,579,052	62,050,005	62,219,812	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	62,220,000
Cu%	0.62	0.60	0.57	0.60	0.57	0.60	0.53	0.45	0.42	0.40	0.37	0.33
Fe%	7.79	9.28	9.39	9.07	10.92	9.44	6.13	7.99	8.00	6.35	6.61	7.07
Zn%	0.12	0.15	0.15	0.31	0.26	0.15	0.10	0.14	0.14	0.12	0.21	0.29
As %	0.017	0.018	0.021	0.014	0.025	0.018	0.013	0.019	0.017	0.019	0.021	0.021
MgO %	8.37	8.59	6.81	10.98	11.08	8.21	6.48	6.66	7.56	6.42	8.28	8.68
Fluor ppm	2,176	1,788	1,838	2,242	2,077	2,085	1,726	1,798	1,720	1,718	1,696	1,497
Ratox %	8.9	8.9	7.3	6.4	8.0	6.9	5.1	5.8	7.6	7.9	9.8	10.2
Hard	2.6	2.6	2.7	2.6	2.6	2.7	2.8	2.7	2.7	2.8	2.7	2.6
Talco %	3.5	2.6	1.9	4.4	4.5	2.9	0.8	2.0	2.1	1.7	2.2	2.2
Intrusivo B %	4%	9%	16%	9%	9%	9%	5%	9%	13%	12%	20%	23%
Hornfels %	14%	5%	5%	14%	10%	6%	4%	4%	4%	5%	9%	14%
Actinolite_Tremolite %	32%	29%	24%	31%	32%	22%	16%	17%	11%	4%	9%	12%
Serpentine_Magnetine %	17%	21%	16%	28%	29%	25%	14%	11%	15%	8%	13%	19%

	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Tonnage	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	54,869,718
Cu%	0.31	0.31	0.33	0.35	0.39	0.38	0.40	0.44	0.37	0.37	0.35	0.37
Fe%	7.46	7.32	6.89	7.01	7.64	6.65	7.15	9.35	7.78	6.86	5.13	5.48
Zn%	0.22	0.21	0.22	0.23	0.27	0.17	0.15	0.14	0.10	0.08	0.09	0.10
As %	0.020	0.020	0.019	0.019	0.017	0.014	0.010	0.013	0.015	0.016	0.011	0.012
MgO %	8.61	8.65	8.98	9.01	9.01	8.03	8.24	8.67	6.80	5.34	4.48	4.82
Fluor ppm	1,479	1,488	1,479	1,516	1,488	1,509	1,769	2,133	1,759	1,704	1,618	1,619
Ratox %	10.4	10.3	9.0	9.1	9.9	7.6	6.3	7.0	8.2	6.8	4.8	5.5
Hard	2.7	2.7	2.6	2.6	2.6	2.6	2.7	2.6	2.7	2.7	2.8	2.8
Talco %	2.3	2.2	2.2	2.4	3.0	2.0	2.1	3.1	2.3	1.8	1.2	1.0
Intrusivo B %	18%	18%	21%	21%	22%	20%	19%	12%	15%	14%	14%	14%
Hornfels %	17%	18%	19%	15%	7%	13%	10%	0%	5%	3%	2%	6%
Actinolite_Tremolite %	21%	22%	19%	16%	11%	16%	23%	27%	17%	13%	7%	12%
Serpentine_Magnetine %	16%	15%	17%	22%	34%	23%	19%	31%	19%	12%	10%	9%

Figura 1-14: Cumplimiento de Restricciones de Ratox, Talco y As



La Figura 1-15, Figura 1-16 y Figura 1-17, se muestra la distribución del Cobre fino, Molibdeno y Plata obtenidos en el plan minero operativo LOM en períodos anuales, respectivamente.

Figura 1-15: Distribución de Cobre Fino Producido

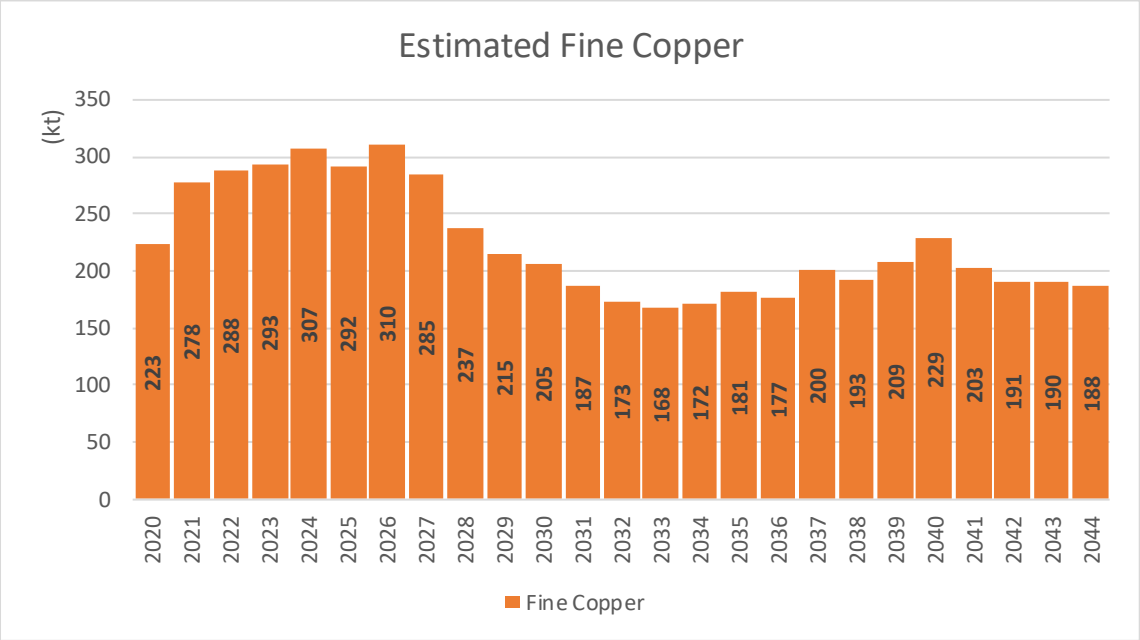


Figura 1-16: Distribución de Fino de Molibdeno

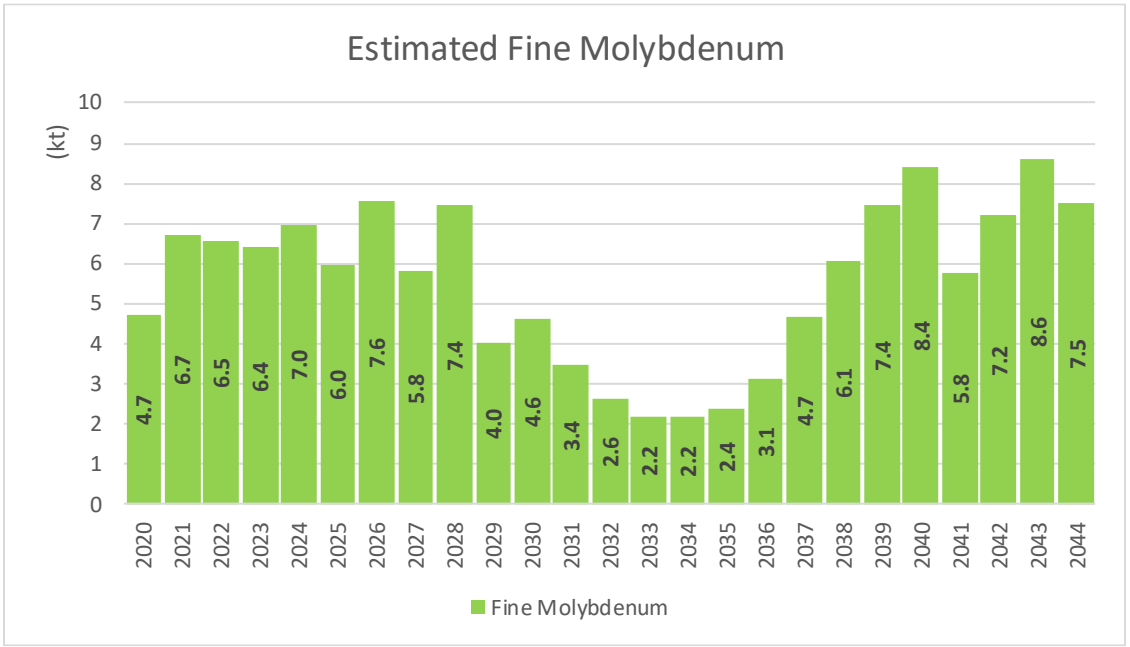
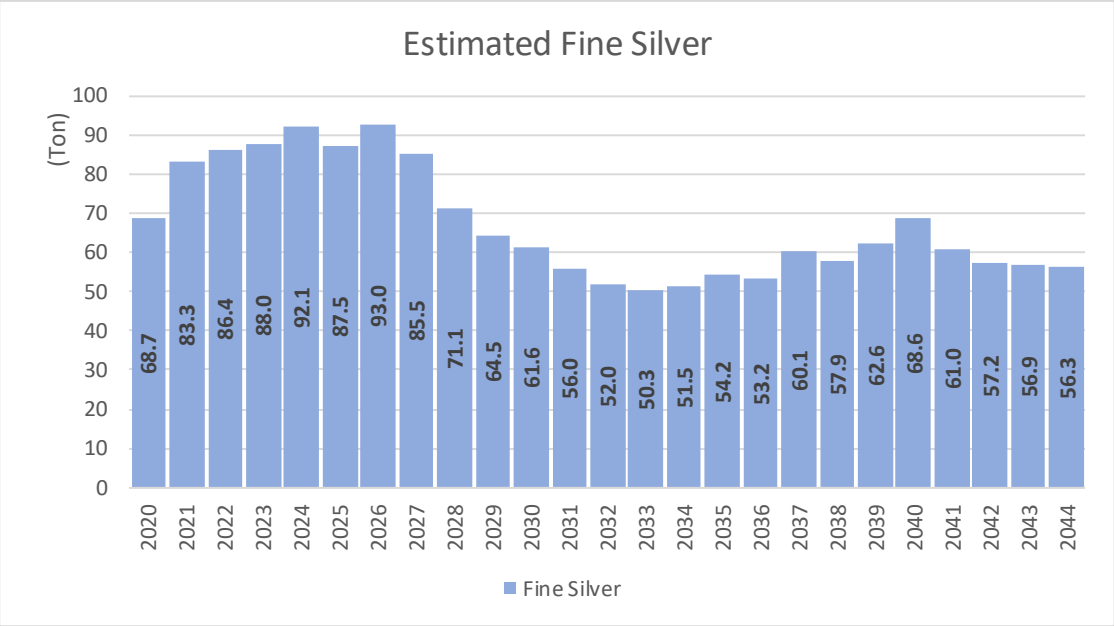
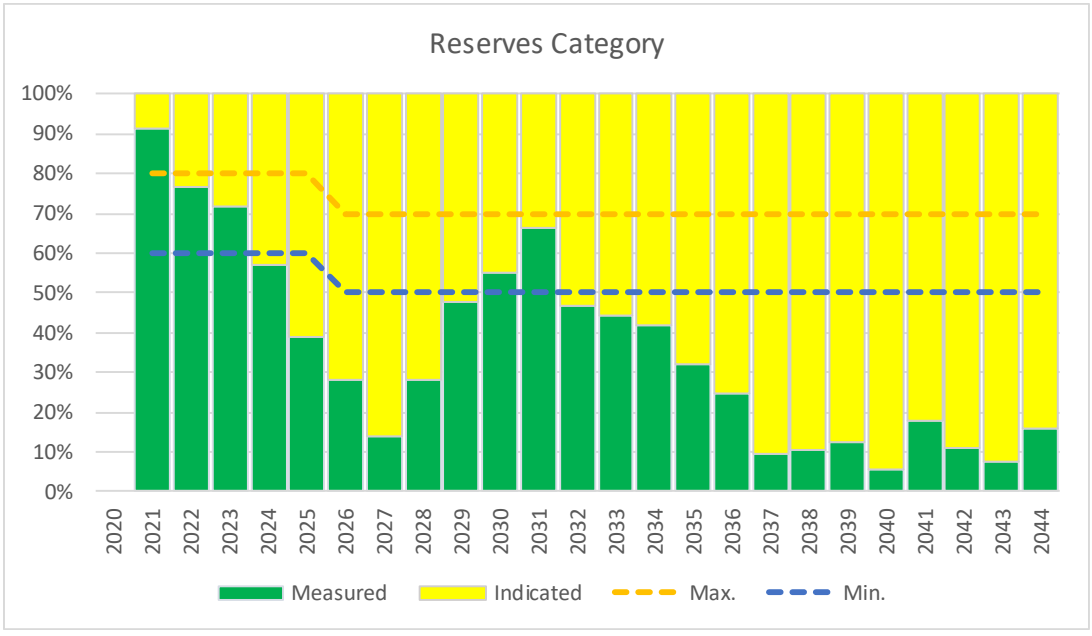


Figura 1-17: Estimación de Fino de Plata



La Figura 1-18, muestra la distribución de la categoría de reservas, para los minerales enviados a proceso, que en su totalidad comprende las Reservas Minerales Probadas y Probables. De esta lámina se aprecia se deben realizar campaña infill, para mejorar la matriz de sustentación de las reservas.

Figura 1-18: Distribución por Categoría de Reservas Minerales en Plan LOM



La Tabla 1-14 y la Tabla 1-15 muestra el plan de producción del LOM (Life Of Mina) a partir del año 2020 en adelante. El plan minero aporta 1,516.7 Mt, de mineral con ley de TCu 0.439 %, 5.59 g/t de Ag y 0.015 % de Mo.

Tabla 1-14: Plan de Producción LOM Toromocho

ORE TO CRUSHER	Units	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
TONNAGE	Ton	45,002,434	54,317,410	58,579,052	62,050,005	62,219,812	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000
Cu	%	0.620	0.620	0.597	0.569	0.598	0.573	0.599	0.529	0.453	0.422	0.398	0.366
Ag	g/t	6.916	5.174	5.783	6.931	7.669	7.071	6.052	6.090	6.130	5.447	5.293	5.407
Mo	%	0.017	0.020	0.018	0.017	0.018	0.016	0.020	0.015	0.019	0.011	0.012	0.009
ORE CONTAMINANTS													
As	%	0.028	0.017	0.018	0.021	0.014	0.025	0.018	0.013	0.019	0.017	0.019	0.021
Zn	%	0.162	0.124	0.155	0.152	0.314	0.259	0.152	0.096	0.138	0.138	0.123	0.211
F	ppm	1,983	2,176	1,788	1,838	2,242	2,077	2,085	1,726	1,798	1,720	1,718	1,696
MgO	%	8.417	8.371	8.593	6.813	10.983	11.080	8.212	6.483	6.664	7.563	6.420	8.281
As in Conc	%	0.007	0.384	0.471	0.621	0.448	0.726	0.473	0.481	0.722	0.687	0.760	0.833
Zn in Conc	%	0.046	3.584	4.528	4.649	8.669	7.457	4.485	3.290	4.701	4.768	4.459	6.936
F in Conc	ppm	856	401	296	297	285	233	309	287	232	208	243	200
MgO in Conc	%	0.796	2.050	1.503	1.394	1.411	1.200	1.391	1.358	1.120	1.024	1.131	1.035
ADITIONAL INFORMATION													
Hardness	ratio	2.67	2.64	2.65	2.65	2.56	2.56	2.66	2.82	2.72	2.73	2.82	2.70
Blastability Index	ratio	17.88	18.16	19.38	19.59	17.53	17.99	18.77	21.35	18.72	19.18	20.50	19.07
XRD TALC	%	3.03	3.53	2.56	1.89	4.39	4.46	2.89	0.82	1.98	2.07	1.68	2.18
Ratox	%	9.49	8.90	8.91	7.28	6.45	8.04	6.87	5.08	5.80	7.59	7.89	9.76
Fe	%	8.52	7.79	9.28	9.39	9.07	10.92	9.44	6.13	7.99	8.00	6.35	6.61
Recovery Cu	%	78.92	82.51	82.30	83.15	82.41	82.08	83.58	86.80	84.03	82.11	83.14	82.14
Recovery Ag	%	67.66	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00
Recovery Mo	%	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00
Cu Concentrate Tonnage	Ton	917,631	1,157,077	1,199,672	1,221,900	1,279,514	1,214,976	1,291,485	1,187,193	987,659	895,946	855,250	777,880
Cu in Concentrate	%	24	24	24	24	24	24	24	24	24	24	24	24
Ag in Conc	g/t	229	176	213	267	290	262	219	236	287	282	283	312
Mo in Conc	%	19	19	19	19	19	19	19	19	19	19	19	19
INP	$/ton	24.000	23.195	21.925	21.207	22.944	19.998	22.581	19.832	16.843	14.158	13.505	11.386
ALTERATION													
INTRUSIVE A	%	31%	33%	36%	39%	18%	20%	38%	61%	59%	57%	71%	49%
INTRUSIVE B	%	6%	4%	9%	16%	9%	9%	9%	5%	9%	13%	12%	20%
HORNFELS	%	10%	14%	5%	5%	14%	10%	6%	4%	4%	4%	5%	9%
SKARN ACTINOLITE TREMOLITE	%	13%	32%	29%	24%	31%	32%	22%	16%	17%	11%	4%	9%
SKARN SERPENTINE MAGNETITE	%	23%	17%	21%	16%	28%	29%	25%	14%	11%	15%	8%	13%
ANHYDRITE	%	17%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
QUALITIES													
CIQ (<= 0.5% FIcon<1000)	Unit												
Tonnage	Ton	-	38,575,328	38,966,887	33,559,865	37,996,156	31,594,759	36,723,673	35,250,650	22,083,946	20,229,914	13,854,677	9,800,468
Cu	%	-	0.629	0.643	0.629	0.655	0.625	0.663	0.559	0.524	0.509	0.470	0.399
Ag	Gr/Tn	-	4.187	4.283	4.660	6.302	5.174	4.930	4.950	4.894	4.424	4.027	3.563
Mo	%	-	0.024	0.016	0.030	0.030	0.014	0.045	0.046	0.055	0.030	0.032	0.027
XRD TALC	%	-	3.397	2.904	2.332	4.471	5.346	3.620	0.943	2.148	2.491	1.968	2.464
Ratox	%	-	9.260	9.074	6.893	6.236	8.182	7.597	5.214	4.958	6.055	6.849	9.549
Fe	%	-	7.899	10.296	11.436	9.502	12.576	11.251	6.939	9.205	10.447	7.821	8.696
Recovery Cu	%	-	82.369	82.000	82.000	82.527	82.000	82.000	86.132	84.252	82.000	83.148	82.000
Recovery Ag	%	-	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	-	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	-	832,728	855,542	721,293	855,248	674,957	832,137	706,822	405,880	351,705	225,412	133,445
Cu in Concentrate	%	-	24	24	24	24	24	24	24	24	24	24	24
Ag in Conc	Gr/Tn	-	139.647	140.458	156.100	201.588	174.388	156.645	177.744	191.731	183.226	178.200	188.397
Mo in Conc	%	-	19	19	19	19	19	19	19	19	19	19	19
Ascon <= 0.5% FIcon >=1000	Unit												
Tonnage	Ton	-	553,740	213,666	326,765	813,437	266,503	262,702	658,225	231,376	13,137	13,025	12,803
Cu	%	-	0.856	1.179	1.565	1.377	0.836	1.796	1.490	1.336	1.361	1.395	1.239
Ag	Gr/Tn	-	4.059	5.598	8.705	8.641	5.229	7.347	7.490	7.404	7.280	7.532	6.720
Mo	%	-	0.024	0.016	0.030	0.030	0.014	0.045	0.046	0.055	0.030	0.032	0.027
XRD TALC	%	-	2.337	1.414	2.008	3.857	1.884	2.365	1.874	0.804	2.692	2.923	2.665
Ratox	%	-	11.042	3.762	4.426	5.622	8.060	4.394	3.974	2.241	5.730	5.654	7.349
Fe	%	-	8.512	6.243	12.193	13.087	12.980	16.870	12.542	10.913	12.995	14.096	13.322
Recovery Cu	%	-	82.974	90.000	90.000	88.419	82.186	89.931	90.000	90.000	88.296	88.090	85.962
Recovery Ag	%	-	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	-	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	-	16,395	9,447	19,180	41,257	7,632	17,678	36,790	11,590	658	667	568
Cu in Concentrate	%	-	24	24	24	24	24	24	24	24	24	24	24
Ag in Conc	Gr/Tn	-	98.703	91.166	106.782	122.671	131.459	78.614	96.491	106.415	104.652	105.892	109.036
Mo in Conc	%	-	19	19	19	19	19	19	19	19	19	19	19
0.5% < Ascon <= 1.0%	Unit												
Tonnage	Ton	-	10,360,239	10,736,757	14,014,543	16,869,811	18,289,707	15,439,561	19,527,343	18,258,900	14,513,989	17,222,072	20,340,261
Cu	%	-	0.584	0.490	0.488	0.490	0.482	0.491	0.452	0.390	0.391	0.375	0.334
Ag	Gr/Tn	-	6.283	5.944	6.737	7.818	6.462	6.006	6.647	5.418	5.163	4.739	5.047
Mo	%	-	0.015	0.013	0.013	0.014	0.010	0.017	0.015	0.019	0.010	0.013	0.008
XRD TALC	%	-	4.175	1.854	1.594	4.755	3.393	2.211	0.630	2.039	2.183	1.307	2.404
Ratox	%	-	8.319	9.311	8.236	6.941	7.158	5.738	4.904	5.451	7.274	7.023	10.438
Fe	%	-	7.592	7.708	8.100	8.586	9.132	7.214	4.961	8.339	7.894	5.149	5.452
Recovery Cu	%	-	82.258	82.000	83.190	82.000	82.000	85.445	87.527	83.337	82.045	85.052	82.000
Recovery Ag	%	-	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	-	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	-	207,404	179,669	236,851	282,182	301,212	269,696	321,790	247,430	194,074	229,120	232,412
Cu in Concentrate	%	-	24	24	24	24	24	24	24	24	24	24	24
Ag in Conc	Gr/Tn	-	225.965	255.729	287.023	336.498	282.502	247.562	290.433	287.865	278.003	256.458	318.054
Mo in Conc	%	-	19	19	19	19	19	19	19	19	19	19	19
1.0% < Ascon <= 1.5%	Unit												
Tonnage	Ton	-	3,182,982	4,889,542	6,952,837	3,925,124	6,129,695	6,326,823	5,632,852	18,165,021	25,251,123	28,869,545	28,585,740
Cu	%	-	0.588	0.478	0.468	0.443	0.451	0.481	0.477	0.424	0.376	0.380	0.378
Ag	Gr/Tn	-	9.195	9.501	8.905	13.155	8.387	8.176	9.422	7.322	6.106	5.872	5.950
Mo	%	-	0.015	0.011	0.015	0.012	0.009	0.016	0.018	0.020	0.013	0.012	0.010
XRD TALC	%	-	3.668	1.776	1.109	3.580	2.252	1.428	0.605	1.850	1.744	1.789	2.055
Ratox	%	-	7.042	8.418	6.987	6.446	7.651	5.896	4.832	7.392	9.006	8.767	9.489
Fe	%	-	7.510	6.779	5.726	7.151	7.832	5.926	4.563	6.422	6.351	6.429	6.944
Recovery Cu	%	-	83.552	82.804	85.887	82.000	82.794	86.395	87.929	83.854	82.000	82.000	82.000
Recovery Ag	%	-	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	-	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	-	65,204	80,691	116,540	59,370	95,315	109,486	98,484	268,935	324,010	375,167	368,905
Cu in Concentrate	%	-	24	24	24	24	24	24	24	24	24	24	24
Ag in Conc	Gr/Tn	-	323.184	414.518	382.534	626.174	388.367	340.156	388.002	356.063	342.605	325.356	331.935
Mo in Conc	%	-	19	19	19	19	19	19	19	19	19	19	19
Ascon > 1.5%	Unit												
Tonnage	Ton	-	1,645,120	3,772,200	7,195,994	2,615,284	5,769,337	3,297,240	980,930	3,480,757	2,041,838	2,090,682	3,310,729
Cu	%	-	0.605	0.555	0.500	0.464	0.689	0.525	0.652	0.427	0.352	0.344	0.365
Ag	Gr/Tn	-	13.923	16.008	15.913	18.039	18.079	14.594	15.920	11.411	9.428	10.227	8.391
Mo	%	-	0.017	0.012	0.014	0.011	0.010	0.013	0.016	0.030	0.015	0.010	0.009
XRD TALC	%	-	2.789	2.018	1.142	2.352	5.415	0.797	0.961	1.358	0.979	1.294	1.068
Ratox	%	-	7.125	6.974	7.604	6.608	10.485	6.077	5.664	4.890	7.657	9.718	8.540
Fe	%	-	6.689	6.605	5.775	7.450	10.658	5.795	5.351	6.398	4.836	5.234	4.669
Recovery Cu	%	-	85.175	85.139	85.488	82.000	82.000	86.615	87.452	86.833	85.079	83.133	84.526
Recovery Ag	%	-	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	-	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	-	35,345	74,324	128,036	41,456	135,860	62,488	23,308	53,823	25,499	24,884	42,550
Cu in Concentrate	%	-	24	24	24	24	24	24	24	24	24	24	24
Ag in Conc	Gr/Tn	-	466.591	584.981	643.929	819.354	552.773	554.453	482.401	531.318	543.546	618.618	470.088
Mo in Conc	%	-	19	19	19	19	19	19	19	19	19	19	19

TETRA TECH

Tabla 1-15: Plan de Producción LOM Toromocho, Continuación

ORE TO CRUSHER	Units	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
TONNAGE	Ton	62,220,000	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	54,869,718
Cu	%	0.331	0.306	0.313	0.328	0.346	0.391	0.375	0.404	0.443	0.375	0.366	0.351	0.374
Ag	g/t	5.209	4.793	5.082	5.579	5.601	5.940	5.469	5.165	4.921	4.273	3.950	4.321	5.833
Mo	%	0.007	0.006	0.006	0.006	0.008	0.012	0.016	0.020	0.022	0.015	0.019	0.023	0.022
ORE CONTAMINANTS														
As	%	0.021	0.020	0.020	0.019	0.019	0.017	0.014	0.010	0.013	0.015	0.016	0.011	0.012
Zn	%	0.291	0.221	0.209	0.223	0.228	0.267	0.165	0.148	0.141	0.105	0.081	0.085	0.100
F	ppm	1.497	1.479	1.488	1.479	1.516	1.488	1.509	1.769	2.133	1.759	1.704	1.618	1.619
MgO	%	8.684	8.614	8.652	8.975	9.013	9.007	8.034	8.244	8.666	6.803	5.340	4.483	4.825
As in Conc	%	0.890	0.866	0.869	0.867	0.842	0.730	0.659	0.513	0.526	0.650	0.681	0.597	0.645
Zn in Conc	%	9.183	7.408	7.072	7.420	7.472	8.352	5.688	5.087	4.748	4.017	3.399	3.596	3.974
F in Conc	ppm	200	200	205	200	200	200	202	230	229	240	269	272	275
MgO in Conc	%	1.048	1.207	1.244	1.207	1.111	1.002	1.025	1.108	1.018	1.006	1.083	1.125	1.179
ADITIONAL INFORMATION														
Hardness	ratio	2.63	2.66	2.66	2.62	2.62	2.63	2.63	2.65	2.58	2.65	2.72	2.85	2.79
Blastability Index	ratio	18.28	18.79	18.61	17.90	17.27	17.01	17.59	18.33	17.99	19.24	20.02	21.09	20.09
XRD TALC	%	2.17	2.28	2.19	2.20	2.42	3.01	2.01	2.11	3.15	2.28	1.84	1.17	0.98
Ratox	%	10.25	10.42	10.31	9.02	9.12	9.86	7.63	6.30	6.98	8.24	6.82	4.80	5.47
Fe	%	7.07	7.46	7.32	6.89	7.01	7.64	6.65	7.15	9.35	7.78	6.86	5.13	5.48
Recovery Cu	%	82.36	82.24	82.27	82.38	82.28	82.77	82.73	82.61	82.51	82.48	84.01	87.02	86.42
Recovery Ag	%	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00
Recovery Mo	%	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00
Cu Concentrate Tonnage	Ton	721,972	698,787	715,041	753,262	738,563	835,277	803,608	869,395	952,855	846,930	794,463	790,027	781,341
Cu in Concentrate	%	24	24	24	24	24	24	24	24	24	24	24	24	24
Ag in Conc	g/t	323	304	315	335	348	337	309	275	240	237	229	255	303
Mo in Conc	%	19	19	19	19	19	19	19	19	19	19	19	19	19
INP	$/ton	9.307	7.834	8.257	9.226	10.247	12.623	12.653	14.563	16.026	12.251	12.457	12.962	14.332
ALTERATION														
INTRUSIVE A	%	31%	28%	27%	24%	28%	26%	29%	28%	29%	44%	56%	65%	58%
INTRUSIVE B	%	23%	18%	18%	21%	21%	22%	20%	19%	12%	15%	14%	14%	14%
HORNFELS	%	14%	17%	18%	19%	15%	7%	13%	10%	0%	5%	3%	2%	6%
SKARN ACTINOLITE TREMOLITE	%	12%	21%	22%	19%	16%	11%	16%	23%	27%	17%	13%	7%	12%
SKARN SERPENTINE MAGNETITE	%	19%	16%	15%	17%	22%	34%	23%	19%	31%	19%	12%	10%	9%
ANHYDRITE	%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%	2%	1%	1%
QUALITIES														
CIQ (<= 0.5% FIcon<1000)	Unit													
Tonnage	Ton	10,311,655	11,599,310	11,969,509	13,838,314	16,535,910	24,465,724	27,169,448	37,962,728	41,903,316	26,395,000	23,713,560	26,328,816	23,872,429
Cu	%	0.350	0.312	0.329	0.377	0.421	0.488	0.429	0.456	0.484	0.484	0.444	0.408	0.436
Ag	Gr/Tn	3.291	2.834	3.088	3.604	4.001	4.667	4.376	4.761	4.474	3.876	3.498	3.178	3.528
Mo	%	0.019	-	-	-	-	0.035	0.019	0.022	0.025	0.048	0.046	0.046	-
XRD TALC	%	2.197	2.227	2.116	3.146	3.695	4.629	2.695	2.474	3.679	3.367	2.853	1.239	0.680
Ratox	%	11.653	10.736	11.940	9.942	11.247	12.961	8.060	5.743	6.517	6.752	5.654	4.059	4.136
Fe	%	8.819	7.811	8.011	8.196	9.617	11.049	7.945	7.951	10.624	10.051	8.804	5.792	5.572
Recovery Cu	%	82.000	82.000	82.000	82.000	82.000	82.000	82.000	82.000	82.000	82.000	83.322	87.348	87.917
Recovery Ag	%	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	123,437	123,639	134,356	178,412	237,576	408,199	398,415	591,179	693,345	436,796	365,214	390,961	381,047
Cu in Concentrate	%	24	24	24	24	24	24	24	24	24	24	24	24	24
Ag in Conc	Gr/Tn	197.970	191.422	198.058	201.269	200.513	201.391	214.850	220.120	194.678	168.649	163.549	154.073	159.129
Mo in Conc	%	19	19	19	19	19	19	19	19	19	19	19	19	19
Ascon <= 0.5% FIcon >=1000	Unit													
Tonnage	Ton	7,699	6,838	6,268	3,925	2,638	24,824	131,963	309,050	392,312	69,310	105,056	13,440	2,143
Cu	%	0.960	0.300	0.300	0.300	0.300	0.615	0.526	0.482	0.631	0.645	0.686	2.014	0.300
Ag	Gr/Tn	5.271	1.845	1.845	1.845	1.845	4.264	3.896	3.487	3.782	3.983	3.627	5.159	1.845
Mo	%	0.019	-	-	-	-	0.035	0.019	0.022	0.025	0.048	0.046	0.046	-
XRD TALC	%	2.204	1.115	1.115	1.115	1.115	0.150	0.544	0.609	1.638	4.064	3.284	1.848	1.115
Ratox	%	10.373	17.527	17.527	17.527	17.527	2.783	6.756	4.392	2.925	2.620	2.507	2.441	17.527
Fe	%	11.939	8.669	8.669	8.669	8.669	5.654	9.348	10.089	16.971	20.094	17.561	12.901	8.669
Recovery Cu	%	82.000	82.000	82.000	82.000	82.000	90.000	83.418	84.552	82.000	82.000	84.397	90.000	82.000
Recovery Ag	%	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	253	84	77	48	32	573	2,411	5,250	8,456	1,527	2,533	1,015	26
Cu in Concentrate	%	24	20	20	20	20	24	24	24	24	24	24	24	20
Ag in Conc	Gr/Tn	115.723	108.023	108.000	107.952	108.165	133.134	153.524	147.804	126.339	130.152	108.311	49.167	107.841
Mo in Conc	%	19	19	19	19	19	19	19	19	19	19	19	19	19
0.5% < Ascon <= 1.0%	Unit													
Tonnage	Ton	24,960,938	26,680,371	26,269,438	27,051,542	26,551,025	23,277,972	25,593,882	18,737,311	14,339,567	20,987,922	25,833,328	26,902,241	19,318,729
Cu	%	0.310	0.267	0.272	0.295	0.308	0.327	0.302	0.316	0.362	0.283	0.303	0.302	0.296
Ag	Gr/Tn	4.865	4.014	4.090	4.492	5.142	5.439	5.169	5.561	5.403	3.590	3.519	4.247	4.919
Mo	%	0.006	0.005	0.005	0.006	0.008	0.014	0.014	0.016	0.020	0.013	0.014	0.021	0.022
XRD TALC	%	2.394	2.099	1.889	1.917	2.164	2.357	1.659	1.503	2.117	1.470	1.177	1.011	0.911
Ratox	%	10.291	9.281	9.027	8.204	7.759	8.031	7.310	7.026	7.583	8.878	7.102	4.918	5.432
Fe	%	6.804	6.743	6.481	6.426	6.178	5.903	6.003	5.872	6.708	5.805	5.549	4.356	4.687
Recovery Cu	%	82.000	82.000	82.000	82.000	82.000	82.192	82.376	83.187	83.400	82.846	84.841	87.324	86.441
Recovery Ag	%	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	264,606	291,591	292,683	326,816	279,620	260,470	265,487	205,408	180,478	245,823	276,779	295,282	246,904
Cu in Concentrate	%	24	20	20	20	24	24	24	24	24	20	24	24	20
Ag in Conc	Gr/Tn	330.445	264.457	264.276	267.726	351.549	349.973	358.802	365.243	309.095	220.866	236.465	278.567	277.135
Mo in Conc	%	19	19	19	19	19	19	19	19	19	19	19	19	19
1.0% < Ascon <= 1.5%	Unit													
Tonnage	Ton	20,029,206	17,837,547	18,232,386	15,146,528	13,784,739	9,319,301	4,843,947	3,547,099	3,322,187	10,698,640	8,406,641	7,342,419	8,886,811
Cu	%	0.359	0.359	0.358	0.346	0.324	0.303	0.323	0.280	0.300	0.320	0.344	0.326	0.367
Ag	Gr/Tn	6.168	6.226	6.433	6.827	6.852	7.668	6.866	6.050	6.659	5.503	5.299	6.447	8.715
Mo	%	0.008	0.006	0.006	0.007	0.010	0.014	0.016	0.017	0.017	0.009	0.013	0.018	0.018
XRD TALC	%	2.344	3.037	3.034	2.454	2.076	1.527	0.651	0.848	1.435	1.928	1.738	1.556	2.065
Ratox	%	10.249	12.503	11.811	10.448	9.715	7.291	7.472	7.730	8.910	10.627	9.732	7.004	9.081
Fe	%	7.678	9.270	8.895	7.637	6.517	4.771	4.188	5.035	5.748	7.313	6.782	5.732	7.150
Recovery Cu	%	82.000	82.000	82.000	82.000	82.000	84.945	85.706	85.255	84.157	82.000	82.000	84.577	82.078
Recovery Ag	%	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	245,869	218,609	223,095	179,268	152,404	100,072	55,930	42,336	41,906	116,981	98,797	84,477	111,682
Cu in Concentrate	%	24	24	24	24	24	24	24	20	20	24	24	24	24
Ag in Conc	Gr/Tn	361.790	365.793	378.553	415.300	446.248	514.128	428.174	364.940	380.078	362.388	324.656	403.460	499.322
Mo in Conc	%	19	19	19	19	19	19	19	19	19	19	19	19	19
Ascon > 1.5%	Unit													
Tonnage	Ton	6,910,502	5,925,934	5,572,400	6,009,691	5,345,688	4,962,179	4,310,760	1,493,812	2,262,618	3,899,128	3,991,416	1,463,084	2,789,606
Cu	%	0.298	0.311	0.329	0.319	0.363	0.375	0.526	0.481	0.362	0.277	0.353	0.342	0.410
Ag	Gr/Tn	6.532	7.825	9.626	11.878	9.602	11.334	12.620	8.701	7.796	7.262	6.596	15.595	22.711
Mo	%	0.009	0.009	0.009	0.010	0.013	0.017	0.026	0.025	0.018	0.011	0.024	0.027	0.025
XRD TALC	%	0.820	0.969	0.992	0.690	0.688	0.877	1.412	3.593	2.580	0.220	0.329	0.947	0.547
Ratox	%	7.967	8.658	7.955	7.009	7.747	8.043	6.956	8.239	9.719	8.410	5.918	4.999	5.635
Fe	%	3.675	4.556	4.679	4.136	4.294	4.343	5.029	7.410	6.478	4.107	3.631	4.355	4.848
Recovery Cu	%	85.235	84.507	84.954	85.932	85.279	85.144	86.111	84.308	83.893	85.061	87.006	87.741	87.370
Recovery Ag	%	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	87,807	64,864	64,831	68,718	68,930	65,964	81,365	25,222	28,670	46,003	51,139	18,292	41,682
Cu in Concentrate	%	20	24	24	24	24	24	24	24	24	20	24	24	24
Ag in Conc	Gr/Tn	370.131	514.699	595.730	747.906	536.173	613.885	481.392	371.026	443.005	443.199	370.651	898.113	1,094.364
Mo in Conc	%	19	19	19	19	19	19	19	19	19	19	19	19	19

1.11 Estimación de Reservas Minerales

La estimación de las Reservas Minerales se fundamenta en un plan minero a largo plazo y a nivel operacional fase-banco, mediante el empleo del software *SP2*, lo que implica que existe un proceso de optimización previo al desarrollo del plan, a través de una planificación minera con ley de corte variable. El nivel de Reservas Minerales Probadas más Probables, al 31 de diciembre de 2019, alcanza los 1,516.7 Mt, con ley de 0.439% TCu, 0.015% Mo y 5.59 g/t de Ag.

Tabla 1-16: Estimación de Reservas Minerales Mina Toromocho

Declaración de Reservas Mineras - 31/Dic/2019
Minera Chinalco Perú - Mina Toromocho
Topografía de 31 Dic. 2019

	Tonelaje	Grado			Metal Contenido		
	ktms	TCu (%)	Mo (%)	Ag (g/t)	Cu (Mlb)	Mo (Mlb)	Ag (koz)
In Pit Sulfuros							
Probada	479,548	0.503	0.016	5.32	5,321	170	81,984
Probable	969,741	0.405	0.015	5.62	8,666	312	175,150
Reserva In Pit Sulfuros	1,449,289	0.438	0.015	5.52	13,987	483	257,134
Stock de Sulfuros (Inicial)							
Probada	67,380	0.463	0.010	7.09	688	15	15,359
Probable							
Reserva Stock de Sulfuros	67,380	0.463	0.010	7.09	688	15	15,359
Reservas de Sulfuro							
Probada	546,928	0.498	0.015	5.54	6,009	186	97,344
Probable	969,741	0.405	0.015	5.62	8,666	312	175,150
Total Reserva de Sulfuros	**1,516,668**	**0.439**	**0.015**	**5.59**	**14,675**	**498**	**272,493**

Nota:

1.- Incorpora reservas plan minero 2020 realizado por MCP

2.- La ley de corte para los minerales alimentados directamente desde la mina es de Income Net of Process (INP)> 1.62 U

3.- La ley de corte para los minerales enviados a Stock es de Income Net of Process (INP)> 2.32 US$/t

4.- Los minerales con alto contenido de Arsénico están considerados como reservas minerales.

5.- El stock inicial no considera los stocks inpit ya que están informados en las fases.

1.12 Determinación de Capex y Opex

La estimación del gasto de capital de los equipos mina, para la adquisición y reemplazos de equipos mineros, se basa en un modelo de determinación de flota de equipos, asociado al movimiento de materiales, del plan minero operativo de largo plazo, y rendimientos de los equipos mineros. Adicionalmente se incorpora algunos gastos en repuestos importantes durante la vida de la mina, como son baldes de pala, hojas de motoniveladoras y componentes mayores.

La Tabla 1-17, muestra el resumen de las inversiones en equipos mineros. Se indica el valor total nominal de las inversiones en equipos mineros y su valor actualizado a una tasa de descuento del 10%.

Tabla 1-17: Resumen Capex Plan Minero Operativo

CAPEX		
Adquisición	kUS$	87,298
Reemplazos	kUS$	361,510
Overhaul	kUS$	-
Repuestos Relevantes	kUS$	274,022
Capex Nominal	kUS$	**722,830**
VAC	kUS$	**353,415**

Total Movimiento	kt	**2,580,029**
Total Capex	US$/t	**0.280**

Utilizando el modelo de determinación de gastos por relaciones de Insumo–Producto (IP) desarrollado para Minera Chinalco Proyecto Toromocho, se determinan los gastos y costos operacionales por elemento de gasto para cada actividad operativa, cuyo resultado considera algunas particularidades como:

- Los materiales del plan minero consideran una humedad promedio de 2.5%. Están separados por tipo de material, de acuerdo con su origen y destino.
- El mantenimiento de los equipos mina, corresponde a mantenimiento propio, por tanto, dentro del costo está incluido la remuneración de la dotación de mantenimiento.
- La estimación del Opex utiliza, los parámetros y consumos principales, los cuales provienen de MCP y base de datos del consultor para los equipos con los que cuenta la mina Toromocho.

La Tabla 1-18, muestra el resumen de gasto de operación por operaciones unitarias, por elemento de gasto e indicadores de costos mina por operación unitaria.

TETRA TECH

Tabla 1-18: Resumen de Gasto y Costo Mina Plan Minero

TOTAL MINA POR CONSUMO	Unidades	Valores
Materiales	MUS$	869.346
Combustible	MUS$	1,321.459
Servicios de Terceros	MUS$	69.431
Remuneraciones	MUS$	179.299
Abastecimiento de Energía	MUS$	63.451
Abastecicmiento de Agua	MUS$	88.636
Mantenimiento	MUS$	1,319.111
Otros	MUS$	116.456
Administración	MUS$	470.528
TOTAL	MUS$	4,498
TOTAL	US$/t	1.742

TOTAL MINA POR OPERACIONES UNITARIAS	Unidades	Valores
Perforación	MUS$	154.069
Voladura	MUS$	567.909
Carguío	MUS$	493.360
Transporye	MUS$	2,248.570
Movimiento de Tierra	MUS$	530.075
Soporte y Apoyo	MUS$	33.207
Equipos Auxiliares	MUS$	0.000
Administración	MUS$	470.528
TOTAL	MUS$	4,498

COSTO MINA PROMEDIO	Unidades	Costo
Perforación	US$/tn	0.060
Voladura	US$/tn	0.220
Carguío	US$/tn	0.191
Transporye	US$/tn	0.871
Movimiento de Tierra	US$/tn	0.205
Soporte y Apoyo	US$/tn	0.013
Equipos Auxiliares	US$/tn	0.000
Administración	US$/tn	0.182
TOTAL	US$/th	1.742
Costo Mina (Sin Transporte)	US$/th	0.871

1.13 Análisis de Capacidad del Tranque de Relaves

De la información disponible, tanto en las revisiones de las distintas consultoras especialistas, se aprecia que la producción del LOM2020, no es contenida en las actuales condiciones de diseño del depósito. Estas proyecciones indican que la capacidad de la relavera es de 1,381 Mt, equivalente a 959 Mm³, Siendo el requerimiento del LOM de 1,683 Mt, equivalentes a 1,169 Mm³.

Dado lo anterior, es necesario buscar materiales de empréstito para subir el nivel del muro, o bien buscar otro sector que pueda contener los 303 Mt requeridas por el LOM2020, hasta el año 2044. Esta capacidad es equivalente a 210 Mm³.

La Tabla 1-19, muestra la nueva capacidad de relavera para contener el relave del LOM 2020.

Tabla 1-19: Resumen de Capacidad de Relavera Requerida por LOM

Año Disponible	Descripción	Producción Mineral		Producción de Relaves		Volume
		Mt	tpd	Mt	tpd	Mm³
1	2020	45.0	122,957	44.0	120,193	30.55
2	2021	54.3	148,815	53.1	145,469	36.87
3	2022	58.6	160,491	57.3	156,882	39.77
4	2023	62.1	170,000	60.7	166,178	42.12
5	2024	62.2	169,999	60.8	166,177	42.24
6	2025	62.0	170,000	60.7	166,178	42.12
7	2026	62.0	170,000	60.7	166,178	42.12
8	2027	62.1	170,000	60.7	166,178	42.12
9	2028	62.2	170,000	60.8	166,178	42.24
10	2029	62.0	170,000	60.7	166,178	42.12
11	2030	62.1	170,000	60.7	166,178	42.12
12	2031	62.1	170,000	60.7	166,178	42.12
13	2032	62.2	170,000	60.8	166,178	42.24
14	2033	62.1	170,000	60.7	166,178	42.12
15	2034	62.0	170,000	60.7	166,178	42.12
16	2035	62.1	170,000	60.7	166,178	42.12
17	2036	62.2	170,000	60.8	166,178	42.24
18	2037	62.0	170,000	60.7	166,178	42.12
19	2038	62.1	170,000	60.7	166,178	42.12
20	2039	62.0	170,000	60.7	166,178	42.12
21	2040	62.2	170,000	60.8	166,178	42.24
22	2041	62.1	170,000	60.7	166,178	42.12
23	2042	62.1	170,000	60.7	166,178	42.12
24	2043	62.0	169,536	60.7	165,724	42.12
25	2044	54.9	150,328	53.6	146,948	37.25
Total		**1,721**		**1,683**		**1,169**

1.14 Cuellos de Botella y Riesgos del Plan de Minado

- La capacidad de diseño del tranque de relaves tiene un déficit de al menos 18% respecto a la capacidad requerida para el LOM-2020.
- Es necesario disponer de mayor área para la ubicación de lastre y acopio de stocks temporales de mineral, especialmente si aumentan las reservas minerales por las nuevas campañas infill que aporten mayores reservas al plan minero.
- Mayor definición en las restricciones de infraestructuras que limitan el crecimiento del pit y aumento de reservas minerales. Se necesario un análisis más profundo para levantar algunas restricciones si fuese el caso y así aumentar las reservas del actual LOM-2020.
- Cambios en la secuencia de desarrollo de la mina podría impactar el cumplimiento del perfil de leyes de alimentación a la planta y el compromiso de la producción de cobre, especialmente en el quinquenio 2021-2026.
- Oxidación de los sulfuros en los stockpiles de mediana y baja ley, lo que podría bajar la recuperación del Cu contenido en estos minerales.
- El aumento de los niveles de talco y el Ratox en los minerales, podría impactar la recuperación de la planta de proceso y modificar el plan de minado, perdiéndose cobre por menor recuperación.
- El no cumplimiento en las recuperaciones proyectadas, producto de la falta de información geometalúrgica.
- La planificación en periodos anuales tiende a suavizar el cumplimiento de las restricciones (promedios anuales), pero es probable que en un desarrollo de la planificación en períodos mensuales sea difícil de cumplir algunos periodos.
- La matriz de sustentabilidad de las reservas deja periodos del plan con demasiado mineral indicado (mayor a 40% durante 7 años, en los primeros 10 años de vida de la mina), lo que implica un menor nivel de confianza en las leyes comprometidas en el plan minero de ese período.
- Déficit superior a 306 millones de toneladas de material de empréstito en comparación con el proyecto inicial, un valor que debe ser ratificado por una actualización del estudio de HATCH (aumento de la capacidad de almacenamiento de la relavera actual) y la búsqueda de materiales de empréstito de la misma cantera actual o en un nuevo sector que aporte el material tanto en cantidad como en calidad requerida.

1.15 Conclusiones y Recomendaciones

Dados los resultados obtenidos durante la presente ingeniería, el consultor concluye y recomienda lo siguiente:

- Para la determinación de las Reservas Minerales se emplearon herramientas computacionales y procedimientos de ingeniería estándares en la industria minera.
- El nivel de Reservas Minerales Probadas más Probables alcanza los 1,516.7 Mt, con ley de 0.439% TCu, 0.015% Mo y 5.59 g/t de Ag.
- Los Recursos Medidos e Indicados fueron valorizados como mineral para ser alimentados a la planta de proceso.
- Los Recursos Inferidos fueron considerado como lastre, con destino a Desmontes.
- Los minerales fueron enviados a proceso, con costos diferenciados de TC/RC, penalidades, de acuerdo con su contenido de As en la cabeza y en el concentrado, del mismo modo que otros contaminantes importantes en el proceso como Zn, Flúor y MGO.
- Las restricciones en la alimentación (por la proporción de minerales, por su componente litológica y de alteración) se cumple en la gran mayoría del plan, salvo cuando se realiza la reclamación en la etapa final del plan de minado, cuando la alimentación a planta es mayoritariamente desde los stocks.
- Durante la operación de la mina, en el corto plazo, se realizan pequeños acopios de minerales en distintos y variados espacios, sin embargo, se deberá simplificar el uso de los materiales de manera de mantener sólo los acopios declarados en el plan de minado.
- Las Reservas Minerales reportadas están basadas en un diseño minero de fases intermedias y en la construcción de un plan de minado de largo plazo, a nivel estratégico y a nivel operativo, empleando una secuencia económica en el consumo de las reservas.
- Se recomienda establecer un modelo de recuperación metalúrgica por tipo de mineral, y no efectuarlo por mezcla de minerales alimentados a la concentradora, mediante la elaboración de un modelo geometalúrgico.
- El plan minero desarrollado cubre los requerimientos planta actualmente establecidos para las mezclas solicitadas como son: % de Skarn Actinolita-Tremolita ≤ 40%, % Hornfels ≤ 30%, Skarn Serpentina Magnetita ≤ 30%, Talco ≤ 6%, Ratox ≤ 16% y % de As en la cabeza de ≤ 0.035%.
- La vida de la mina con las reservas actuales tiene una duración de 25 años.
- Se recomienda la adquisición de nuevas áreas para aumentar la capacidad de acopio de mineral (stock) y lastre, lo que implicaría optimizar de mejor forma el negocio a través de la política de ley de corte variable y además permitiría tener los espacios suficientes para el acopio de mineral y lastre en la eventualidad de aumentar las reservas minerales.

- Mantener la secuencia de extracción del plan minero de largo plazo, evitando cambios en la planificación de corto plazo que impacten negativamente el perfil de leyes comprometidas en el quinquenio.
- Estudiar y presupuestar futuras campañas de sondajes infill con el objetivo de mejorar la categorización de recursos y el aumento de reservas minerales, especialmente en los contornos del pit.
- Cuando se realicen campañas infill actualizar el modelo geológico y de estimación de recursos solo en los sectores cubiertos por los nuevos sondajes, evitando modificar el alcance a todo el modelo de geológico.
- Los minerales de baja ley que están sobre la ley de corte marginal constituyen reservas, por lo tanto, se deben acopiar para ser procesados al final de la vida de la mina.
- Construir un modelo geo-metalúrgico para optimizar la recuperación de los diferentes materiales.

- El análisis de relavera implica que hay un déficit superior a 306 millones de toneladas de material de empréstito en comparación con el proyecto inicial, un valor que debe ser ratificado por una actualización del estudio de HATCH (aumento de la capacidad de almacenamiento de la relavera actual) y la búsqueda de materiales de empréstito de la misma cantera actual, analizando los materiales que están en la parte inferior o buscando otro sector que proporcione la cantidad y calidad de materiales necesarios para completar la capacidad del muro de relaves.
- Estandarizar el proceso del LOM, que incorpore fechas límites para la entrega y tiempo de análisis de los Inputs, con tipo de información a entregar y responsables por área (disponibilidades físicas de los equipos, productividades históricas de los equipos, precios de largo plazo de los metales bases, capex para la expansión o reposición de instalaciones, costos de cierre de mina, etc.); calendarizando el proceso completo para un mejor cumplimiento de los objetivos del LOM.
- Introducir nuevos parámetros en la optimización del plan minero, como el uso del throughput por tipo de roca por ejemplo (US$/hr), en lugar de US$/ton (INP).
- Evaluar la posición del dique en la zona Buenaventura, ya que estaría a una distancia menor de 100 m, respecto a la pared del pit.
- Programar campaña de infill, pues la matriz de sustentabilidad de las reservas deja periodos del plan con demasiado mineral indicado (mayor a 40% durante 7 años, en los primeros 10 años de vida de la mina), lo que implica un menor nivel de confianza en las leyes comprometidas en el plan minero de ese período.
- Algunas infraestructuras deben ser removidas o cambiadas.
    - El Pique Central será impactada en el 2022, para ello el sistema de drenaje debe ser reubicado hacia el Pique Maria.
    - El AK15 será impactado en el 2021, para ello debe ser reubicado.
    - La planta de procesamiento de Argentum debe ser removido antes del 2022 para empezar el desmantelamiento y acondicionamiento para el minado.

    - La vía o camino de los equipos livianos que van al truck shop seria impactado en el 2029, pero estaría muy cerca de la zona de la fase 03.

- Para el Quinquenio se debe realizar un plan minero en periodos mensuales y trimestrales, ya que las restricciones podrían no ser completamente satisfechas.
- Estudiar las interferencias entre las fases, ya que las fases en desarrollo pueden ocasionar interrupciones o problemáticas de acceso a las zonas de mejor ley, que se encuentra por lo general en el fondo de las fases en producción.
- Evaluar Trade-off entre IPCC versus camiones, etc., para disminuir el número de camiones que se incrementan drásticamente a partir del 2024.
- Evaluar ampliación de la vida de la mina con minerales de la zona norte del rajo, ya sea mediante el trasladando la carretera central u otro método de explotación.
- Evaluar análisis marginal de fases en los anchos operativos de las últimas fases (F06, F08 y F09)
- Preparar por parte del área de mantenimiento los perfiles de disponibilidad física variables (anualmente) de acuerdo con el uso de los equipos y diferenciar entre equipos en uso y nuevos.

2 INTRODUCCIÓN

El presente documento ha sido preparado por Tetra Tech Chile S.A. (Tetra Tech), a solicitud de Minera Chinalco Perú, para el Proyecto Toromocho, denominado “Estimación de Reservas Minerales y Plan de Vida de Mina” actualizado al 31 de diciembre de 2019.

El yacimiento Toromocho se encuentra a más de 4,500 metros de altura, en el distrito de Morococha, provincia de Yauli, departamento de Junín, adyacente a la Mina Morocha.

El yacimiento cuenta con una posición geográfica privilegiada, con conectividad a la Carretera Central, acceso al Ferrocarril Central, con disponibilidad de agua, energía eléctrica y en la zona existe mano de obra especializada en minería.

Minera Chinalco Perú (MCP) cuenta en la actualidad con una estimación de reservas basada en la información reportada en el Estudio de Factibilidad, de noviembre 2007, y la Estimación de Reservas Minerales y Plan de Vida de la Mina Toromocho, de octubre 2017; las cuales fueron realizadas y visadas por personas calificadas de empresas consultoras de acuerdo con el código JORC.

La información y datos en este informe relativos a la Estimación de las Reservas Minerales han sido compilados, analizados y desarrollados por Raúl Contreras Guzmán, Ingeniero Civil de Minas (34 años de experiencia, Miembro de la Comisión Calificadora de Competencias en Recursos y Reservas Mineras, de Chile, registro público # 0128.

La persona anteriormente mencionada tiene suficiente experiencia, la cual es relevante al estilo de la mineralización, al tipo de depósito bajo consideración, y al tipo de actividad desarrollada, la cual los acredita como personas competentes para la certificación de Reservas Mineras.

Los aspectos legales y ambientales de Toromocho son de responsabilidad de las respectivas entidades competentes de minera Chinalco Perú. Tetra Tech tomó conocimiento de la existencia de las resoluciones de permisos ambientales y sectoriales presentadas a la fecha.

Tanto la persona competente como el ingeniero especialista en minería, que desarrollaron la presente estimación de reservas minerales, cuenta con el conocimiento de la faena minera por visitas realizadas en los años 2016 y 2017.

Las definiciones de los recursos y reservas mineras, que se utilizaron para preparar el reporte técnico, y que están definidas en el código JORC para reportar resultados de exploración, recursos y reservas minerales del año 2012, son las siguientes:

Recurso Mineral

Un “Recurso Mineral” es una concentración u ocurrencia de material de interés económico intrínseco en o sobre la corteza de la Tierra en forma y cantidad en que haya probabilidades razonables de una eventual extracción económica. La ubicación, cantidad, ley, características geológicas y continuidad de un Recurso Mineral son conocidas, estimadas o interpretadas a partir de evidencia y conocimientos específicos geológicos. Los Recursos Minerales se subdividen, en orden de confianza geológica ascendente, en categorías de Inferidos, Indicados y Medidos.

Reserva Mineral

Una “Reserva Mineral” es la parte económicamente explotable de un Recurso Mineral Medido o Indicado. Incluye dilución de materiales y tolerancias por pérdidas que se puedan producir cuando se extraiga el material. Se han realizado las evaluaciones apropiadas, que pueden incluir estudios de factibilidad e incluyen la consideración de y modificación por factores razonablemente asumidos de extracción, metalúrgicos, económicos, de mercados, legales, ambientales, sociales y gubernamentales. Estas evaluaciones demuestran en la fecha en que se reporta que podría justificarse razonablemente la extracción. Las Reservas de Mena se subdividen en orden creciente de confianza en Reservas Probables Minerales D30 y Reservas Probadas Minerales.

La presente estimación de Reservas Minerales se sustenta en el diseño del pit final de la mina y en la planificación minera estratégica y operacional, cuyo desarrollo aborda las etapas de revisiones y validaciones siguientes:

- Información base.
- Determinación de pit óptimo económico.
- Diseño de fases y análisis de secuencia minera.
- Diseño de Desmontes y Stocks
- Definición de Ley de Corte
- Plan minero Estratégico
- Plan Minero Operacional
- Estimación de Flota minera requerida por el Plan Operativo
- Estimación de Gasto en inversión en equipos mineros
- Estimación de Costos Operacionales.
- Declaración de Reservas Minerales.

3 MODELO DE RECURSOS

El Modelo de Recursos fue desarrollado y actualizado por la empresa consultora Golder Associates en el año 2019. Este modelo es utilizado para el estudio de reservas y corresponde al archivo digital denominado **"toromocho_2019_rbk.asc"** de octubre del año 2019, en formato ASCII. Dicho archivo es cargado en el software minero MineSight ®, con la información que lo sustenta como son de leyes de minerales, categorías, densidad, dureza, alteración, entre otras, sobre un total de 1,540,575 celdas regulares de 20 x 20 x 15 metros.

3.1 Análisis Descriptivo

Los límites del Modelo de Recursos de la mina Toromocho, se presentan en la Tabla 3-1, donde se muestra las coordenadas del modelo, las dimensiones de los bloques y el número de bloques en las 3 direcciones X, Y, Z.

Tabla 3-1: Límites del Modelo de Recursos

	Min	Max	Dim. Bloque	# Bloques
Este	374.320	376.780	20	123
Norte	8.715.340	8.718.680	20	167
Elev.	3.870	4.995	15	75

El listado de las 67 variables (campos) contenidas en el modelo de recursos, con su respectiva descripción, se muestra en la Tabla 3-2.

Tabla 3-2: Variables del Modelo de Recursos

Variables	Descripción
cu	Estimacion Cobre Total (%)
mo	Estimacion Molibdeno (%)
as	Estimacion Arsenico (%)
ag	Estimacion Plata (g/t)
zn	Estimacion Zinc (%)
cuas	Estimacion Cobre Soluble en Ac. Sulfurico (%)
cucn	Estimacion Cobre Soluble en Cianuro (%)
au	Estimacion Oro (g/t)
pb	Estimacion Plomo (%)
fe	Estimacion Fierro (%)
f	Estimacion Fluor (ppm)
mgo	Estimacion oxido de magnesio (%)
talco	Estimacion XRD Talco
densidad	Estimacion Densidad (t/m3)
categ	Categoria de Recursos (1=medido,2=indicado,3=inferido)
proproca_ini	proporcion roca topografia inicial (%)
proproca_dic	proporcion roca al 31 de diciembre del 2018 (%)
topo_ini	topografia inicial (0:aire,1:roca)
topo_dic	topografia al 31 de diciembre del 2018 (0:aire,1:roca)
passcu	Pasada de estimacion Cobre Total (1-4=Estimacion, 5=Asignacion)
kvarcu	varianza de kriging cobre total 2019
kvarag	varianza de kriging plata 2019
kvarmo	varianza de kriging molibdeno 2019
kvaras	varianza de kriging arsenico 2019
kvarzn	varianza de kriging zinc 2019
kvarcuas	varianza de kriging Cobre Soluble en Ac. Sulfurico 2019
kvarcucn	varianza de kriging Cobre Soluble en Cianurol 2019
kvarau	varianza de kriging oro 2019
kvarpb	varianza de kriging plomo 2019
kvarfe	varianza de kriging fierro 2019
kvarf	varianza de kriging fluor 2019
kvarmgo	varianza de kriging oxido de magnesio 2019
kvartal	varianza de kriging talco 2019
kvarden	varianza de kriging densidad 2019

TETRA TECH

Tabla 3-3: Modelo de Reservas

MS3D (Tetra Tech)	Descripción
PTOPO	Topografía a Dic 2020
ROCK	Modelo Litologia
ALT	Modelo Alteracion
MINZ	Modelo Zona Mineral
DENS	Estimacion Densidad (t/m3)
TCU	Estimacion Cobre Total (%)
CUAS	Estimacion Cobre Soluble en Ac. Sulfurico (%)
CUCN	Estimacion Cobre Soluble en Cianuro (%)
AG	Estimacion Plata (g/t)
MO	Estimacion Molibdeno (%)
AS	Estimacion Arsenico (%)
ZN	Estimacion Zinc (%)
PB	Estimacion Plomo (%)
AU	Estimacion Oro (g/t)
CATE	Categoria de Recursos (1=medido,2=indicado,3=inferido)
FL	Estimacion Fluor (ppm)
MGO	Estimacion oxido de magnesio (%)
FE	Estimacion Fierro (%)
TALC	Estimacion XRD Talco
LIG	Limite de informacion geologica (1: dentro LIG)
ZONE	Zona Geotécnica Itasca 2019 (1-29)
TNBLK	Tonelaje del Bloque
HARD	Durezas
RATOX	Relación CUCN/CU *100
BI	Índice de Tronadura
UALTE	Unidad de Alteración 1USKSM,2 USKAT,3UBXSI,4UHORN,5UINTA,6UINTB,7UYAH
TCC	Toneladas de Concentrado de Cu
TCMO	Toneladas de Concentrado de Mo
TMOO3	Toneladas de Concentrado de MoO3C
RCU	Recuperación de Cu
RAG	Recuperación de Ag
RAS	Recuperación de As
RZN	Recuperación de Zn
RFL	Recuperación de Fluor
RMO	Recuperación de Mo
RMGO	Recuperación de MGO
RMOO3	Recuperación de MoO3C
CUCC	Ley de Cobre en el Concentrado
AGCC	Ley de Plata en el Concentrado
ASCC	Ley de Arsénico en el Concentrado
ZNCC	Ley de Zing en el Concentrado
FLCC	Ley de Fluor en el Concentrado
MOCMO	Ley de Mo en Concentrado de Mo
MGOCC	Ley de Mo de Concentrado
MOO3C	Trioxido de Mo
NSR1	NSR de Cobre (US$/t)
NSR2	NSR de Mo (US$/t)
NSR3	NSR de Ag (US$/t)
NSR	NSR Total (US$/t)
MCAF	MCAF (US$/t)
INP	INP (US$/t)

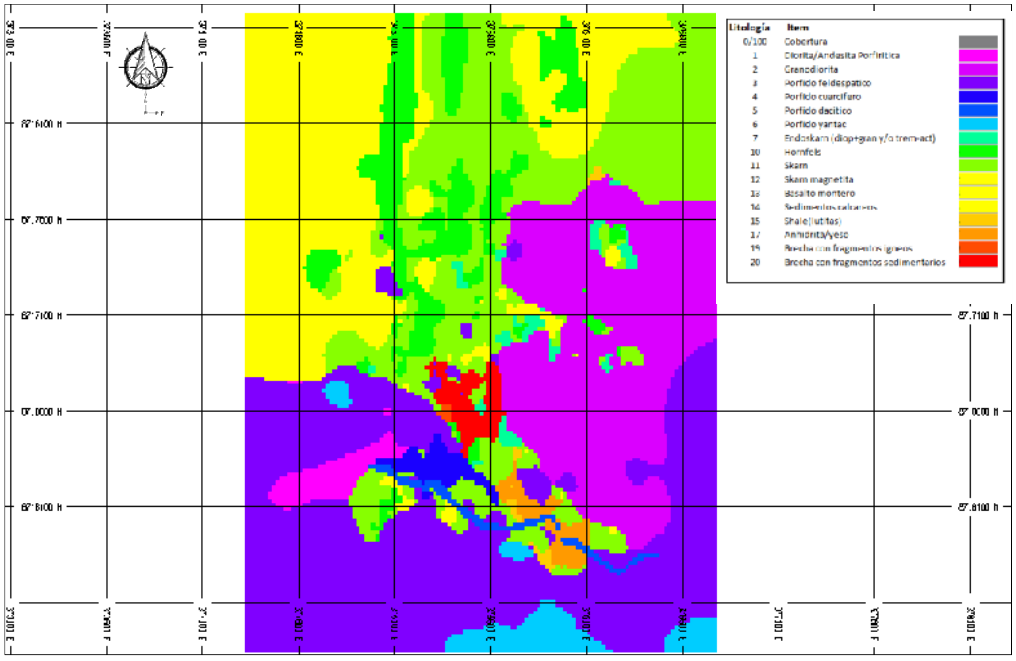
3.2 Litología

El modelo litológico del yacimiento incluye 16 diferentes tipos litológicos más un material de Cobertura (Coluvio) ubicado en la superficie. La Tabla 3-4 muestra los diferentes tipos de litología contenidos en el yacimiento.

Tabla 3-4: Tipo de litología

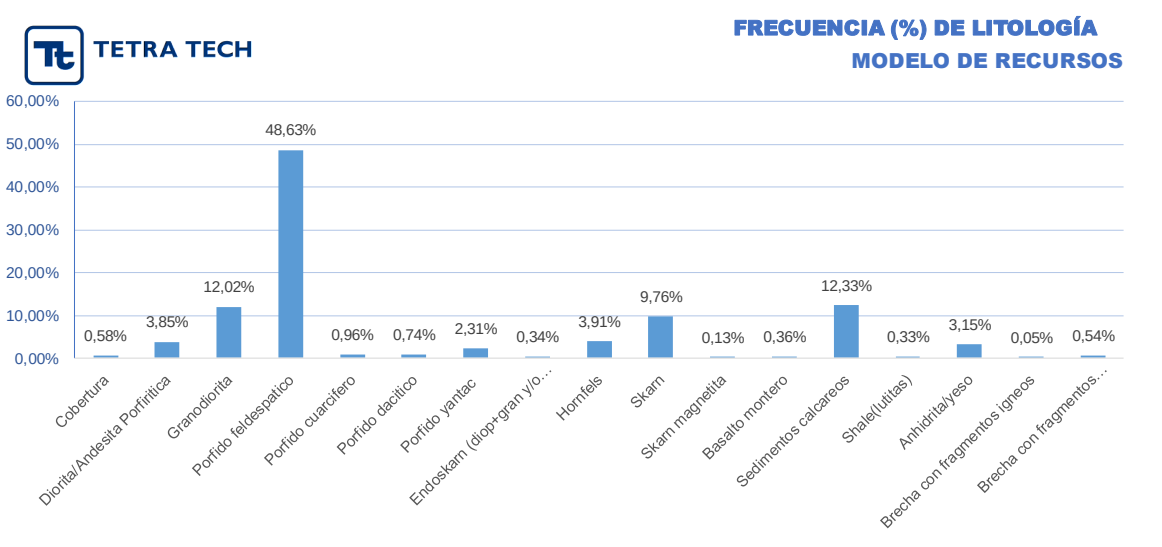
Lito / Rock	Litología
0/100	Cobertura
1	Diorita/Andesita Porfiritica
2	Granodiorita
3	Porfido feldespatico
4	Porfido cuarcifero
5	Porfido dacitico
6	Porfido yantac
7	Endoskarn (diop+gran y/o trem-act)
10	Hornfels
11	Skarn
12	Skarn magnetita
13	Basalto montero
14	Sedimentos calcareos
15	Shale(lutitas)
17	Anhidrita/yeso
19	Brecha con fragmentos igneos
20	Brecha con fragmentos sedimentarios

Figura 3-1: Distribución Litológica en la Elevación 4410



En la Figura 3-2 se muestra la distribución de la litología presente en el modelo de bloques.

Figura 3-2: Distribución de la Litología en el Modelo de Bloques



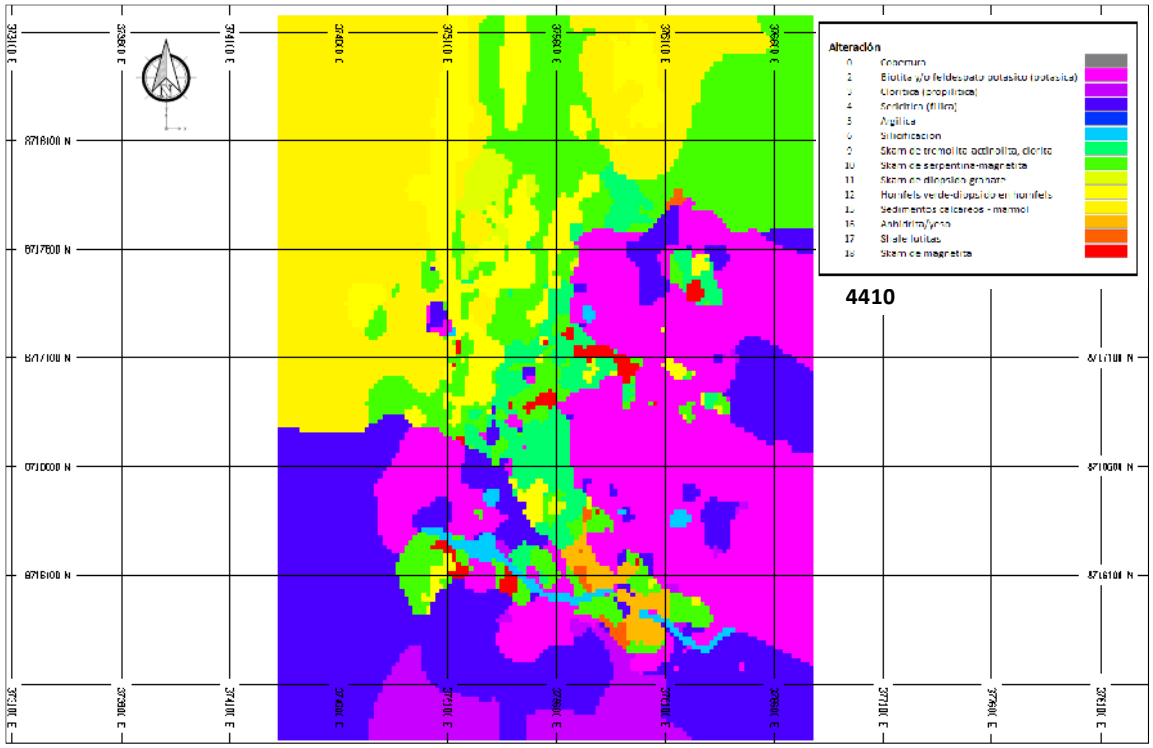
3.3 Alteración

El modelo de alteración del yacimiento incluye 18 diferentes tipos de alteración más un material de Coluvio, ubicado en la superficie. La Tabla 3-4 muestra los diferentes tipos de alteración contenidos en el yacimiento.

Tabla 3-5: Tipos de Alteración en el Modelo de Bloques

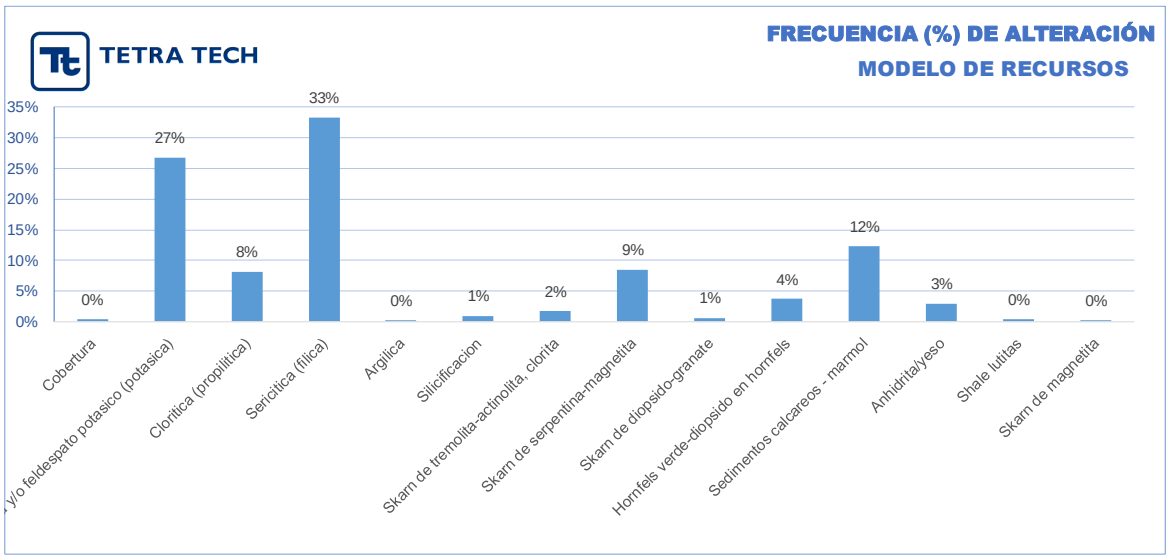
Alte	Alteration
0	Coverage
2	Biotite and/or potassic feldspar (potassic)
3	Chlorite (propylitic)
4	Sericitic (filic)
5	Argillic
6	Silicification
9	Tremolite-actinolite skarn, chlorite
10	Serpentine-magnetite skarn
11	Diopside-granite skarn
12	Green hornfels -diopside in hornfels
15	Calcareous sediments – marble
16	Anhidrite/gypsum
17	Shale lutites
18	Magnetite skarn

Figura 3-3: Distribución de la Alteración en la Elevación 4410



En la Figura 3-4 se muestra la distribución de alteración presente en el modelo de bloques.

Figura 3-4: Distribución de la Alteración en el Modelo de Bloques



3.4 Curvas Tonelaje-Ley

Los recursos geológicos contenidos en el modelo de bloques del yacimiento, para una ley de corte de 0.20% TCu es de 2,060.8 Mt con 0.46% TCu, para las categorías medido e indicado. La Tabla 3-6, muestra la distribución de los recursos por categoría.

Tabla 3-6: Distribución de Recursos por Categorías

CutOff	Medido		Indicado		Inferido		Total	
	kt	TCu	kt	TCu	kt	TCu	kt	TCu
0,00	384.427.309	0,450	1.779.786.188	0,320	14.421.689.749	0,060	36.795.873	0,048
0,10	378.571.316	0,450	1.562.435.205	0,360	2.905.798.846	0,280	4.933.410	0,335
0,20	348.600.541	0,480	1.259.802.338	0,410	1.946.842.002	0,350	3.630.873	0,406
0,30	290.732.141	0,520	886.094.625	0,480	881.139.245	0,460	2.408.627	0,485
0,40	208.397.165	0,590	538.551.896	0,560	384.650.697	0,620	1.420.042	0,581
0,50	134.292.486	0,670	303.899.614	0,650	208.206.280	0,760	810.772	0,684
0,60	83.690.510	0,740	167.313.472	0,730	121.073.920	0,920	457.436	0,792
0,70	46.680.144	0,810	87.949.391	0,810	80.864.647	1,060	265.694	0,898
0,80	23.319.310	0,880	41.732.589	0,880	61.048.464	1,160	159.462	0,999
0,90	8.770.900	0,950	14.601.851	0,940	51.425.471	1,220	94.978	1,103
1,00					45.535.316	1,260	56.127	1,213

En la Figura 3-5 a la Figura 3-7 se muestra la distribución y comportamiento de los Recursos Geológicos Medidos, Indicados e Inferidos, para diferentes leyes de corte de TCu.

Figura 3-5: Curva Tonelaje-Ley Recursos Medidos

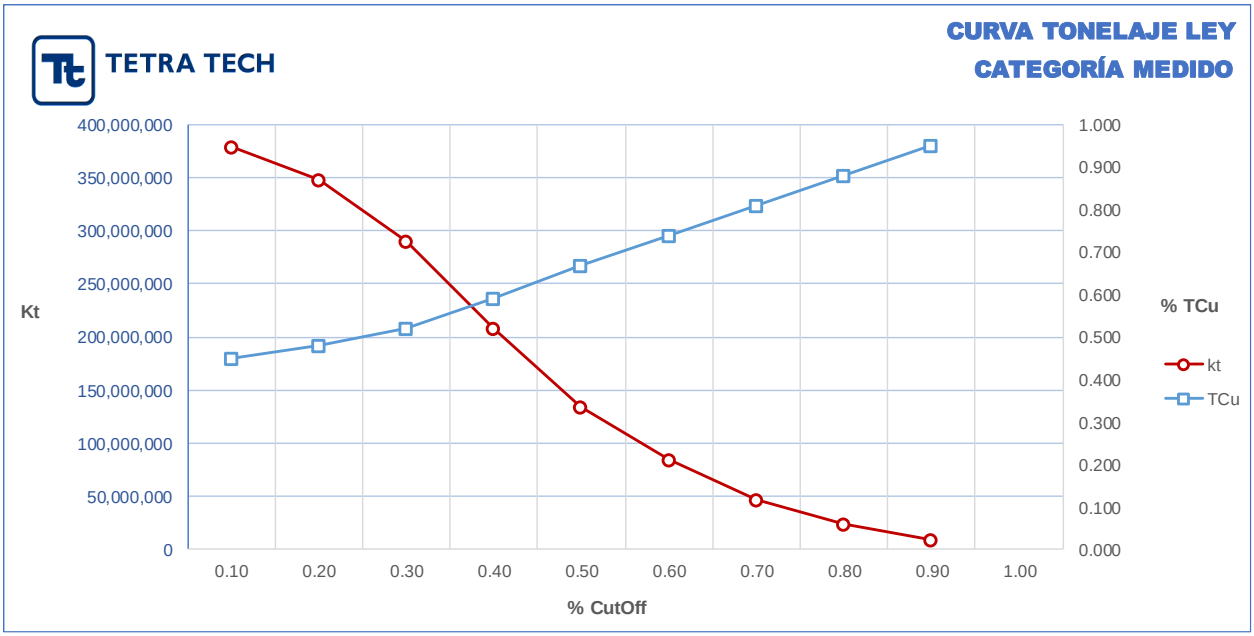


Figura 3-6: Curva Tonelaje-Ley Recursos Indicados

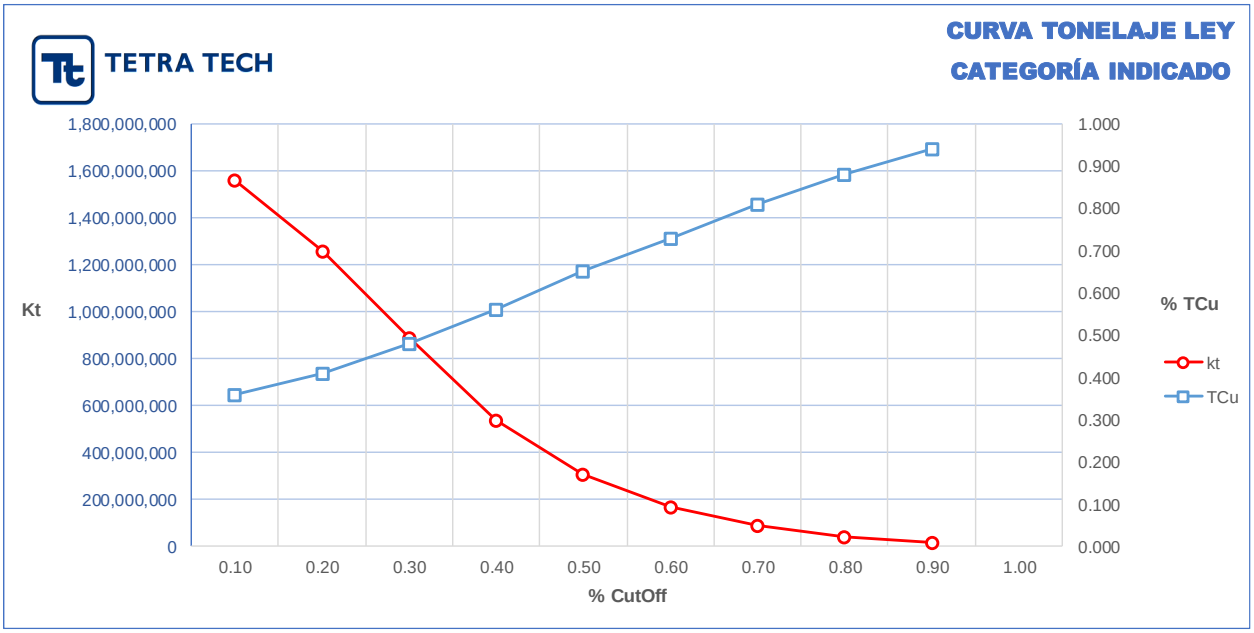
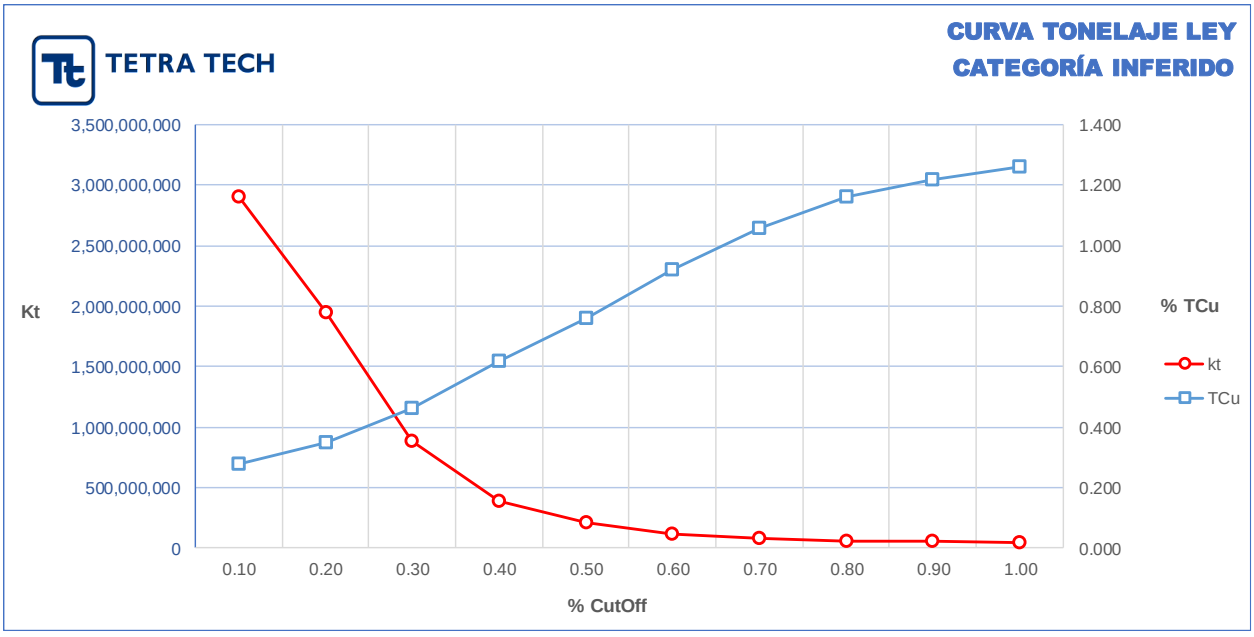
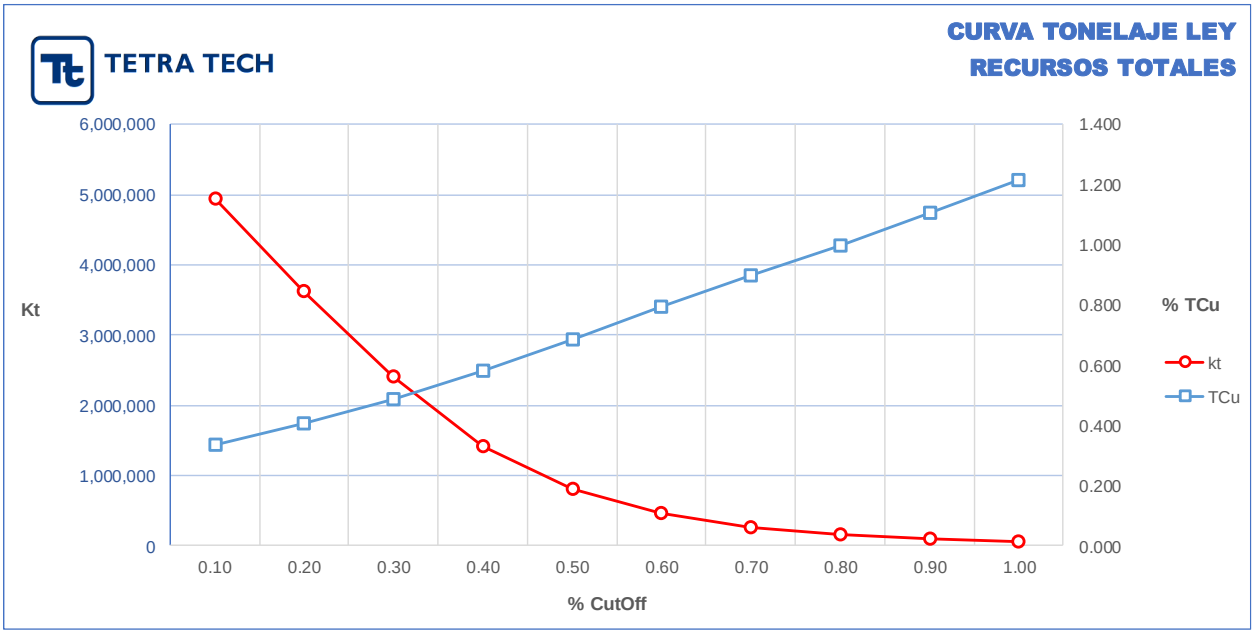


Figura 3-7: Curva Tonelaje-Ley Recursos Inferidos



La Figura 3-8, muestra el gráfico con la curva tonelaje y ley para el total de recursos geológicos con todas las categorías.

Figura 3-8: Curva Tonelaje-Ley Recursos Totales



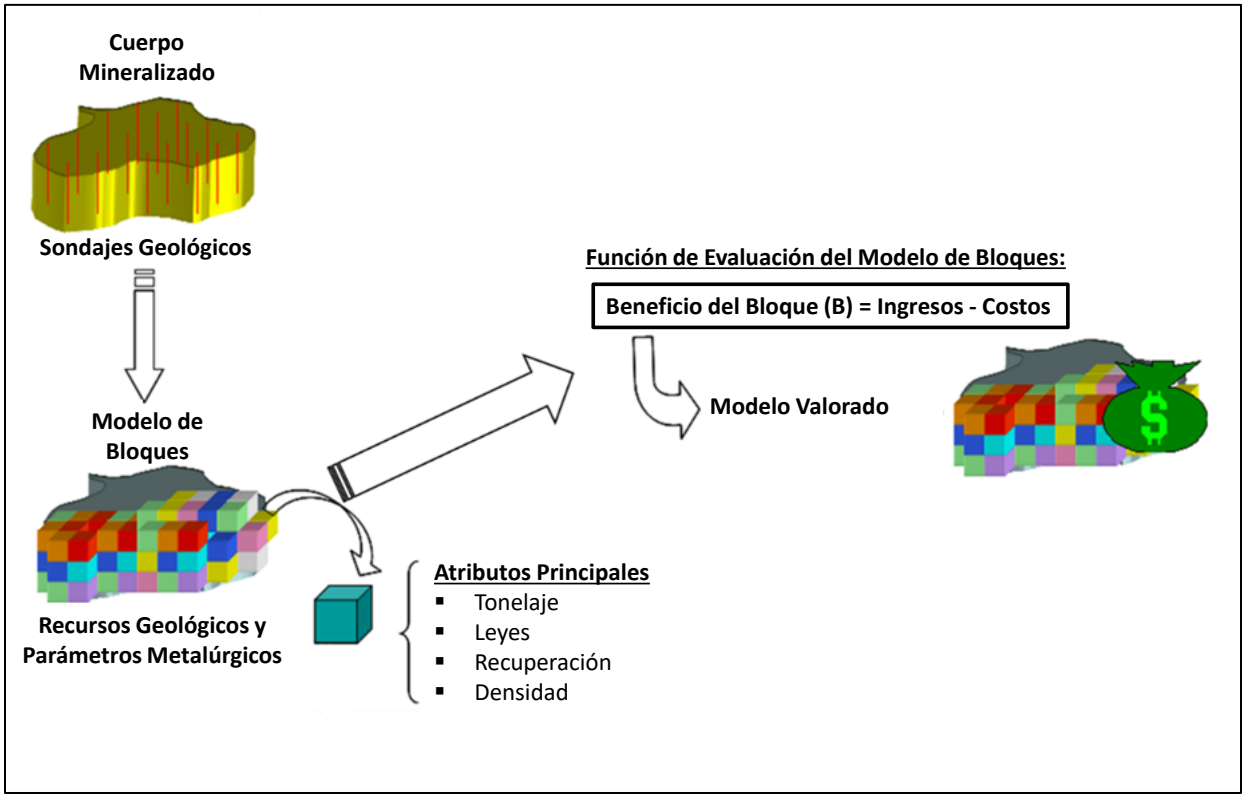
4 DETERMINACIÓN DEL PIT ECONÓMICO

Para la determinación de los límites económicos de explotación del pit, se utiliza el software Whittle, el cual está basado en el algoritmo de Lerchs & Grossman. En el proceso de optimización del pit se genera una serie de pits anidados, a diferentes precios de Cu, para posteriormente realizar el análisis del pit final.

4.1 Valorización de Bloques

En la Figura 4-1, se describe el proceso de valorización del modelo de bloques que realiza el software Whittle, donde se calcula el beneficio del bloque, descontando de los ingresos, los costos asociados al proceso completo de producción, transporte y venta. Posteriormente el software determina el destino del bloque, según su valor económico, de acuerdo con una ley mínima o costo de corte asociado al negocio.

Figura 4-1: Esquema de Valorización del Modelo de Recursos



Sólo los Recursos Medidos e Indicados fueron valorizados como mineral para alimentar la planta de proceso. Los Recursos Inferidos fueron considerados como lastre, con destino a Desmonte.

Los parámetros técnico-económicos utilizados en la valorización del modelo de recursos de la Mina Toromocho fueron proporcionados por Minera Chinalco Perú y son los que se muestran en Tabla 4-1, Tabla 4-2, Tabla 4-3 y Tabla 4-4.

TETRA TECH

Tabla 4-1: Costos de Proceso, Costos de Productos y Pagables

Minera Chinalco Peru - Toromocho Project Optimization Parameters Whittle 2020		
		ING 2020
Mine Cost		
Ore Waste MCAF	US/tore US/twaste (per bench) (Bench Base 4725)	Base 1.1211 x MCAF + Sust. Capital * Equation
Process Cost		
Mill	US/tm	5.7546 + Sust Capital + Kingsmill
G&A	US/tm	0.4627 + Sust Capital
Minimun Cu Grade	%	0.15
Throughtput	ton Ore	** Equation
Commodities Price		
Cu	US/lb	2.74
Mo	US/lb	11.3
Ag	US/t.oz	16.78
Payable		
Cu (ore)	%	Cu Conc -1%
Mo (Ore)	%	100
Ag (ore)	%	90
Sustaining Capital		
Mine Sustaining Capital	US$/ton Mined	0.312
Process Sustaining Capital	US$/tons processed	0.356
General & Admin Sustaining Capital	US$/tons processed	0.039
Concentrate Moisture		
Concentrate Moisture		9%
Fixed Cost		
Fixed Administrative Cost	US/tm	0.822
Insurance	US/tm	0.139
Royalties	US/tm	0.159
Kingsmill Cost	US/tm	0.094

* **(0.00000031*WBENCH**4-0.00002964*WBENCH**3+ 0.00073297*WBENCH**2-0.0287439*WBENCH**1+2.58100786)**
* **(0.00000064*WBENCH**4-0.0001173*WBENCH**3+0.00761221*WBENCH**2-0.22955765*WBENCH**1+4.37619922)**
** **(100320-1685*HARD+1572*FE-609*MGO+38471*RTOX+5482*SKR_ACT_TREM/100-11359*HORN/100)**

La ecuación de throughput (**) fue referencial ya que la alimentación considera el ramp-up definido por la planta ajustado a una tasa plana de 170 ktpd.

TETRA TECH

Tabla 4-2: Costos de Venta

Minera Chinalco Peru - Toromocho Project Optimization Parameters Whittle 2020		
Selling Cost	**Unit**	**Values**
a) Treatment charges (TC) Cu		
CIQ Compliance As in Conc < =0.5%	US$/dtm	82.530
0.5% < = As in Conc, high F > 1000 ppm	US$/dtm	91.720
0.5% < = As in Conc ≤ 1%	US$/dtm	110.720
1% < As in Conc ≤ 1.5%	US$/dtm	115.720
1.5 % < As in Conc	US$/dtm	135.720
b) Refining charges (RC) Cu		
CIQ Compliance As in Conc < =0.5%	US$/dtm	37.299
0.5% < As in Conc, high F > 1000 ppm	US$/dtm	41.453
0.5% < As in Conc ≤ 1%	US$/dtm	50.040
1% < As in Conc ≤ 1.5%	US$/dtm	52.299
1.5 % ≤ As in Conc	US$/dtm	61.338
c) Refining charges (RC) Ag		
CIQ Compliance As in Conc <= 0.5%	US$/oz payable	0.50
0.5% < As in Conc, high F > 1000 ppm	US$/oz payable	0.50
0.5% < As in Conc ≤ 1%	US$/oz payable	0.50
1% < As in Conc ≤ 1.5%	US$/oz payable	0.50
1.5 % ≤ As in Conc	US$/oz payable	0.50
		0.50
d) Cu Selling Cost		
Rail Transport - Mine to Warehouse Callao	USD/wmt	23.50
Bulk International Cargo Transportation	USD/wmt	38.07
Storage	USD/wmt	14.50
Warehouse operations	USD/wmt	3.17
Conveyor Belt	USD/wmt	8.50
Bulk Customs Agency	USD/wmt	0.10
Reception Concentrate Supervision	USD/wmt	0.30
Dispatch Concentrate Supervision	USD/wmt	0.35
Sample Analysis at Reception	USD/wmt	0.70
Dispatch Sample Analysis	USD/wmt	0.45
Destination supervision, Part analysis and resolutions.	USD/wmt	1.50
		91.14
e) Mo Selling Cost		
Laboratory	US$/dtm MoO3	10
Logistics	US$/dtm MoO4	75
Freight	US$/dtm MoO5	15
Logistics in Destiny	US$/dtm MoO6	50
		150

Para la penalización o cargo por posibles contaminantes, el concentrado de cobre se ha clasificado en cinco tipos:

- La calidad 1 o CIQ Compliance (China inspection and Quarantine), es el concentrado de cobre con ley de As menor a 0.5% y Flúor en el concentrado bajo los 1000 ppm.
- La calidad 2 corresponde al concentrado de cobre con ley de As menor a 0.5% y Flúor en el concentrado sobre 1000 ppm.
- La calidad 3 corresponde al concentrado de cobre con ley de As entre 0.5% y 1%.
- La calidad 4 corresponde al concentrado de cobre con ley de As entre 1.0% y 1.5%.
- La calidad 5 es el concentrado de cobre cuya ley de As es mayor a 1.5%.

Tabla 4-3: Penalidades

Minera Chinalco Peru - Toromocho Project Optimization Parameters Whittle 2020		
Penalties		
As and Zn penalization model		
As		
0.20 % < As in Conc ≤ 1.0%	US$/dmt conc	4 * (per each 0.1 %)
1.0 % < As in Conc	US$/dmt conc	8 * (per each 0.1 %)
Zn		
3% ≤ Zn in Conc	US$/dmt conc	3 * (per each 1.00 %)
MgO		
1% ≤ MgO in Conc	US$/dmt conc	3 * (per each 1.0 %)
F		
400 ppm < F in Conc ≤ 1000 ppm	US$/dmt conc	2.0 * (per each 100 ppm)
1000 ppm < F in Conc	US$/dmt conc	3.0 * (per each 100 ppm)

Tabla 4-4: Recuperación Metalúrgica y Ley de Concentrado

Metallurgical Recovery		Expression
Rec Cu (%)	=	(95.95-0.02498*(UINTA+UINTB)-0.1607*USKSM-1.237*RATOX-0.056*(FE/CU)+0.486*MGO + 0.001726*USKSM*USKSM + 0.001732*(UINTA+UINTB)*USKSM+0.0296*RATOX*(FE/CU)-0.0669*(FE/CU)*MGO)
Rec Ag (%)	=	72%
Rec Mo (%)	=	66%
Rec MOO3 (%)	=	93%
Rec As (%)	=	ASCC*TCC/(ton*AS)*100
Rec Zn (%)	=	ZNCC*TCC/(ton*ZN)*100
Rec F (%)	=	FCC*TCC/(ton*F)*100
Rec MgO (%)	=	MGOCC*TCC/(ton*MGO)*100

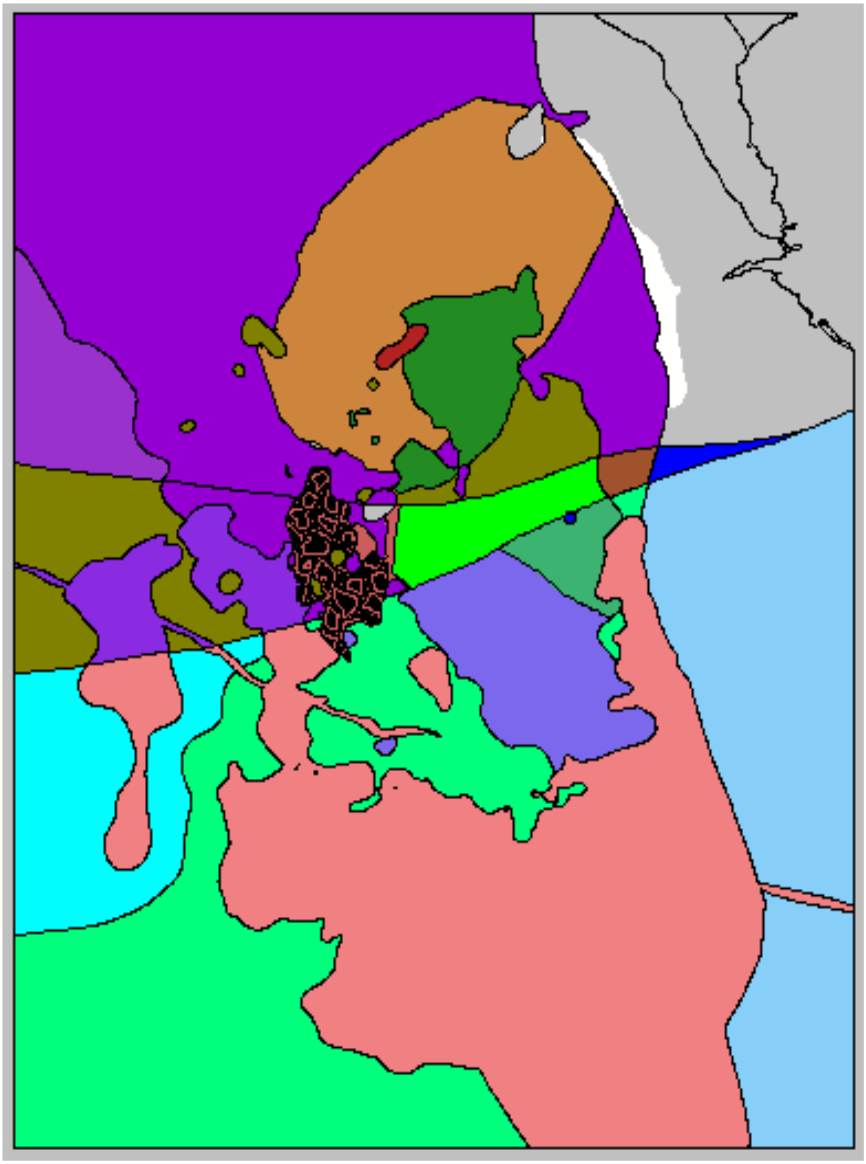
Concentrade Grades Estimation	Unit	Expression
Cu Conc	%	24%
Ag Conc	g/t	ton*AG*RAG/TCC
Mo Conc	%	19%
MOO3C	%	66%
As Conc	%	(0.6906-1.4405*TCU+0.03947*AG+24.54*AS-0.502*RATOX/100)
Zn Conc	%	(2.491-4.057*TCU+0.0622*AG+26.497*ZN)
F Conc	%	(67+559.8*TCU-44.03*AG-15.46*MGO+0.1819*FL-205.9*USKSM/100+475*UHONR/100-2499*TALC/100)
MgO Conc	%	(0.286+0.0155*MGO+3.626*TCU+0.000436*FL-12.48*TALC/100-1.904*USKSM/100+4.271*UHONR/100-0.2780*AG)

4.2 Parámetros Geotécnicos

El modelo geotécnico utilizado en el presente estudio fue realizado por el área de Geotecnia de MCP basado en los parámetros definidos en el reciente estudio desarrollado por la empresa consultora Itasca S.A.C. finalizado en Julio del 2019.

La zonificación geotécnica empleada para la asignación de los ángulos de talud global para el proceso de optimización y diseño minero fue facilitada por personal de Geotecnia de Minera Chinalco Perú, la cual se presenta en la Figura 4-2, para el nivel 4480.

Figura 4-2: Zonificación Geotécnica Mina Toromocho

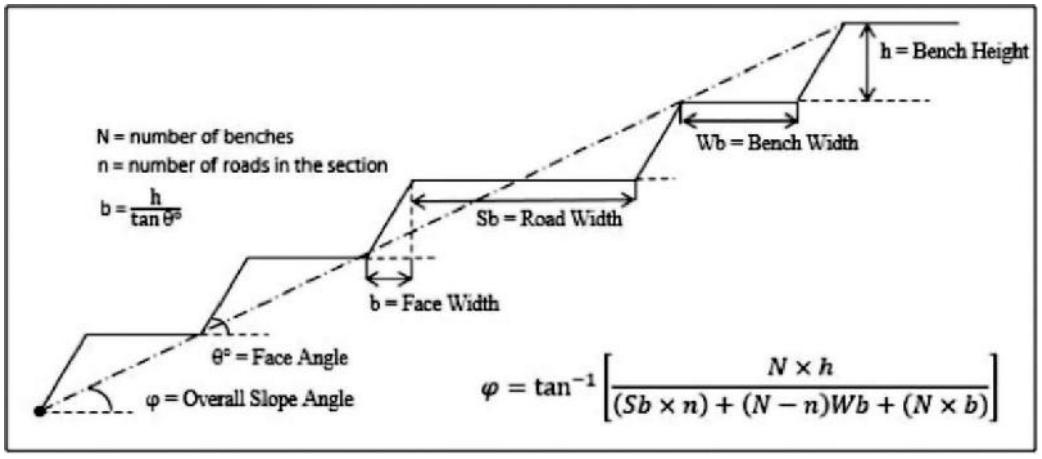


La Tabla 4-5 resume los parámetros geotécnicos por zona, que fueron considerados en la determinación del pit final y el diseño minero.

Tabla 4-5: Parámetros Geotécnicos Mina Toromocho

CODE	IRA	BFA	Berm (m)	N° Benches Uncoupling	Uncoupling Width (m)	Height Uncoupling (m)	Ramp (m)	Overall Slope
1	38	60	10.54	8	30.00	120.00	40.00	33
2	44	73	10.95	8	30.00	120.00	40.00	38
3	40	64	10.56	8	30.00	120.00	40.00	35
4	49	80	10.39	8	30.00	120.00	40.00	42
5	49	80	10.39	8	30.00	120.00	40.00	42
6	44	73	10.95	8	30.00	120.00	40.00	38
7	42	69	10.90	8	30.00	120.00	40.00	36
8	49	80	10.39	8	30.00	120.00	40.00	42
9	40	64	10.56	8	30.00	120.00	40.00	35
10	49	80	10.39	8	30.00	120.00	40.00	42
11	44	75	11.51	8	30.00	120.00	40.00	38
12	49	80	10.39	8	30.00	120.00	40.00	42
13	37	63	12.26	8	30.00	120.00	40.00	33
14	19	38	24.36	8	30.00	120.00	40.00	18
15	49	80	10.39	8	30.00	120.00	40.00	42
16	44	72	10.66	8	30.00	120.00	40.00	38
17	40	64	10.56	8	30.00	120.00	40.00	35
18	49	80	10.39	8	30.00	120.00	40.00	42
19	40	66	11.20	8	30.00	120.00	40.00	35
20	44	75	11.51	8	30.00	120.00	40.00	38
21	22	43	21.04	8	30.00	120.00	40.00	21
22	44	75	11.51	8	30.00	120.00	40.00	38
23	44	75	11.51	8	30.00	120.00	40.00	38
24	40	64	10.56	8	30.00	120.00	40.00	35
Tailing (25)	14	27	30.72	8	30.00	120.00	40.00	14
100	23	37	15.00	8	30.00	120.00	40.00	22

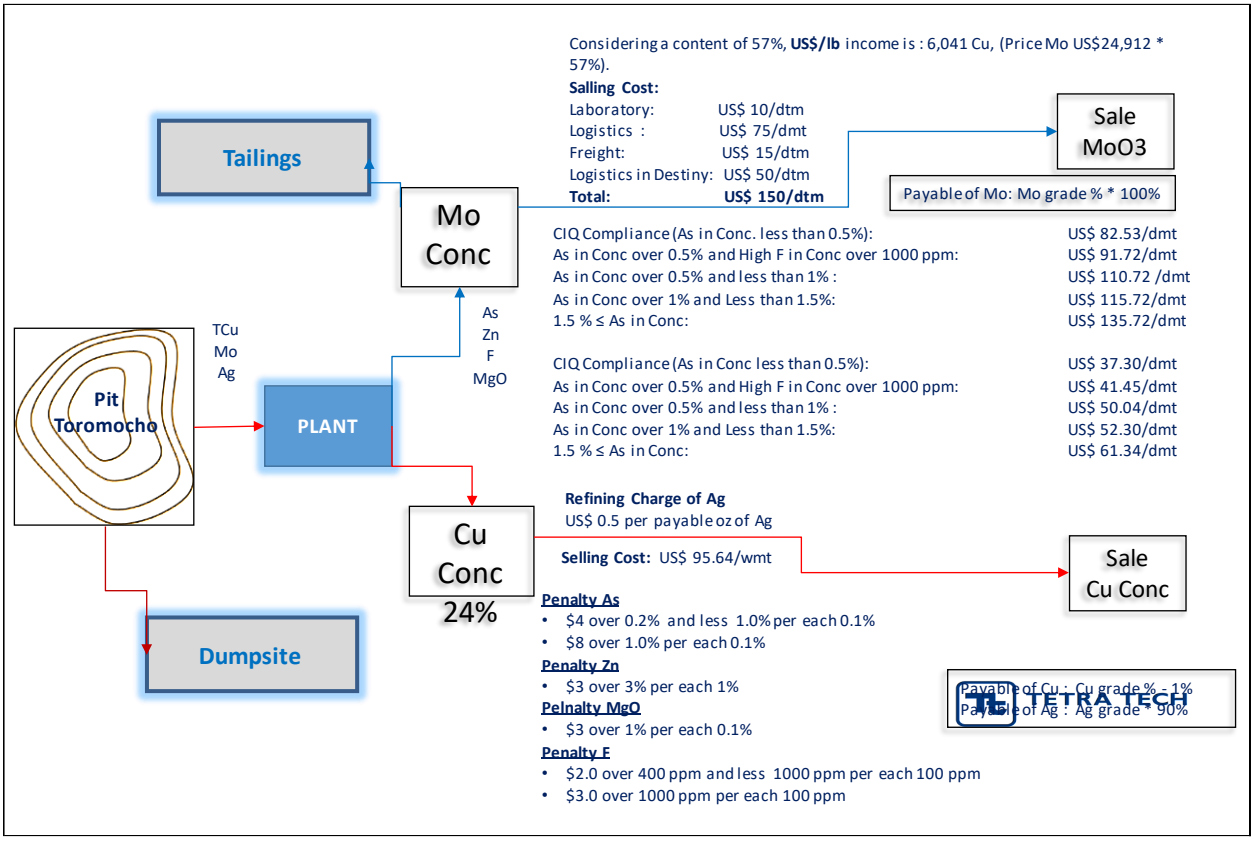
El cálculo del ángulo global está en función de la altura de desacople y longitud de la berma, como lo muestra la siguiente expresión.



4.3 Modelo del Proceso Productivo

El modelo del proceso productivo se muestra en la Figura 4-3, en donde desde la mina se extrae dos tipos de materiales: mineral a proceso y lastre a Desmonte. Del mineral que entra a proceso se obtiene concentrado de Cu y concentrado de Trióxido de Molibdeno (MoO3) y los relaves producidos son enviados a la cancha de relave.

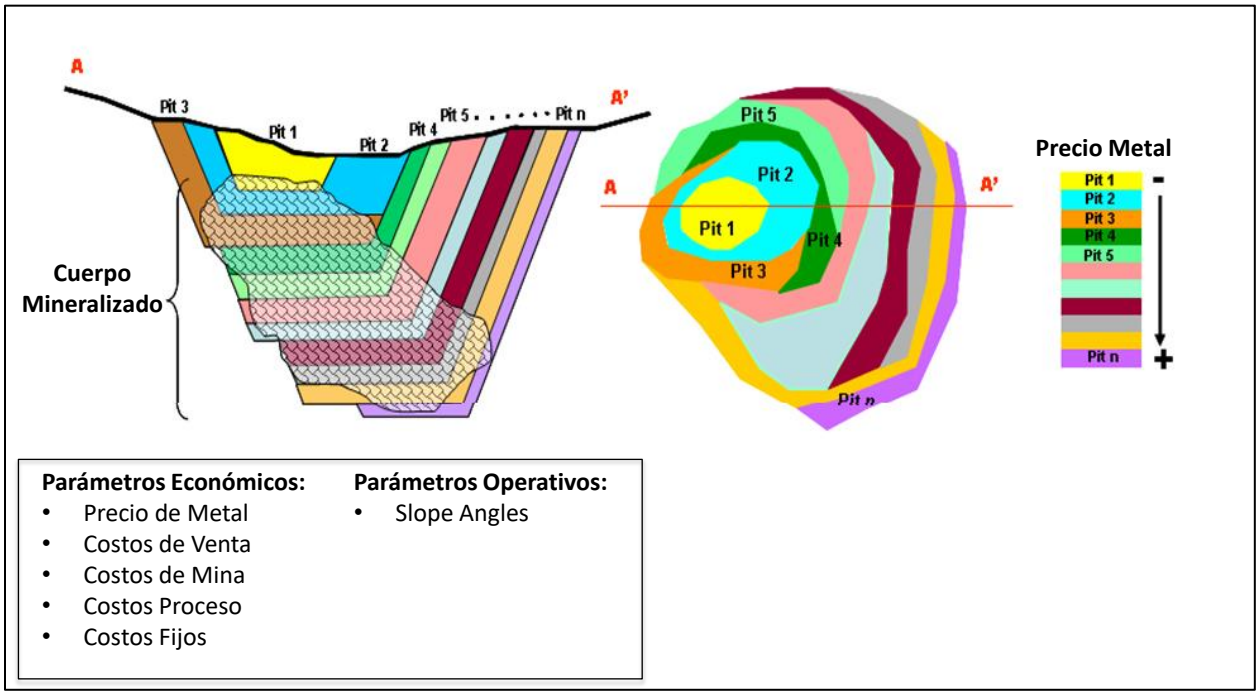
Figura 4-3: Modelo del Proceso Productivo



4.4 Optimización del Pit

El proceso de optimización de pit, consiste en definir la estrategia de consumo de las reservas según una serie de pit anidados o auto contenidos. En este caso, se ha generado la serie de pits anidados mediante la variación de precios del metal desde valores mínimos a valores máximos, es decir, controlando el ingreso de la función de beneficio. Esto asegura que los primeros pit sean más económicos que los siguientes, ya que ellos están sujetos a una condición de precios más exigente y, por lo tanto, para que se genere la envolvente respectiva, la función de beneficio debe tener un mayor rédito, ya sea por efecto de alta ley del mineral contenido o alternativamente un bajo costo (baja razón lastre mineral). El resultado de este proceso se ilustra en la Figura 4-4.

Figura 4-4: Diseño Esquemático para la Optimización del Pit.



De esta forma y tomando en consideración todos los parámetros técnicos y económicos señalado en los puntos anteriores, tenemos como resultado la optimización que se señala en Tabla 4-6.

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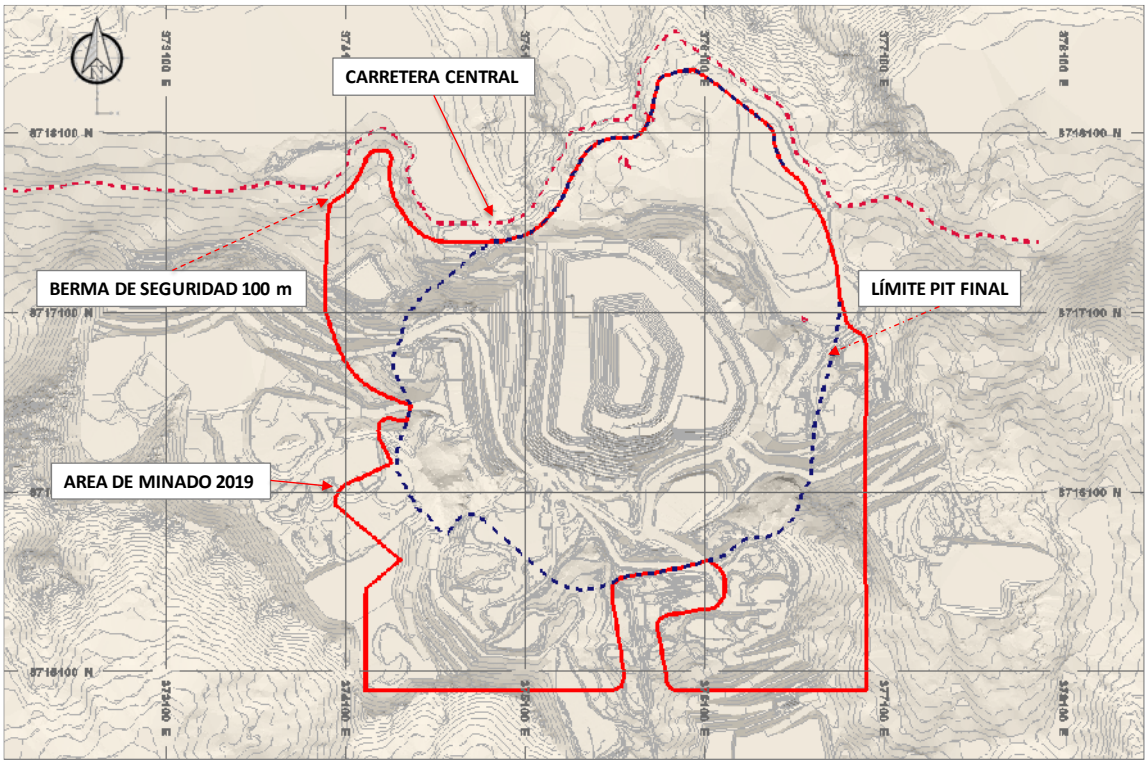
Tabla 4-6: Resultados Optimización Whittle 4X

Pit	Revenue Factor	Copper Price	Total (kt)	Waste (kt)	Ore (kt)	Strip Ratio	Max Bench	Min Bench	Cu (%)	Mo (%)	As Conc (%)	Ag (g/t)
1	0.30	0.82	181	56	125	0.45	70	37	1.494	0.016	0.124	8.6
2	0.31	0.85	221	59	162	0.36	70	37	1.432	0.014	0.123	7.5
3	0.32	0.88	547	195	352	0.55	70	37	1.377	0.015	0.156	7.4
4	0.33	0.90	1,288	437	851	0.51	70	35	1.268	0.020	0.182	8.3
5	0.34	0.93	2,892	658	2,234	0.29	70	34	1.127	0.023	0.149	6.3
6	0.35	0.96	6,439	1,396	5,043	0.28	70	34	1.038	0.026	0.191	6.0
7	0.36	0.99	8,463	1,623	6,840	0.24	70	34	1.004	0.026	0.190	5.8
8	0.37	1.01	11,155	1,953	9,202	0.21	70	33	0.978	0.025	0.201	5.7
9	0.38	1.04	16,028	2,999	13,029	0.23	70	33	0.945	0.025	0.230	6.2
10	0.39	1.07	33,732	7,856	25,876	0.30	70	32	0.834	0.032	0.216	5.9
11	0.40	1.10	41,211	8,721	32,490	0.27	70	32	0.812	0.031	0.254	6.3
12	0.41	1.12	45,646	9,096	36,550	0.25	70	31	0.797	0.030	0.271	6.3
13	0.42	1.15	118,988	50,010	68,978	0.73	70	27	0.815	0.027	0.273	6.5
14	0.43	1.18	153,031	66,874	86,157	0.78	70	26	0.799	0.027	0.289	6.6
15	0.44	1.21	166,047	68,986	97,061	0.71	70	26	0.779	0.026	0.300	6.5
16	0.45	1.23	180,202	71,023	109,179	0.65	70	25	0.760	0.026	0.314	6.5
17	0.46	1.26	209,843	82,499	127,344	0.65	74	25	0.741	0.025	0.329	6.4
18	0.47	1.29	230,599	87,063	143,536	0.61	74	25	0.723	0.025	0.347	6.4
19	0.48	1.32	240,227	86,012	154,215	0.56	74	24	0.709	0.025	0.360	6.4
20	0.49	1.34	272,162	97,516	174,646	0.56	74	23	0.692	0.024	0.378	6.3
25	0.54	1.48	694,275	284,187	410,088	0.69	74	23	0.601	0.021	0.506	6.6
30	0.59	1.62	1,113,607	430,248	683,359	0.63	74	20	0.548	0.019	0.567	6.3
35	0.64	1.75	1,377,355	501,550	875,805	0.57	74	19	0.514	0.018	0.596	6.1
40	0.69	1.89	1,562,259	538,576	1,023,683	0.53	75	18	0.489	0.017	0.617	5.9
45	0.74	2.03	1,703,277	578,202	1,125,075	0.51	75	18	0.474	0.017	0.631	5.8
50	0.79	2.16	1,884,089	651,189	1,232,900	0.53	75	17	0.460	0.016	0.651	5.7
55	0.84	2.30	1,974,509	681,232	1,293,277	0.53	75	17	0.451	0.016	0.661	5.7
61	0.90	2.47	2,049,215	704,193	1,345,022	0.52	75	17	0.444	0.016	0.668	5.6
62	0.91	2.49	2,066,877	712,798	1,354,079	0.53	75	17	0.442	0.016	0.669	5.6
63	0.92	2.52	2,068,800	710,659	1,358,141	0.52	75	17	0.442	0.016	0.670	5.6
64	0.93	2.55	2,080,852	715,640	1,365,212	0.52	75	17	0.441	0.015	0.671	5.6
65	0.94	2.58	2,093,108	720,178	1,372,930	0.52	75	17	0.440	0.015	0.671	5.6
66	0.95	2.60	2,103,441	725,479	1,377,962	0.53	75	17	0.439	0.015	0.672	5.6
67	0.96	2.63	2,110,372	726,867	1,383,505	0.53	75	17	0.438	0.015	0.672	5.6
68	0.97	2.66	2,135,382	742,872	1,392,510	0.53	75	17	0.437	0.015	0.672	5.6
69	0.98	2.69	2,143,761	746,329	1,397,432	0.53	75	17	0.436	0.015	0.673	5.6
70	0.99	2.71	2,153,384	750,414	1,402,970	0.53	75	17	0.435	0.015	0.673	5.6
71	1.00	2.74	2,154,591	749,679	1,404,912	0.53	75	17	0.435	0.015	0.673	5.5
72	1.01	2.77	2,167,662	757,738	1,409,924	0.54	75	17	0.434	0.015	0.674	5.5
73	1.02	2.79	2,172,081	759,343	1,412,738	0.54	75	17	0.434	0.015	0.674	5.5
74	1.03	2.82	2,185,089	768,043	1,417,046	0.54	75	17	0.433	0.015	0.674	5.5
75	1.04	2.85	2,188,223	768,715	1,419,508	0.54	75	17	0.433	0.015	0.674	5.5
76	1.05	2.88	2,193,619	771,894	1,421,725	0.54	75	17	0.433	0.015	0.674	5.5
77	1.06	2.90	2,206,883	780,762	1,426,121	0.55	75	17	0.432	0.015	0.675	5.5
78	1.07	2.93	2,212,656	784,510	1,428,146	0.55	75	17	0.432	0.015	0.675	5.5
79	1.08	2.96	2,213,259	784,423	1,428,836	0.55	75	17	0.432	0.015	0.675	5.5
80	1.09	2.99	2,220,731	789,838	1,430,893	0.55	75	17	0.431	0.015	0.675	5.5
81	1.10	3.01	2,226,801	793,264	1,433,537	0.55	75	17	0.431	0.015	0.676	5.5
82	1.11	3.04	2,231,047	796,292	1,434,755	0.56	75	17	0.431	0.015	0.676	5.5
83	1.12	3.07	2,238,219	801,832	1,436,387	0.56	75	17	0.431	0.015	0.676	5.5
84	1.13	3.10	2,241,948	804,241	1,437,707	0.56	75	17	0.430	0.015	0.676	5.5
85	1.14	3.12	2,252,082	811,774	1,440,308	0.56	75	17	0.430	0.015	0.676	5.5
86	1.15	3.15	2,253,195	812,483	1,440,712	0.56	75	17	0.430	0.015	0.676	5.5
87	1.16	3.18	2,255,422	814,025	1,441,397	0.56	75	17	0.430	0.015	0.676	5.5
88	1.17	3.21	2,258,289	815,746	1,442,543	0.57	75	17	0.430	0.015	0.676	5.5
89	1.18	3.23	2,258,940	816,146	1,442,794	0.57	75	17	0.430	0.015	0.676	5.5

En Tabla 4-6 se observa que el pit generado para el RF 1.0 (pit 71), el cual nos indica que a un precio del Cu de 2.74 US$/lb, Mo de 11.3 US$/lb y Ag de 16.78 US$/t.oz, obtendremos un pit con aproximadamente 2,155 Mt de material, de los cuales 1,405 Mt corresponde a mineral procesable con una ley media de 0.435 % de TCu y un ratio de estéril/mineral de 0.53.

La Figura 4-5 muestra los límites físicos de minado como restricción de ingreso al proceso de optimización del pit en Whittle; para lo cual, en color azul se muestra los límites físicos de minado que fueron considerados en el plan LOM del año 2019, y en color rojo segmentado el límite físico a 100 m de la carretera que pasa por el sector.

Figura 4-5: Límite de Pit Final Versus Límite de Minado



A continuación, se muestra una planta con los límites del pit final (Figura 4-6) y 2 perfiles tipo (Figura 4-7, Figura 4-8), los cuales indican el resultado de la optimización (pit 71) sobre la topografía y los límites máximos de minado entregados por Minera Chinalco Perú.

Figura 4-6: Vista de Planta Límites de Pit Final RF 1.0

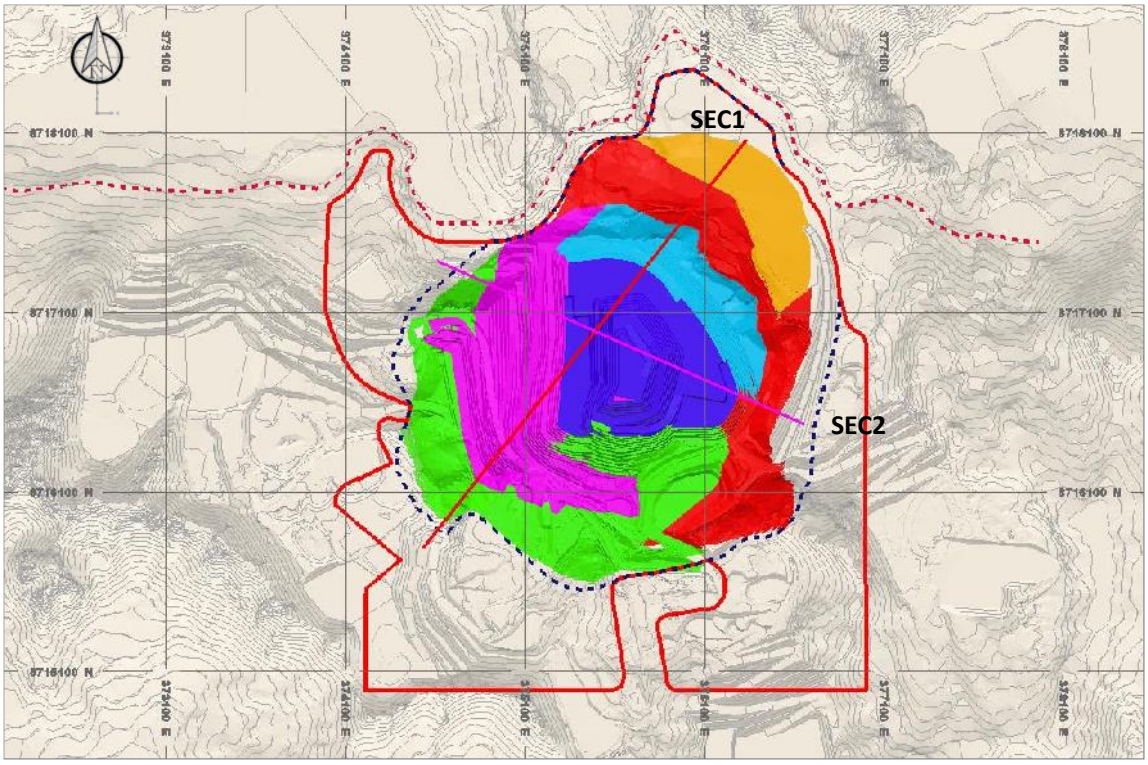


Figura 4-7: Perfil SEC1 para Límite de Pit Final RF 1.0

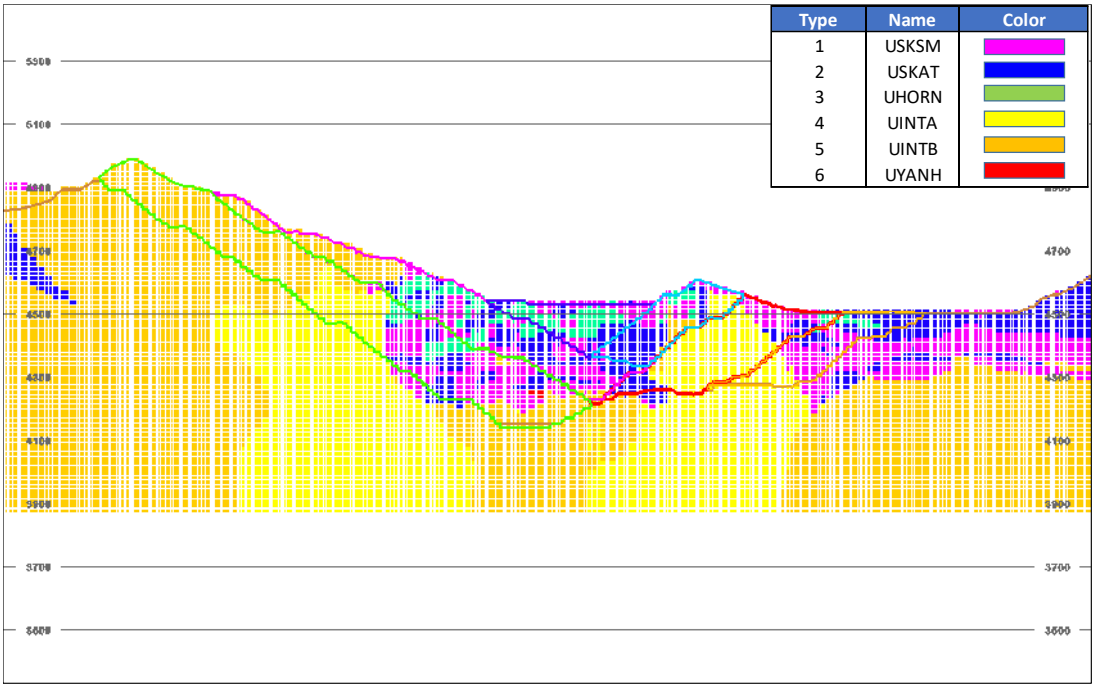
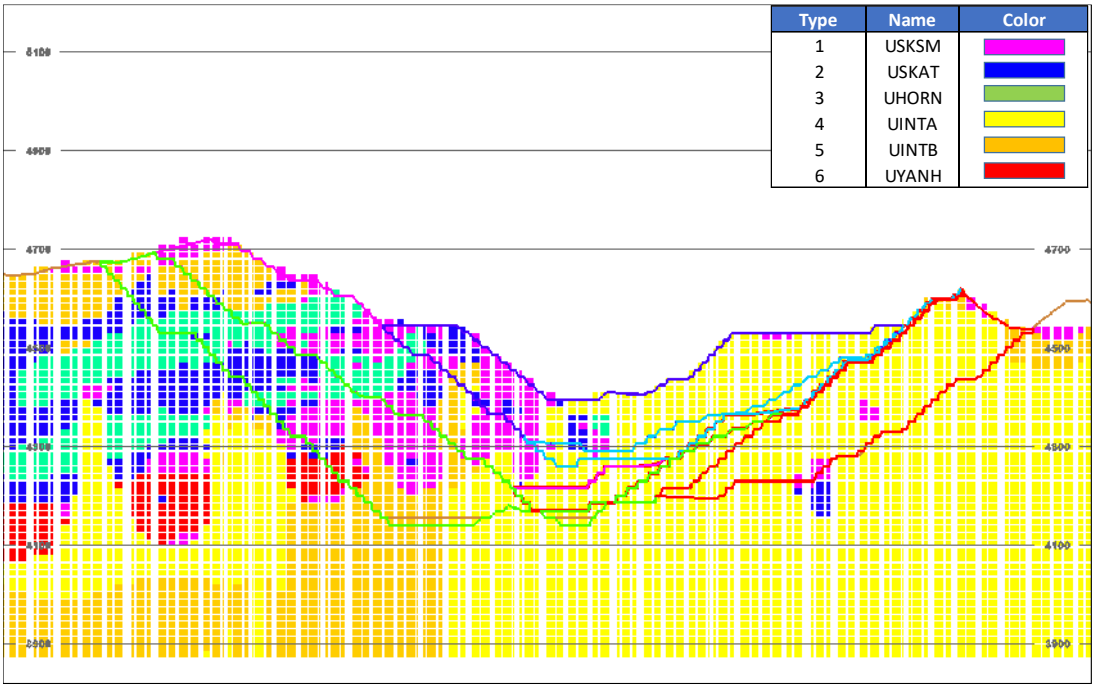


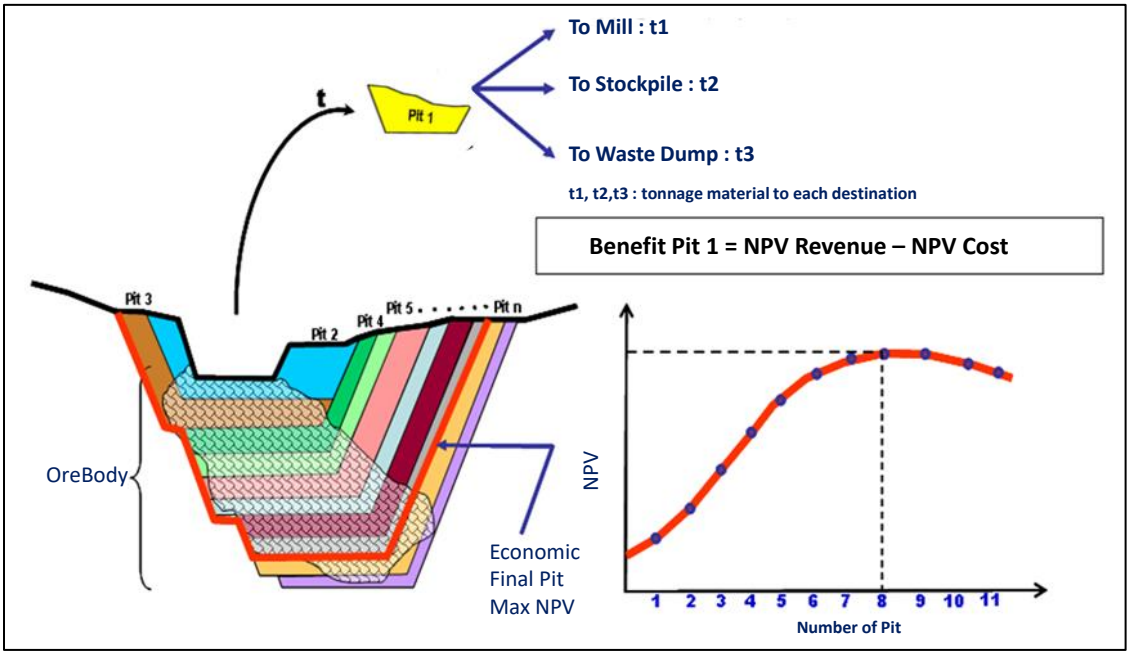
Figura 4-8: Perfil SEC2 para Límite de Pit Final RF 1.0



4.5 Análisis de Pit Final

Esta etapa consiste en definir el pit final económico (Figura 4-9), para lo cual el algoritmo utilizado (módulo Milawa de Whittle) evalúa el aporte económico de cada uno de los incrementos o pit anidados, en función del tiempo y ligados a los parámetros económicos y técnicos que el planificador introduce al modelo (capacidades de mina y planta, recuperaciones, costos de operación, inversiones y precios de venta de los productos, entre otros). De esta manera es posible determinar la envolvente final económica de la explotación, que es la que define el máximo NPV del negocio. En este contexto, todos los incrementos o pit que están más allá de la envolvente económica definida, le restan beneficio al negocio.

Figura 4-9: Análisis de Pit Final Económico

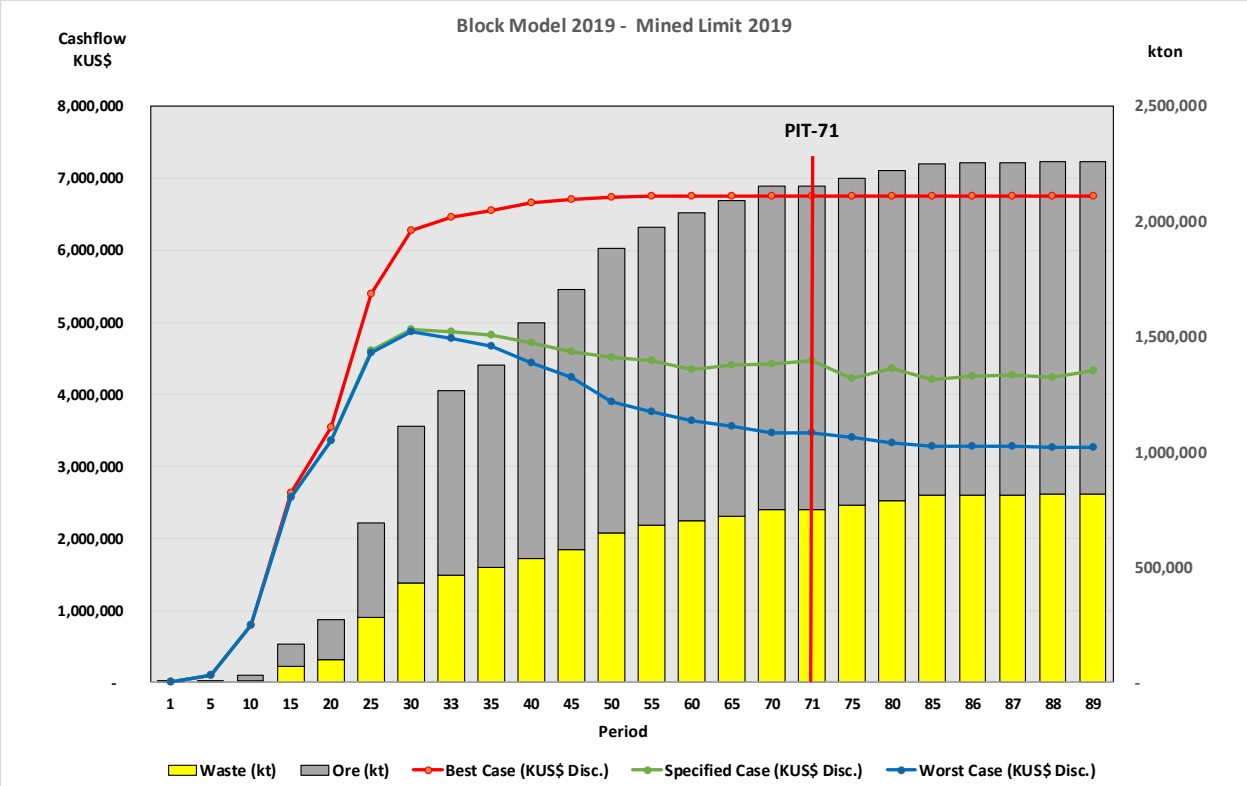


El resultado de las corridas Milawa es mostrado en la Tabla 4-7 y Figura 4-10, las cuales fueron definidas para precios de 2.74 US$/lb de cobre.

Tabla 4-7: Resultados Análisis Milawa

			Open Pit Cashflow			Ore	Waste	Mine Life		
Pit	Revenue Factor	Copper Price	Best Case KUS$ Disc.	Specified Case KUS$ Disc.	Worst Case KUS$ Disc.	Input (tonnes)	Best (tonnes)	Years Best	Years Specified	Years Worst
1	0.30	0.82	7,737	7,737	7,737	144	37	0.00	0.00	0.00
5	0.34	0.93	99,381	99,381	99,381	2,764	128	0.05	0.05	0.05
10	0.39	1.07	801,188	801,188	801,188	32,374	1,357	0.60	0.60	0.60
15	0.44	1.21	2,634,946	2,568,185	2,568,185	162,595	3,452	2.80	2.80	2.80
20	0.49	1.34	3,547,601	3,354,759	3,352,177	260,242	11,920	4.37	4.37	4.37
25	0.54	1.48	5,388,142	4,614,542	4,576,885	596,351	97,924	9.79	9.79	9.79
30	0.59	1.62	6,278,251	4,904,505	4,868,923	898,822	214,785	14.66	14.66	14.72
33	0.62	1.70	6,458,374	4,874,816	4,774,642	1,001,811	263,798	16.32	16.32	16.52
35	0.64	1.75	6,549,201	4,824,449	4,676,364	1,066,485	310,871	17.36	17.36	17.66
40	0.69	1.89	6,658,619	4,708,659	4,440,371	1,169,630	392,629	19.02	19.02	19.57
45	0.74	2.03	6,705,114	4,597,834	4,243,264	1,230,162	473,115	20.07	20.03	20.75
50	0.79	2.16	6,743,377	4,515,177	3,905,050	1,308,989	575,100	21.55	21.27	22.36
55	0.84	2.30	6,753,494	4,473,594	3,758,165	1,342,787	631,722	22.12	21.82	23.06
60	0.89	2.44	6,757,635	4,342,590	3,642,871	1,366,406	673,243	22.59	22.20	23.59
65	0.94	2.58	6,758,551	4,402,596	3,563,677	1,385,978	707,130	22.99	22.51	23.98
70	0.99	2.71	6,757,653	4,424,705	3,460,575	1,404,467	748,917	23.44	22.82	24.39
71	1.00	2.74	6,757,618	4,463,340	3,459,270	1,404,912	749,678	23.45	22.82	24.40
75	1.04	2.85	6,756,269	4,221,434	3,397,070	1,414,359	773,864	23.70	22.97	24.63
80	1.09	2.99	6,754,457	4,362,448	3,333,309	1,422,473	798,258	23.94	23.10	24.85
85	1.14	3.12	6,752,032	4,207,354	3,281,610	1,430,701	821,381	24.18	23.23	25.04
86	1.15	3.15	6,751,937	4,249,985	3,280,263	1,430,975	822,220	24.19	23.24	25.04
87	1.16	3.18	6,751,744	4,263,545	3,277,190	1,431,519	823,903	24.20	23.25	25.06
88	1.17	3.21	6,751,444	4,231,991	3,272,796	1,432,502	825,787	24.23	23.26	25.08
89	1.18	3.23	6,751,380	4,329,410	3,272,138	1,432,676	826,264	24.23	23.26	25.08

Figura 4-10: Resultados Análisis Milawa



Se opta por la seleccionar el pit 71 como pit final debido a:

Presenta el pit al precio de largo plazo de 2.74 US$/lb de Cu.

- El pit 71 maximiza las reservas para el plan de expansión (170 ktpd), permitiendo una duración de 22.8 años, con las actuales reservas sin stock.
- Disminuye la cantidad de Lastre a las consideradas en el estudio de factibilidad.

5 RECUPERACIONES METALÚRGICAS

El área de metalurgia de MCP, en conformidad a los resultados obtenidos durante la actual operación, ha realizado distintos ajustes a sus niveles de recuperación de acuerdo con la composición de la alteración en los minerales que ingresan al proceso de flotación. Para ello, clasifica los minerales como se indica en la Tabla 5-1. Esta clasificación se basa en la información de alteraciones contenidas en el modelo de recursos minerales.

Tabla 5-1: Clasificación por Alteración

Type	Name	Ore Classification	Alternation Code
1	USKSM	Skarn Serpentine-Magnetite	10, 18
2	USKAT	Skarn Actinolite-Tremolite	9
3	UHORN	Hornfels	12
4	UINTA	Intr A	2
5	UINTB	Intr B	3, 4, 5 and 6
6	UYANH	Yanh	16

5.1 Recuperación de Cu

Con la clasificación de materiales por alteración y la ley de cabeza de los minerales que ingresan mezclados a la planta, se aplica la siguiente expresión que permite determinar la recuperación de cobre.

$$Rec\ Cu\ (\%) = (95.95 - 0.02498 * (UINTA + UINTB) - 0.1607 * USKSM - 1.237 * RATOX - 0.056 * (Fe/TCu) + 0.486 * MgO + 0.001726 * USKSM * USKSM + 0.001732 * (UINTA + UINTB) * USKSM + 0.0296 * RATOX * (Fe/TCu) - 0.0669 * (Fe/TCu) * MgO)$$

De la expresión anterior, las variables que determinan la recuperación de cobre son:

UINTA: Unidad de Intrusivo A

UINTB: Unidad de Intrusivo B

USKSM: Unidad de Skarn Serpentina-Magnetita

RATOX: Relación de SCu/TCu

Fe: Ley de cabeza del Fierro

TCu: Ley de cabeza del Cobre

MgO: Ley de cabeza del Magnesio

La expresión matemática de recuperación aplica a los minerales cuya ley de cabeza sea mayor a 0.15% de TCu y la categoría sea medido e indicado. Además, estará dada por la alteración geológica fijando límites, que se indican en la Tabla 5-2.

Tabla 5-2: Rangos de Recuperación por Alteración

Alteración	Mínimos	Máximos
UINTA	85%	90%
UINTB	85%	90%
USKSM	72%	90%
UHORN	78.5%	90%
USKAT	80%	90%
UYANH	70%	90%

5.2 Recuperación de Ag

La recuperación de la plata (Ag), está dado por un valor constante de 72%, el cual es incluido en el modelo de bloques.

5.3 Recuperación de Mo

La recuperación de molibdeno (Mo), es un valor constante de 66%, el que está incluido en el modelo de bloques.

5.4 Hidrometalurgia Mo

Recuperación de Mo: 93%
% Mo en MoO3: 57%
% Cu en Cátodos: 99.99%

5.5 Recuperación de As

La recuperación de molibdeno considera la siguiente expresión:

Rec As (%)	=	ASCC*TCC/(ton*AS)

Donde:

ASCC: Ley de Arsénico en el Concentrado Cu
TCC: Toneladas de Concentrado Cu
ton: Toneladas del bloque * % topo
AS: Ley de cabeza del Arsénico

5.6 Recuperación de Zn

La recuperación de molibdeno considera la siguiente expresión:

$$\text{Rec Zn (\%)} = \text{ZNCC*TCC/(ton*ZN)}$$

Donde:

ZNCC: Ley de Zinc en el Concentrado Cu
TCC: Toneladas de Concentrado Cu
ton: Toneladas del bloque * % topo
ZN: Ley de cabeza del Zinc

5.7 Recuperación de F

La recuperación de molibdeno considera la siguiente expresión:

$$\text{Rec F (\%)} = \text{FCC*TCC/(ton*F)}$$

Donde:

FCC: Ley de Flúor en el Concentrado Cu
TCC: Toneladas de Concentrado Cu
ton: Toneladas del bloque * % topo
F: Ley de cabeza del Flúor

5.8 Recuperación de MgO

La recuperación de molibdeno considera la siguiente expresión:

$$\text{Rec MGO (\%)} = \text{MGOCC*TCC/(ton*MGO)}$$

Donde:

MGOCC: Ley del Oxido de Magnesio en el Concentrado Cu
TCC: Toneladas de Concentrado Cu
ton: Toneladas del bloque * % topo
MGO: Ley de cabeza del Óxido de Magnesio

6 DISEÑO MINERO

El diseño minero considera la topografía proyectada del pit al 31 de diciembre de 2020 y los parámetros de diseño que se detallan en el desarrollo de este capítulo. En cuanto a la secuencia de extracción minera, está dada por la orientación de los pits anidados resultantes del proceso de optimización en el software Whittle 4X y a los análisis de optimización realizados por MCP.

El set de diseños de fases seleccionado corresponde al “SET F”, que es el diseño que aportó mayor beneficio a los lineamientos y requerimientos planteados por MCP.

En este SET F, se modifican y agrupan las fases 3 C y D, la fase 4 se hace cargo del fondo de la mina absorbiendo a las fases 3 A y B, la fase 5 se angosta para bajar más rápido y se amplían las fases 6, 7 y 8 ajustando al pit final y se diseña la fase 9, que busca la zona sur este del rajo.

Los stocks 4, 8 y 9, que están ubicados dentro de los límites del rajo, son extraídos con el avance de cada una de las fases.

6.1 Topografía Inicial

La topografía considerada en este estudio es la que se observa en la Figura 6-1, que representa el avance de la mina al 31 de diciembre de 2020, y además se muestra el límite para el diseño del pit.

Figura 6-1: Topografía del área al 31 de diciembre de 2020

6.2 Parámetros de Diseño del Pit

6.2.1 Altura de Bancos

Se mantiene la actual altura de bancos, que está de acuerdo con el tamaño de los actuales equipos de la mina, siendo de 15 m para roca (banco simple).

6.2.2 Dimensiones de Bermas

El ancho de las bermas de seguridad es el valor que resulta entre el ángulo cara de banco, ángulo interrampa y la altura del banco. Para la roca ígnea la berma varía entre 10.39 a 10.90 m, para la roca sedimentaria la berma es de 11.51 m, y para la zona de depósito de relaves antiguos la berma es de 24.36 m.

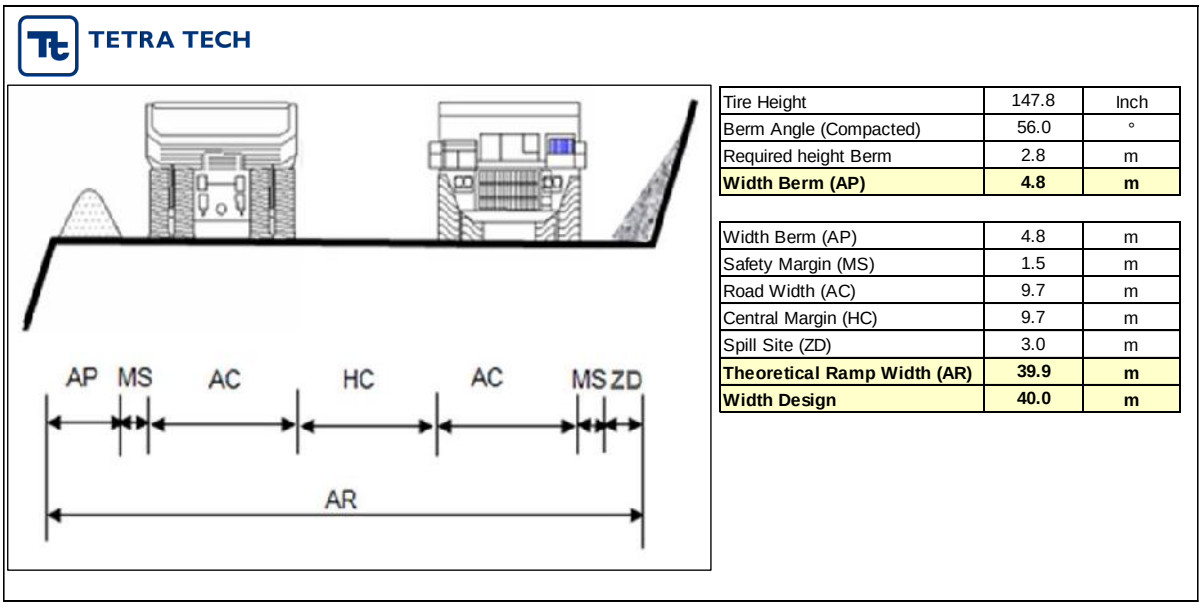
6.2.3 Altura Inter-Rampa

La altura máxima interrampa permitida es de 120 m, con ancho de bermas de desacople de 30 m, de acuerdo con las recomendaciones del área geomecánica (desacople cada 8 bancos).

6.2.4 Ancho de Rampas

Las rampas al interior de la mina se diseñan con un ancho de 40 m, incluyendo los espacios para permitir la circulación expedita de los camiones en todo instante. Las pendientes de las rampas, tanto internas como externas son de 10%, como máximo y corresponden a las usadas en la mayoría de los actuales rajos. El ancho se define de acuerdo con lo presentado en la Figura 6-2.

Figura 6-2: Ancho de Rampas y Caminos Mineros



6.2.5 Ancho Mínimo de Carguío

Se entiende por ancho mínimo de carguío al espacio mínimo necesario para efectuar la operación de carguío en forma eficiente y corresponde a la suma de las distancias requeridas para maniobras que deben efectuar las palas de mayor dimensión y los camiones en el frente de carguío.

Respecto de los anchos operativos mínimos de las fases, se pueden identificar las siguientes situaciones típicas:

- Pala de 73 yd^3 con espacio para aculatar dos camiones (uno a cada lado), considerando además una franja de control de pared.
- Pala de 73 yd^3 con espacio para aculatar un camión, considerando además una franja de control de pared.
- Pala de 73 yd^3 con espacio para aculatar un camión, sin considerar franja de control de pared (sector próximo a los extremos de la fase).
- Cargador Frontal con espacio para aculatar un camión, sin considerar franja de control de pared (extremos de la fase).

En la Figura 6-3, se representa el esquema de extracción de materiales de las dos primeras situaciones descritas anteriormente. Se observa una pala de 73 yd^3 y aculatando dos camiones a la vez. En este caso, el ancho mínimo de la fase debe estar entorno a los 90 m. comprendidos entre el ancho de operación y la zona de control de pared, que de acuerdo con parámetros del estudio es de 30 m. Mientras En el Figura 6-4, se muestra la misma situación, pero considerando sólo el aculatamiento de un camión. En este caso, el ancho operativo mínimo disminuye a valores de 75 m.

Figura 6-3: Esquema de Extracción con 2 Camiones y Control de Pared

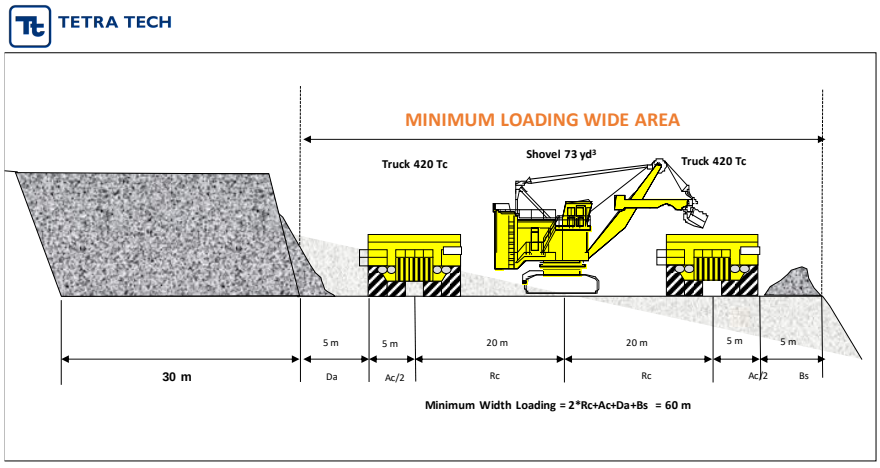
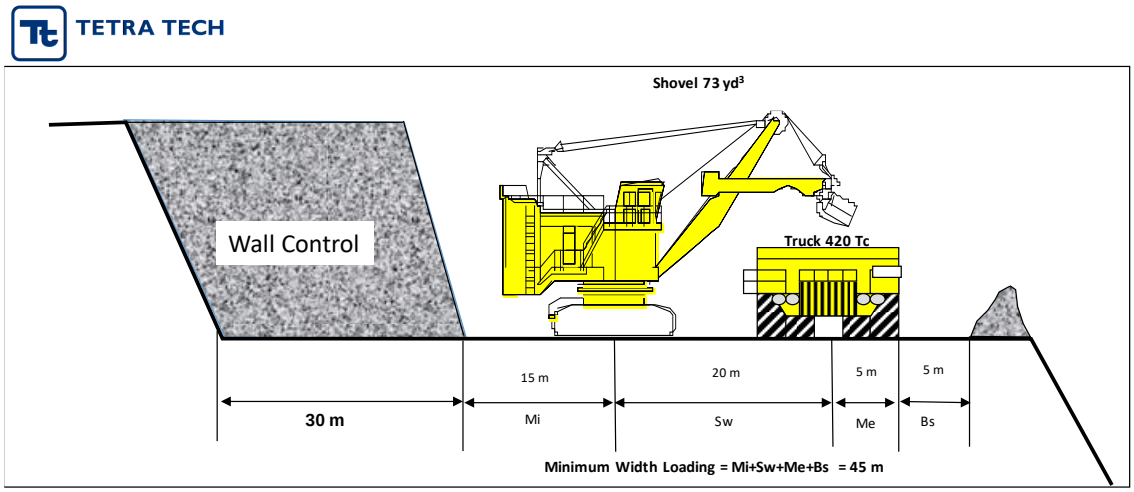


Figura 6-4: Esquema de Extracción con 1 Camión y Control de Pared



La Figura 6-5, muestra el esquema de extracción mínimo de una pala cargando un camión, en un sector donde no existe control de pared, mientras que la Figura 6-6, muestra el esquema de extracción mínimo para un cargador frontal, en la misma condición anterior, es decir, sin control de pared. En ambas figuras el espacio abarca desde 45 a 40 metros respectivamente. Para el caso evaluado en la Mina Toromocho, el ancho mínimo considerado en el diseño de fases es de 60 m.

Figura 6-5: Esquena de Extracción de Pala, Sin Control de Pared

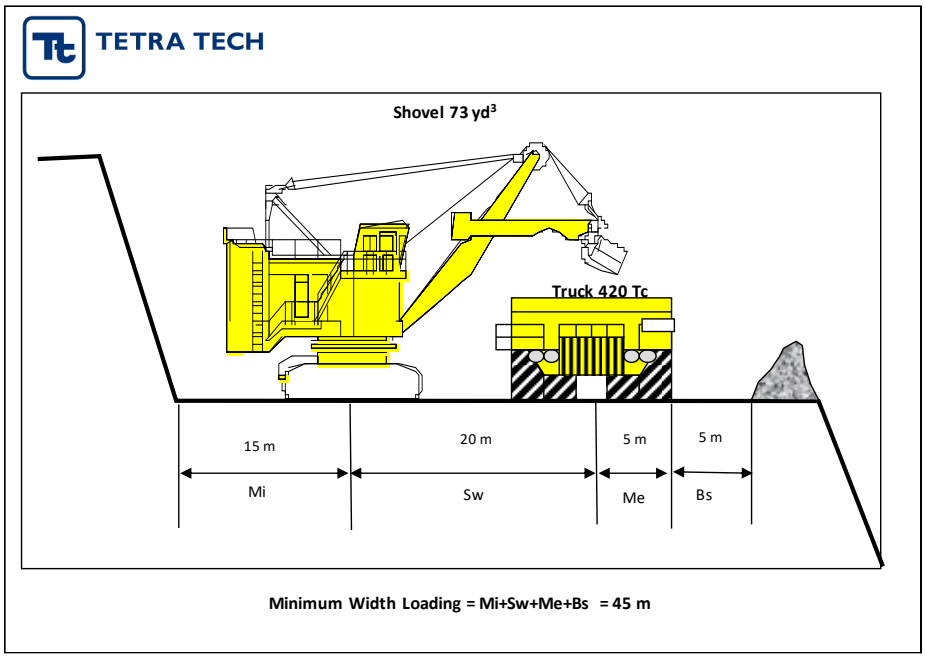
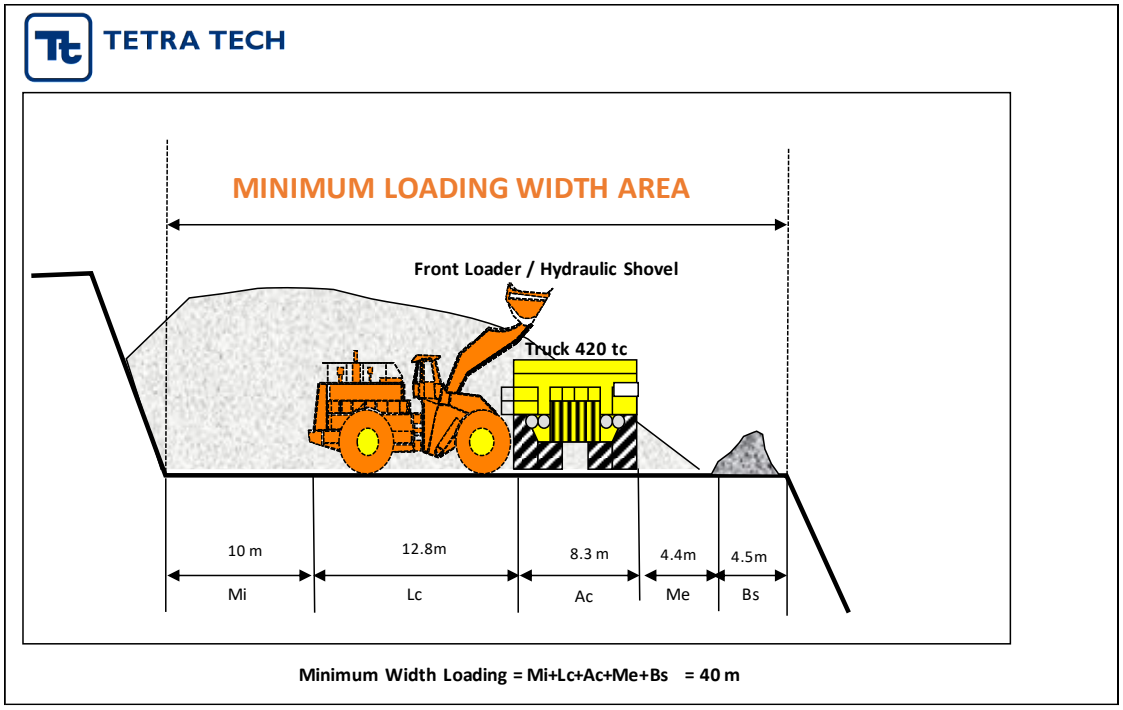


Figura 6-6: Esquema de Extracción Cargador Frontal, Sin Control de Pared



En general, el tamaño de fases ha sido definido considerando la posibilidad de operar con al menos 2 equipos de carguío, lo cual permite tener más flexibilidad en cuanto a los ritmos de extracción del plan minero. En tal perspectiva, los anchos mínimos requeridos para las fases se sitúan en torno a los 90 a 120 m, dependiendo del ancho de la tronadura para el control de pared, como se muestra en las siguientes figuras.

Figura 6-7: Ancho Mínimo de Fase para 2 o más Palas

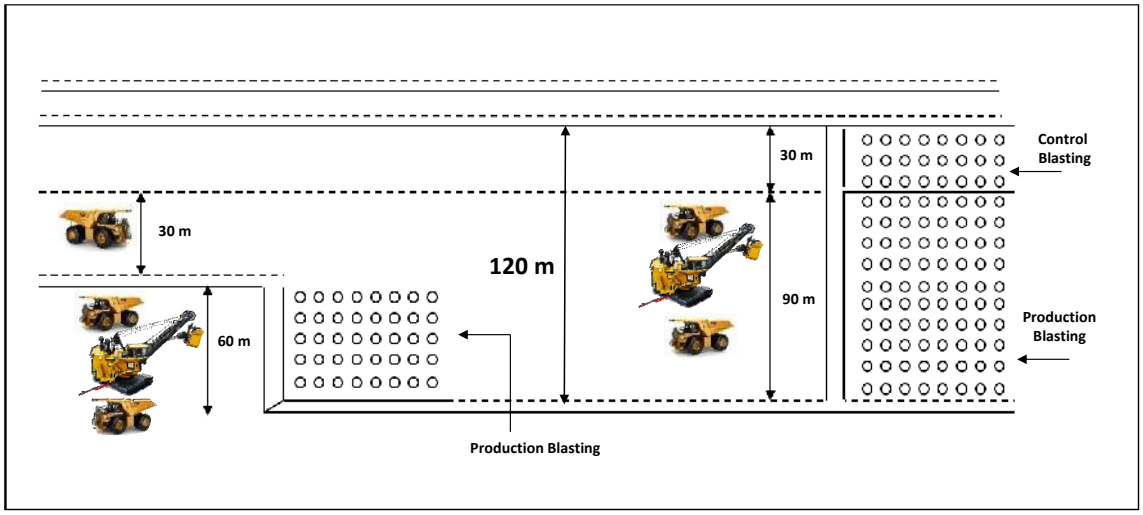
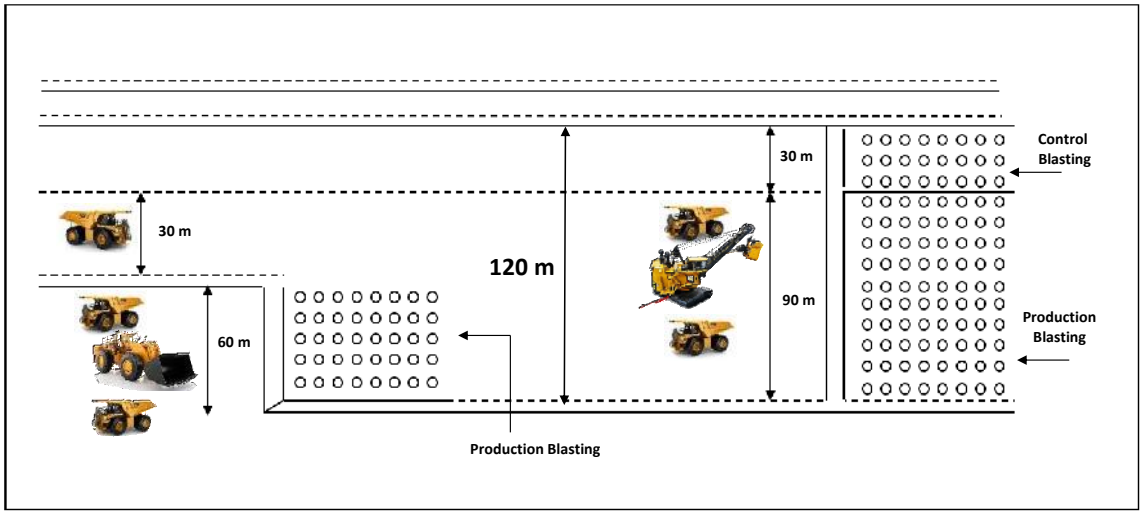


Figura 6-8: Ancho Mínimo de Fase para Palas y Cargador Frontal



Dado los esquemas de explotación señalados anteriormente, permiten validar que el ancho mínimo operacional de 60 m, para la mina Toromocho, es un criterio adecuado.

6.2.6 Fondo Mínimo de Fase

El fondo mínimo de fase es aquel que permite un ancho mínimo de operación en la zona inferior del diseño minero; que, de acuerdo con lo señalado anteriormente, considera 60 m de ancho.

6.2.7 Esquema de Bancos

El esquema de bancos será de bancos cerrados.

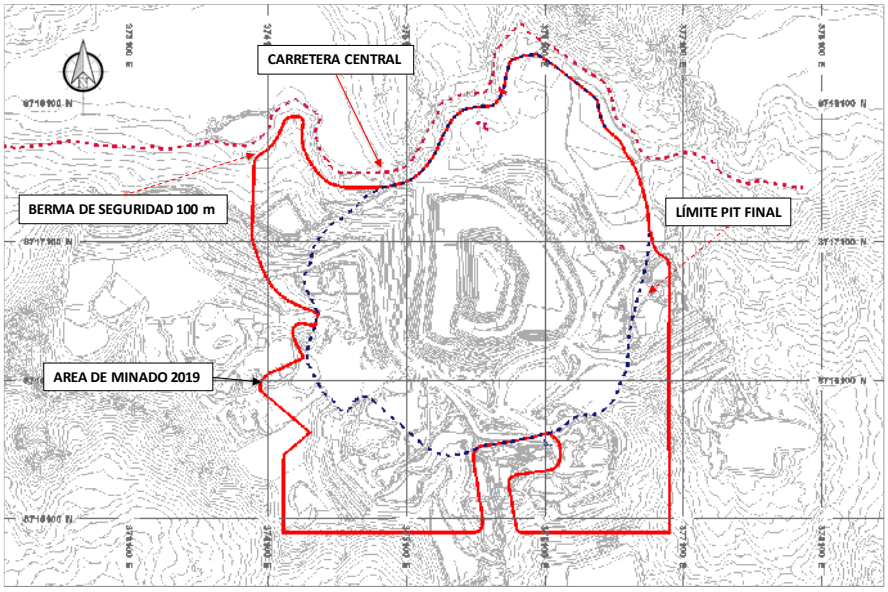
6.2.8 Ancho de Expansiones o Fases

El ancho de expansiones será de mínimo 210 m que permitirá trabajar hasta con 2 a 3 equipos de carguío por fase, dependiendo por supuesto de la longitud de la fase.

6.2.9 Límite de Diseño

El diseño de fases se encuentra al interior del polígono que limita el área del pit de largo plazo, de acuerdo con la infraestructura vial, Chancador Primario y espacios para Desmontes de lastre, como se indica en la Figura 6-9, que a su vez muestra el límite para el pit final.

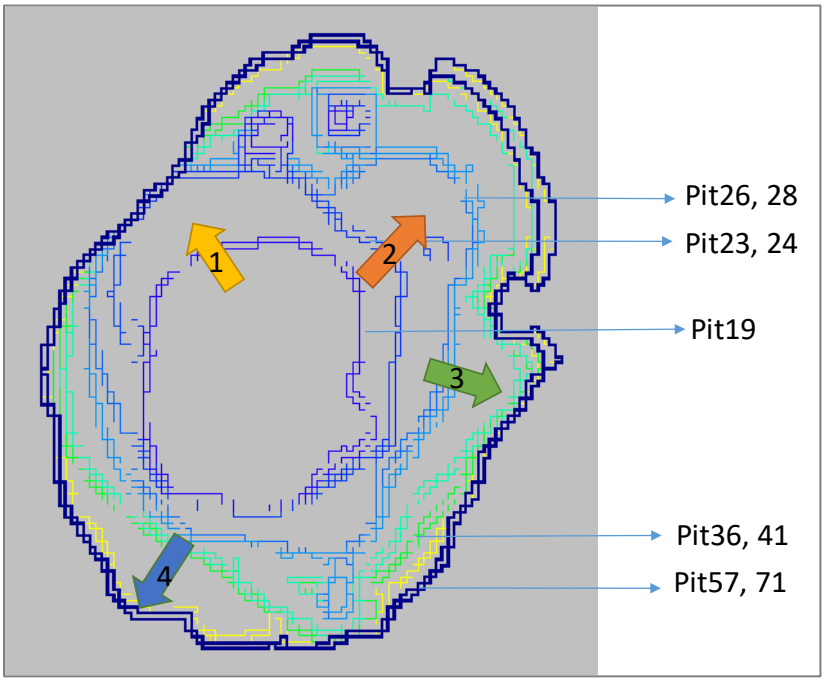
Figura 6-9: Límite de Diseño para Pit Final



6.3 Secuencia Minera, Diseño de Fases y Pit Final

En la Figura 6-10 se aprecia el desarrollo económico que presenta los pit anidados Whittle, orientando el diseño y la precedencia geométrica para el desarrollo de las fases.

Figura 6-10: Precedencia de Fases



La Figura 6-11, muestra que las fases inmediatas son más angostas con la finalidad de llegar a fondo en menos tiempo que es en donde se encuentran las mejores leyes, en comparación con las fases periféricas las cuales tienen mayor amplitud, menor ley y mayor desarrollo, como es el caso de las fases 6 y 9, las cuales tiene gran cantidad de lastre. La Figura 6-12, muestra una sección que permite visualizar la precedencia geométrica del diseño.

Figura 6-11: Precedencia de Fases Vista en Planta

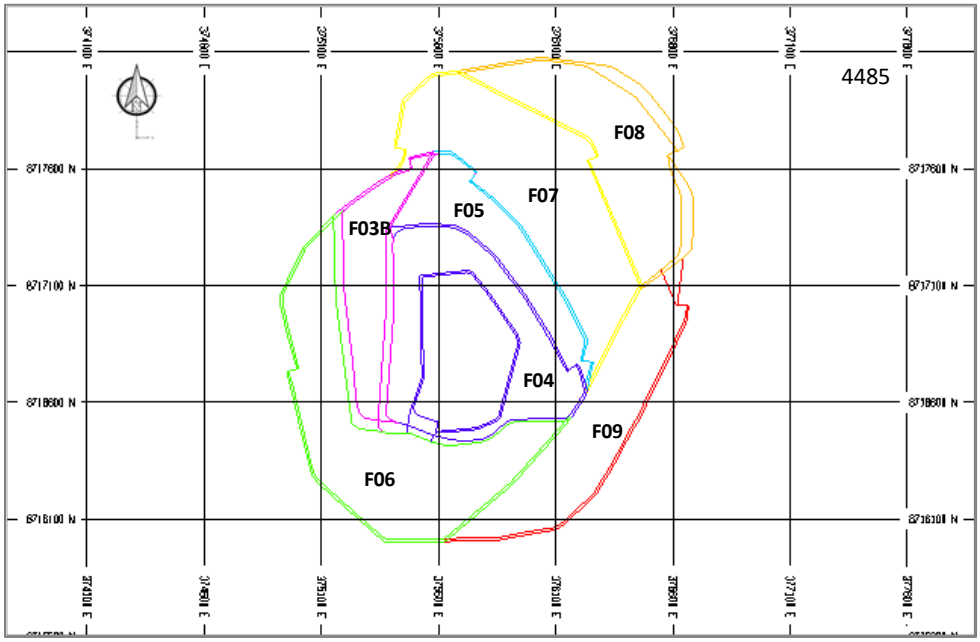
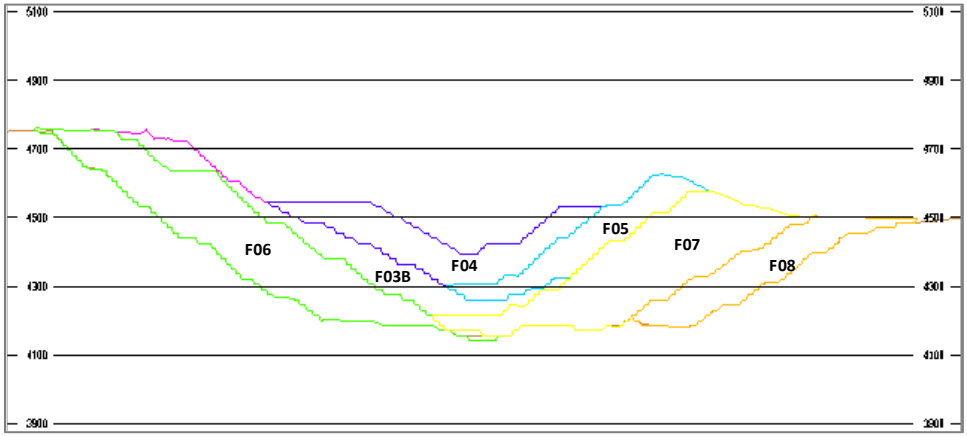


Figura 6-12: Vista 45° dirección Noreste del Diseño SET F



Desde la Figura 6-13, hasta la Figura 6-19, se presentan los diseños de fases propuestos por MCP, para el presente LOM.

Figura 6-13: Diseño de Fase 3B

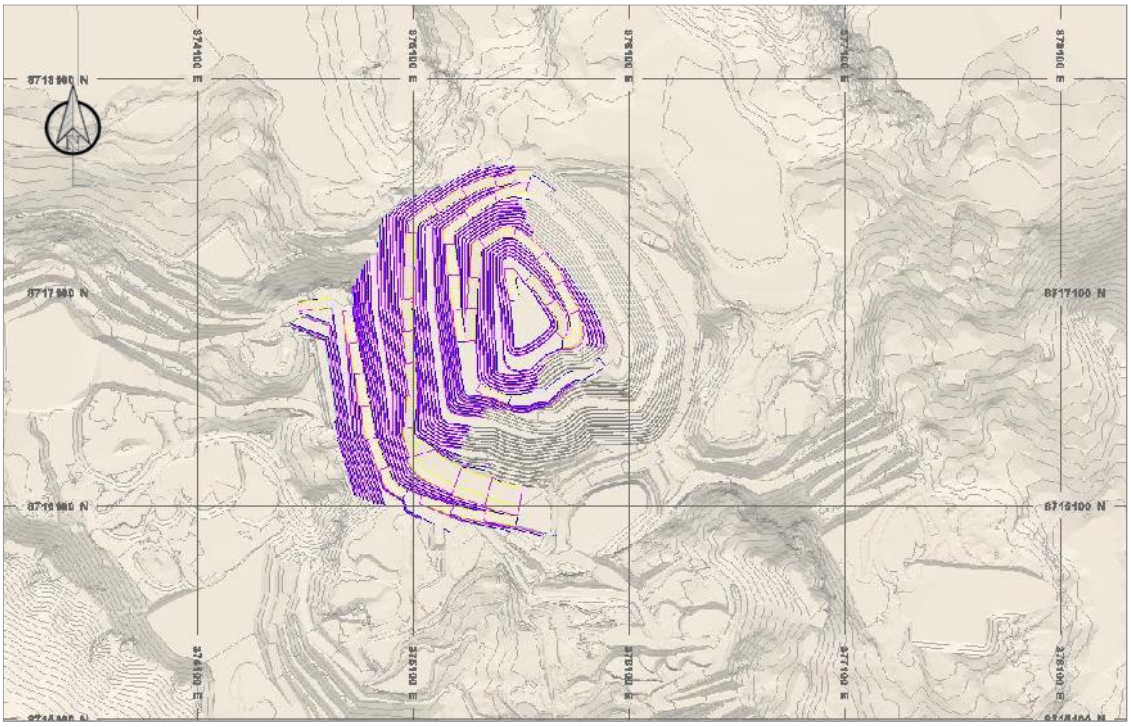


Figura 6-14: Diseño de Fase 4

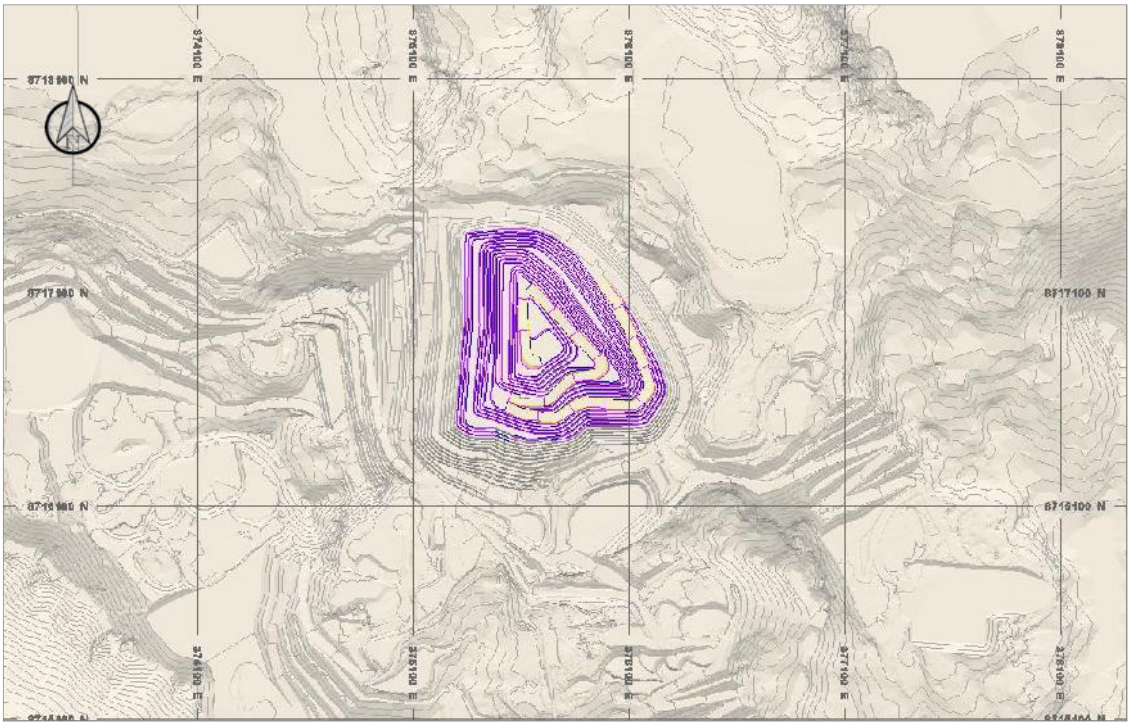


Figura 6-15: Diseño de Fase 5

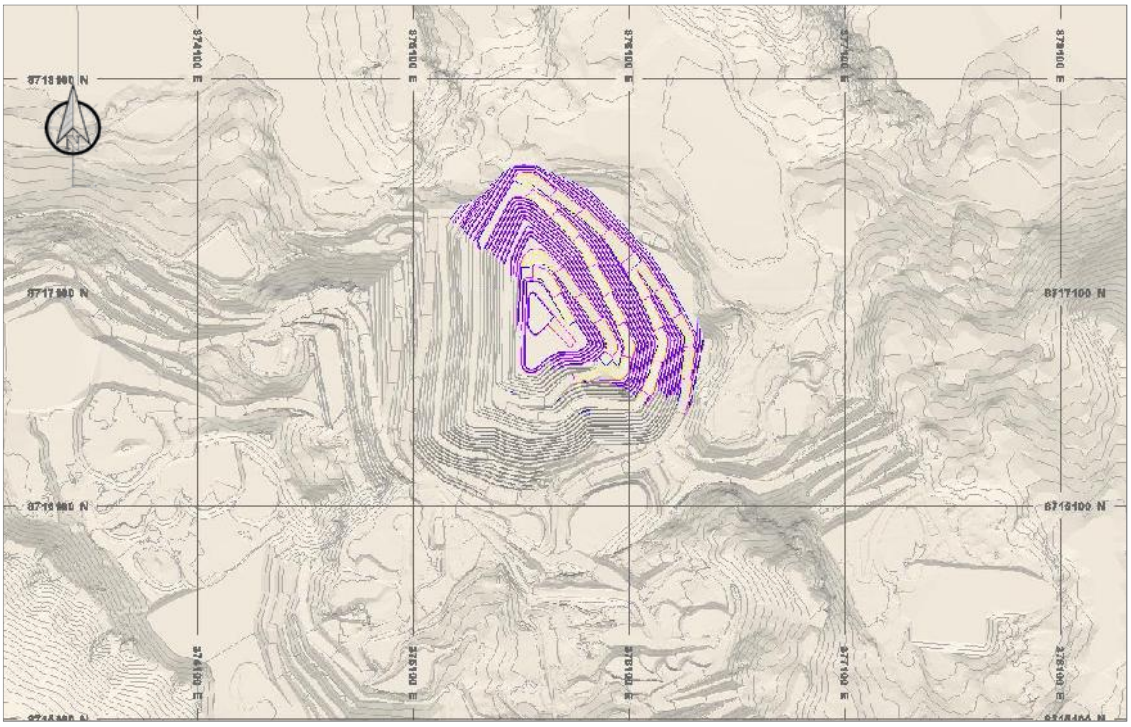


Figura 6-16: Diseño de Fase 6

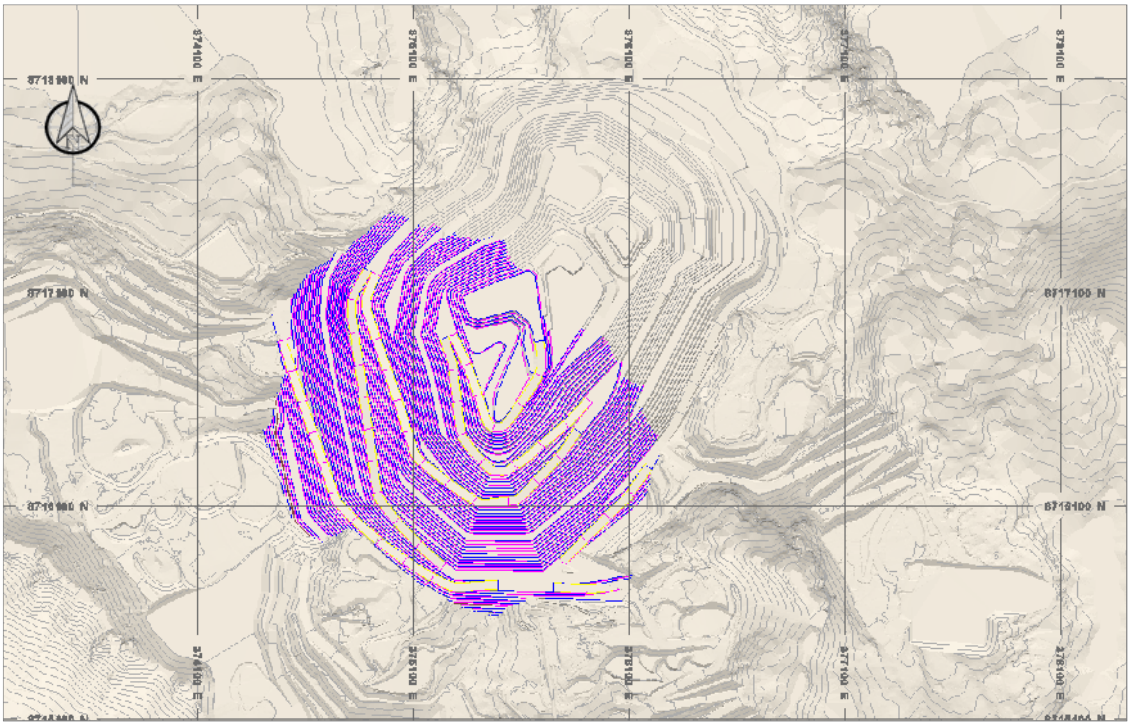


Figura 6-17: Diseño de Fase 7

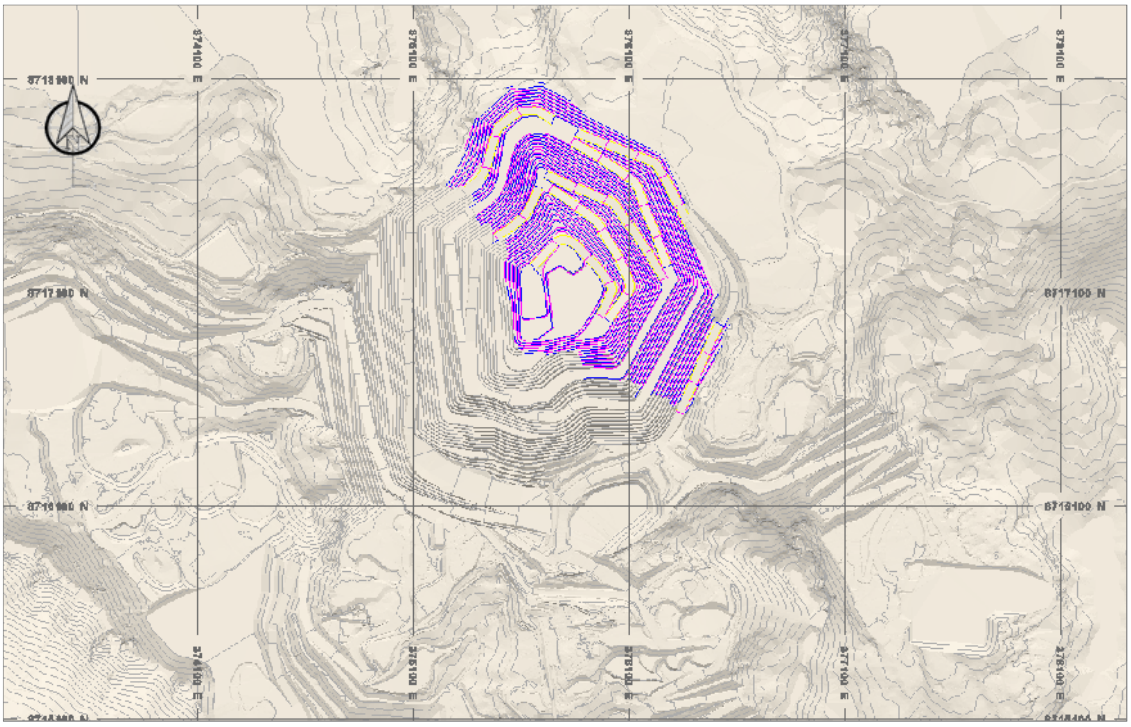


Figura 6-18: Diseño de Fase 8

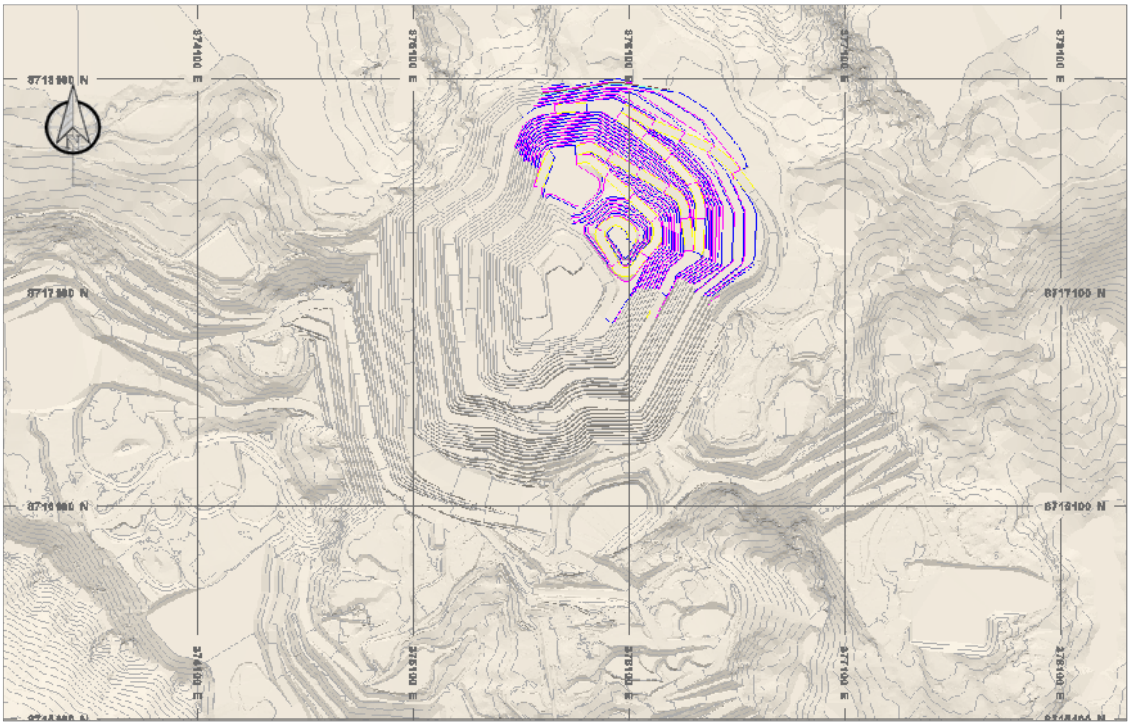


Figura 6-19: Diseño de Fase 9

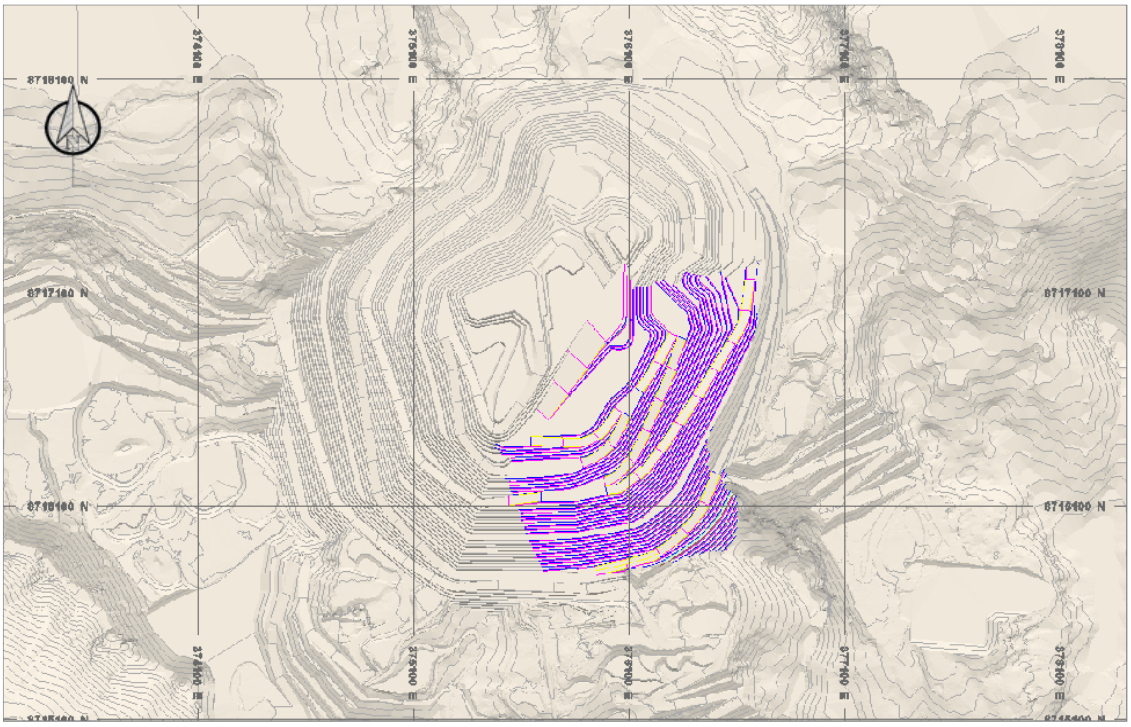
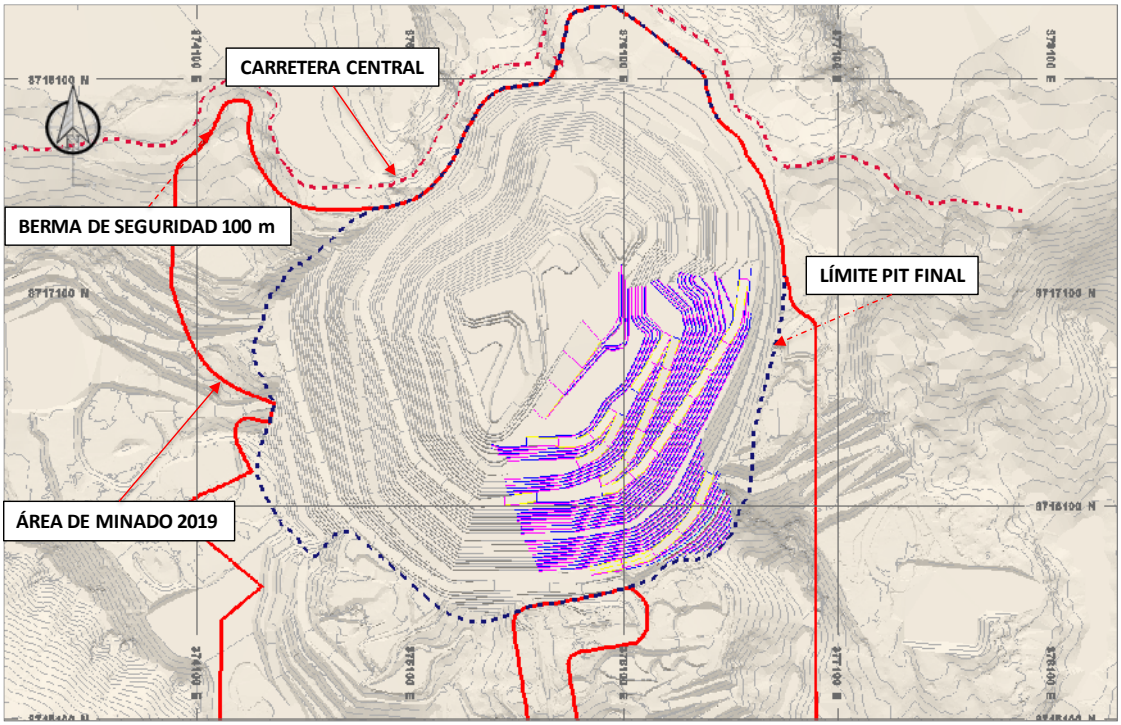


Figura 6-20: Diseño de Fase 9 y Límites de Minado



En la Figura 6-20, se observa el diseño de la fase 9 y como esta se enmarca al límite definido por un ancho de seguridad de 100 metros desde la carretera (que se muestra en línea discontinua en el sector norte de la figura) y al límite de diseño de los otros sectores.

6.4 Cubicación de Fases

En la Tabla 6-1, se muestra la clasificación de los minerales, según el tipo de alteración y en la Tabla 6-2 se muestra la cubicación de los materiales de cada una de las fases, considerando la topografía al 31 de diciembre de 2019 y una ley de corte INP > 1.62 US$/t, con el fin de obtener una cantidad de mineral referencial.

Tabla 6-1: Clasificación de Minerales por Tipo de Alteración

Type	Name	Ore Classification	Alternation Code
1	USKSM	Skarn Serpentine-Magnetite	10, 18
2	USKAT	Skarn Actinolite-Tremolite	9
3	UHORN	Hornfels	12
4	UINTA	Intr A	2
5	UINTB	Intr B	3, 4, 5 and 6
6	UYANH	Yanh	16

Tabla 6-2: Cubicación de Fases Toromocho

Phases	Ore (Cutoff > 1.62 US$/t INP)				Waste	Total	W/O	GI
	kt	(%) TCu	(%) Mo	(g/t) Ag	kt	kt		
F02	26,695	0.519	0.025	4.82	112	26,807	0.00	0.52
F03AD	34,277	0.509	0.013	7.10	11,834	46,111	0.35	0.38
F03B	187,461	0.492	0.016	6.77	70,957	258,417	0.38	0.36
F04D	191,256	0.520	0.017	4.79	8,691	199,947	0.05	0.50
F05	121,759	0.463	0.011	5.28	17,076	138,835	0.14	0.41
F06	434,668	0.391	0.018	5.50	389,088	823,756	0.90	0.21
F07	229,338	0.433	0.012	5.78	102,994	332,332	0.45	0.30
F08	58,189	0.476	0.008	5.42	102,982	161,171	1.77	0.17
F09	165,646	0.352	0.013	4.64	140,948	306,594	0.85	0.19
TOTAL	**1,449,289**	**0.438**	**0.015**	**5.52**	**844,682**	**2,293,971**	**0.58**	**0.28**

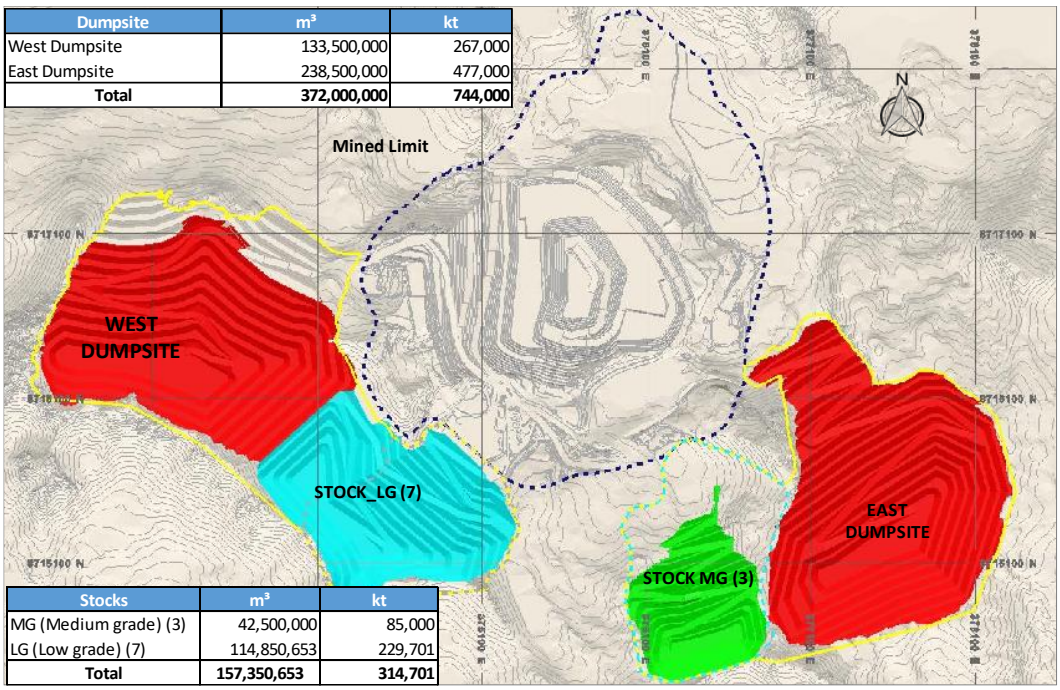
Measured and Indicated

7 DEPÓSITO DE DESMONTES Y STOCKS DE MINERAL

7.1 Diseño de Desmontes y Stocks

En la Figura 7-1 se muestra el diseño inicial de los desmontes de lastre y stocks propuestos por MCP, de acuerdo con los requerimientos del plan minero de largo plazo. Existen dos desmontes de lastre de gran capacidad y dos stocks para el remanejo de los minerales. El área que ocupa el Stock MG (Stock-3, ubicado en el sector Este) debe quedar disponible, para acopiar lastre, a partir del año 2033. El Stock LG (Stock-7, ubicado en el sector Oeste), está diseñado de forma auto soportada (separado del botadero de lastre), debido a que es necesario ocupar este stock para envió de minerales en forma simultánea, a medida que avanza el botadero de lastre. De esta forma se evita contaminar el mineral con estéril.

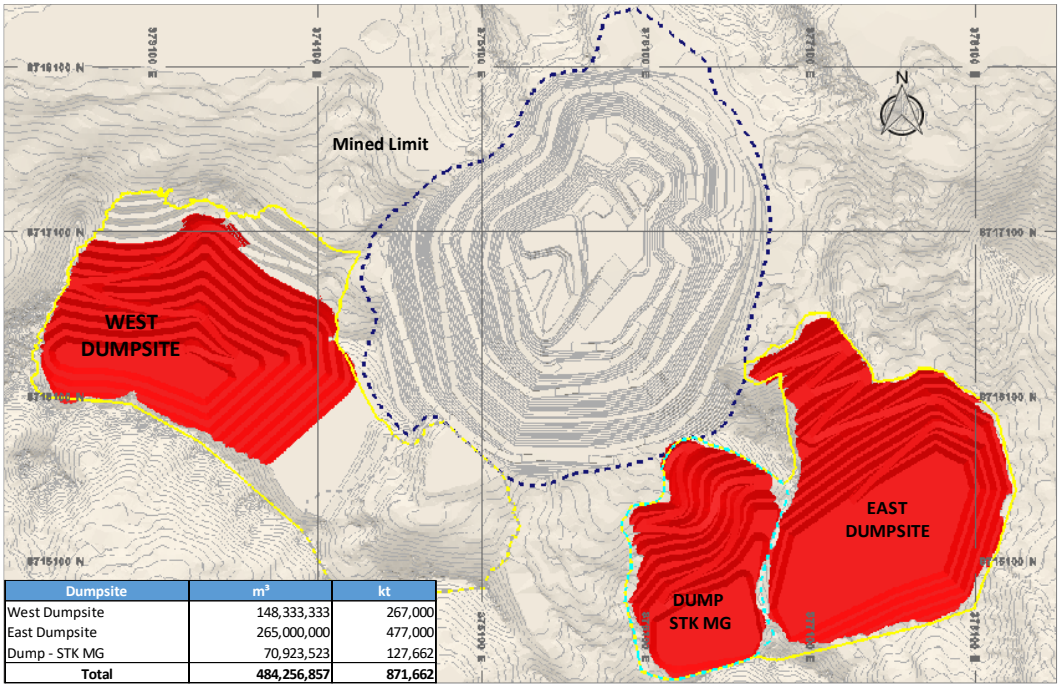
Figura 7-1: Diseños Depósito de Desmontes y Stocks Iniciales.



En la Figura 7-2 se muestra la disposición final de los desmontes de estéril, diseñados para el actual plan LOM. Estos se ubican en el sector Este de la mina “Desmonte Este” (que incorpora el espacio que deja el stock MG (3) a partir del periodo 2033) y el sector Oeste (“Desmonte Oeste”), sector en el cual se aprecia que el Stock LG (7) fue extraído totalmente dejando la topografía natural. A su vez, esta configuración de desmontes muestra que existe una capacidad superior a 350 Mt., que podría ser utilizado como desmonte en una eventual ampliación de reservas mineras, o bien un mejoramiento del negocio al tener la posibilidad de mantener la

política de ley de corte variable por un mayor período de tiempo, procesando los minerales de menor ley hacia finales del plan LOM.

Figura 7-2: Diseños Depósito de Desmontes Finales



Dumpsite	m³	kt
West Dumpsite	148,333,333	267,000
East Dumpsite	265,000,000	477,000
Dump - STK MG	70,923,523	127,662
Total	**484,256,857**	**871,662**

La Tabla 7-1 muestra las capacidades de los desmontes que se indican en la Figura anterior. La capacidad total del Desmonte de lastre es de aproximadamente 872 Mt. Esta capacidad está distribuida en 267 Mt en el Desmonte Oeste, 477 Mt en el Desmonte Este y 128 Mt en el espacio que dejó el Stock MG. Esta capacidad es suficiente para cubrir el requerimiento del plan minero, el cual es de 844 Mt de Lastre a partir de enero del año 2020. La densidad base para el cálculo del tonelaje es 1.8 t/m³.

Tabla 7-1: Capacidad de Desmontes

Dumpsite	m³	kt
West Dumpsite	148,333,333	267,000
East Dumpsite	265,000,000	477,000
Dump - STK MG	70,923,523	127,662
Total	**484,256,857**	**871,662**

La Tabla 7-2, muestra la capacidad de 315 Mt, diseñada para el acopio de minerales, distribuidas en dos posiciones principales, donde el Stock MG (minerales de mediana ley), con capacidad de 85 Mt y el Stock LG (minerales de baja ley), con capacidad de 230 Mt. El plan minero requiere

229 Mt de baja ley por tanto la capacidad de stock es suficiente. La capacidad es calculada en base a una densidad de 2.0 t/m^3, humedad de 2.5% y un esponjamiento de 30%.

Tabla 7-2: Capacidad de Stocks

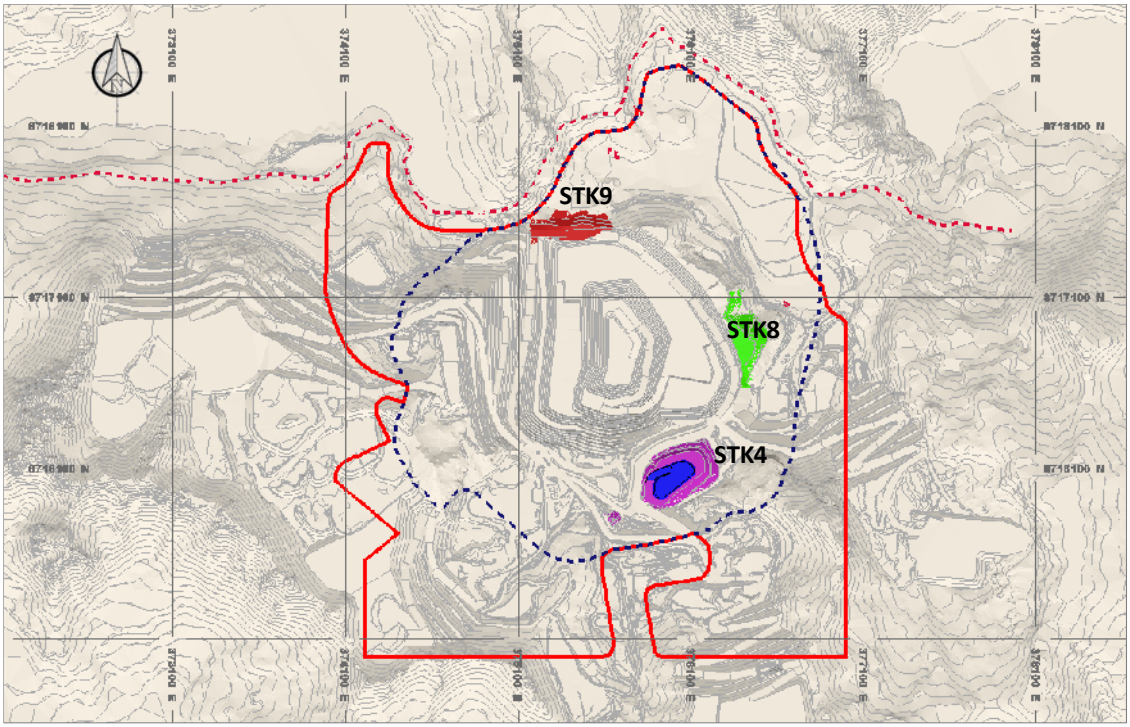
Stocks	m³	kt
MG (Medium grade) (3)	42,500,000	85,000
LG (Low grade) (7)	114,850,653	229,701
Total	**157,350,653**	**314,701**

La densidad estimada para los stocks considera un grado de compactación debido al continuo tránsito de camiones de alto tonelaje durante la operación de acopio.

Además, en la actualidad se cuenta con 130 Mt de mineral en stock, por tanto, el plan minero LOM, mueve 358 Mt de remanejo.

La Figura 7-3, muestra la actual disposición de los stocks interiores, que corresponde a stocks emplazados dentro del área mina y que son enviados a planta durante los primeros diez años del plan con el desarrollo propio de la fase. Estos stocks están debidamente identificados e incorporados en el modelo de bloques.

Figura 7-3: Stocks Interiores



8 PLAN MINERO ESTRATÉGICO

En el presente capítulo, se exponen los resultados de la planificación estratégica realizada por MCP, que consiste en diseñar 6 set de fases a las cuales se realizan diferentes planes mineros optimizados mediante el módulo MPSO del software MineSight de Hexagon, con el objetivo de maximizar el NPV, subir la ley de alimentación en los primeros 10 años, maximizar el movimiento y uniforme por el máximos de periodos, optimizar la capacidad de stockpiles y desmontes, mantener las restricciones de alimentación a planta y aplicar las nuevas ecuaciones metalúrgicas al bloque y al plan de minado.

Para el diseño de fases MCP realiza iteraciones en cuanto a los set de fases, uniendo algunas fases originales como la F04 con la F03AD, une la F03BD con la F03CD, seguido con realizar pruebas en cuanto al ancho operativo formando la F03B, para la F05, es de igual forma itera en cuanto al ancho operativo dejando finalmente fases con un máximo de 170 m, en las fases 04, 03 y 05, Para las fases 07 y 08 estas presentan mayor tamaño, pero con menor sobrecarga de estéril, por tanto esto permite mejorar el plan de los primeros 10 años. Para completar con el desarrollo y minado de las reservas quedan las fases 06 y 09 las que comienzan el desarrollo de lastre a fines de los primeros 10 años quedando hasta el fin de la mina con las leyes que aparecen, más la incorporación de los stocks de minerales a partir del año 2033 hasta agotarlos en el 2044.

8.1 Consideraciones

Los planes estratégicos se realizaran mediante el módulo MPSO de Hexagon, que permite construir planes mineros de largo plazo optimizando una política de corte (ley de Cobre, Costos de proceso, etc.), sujeto a condiciones de minado, dadas por requerimientos de producción, velocidades verticales de fases, clasificación de minerales a la planta, secuencia de consumo de reservas, precios de productos, costos de proceso, venta y tratamiento-refinación de productos, penalidades por impurezas, entre otras. El objetivo de este plan estratégico es orientar el desarrollo de la mina, optimizando el negocio, bajo los supuestos y restricciones técnicas y económicas.

En el caso de la Mina Toromocho, el plan estratégico desarrollado por MCP debe alcanzar la expansión desde 148 ktpd a 170 ktpd, con un ramp-up durante el período 2021-2022, que permita una producción a régimen a partir del año 2023.

El plan estratégico considera la parte final del ramp-up de la expansión de 148.8 ktpd en el año 2021 y 160.0 ktpd en el año 2022. A partir de enero de 2023 la planta concentradora logra su régimen de producción de 170 ktpd (base 365 días/año). El Ramp-up se muestra en la Tabla 8-1.

Tabla 8-1: Ramp-Up de Producción para la Expansión

Periodo	Días Calendario	Días Operativos	kt/d	Total Mineral Procesado (kt)
2020	366	352	123	**45,002**
2021	365	352	149	**54,317**
2022	365	352	160	**58,579**
2023	365	352	170	**62,053**
2024	366	352	170	**62,220**
2025	365	352	170	**62,050**
2026-2044	365	352	170	**62,050**

MPSO, es una herramienta que permite maximizar una función objetivo (VAN o NPV) sujeta a una serie de restricciones, mediante la optimización de una política de corte. Lo anterior, genera una “estrategia o política de corte” variable en el tiempo, la cual da origen a la separación de materiales, estableciendo un plan minero. La optimización se realiza mediante el algoritmo de Kenneth Lane instalado en un motor Cplex. La optimización se realiza en base anual desde el 2021 hasta agotar las reservas minerales.

8.2 Criterios de Planificación

Los criterios de planificación constituyen la información inicial que se requiere para la búsqueda de una estrategia adecuada de consumo de reservas para la mina Toromocho.

8.2.1 Topografía

La topografía considerada en este estudio es la que se observa en la Figura 6-1, donde se proyecta el avance de la mina al 31 de diciembre de 2020.

8.2.2 Horizonte de Planificación

Se considerado como horizonte de planificación la vida de la mina, es decir, hasta el consumo total de las reservas definidas por el diseño de la mina al interior de los límites establecidos por el diseño del pit final operativo y las restricciones o límites físicos de área que están establecidas en forma previa, más los acopios de mineral fuera del pit acumulados hasta el inicio del período de planificación de largo plazo. El plan iniciará el año 2021, considerando la extracción estimada a diciembre de 2020 (de acuerdo con el plan de minado del año 2020, versión Chinalco-Perú).

8.2.3 Período de Planificación

Para la planificación de largo plazo, se consideran períodos anuales a partir del año 2021 hasta agotar las reservas minerales.

8.2.4 Categoría de Reservas

Se consideraron Reservas Minerales aquellas que provienen directamente de la transformación de Recursos Medidos e Indicados. Los Recursos Inferidos fueron considerados como lastre, por lo tanto, fueron valorizados con ingreso igual a cero.

8.2.5 Movimiento Máximo por Fase

En aquellas fases que tengan un ancho alrededor de los 210 m o más, será posible trabajar con hasta 3 palas de cable, condición que le da a la mina una capacidad de hasta alrededor de 370 a 400 ktpd.

8.2.6 Tasas de Profundización Máxima

La tasa de profundización máxima por fase será estimada en 10 bancos por año como máximo, excepto en la parte superior de apertura de fase, en la cual se podrá superar esta cantidad de bancos, por la existencia de bancos de tonelaje menor.

8.2.7 Ley de Corte

La estrategia de ley corte para la mina Toromocho se basó en el concepto Income Net of Process (INP), que está relacionado con:

Income Net of Process = Net Smelter Return – Mill Process Cost

Los beneficios de procesar un bloque de mineral con contenido de cobre, molibdeno y plata están incluidos en el cálculo del NSR y por lo tanto también en el INP. Para la construcción de los planes de minado se emplearon los mismos precios de los metales bases que se utilizaron en la definición del pit final en Whittle; esto es, 2.74 US$/lb cobre, 11.3 US$/lb de molibdeno y 16.78 US$/onza de plata.

Para el cálculo del NSR se incorporaron, además de los costos de minado, Proceso y G&A, los costos de venta, cargos por TC/RC y las penalidades para el As, Zn, MgO y F.

Si consideramos un costo de minado de 1.121 (minado) + 0.312 (sustaining)+ 0.12 (MCAF) = 1.55 US$/t

El costo de remanejo en la mina se estimó en 0.7 US$/t

El costo de proceso está dado por 5.75 (proceso) + 0.356 (sustaining) = 6.11 US$/t

El costo de G&A está dado por 0.463 + 0.039 + 0.822 + 0.139 + 0.159 = 1.621 US$/t

Por lo tanto, el breakeven cut-off grade para la mina Toromocho, según los costos anteriormente descritos es de INP = 3.49 US$/t. Este valor está basado en un costo de mina promedio de 1.53 US$/t más un costo de G&A de 1.62 US$/t.

El marginal cut-off grade para los minerales, alimentados al chancador directamente desde la mina, sería de INP = 1.62 US$/t. Este valor está basado en el costo del G&A.

El marginal cut-off grade para los minerales que se deben enviar a stock y posteriormente pagar el remanejo sería de INP = 2.32 US$/t. Este valor está basado en el costo de G&A de 1.62 US$/t y un costo de remanejo de 0.7 US$/t.

8.2.8 Clasificación de Minerales por Tipo de Alteración

La Tabla 8-2 muestra la clasificación de los materiales por tipo de alteración, según el modelo geológico entregado por MCP. Esta clasificación es la base para el cálculo de la recuperación de cobre y el plan de minado contempla restricciones límites de envío de minerales tipo Hornfels, Skarn SM y AT a la concentradora.

Tabla 8-2: Clasificación de Minerales por Tipo de Alteración

Type	Name	Ore Classification	Alternation Code
1	USKSM	Skarn Serpentine-Magnetite	10, 18
2	USKAT	Skarn Actinolite-Tremolite	9
3	UHORN	Hornfels	12
4	UINTA	Intr A	2
5	UINTB	Intr B	3, 4, 5 and 6
6	UYANH	Yanh	16

8.2.9 Restricciones Impuestas en la Alimentación a la Concentradora

El plan de minado considera 6 restricciones en la alimentación a la concentradora, cuyos límites máximos se deben aplicar de la siguiente manera:

- Ratox: <= 16%
- Skarn Serpentina-Magnetita: <= 30%
- Hornfels: <= 30%
- Talco: <= 6%
- Skarn Actinolita-Tremolita: <= 40%
- As en el concentrado: <= 0,035%

8.3 Resultados y Comparaciones de Casos

Cada uno de los planes de minado realizados con el módulo MPSO y es operativizado mediante el software de planificación *SP2*, obteniendo planes mineros operativos cuya comparación es la siguiente:

Tabla 8-3: Casos Estratégicos Evaluados

Cases	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
	PH04	PH03	PH05	PH06*	PH07*	PH08	PH9	PH10	
SET-1	PH3A	PH3B	PH4	PH3C	PH5	PH6	PH7	PH8	PH9
SET-A	PH3A	PH3B	PH4	PH5	PH3C	PH6	PH7	PH8	PH9
SET-B	PH3A	PH4	PH5	PH3B	PH7	PH8	PH6	PH9	
SET-C	PH4	PH5	PH3B	PH7	PH8	PH6	PH9		
SET-D	PH4	PH5	PH3B	PH7	PH8	PH6	PH9		
SET-E	PH4	PH5	PH3B	PH7	PH8	PH6	PH9		
SET-F	PH4	PH5	PH3B	PH7	PH8	PH6	PH9		

Las siguientes figuras, muestran las comparaciones entre los casos para los primeros 5 años, 10 años y para el LOM total.

Figura 8-1: Comparación de Casos 5 y 10 Años

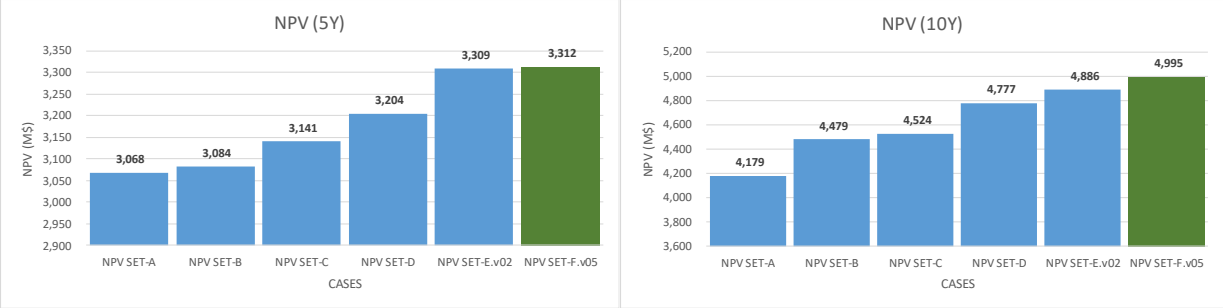
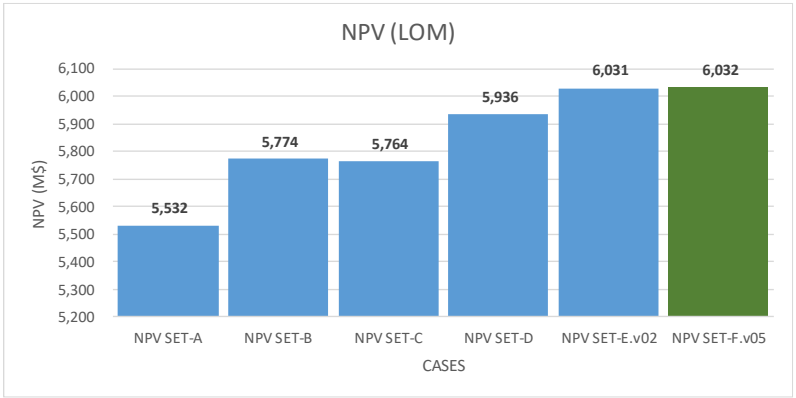


Figura 8-2: Comparación de Casos LOM



8.4 Resultados Plan Minero Estratégico

El plan estratégico seleccionado es el desarrollado a partir del SET F que fue el que obtuvo mayor NPV, de acuerdo con la optimización realizada por MCP. Este plan fue operativizado mediante el software *SP2* que es un secuenciador utilizado en el corto plazo, que permite asignar equipos de carguío a los movimientos por fase y banco, utilizando indicadores de gestión, con la periodicidad que estime el planificador, para efecto del presente LOM este plan está desarrollado en periodos anuales.

La Tabla 8-4, muestra el resumen del plan estratégico desglosado en los movimientos generales de la mina.

Tabla 8-4: Resumen Movimientos Plan Minero Estratégico

	Unit	Total	Year											
			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Ore to Process														
Total	**kt**	**1,097,523**	**54,032**	**56,673**	**59,659**	**60,663**	**62,050**	**62,050**	**62,050**	**45,343**	**28,203**	**19,839**	**9,190**	**23,114**
TCu	%	0.465	0.621	0.603	0.575	0.604	0.573	0.599	0.529	0.466	0.457	0.422	0.351	0.309
Mo	%	0.017	0.020	0.018	0.017	0.018	0.016	0.020	0.015	0.022	0.009	0.014	0.004	0.004
Ag	g/t	5.710	5.168	5.768	6.960	7.750	7.071	6.052	6.090	6.057	5.292	4.608	5.091	5.319
Ore to Stocks														
Total	**kt**	**228,587**	**42,624**	**41,135**	**47,077**	**25,428**	**19,871**	**42,650**	**9,802**	**-**	**-**	**-**	**-**	**-**
TCu	%	0.298	0.328	0.283	0.275	0.295	0.294	0.324	0.254	-	-	-	-	-
Mo	%	0.007	0.007	0.009	0.005	0.006	0.008	0.007	0.005	-	-	-	-	-
Ag	g/t	4.43	4.199	4.050	5.255	5.169	3.972	4.146	3.347	-	-	-	-	-
Stock to Process														
Total	**kt**	**374,143**	**285**	**1,906**	**2,391**	**1,557**	**-**	**-**	**-**	**16,877**	**33,847**	**42,211**	**52,860**	**39,106**
TCu	%	0.342	0.420	0.420	0.420	0.375	-	-	-	0.417	0.393	0.386	0.369	0.345
Mo	%	0.017	0.010	0.010	0.010	0.010	-	-	-	0.012	0.012	0.011	0.044	0.040
Ag	g/t	4.94	6.210	6.210	6.210	4.535	-	-	-	6.328	5.575	5.614	4.927	4.636
Total to process														
Total	**kt**	**1,471,666**	**54,317**	**58,579**	**62,050**	**62,220**	**62,050**	**62,050**	**62,050**	**62,220**	**62,050**	**62,050**	**62,050**	**62,220**
TCu	%	0.433	0.620	0.597	0.569	0.598	0.573	0.599	0.529	0.453	0.422	0.398	0.366	0.331
Mo	%	0.015	0.020	0.018	0.017	0.018	0.016	0.020	0.015	0.019	0.011	0.012	0.009	0.007
Ag	g/t	5.55	5.174	5.783	6.931	7.669	7.071	6.052	6.090	6.130	5.447	5.293	5.407	5.209
Rehandling	kt	55,652	2,716	2,929	3,103	3,111	3,103	3,103	3,103	2,267	1,410	999	714	1,331
Waste														
Total	kt	**824,124**	28,511	25,708	17,769	38,593	41,746	25,884	58,559	68,573	68,239	68,377	62,764	53,888
Total	**kt**	**2,150,233**	**125,167**	**123,517**	**124,504**	**124,684**	**123,667**	**130,583**	**130,411**	**113,916**	**96,442**	**88,216**	**71,954**	**77,003**
Total	**kt**	**2,580,029**	**128,168**	**128,351**	**129,998**	**129,352**	**126,770**	**133,686**	**133,513**	**133,060**	**131,699**	**131,426**	**125,528**	**117,439**

	Unit	Total	Year											
			2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Ore to Process														
Total	**kt**	**1,097,523**	**15,667**	**19,742**	**35,602**	**44,443**	**61,760**	**62,050**	**62,050**	**62,220**	**44,322**	**51,413**	**54,959**	**40,428**
TCu	%	0.465	0.306	0.331	0.345	0.363	0.391	0.375	0.404	0.443	0.403	0.379	0.357	0.399
Mo	%	0.017	0.006	0.005	0.007	0.009	0.012	0.016	0.020	0.022	0.019	0.022	0.025	0.028
Ag	g/t	5.71	5.337	6.117	6.309	6.003	5.949	5.469	5.165	4.921	4.143	3.817	4.286	6.275
Ore to Stocks														
Total	**kt**	**228,587**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
TCu	%	0.298	-	-	-	-	-	-	-	-	-	-	-	-
Mo	%	0.007	-	-	-	-	-	-	-	-	-	-	-	-
Ag	g/t	4.43	-	-	-	-	-	-	-	-	-	-	-	-
Stock to Process														
Total	**kt**	**374,143**	**46,383**	**42,308**	**26,448**	**17,777**	**290**	**-**	**-**	**-**	**17,728**	**10,637**	**7,091**	**14,441**
TCu	%	0.342	0.306	0.305	0.305	0.305	0.360	-	-	-	0.305	0.305	0.305	0.305
Mo	%	0.017	0.008	0.006	0.006	0.006	0.010	-	-	-	0.006	0.006	0.006	0.006
Ag	g/t	4.94	4.569	4.590	4.596	4.596	3.990	-	-	-	4.596	4.596	4.596	4.596
Total to process														
Total	**kt**	**1,471,666**	**62,050**	**62,050**	**62,050**	**62,220**	**62,050**	**62,050**	**62,050**	**62,220**	**62,050**	**62,050**	**62,050**	**54,870**
TCu	%	0.433	0.306	0.313	0.328	0.346	0.391	0.375	0.404	0.443	0.375	0.366	0.351	0.374
Mo	%	0.015	0.006	0.006	0.006	0.008	0.012	0.016	0.020	0.022	0.015	0.019	0.023	0.022
Ag	g/t	5.55	4.793	5.082	5.579	5.601	5.940	5.469	5.165	4.921	4.273	3.950	4.321	5.833
Rehandling	kt	55,652	798	991	1,780	2,222	3,103	3,103	3,103	3,111	2,216	2,571	2,748	2,021
Waste														
Total	kt	**824,124**	22,461	21,590	23,529	16,135	23,528	22,357	20,517	20,419	20,878	21,929	22,316	29,853
Total	**kt**	**2,150,233**	**38,129**	**41,331**	**59,130**	**60,578**	**85,289**	**84,407**	**82,567**	**82,639**	**65,200**	**73,342**	**77,275**	**70,281**
Total	**kt**	**2,580,029**	**85,310**	**84,630**	**87,359**	**80,577**	**88,681**	**87,510**	**85,669**	**85,750**	**85,144**	**86,550**	**87,114**	**86,744**

La Tabla 8-5, muestra el resumen de la alimentación a planta, con los tonelajes, leyes, recuperaciones proyectadas y el porcentaje de materiales que componen el mineral por cada periodo.

Tabla 8-5: Plan de Minado Estratégico para Alimentación

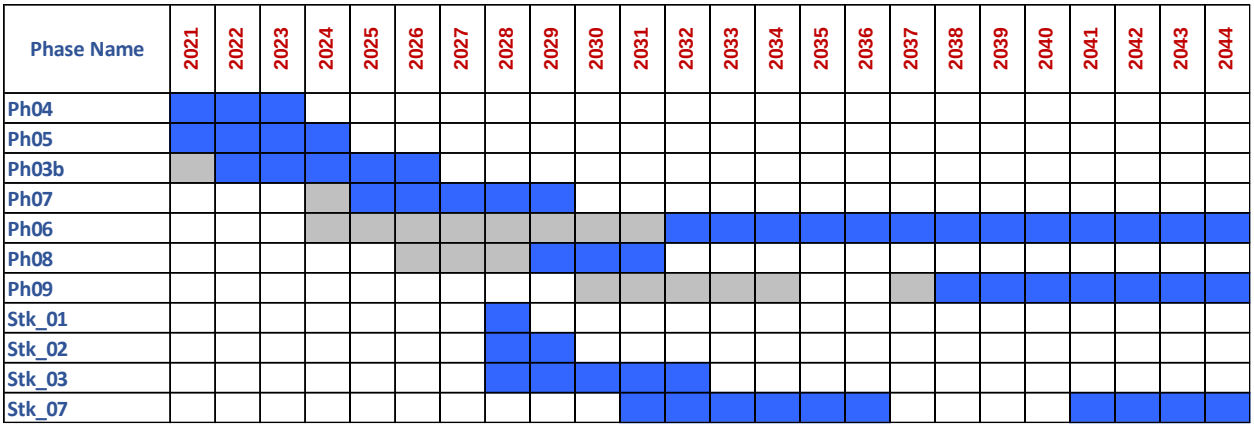
ORE TO CRUSHER	Units	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
TONNAGE	Ton	54,317,410	58,579,052	62,050,005	62,219,812	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	62,220,000
Cu	%	0.620	0.597	0.569	0.598	0.573	0.599	0.529	0.453	0.422	0.398	0.366	0.331
Ag	g/t	5.174	5.783	6.931	7.669	7.071	6.052	6.090	6.130	5.447	5.293	5.407	5.209
Mo	%	0.020	0.018	0.017	0.018	0.016	0.020	0.015	0.019	0.011	0.012	0.009	0.007
ORE CONTAMINANTS													
As	%	0.017	0.018	0.021	0.014	0.025	0.018	0.013	0.019	0.017	0.019	0.021	0.021
Zn	%	0.124	0.155	0.152	0.314	0.259	0.152	0.096	0.138	0.138	0.123	0.211	0.291
F	ppm	2,176	1,788	1,838	2,242	2,077	2,085	1,726	1,798	1,720	1,718	1,696	1,497
MgO	%	8.371	8.593	6.813	10.983	11.080	8.212	6.483	6.664	7.563	6.420	8.281	8.684
As in Conc	%	0.384	0.471	0.621	0.448	0.726	0.473	0.481	0.722	0.687	0.760	0.833	0.890
Zn in Conc	%	3.584	4.528	4.649	8.669	7.457	4.485	3.290	4.701	4.768	4.459	6.936	9.183
F in Conc	ppm	401	296	297	285	233	309	287	232	208	243	200	200
MgO in Conc	%	2.050	1.503	1.394	1.411	1.200	1.391	1.358	1.120	1.024	1.131	1.035	1.048
ADITIONAL INFORMATION													
Hardness	ratio	2.636	2.649	2.652	2.556	2.565	2.656	2.817	2.722	2.727	2.821	2.696	2.626
Blastability Index	ratio	18.164	19.381	19.587	17.528	17.991	18.773	21.355	18.718	19.178	20.498	19.070	18.282
XRD TALC	%	3.532	2.555	1.888	4.395	4.456	2.891	0.824	1.980	2.065	1.679	2.181	2.171
Ratox	%	8.904	8.908	7.276	6.448	8.041	6.867	5.076	5.799	7.594	7.886	9.759	10.245
Fe	%	7.788	9.276	9.390	9.066	10.915	9.437	6.135	7.988	7.999	6.346	6.611	7.073
Recovery Cu	%	82.508	82.298	83.151	82.406	82.079	83.584	86.796	84.033	82.113	83.143	82.136	82.359
Recovery Ag	%	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	1,157,077	1,199,672	1,221,900	1,279,514	1,214,976	1,291,485	1,187,193	987,659	895,946	855,250	777,880	721,972
Cu in Concentrate	%	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000
Ag in Conc	g/t	176.351	212.906	267.357	289.886	262.391	218.787	236.249	286.599	282.094	283.211	312.039	322.961
Mo in Conc	%	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000
INP	$/ton	23.195	21.925	21.207	22.944	19.998	22.581	19.832	16.843	14.158	13.505	11.386	9.307
ALTERATION													
INTRUSIVE A	%	33%	36%	39%	18%	20%	38%	61%	59%	57%	71%	49%	31%
INTRUSIVE B	%	4%	9%	16%	9%	9%	9%	5%	9%	13%	12%	20%	23%
HORNFELS	%	14%	5%	5%	14%	10%	6%	4%	4%	4%	5%	9%	14%
SKARN ACTINOLITE TREMOLITE	%	32%	29%	24%	31%	32%	22%	16%	17%	11%	4%	9%	12%
SKARN SERPENTINE MAGNETITE	%	17%	21%	16%	28%	29%	25%	14%	11%	15%	8%	13%	19%
ANHYDRITE	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

ORE TO CRUSHER	Units	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
TONNAGE	Ton	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	54,869,718
Cu	%	0.306	0.313	0.328	0.346	0.391	0.375	0.404	0.443	0.375	0.366	0.351	0.374
Ag	g/t	4.793	5.082	5.579	5.601	5.940	5.469	5.165	4.921	4.273	3.950	4.321	5.833
Mo	%	0.006	0.006	0.006	0.008	0.012	0.016	0.020	0.022	0.015	0.019	0.023	0.022
ORE CONTAMINANTS													
As	%	0.020	0.020	0.019	0.019	0.017	0.014	0.010	0.013	0.015	0.016	0.011	0.012
Zn	%	0.221	0.209	0.223	0.228	0.267	0.165	0.148	0.141	0.105	0.081	0.085	0.100
F	ppm	1,479	1,488	1,479	1,516	1,488	1,509	1,769	2,133	1,759	1,704	1,618	1,619
MgO	%	8.614	8.652	8.975	9.013	9.007	8.034	8.244	8.666	6.803	5.340	4.483	4.825
As in Conc	%	0.866	0.869	0.867	0.842	0.730	0.659	0.513	0.526	0.650	0.681	0.597	0.645
Zn in Conc	%	7.408	7.072	7.420	7.472	8.352	5.688	5.087	4.748	4.017	3.399	3.596	3.974
F in Conc	ppm	200	205	200	200	200	202	230	229	240	269	272	275
MgO in Conc	%	1.207	1.244	1.207	1.111	1.002	1.025	1.108	1.018	1.006	1.083	1.125	1.179
ADITIONAL INFORMATION													
Hardness	ratio	2.662	2.657	2.616	2.616	2.627	2.632	2.651	2.585	2.655	2.719	2.849	2.795
Blastability Index	ratio	18.794	18.615	17.899	17.274	17.010	17.589	18.332	17.992	19.241	20.020	21.087	20.086
XRD TALC	%	2.285	2.188	2.203	2.425	3.009	2.015	2.105	3.147	2.280	1.843	1.171	0.979
Ratox	%	10.421	10.311	9.024	9.118	9.863	7.625	6.297	6.984	8.239	6.821	4.802	5.470
Fe	%	7.461	7.324	6.895	7.005	7.637	6.651	7.154	9.351	7.780	6.857	5.130	5.479
Recovery Cu	%	82.239	82.265	82.381	82.282	82.769	82.733	82.613	82.507	82.479	84.014	87.020	86.424
Recovery Ag	%	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	698,787	715,041	753,262	738,563	835,277	803,608	869,395	952,855	846,930	794,463	790,027	781,341
Cu in Concentrate	%	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000
Ag in Conc	g/t	303.817	314.831	335.424	348.241	337.061	309.266	275.494	239.546	236.925	228.962	255.080	303.321
Mo in Conc	%	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000
INP	$/ton	7.834	8.257	9.226	10.247	12.623	12.653	14.563	16.026	12.251	12.457	12.962	14.332
ALTERATION													
INTRUSIVE A	%	28%	27%	24%	28%	26%	29%	28%	29%	44%	56%	65%	58%
INTRUSIVE B	%	18%	18%	21%	21%	22%	20%	19%	12%	15%	14%	14%	14%
HORNFELS	%	17%	18%	19%	15%	7%	13%	10%	0%	5%	3%	2%	6%
SKARN ACTINOLITE TREMOLITE	%	21%	22%	19%	16%	11%	16%	23%	27%	17%	13%	7%	12%
SKARN SERPENTINE MAGNETITE	%	16%	15%	17%	22%	34%	23%	19%	31%	19%	12%	10%	9%
ANHYDRITE	%	0%	0%	0%	0%	0%	1%	0%	0%	1%	2%	1%	1%

Nota: MCP desarrolla el Plan Minero Estratégico a partir de la topografía a fin de diciembre del 2020 en periodos anuales.

La Tabla 8-6, representa el movimiento de materiales por fases y stocks de minerales por cada periodo, siendo el color azul, el mineral a proceso con beneficio mayor que cero, mientras que el color gris es el desarrollo o movimiento de lastre sin beneficio.

Tabla 8-6: Secuencia de Extracción de Fases y Remanejo de Stocks



9 PLAN MINERO OPERATIVO

El plan minero operativo corresponde al mejor caso seleccionado en la planificación estratégica realizada por MCP, desarrollando la opción del Set F de fases o pushbacks; las que tienen por finalidad, mejorar el perfil de ley de alimentación los primeros 10 años, acercarse al pit RF1 optimizado con el software Whittle, y buscando entre todos los requerimientos no perder mineral, ni aumentar la cantidad de desmonte y mantener las definiciones dadas por la planificación estratégica (en relación con el perfil de ley de corte y movimientos por fases). Se realizó el plan minero operativo, mediante el software secuenciador *SP2,* el que permite programar en base a los equipos de carguío dispuestos en cada fase con sus correspondientes indicadores de gestión. El objetivo fue dar cumplimiento a los requerimientos de la planta, en cuanto a cantidad y calidad.

9.1 Criterios del Plan Operativo

Los criterios considerados en el plan minero operativo son similares a los del plan estratégico, que se resume en lo siguiente:

- La topografía de inicio es al 31 de diciembre del 2020.
- La planificación se desarrolla a nivel de fase-banco, para todos los periodos con el siguiente desglose:
  - Asignación de equipos de carguío de acuerdo con el sinking rate definido en el estratégico, en base a rendimientos históricos promedio.
  - Períodos anuales, desde el 2021 hasta el fin de la vida de la mina.
- Seguir los lineamientos entregados por el plan estratégico desarrollado por MCP (MPSO de MineSight®), en cuanto a estrategia de ley de corte, secuencia minera y capacidad de mina.

- La estrategia del manejo de stock se mantiene respecto al plan estratégico, desarrollando un stock de alta ley y otro de mediana ley de cobre y se consumen los minerales desde stocks en forma anticipada, para dejar los espacios disponibles para acopiar material estéril.
- Incorpora al reporte el plan minero operativo del periodo 2020 realizado por MCP.

9.2 Clasificación de Materiales

Se mantiene la misma clasificación de los minerales utilizada en la definición del Pit Final y la construcción del plan estratégico, mostrados en la Tabla 8-2.

9.3 Restricciones Impuestas en la Alimentación a la Concentradora

El plan de minado operativo mantiene las mismas 6 restricciones impuestas en el plan estratégico, descritas de la siguiente manera:

- Ratox: <= 16%
- Skarn Serpentina-Magnetita: <= 30%
- Hornfels: <= 30%
- Talco: <= 6%
- Skarn Actinolita-Tremolita: <= 40%
- As en el concentrado: <= 0,035%

9.4 Ley de Corte para el Plan Minero

Como fue mencionado en el capítulo de planificación estratégica, el plan minero operativo utiliza la misma definición de ley de corte, esto es basada en el concepto de INP, de acuerdo con los siguientes valores:

- El marginal cut-off grade para los minerales, alimentados al chancador directamente desde la mina, sería de INP > 1.62 US$/t. Este valor está basado en el costo del G&A.
- El marginal cut-off grade para los minerales que se deben enviar a stock y posteriormente pagar el remanejo sería de INP > 2.32 US$/t. Este valor está basado en el costo de G&A de 1.62 US$/t y un costo de remanejo de 0.7 US$/t.

La Tabla 9-1, muestra el perfil de ley de corte para el plan minero operativo por tipo de mineral.

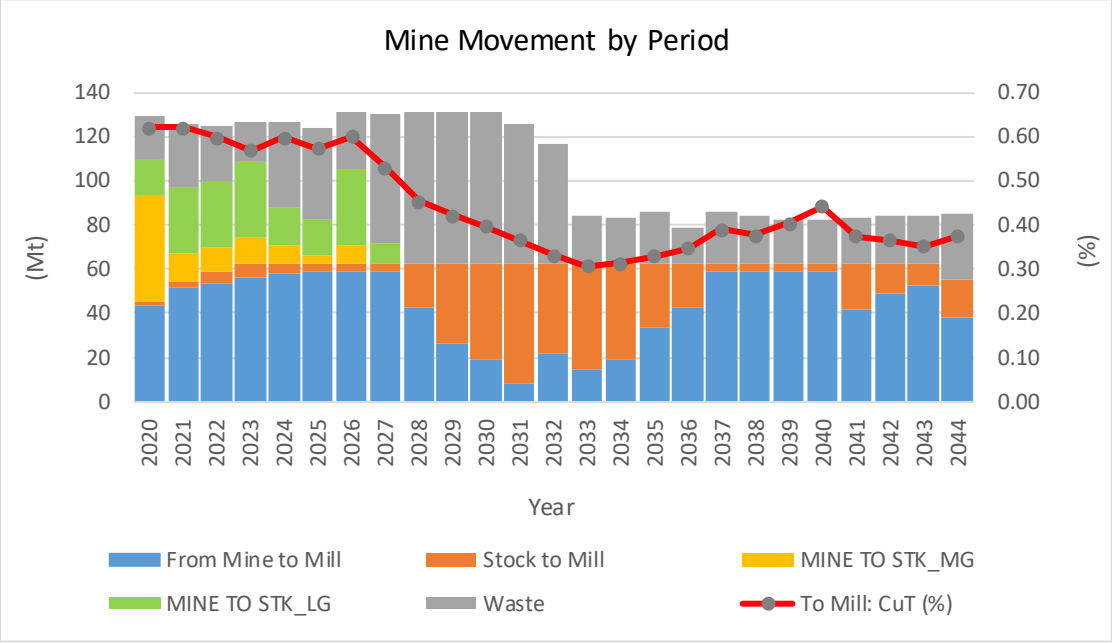
Tabla 9-1: Perfil de Ley de Corte, Basada en INP según tipo de Mineral

Periodo		Clasificación	
Inicial	Final	A Proceso	A Stock
		INP >1.62	INP >1.62
2021	2021	13.5	11
2022	2022	11.5	9
2023	2023	11	9
2024	2024	11	9
2025	2025	8.5	8
2026	2026	12	11
2027	2027	8.5	8.5
2028	2044	1.62	1.62

9.5 Resultados Plan Minero Operativo LOM

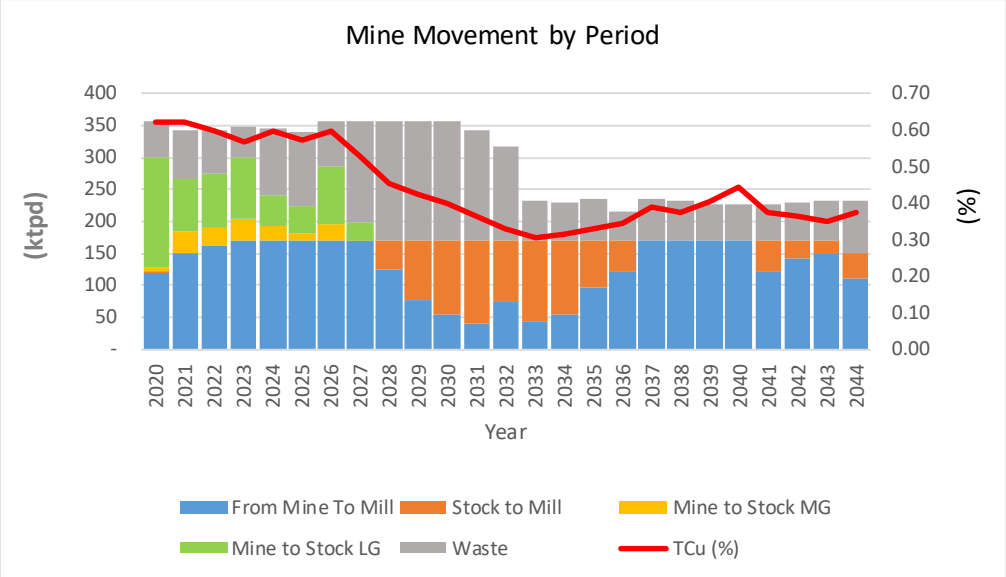
La Figura 9-1, muestra el resultado del movimiento de materiales programado para la mina Toromocho, señalando el desglose de los materiales desde mina, de stock, remanejo y movimiento de estéril.

Figura 9-1: Movimiento de Materiales para LOM Operativo



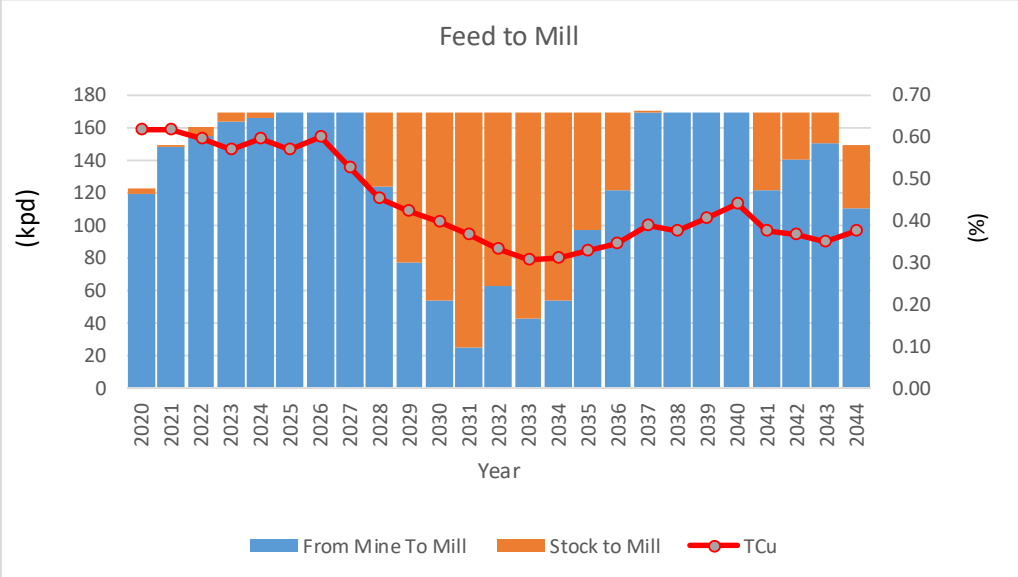
La Figura 9-2, muestra la tasa de minado por periodos anuales, expresados en ktpd, representando los minerales alimentados directamente desde mina, desde stock, los minerales enviados a stock y el movimiento de estéril.

Figura 9-2: Perfil de Capacidad de Mina en ktpd



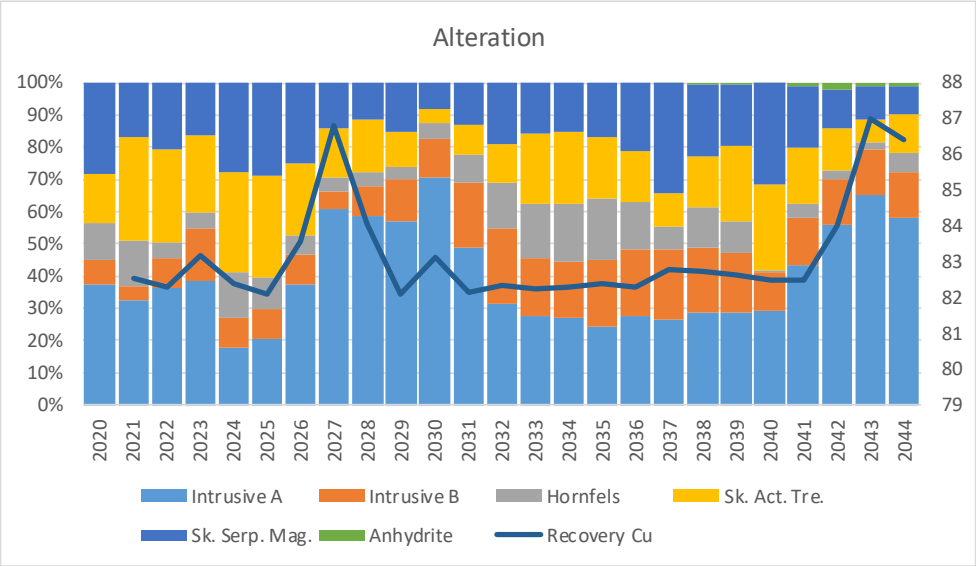
La alimentación programada en el plan operativo considera minerales enviados directamente desde la mina y minerales remanejados desde stock, como se muestra en la Figura 9-3.

Figura 9-3: Alimentación de Mineral a la Concentradora como promedio diario



La Figura 9-4, muestra la distribución de los minerales por tipos de alteración, alimentados a la concentradora en periodos anuales, que cumple con las restricciones máximas para los tipos Skarn AT, Skarn SM y Hornfels.

Figura 9-4: Distribución de Minerales a Proceso



La Figura 9-5 y Figura 9-6, se muestra el cumplimiento de las restricciones máximas para los minerales tipo Hornfels; Skarn SM y AT; Ratox; Talco y As. Hay valores que sobrepasan las restricciones en los periodos finales al incorporar los materiales desde los stocks en forma masiva.

Figura 9-5: Cumplimiento de Restricciones de Ratox, Talco y As

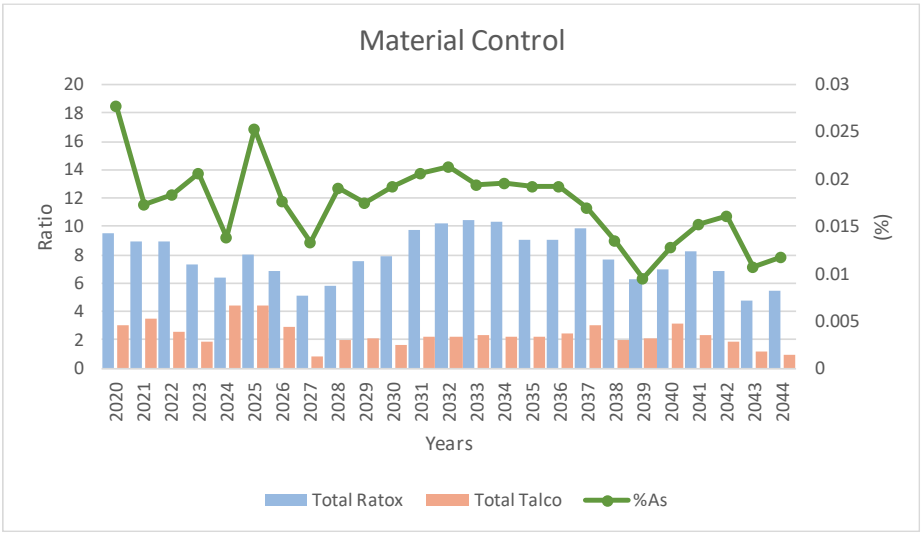


Figura 9-6: Cumplimiento de Restricciones de Hornfels, Skarn SM y AT

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Tonnage	54,317,410	58,579,052	62,050,005	62,219,812	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	62,220,000
Cu%	0.62	0.60	0.57	0.60	0.57	0.60	0.53	0.45	0.42	0.40	0.37	0.33
Fe%	7.79	9.28	9.39	9.07	10.92	9.44	6.13	7.99	8.00	6.35	6.61	7.07
Zn%	0.12	0.15	0.15	0.31	0.26	0.15	0.10	0.14	0.14	0.12	0.21	0.29
As %	0.017	0.018	0.021	0.014	0.025	0.018	0.013	0.019	0.017	0.019	0.021	0.021
MgO %	8.37	8.59	6.81	10.98	11.08	8.21	6.48	6.66	7.56	6.42	8.28	8.68
Fluor ppm	2,176	1,788	1,838	2,242	2,077	2,085	1,726	1,798	1,720	1,718	1,696	1,497
Ratox %	8.9	8.9	7.3	6.4	8.0	6.9	5.1	5.8	7.6	7.9	9.8	10.2
Hard	2.6	2.6	2.7	2.6	2.6	2.7	2.8	2.7	2.7	2.8	2.7	2.6
Talco %	3.5	2.6	1.9	4.4	4.5	2.9	0.8	2.0	2.1	1.7	2.2	2.2
Intrusivo B %	4%	9%	16%	9%	9%	9%	5%	9%	13%	12%	20%	23%
Hornfels %	14%	5%	5%	14%	10%	6%	4%	4%	4%	5%	9%	14%
Actinolite_Tremolite %	32%	29%	24%	31%	32%	22%	16%	17%	11%	4%	9%	12%
Serpentine_Magnetine %	17%	21%	16%	28%	29%	25%	14%	11%	15%	8%	13%	19%

	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Tonnage	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	54,869,718
Cu%	0.31	0.31	0.33	0.35	0.39	0.38	0.40	0.44	0.37	0.37	0.35	0.37
Fe%	7.46	7.32	6.89	7.01	7.64	6.65	7.15	9.35	7.78	6.86	5.13	5.48
Zn%	0.22	0.21	0.22	0.23	0.27	0.17	0.15	0.14	0.10	0.08	0.09	0.10
As %	0.020	0.020	0.019	0.019	0.017	0.014	0.010	0.013	0.015	0.016	0.011	0.012
MgO %	8.61	8.65	8.98	9.01	9.01	8.03	8.24	8.67	6.80	5.34	4.48	4.82
Fluor ppm	1,479	1,488	1,479	1,516	1,488	1,509	1,769	2,133	1,759	1,704	1,618	1,619
Ratox %	10.4	10.3	9.0	9.1	9.9	7.6	6.3	7.0	8.2	6.8	4.8	5.5
Hard	2.7	2.7	2.6	2.6	2.6	2.6	2.7	2.6	2.7	2.7	2.8	2.8
Talco %	2.3	2.2	2.2	2.4	3.0	2.0	2.1	3.1	2.3	1.8	1.2	1.0
Intrusivo B %	18%	18%	21%	21%	22%	20%	19%	12%	15%	14%	14%	14%
Hornfels %	17%	18%	19%	15%	7%	13%	10%	0%	5%	3%	2%	6%
Actinolite_Tremolite %	21%	22%	19%	16%	11%	16%	23%	27%	17%	13%	7%	12%
Serpentine_Magnetine %	16%	15%	17%	22%	34%	23%	19%	31%	19%	12%	10%	9%

La Figura 9-7, Figura 9-8 y Figura 9-9, muestra la distribución del cobre fino, Molibdeno y Plata obtenido en el plan operativo LOM, en períodos anuales respectivamente.

Figura 9-7: Distribución de Cobre Fino Producido

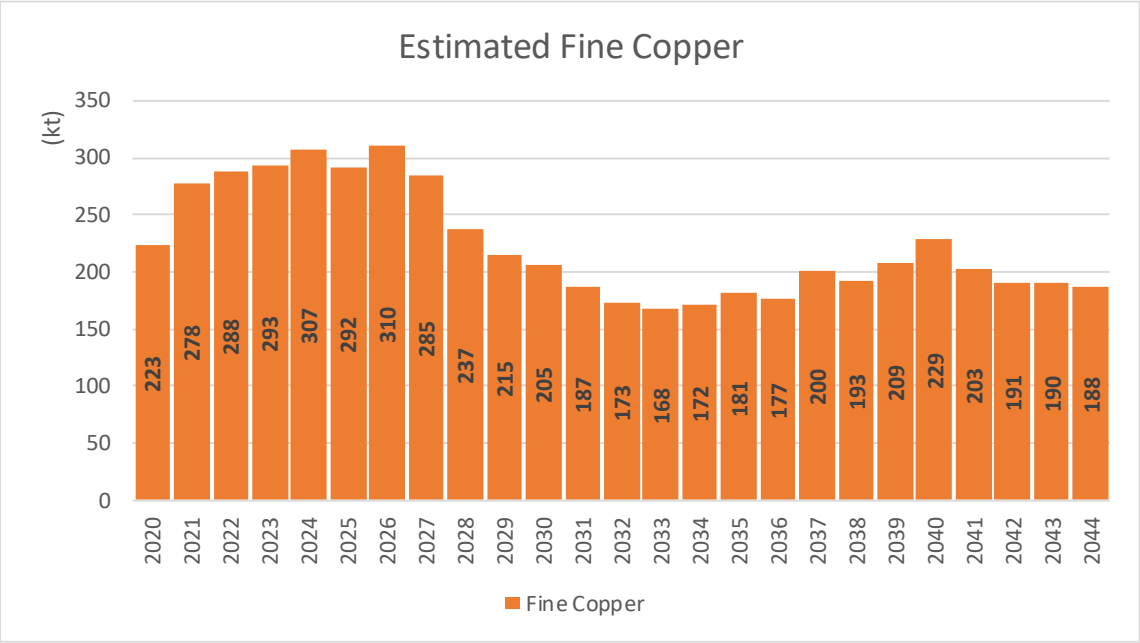


Figura 9-8: Distribución de Fino de Molibdeno

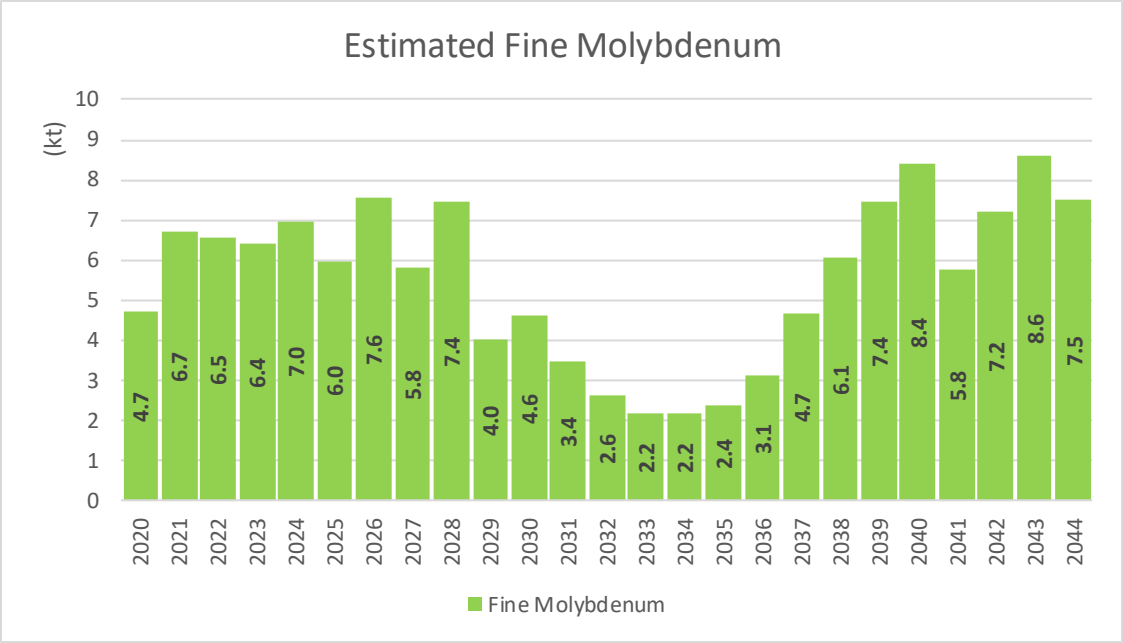
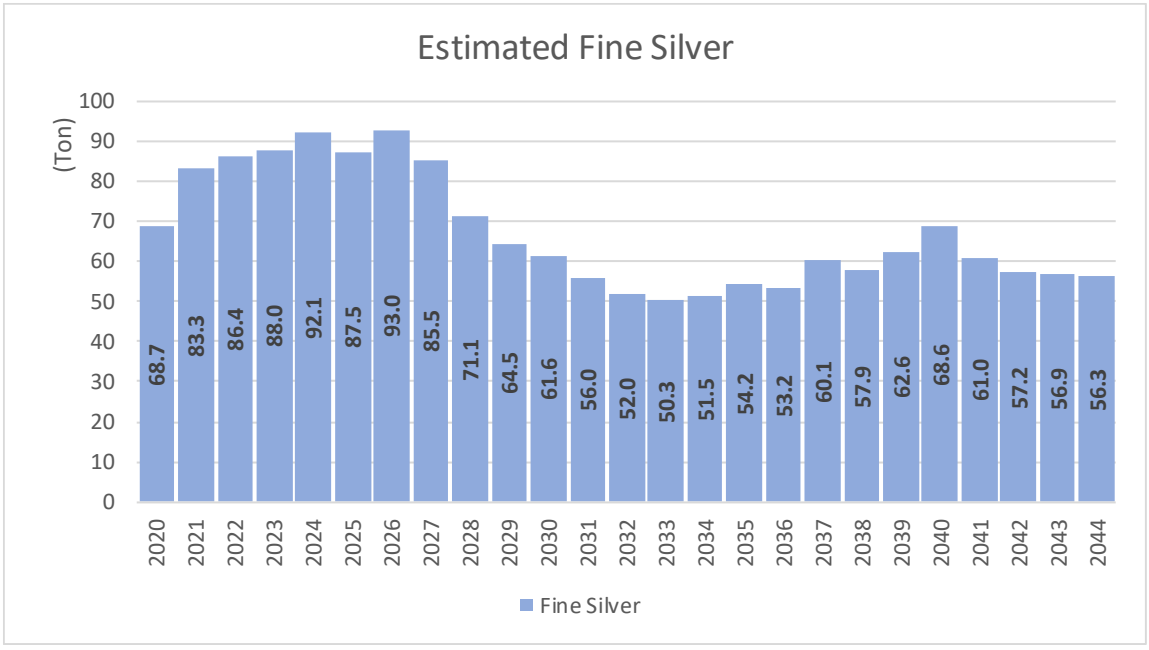
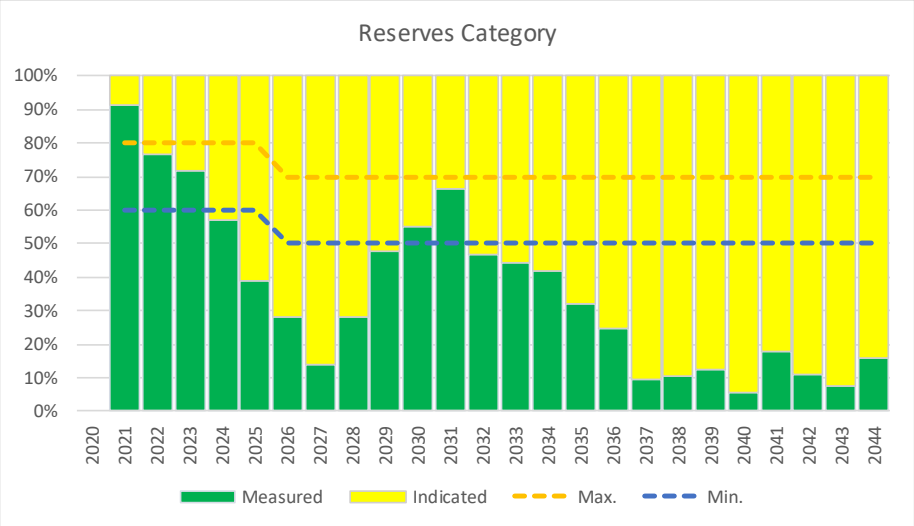


Figura 9-9: Estimación de Fino de Plata



La Figura 9-10, muestra la distribución de la categoría de reservas minerales, para los minerales enviados a proceso, que en su totalidad comprende las Reservas Minerales Probadas y Probables. De esta lámina se desprende que es necesario realizar campaña de sondajes infill para mejorar la certidumbre de las reservas minerales de los primeros 10 años.

Figura 9-10: Distribución por Categoría de Reservas Minerales en Plan LOM



La Figura 9-11 y Figura 9-12 muestra la distribución de mineral enviado a proceso por origen y periodos y el movimiento total por periodo de cada fase.

Figura 9-11: Distribución de Minerales a Proceso por Fases

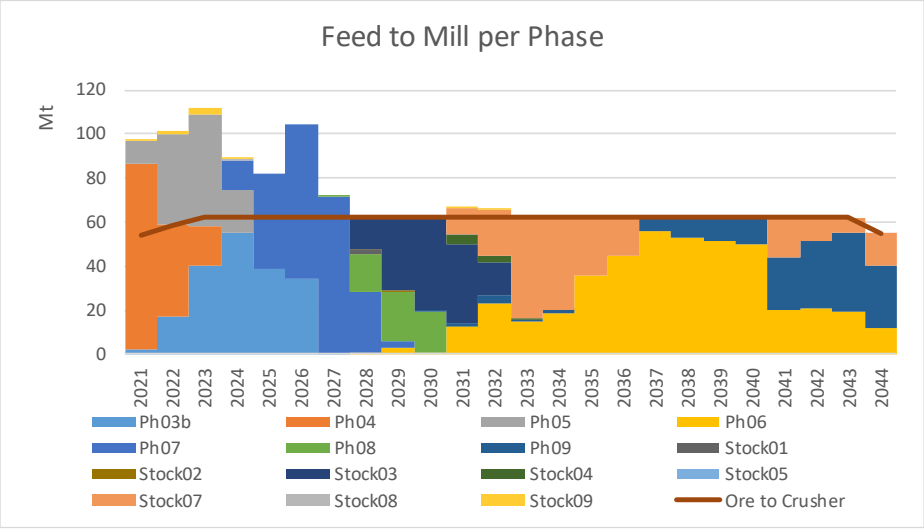
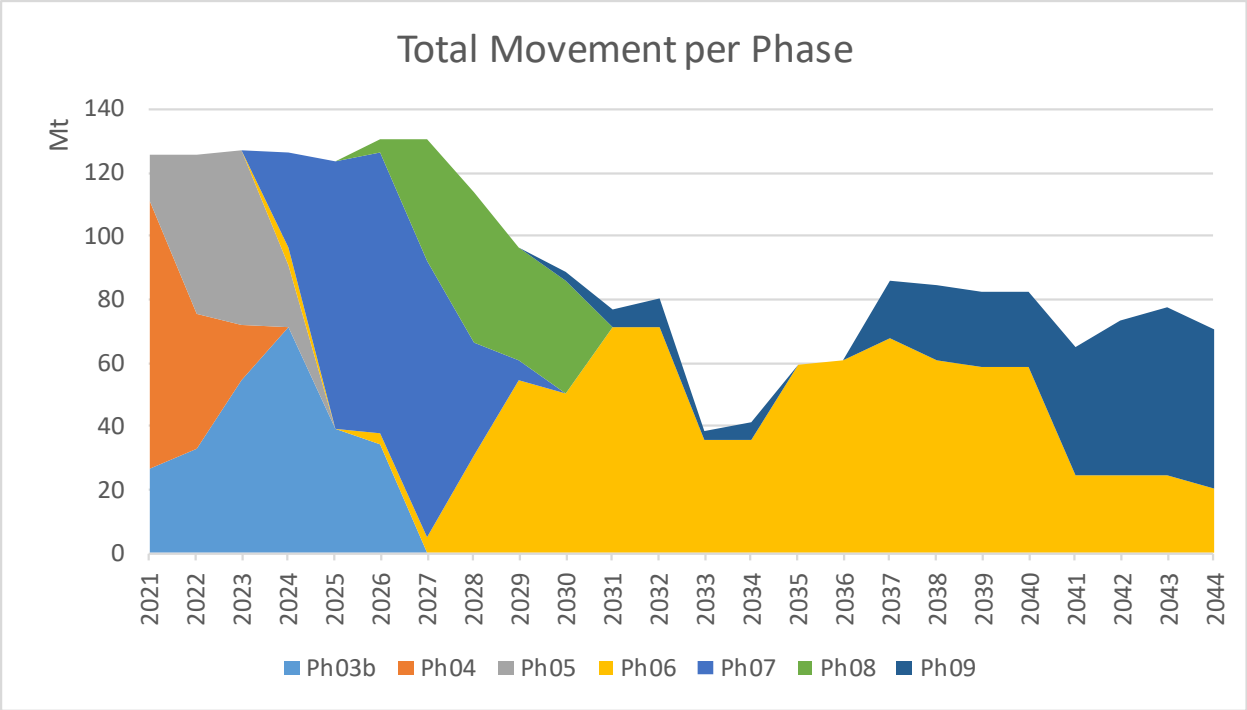
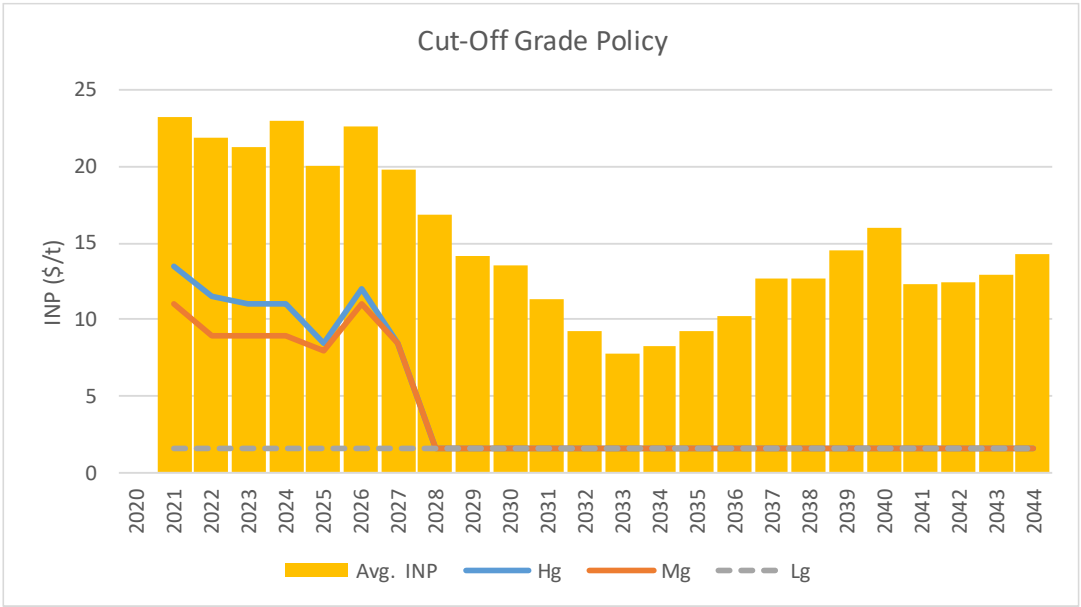


Figura 9-12: Movimiento Mina por Fases



La Figura 9-13, muestra la definición de ley de corte por INP(US$/t), para cada periodo.

Figura 9-13: Ley de Corte por Periodos



La **Figura 9-14**, muestra el gráfico de serrucho para el mineral y estéril, señalando la cantidad de mineral expuesto en función del desarrollo. De esta gráfica se desprende que la fase 08, no alcanza a cubrir un año de producción durante el año 2028, copando esta diferencia con mineral desde stock. Para mejorar esta condición es necesario balancear las fases 07, 08 y 09 o bien adelantar el desarrollo de estéril de la fase 06 o 09.

Figura 9-14: Gráfico de Serrucho Mineral y Estéril

9.6 Reportes del Plan Minero LOM

La Tabla 9-3 y la Tabla 9-4 muestra el plan de producción del LOM (Life Of Mine) que considera la producción a partir del año 2020 en adelante. El plan de producción aporta 1,516.7 Mt, de mineral con ley de 0.439% de TCu, 5.59 g/t de Ag y 0.015 % de Mo. La Tabla 9-5 y Tabla 9-6, muestra el detalle del movimiento mina del plan minero LOM separando el mineral enviado directamente desde la mina, desde stocks y el movimiento de lastre.

Finalmente, la secuencia por fases se encuentra en el ANEXO - FOTOS POR PERIODOS.

Tabla 9-2: Resumen Movimiento Plan Minero LOM

	Unit	Total	Year											
			2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Ore to Process														
Total	**kt**	**1,141,217**	**43,694**	**54,032**	**56,673**	**59,659**	**60,663**	**62,050**	**62,050**	**62,050**	**45,343**	**28,203**	**19,839**	**9,190**
TCu	%	0.471	0.622	0.621	0.603	0.575	0.604	0.573	0.599	0.529	0.466	0.457	0.422	0.351
Mo	%	0.017	0.017	0.020	0.018	0.017	0.018	0.016	0.020	0.015	0.022	0.009	0.014	0.004
Ag	g/t	5.757	6.927	5.168	5.768	6.960	7.750	7.071	6.052	6.090	6.057	5.292	4.608	5.091
Ore to Stocks														
Total	**kt**	**292,550**	**63,964**	**42,624**	**41,135**	**47,077**	**25,428**	**19,871**	**42,650**	**9,802**	**-**	**-**	**-**	**-**
TCu	%	0.312	0.360	0.328	0.283	0.275	0.295	0.294	0.324	0.254	-	-	-	-
Mo	%	0.008	0.010	0.007	0.009	0.005	0.006	0.008	0.007	0.005	-	-	-	-
Ag	g/t	4.55	4.97	4.199	4.050	5.255	5.169	3.972	4.146	3.347	-	-	-	-
Stock to Process														
Total	**kt**	**375,451**	**1,308**	**285**	**1,906**	**2,391**	**1,557**	**-**	**-**	**-**	**16,877**	**33,847**	**42,211**	**52,860**
TCu	%	0.343	0.571	0.420	0.420	0.420	0.375	-	-	-	0.417	0.393	0.386	0.369
Mo	%	0.017	0.010	0.010	0.010	0.010	0.010	-	-	-	0.012	0.012	0.011	0.044
Ag	g/t	4.95	6.56	6.210	6.210	6.210	4.535	-	-	-	6.328	5.575	5.614	4.927
Total to process														
Total	**kt**	**1,516,668**	**45,002**	**54,317**	**58,579**	**62,050**	**62,220**	**62,050**	**62,050**	**62,050**	**62,220**	**62,050**	**62,050**	**62,050**
TCu	%	0.439	0.620	0.620	0.597	0.569	0.598	0.573	0.599	0.529	0.453	0.422	0.398	0.366
Mo	%	0.015	0.017	0.020	0.018	0.017	0.018	0.016	0.020	0.015	0.019	0.011	0.012	0.009
Ag	g/t	5.59	6.92	5.174	5.783	6.931	7.669	7.071	6.052	6.090	6.130	5.447	5.293	5.407
Rehandling	kt	55,652	-	2,716	2,929	3,103	3,111	3,103	3,103	3,103	2,267	1,410	999	714
Waste														
Total	kt	**844,682**	**20,558**	28,511	25,708	17,769	38,593	41,746	25,884	58,559	68,573	68,239	68,377	62,764
Total	**kt**	**2,278,449**	**128,216**	**125,167**	**123,517**	**124,504**	**124,684**	**123,667**	**130,583**	**130,411**	**113,916**	**96,442**	**88,216**	**71,954**
Total	**kt**	**2,709,553**	**129,524**	**128,168**	**128,351**	**129,998**	**129,352**	**126,770**	**133,686**	**133,513**	**133,060**	**131,699**	**131,426**	**125,528**

	Unit	Year												
		2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Ore to Process														
Total	**kt**	**23,114**	**15,667**	**19,742**	**35,602**	**44,443**	**61,760**	**62,050**	**62,050**	**62,220**	**44,322**	**51,413**	**54,959**	**40,428**
TCu	%	0.309	0.306	0.331	0.345	0.363	0.391	0.375	0.404	0.443	0.403	0.379	0.357	0.399
Mo	%	0.004	0.006	0.005	0.007	0.009	0.012	0.016	0.020	0.022	0.019	0.022	0.025	0.028
Ag	g/t	5.319	5.337	6.117	6.309	6.003	5.949	5.469	5.165	4.921	4.143	3.817	4.286	6.275
Ore to Stocks														
Total	**kt**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
TCu	%	-	-	-	-	-	-	-	-	-	-	-	-	-
Mo	%	-	-	-	-	-	-	-	-	-	-	-	-	-
Ag	g/t	-	-	-	-	-	-	-	-	-	-	-	-	-
Stock to Process														
Total	**kt**	**39,106**	**46,383**	**42,308**	**26,448**	**17,777**	**290**	**-**	**-**	**-**	**17,728**	**10,637**	**7,091**	**14,441**
TCu	%	0.345	0.306	0.305	0.305	0.305	0.360	-	-	-	0.305	0.305	0.305	0.305
Mo	%	0.040	0.008	0.006	0.006	0.006	0.010	-	-	-	0.006	0.006	0.006	0.006
Ag	g/t	4.636	4.569	4.590	4.596	4.596	3.990	-	-	-	4.596	4.596	4.596	4.596
Total to process														
Total	**kt**	**62,220**	**62,050**	**62,050**	**62,050**	**62,220**	**62,050**	**62,050**	**62,050**	**62,220**	**62,050**	**62,050**	**62,050**	**54,870**
TCu	%	0.331	0.306	0.313	0.328	0.346	0.391	0.375	0.404	0.443	0.375	0.366	0.351	0.374
Mo	%	0.007	0.006	0.006	0.006	0.008	0.012	0.016	0.020	0.022	0.015	0.019	0.023	0.022
Ag	g/t	5.209	4.793	5.082	5.579	5.601	5.940	5.469	5.165	4.921	4.273	3.950	4.321	5.833
Rehandling	kt	1,331	798	991	1,780	2,222	3,103	3,103	3,103	3,111	2,216	2,571	2,748	2,021
Waste														
Total	kt	53,888	22,461	21,590	23,529	16,135	23,528	22,357	20,517	20,419	20,878	21,929	22,316	29,853
Total	**kt**	**77,003**	**38,129**	**41,331**	**59,130**	**60,578**	**85,289**	**84,407**	**82,567**	**82,639**	**65,200**	**73,342**	**77,275**	**70,281**
Total	**kt**	**117,439**	**85,310**	**84,630**	**87,359**	**80,577**	**88,681**	**87,510**	**85,669**	**85,750**	**85,144**	**86,550**	**87,114**	**86,744**

TETRA TECH

Tabla 9-3: Plan de Producción LOM Toromocho

ORE TO CRUSHER	Units	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
TONNAGE	Ton	45,002,434	54,317,410	58,579,052	62,050,005	62,219,812	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	62,220,000
Cu	%	0.620	0.620	0.597	0.569	0.598	0.573	0.599	0.529	0.453	0.422	0.398	0.366	0.331
Ag	g/t	6.916	5.174	5.783	6.931	7.669	7.071	6.052	6.090	6.130	5.447	5.293	5.407	5.209
Mo	%	0.017	0.020	0.018	0.017	0.018	0.016	0.020	0.015	0.019	0.011	0.012	0.009	0.007
ORE CONTAMINANTS														
As	%	0.028	0.017	0.018	0.021	0.014	0.025	0.018	0.013	0.019	0.017	0.019	0.021	0.021
Zn	%	0.162	0.124	0.155	0.152	0.314	0.259	0.152	0.096	0.138	0.138	0.123	0.211	0.291
F	ppm	1,983	2,176	1,788	1,838	2,242	2,077	2,085	1,726	1,798	1,720	1,718	1,696	1,497
MgO	%	8.417	8.371	8.593	6.813	10.983	11.080	8.212	6.483	6.664	7.563	6.420	8.281	8.684
As in Conc	%	0.007	0.384	0.471	0.621	0.448	0.726	0.473	0.481	0.722	0.687	0.760	0.833	0.890
Zn in Conc	%	0.046	3.584	4.528	4.649	8.669	7.457	4.485	3.290	4.701	4.768	4.459	6.936	9.183
F in Conc	ppm	856	401	296	297	285	233	309	287	232	208	243	200	200
MgO in Conc	%	0.796	2.050	1.503	1.394	1.411	1.200	1.391	1.358	1.120	1.024	1.131	1.035	1.048
ADITIONAL INFORMATION														
Hardness	ratio	2.67	2.64	2.65	2.65	2.56	2.56	2.66	2.82	2.72	2.73	2.82	2.70	2.63
Blastability Index	ratio	17.88	18.16	19.38	19.59	17.53	17.99	18.77	21.35	18.72	19.18	20.50	19.07	18.28
XRD TALC	%	3.03	3.53	2.56	1.89	4.39	4.46	2.89	0.82	1.98	2.07	1.68	2.18	2.17
Ratox	%	9.49	8.90	8.91	7.28	6.45	8.04	6.87	5.08	5.80	7.59	7.89	9.76	10.25
Fe	%	8.52	7.79	9.28	9.39	9.07	10.92	9.44	6.13	7.99	8.00	6.35	6.61	7.07
Recovery Cu	%	78.92	82.51	82.30	83.15	82.41	82.08	83.58	86.80	84.03	82.11	83.14	82.14	82.36
Recovery Ag	%	67.66	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00
Recovery Mo	%	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00
Cu Concentrate Tonnage	Ton	917,631	1,157,077	1,199,672	1,221,900	1,279,514	1,214,976	1,291,485	1,187,193	987,659	895,946	855,250	777,880	721,972
Cu in Concentrate	%	24	24	24	24	24	24	24	24	24	24	24	24	24
Ag in Conc	g/t	229	176	213	267	290	262	219	236	287	282	283	312	323
Mo in Conc	%	19	19	19	19	19	19	19	19	19	19	19	19	19
INP	$/ton	24.000	23.195	21.925	21.207	22.944	19.998	22.581	19.832	16.843	14.158	13.505	11.386	9.307
ALTERATION														
INTRUSIVE A	%	31%	33%	36%	39%	18%	20%	38%	61%	59%	57%	71%	49%	31%
INTRUSIVE B	%	6%	4%	9%	16%	9%	9%	9%	5%	9%	13%	12%	20%	23%
HORNFELS	%	10%	14%	5%	5%	14%	10%	6%	4%	4%	4%	5%	9%	14%
SKARN ACTINOLITE TREMOLITE	%	13%	32%	29%	24%	31%	32%	22%	16%	17%	11%	4%	9%	12%
SKARN SERPENTINE MAGNETITE	%	23%	17%	21%	16%	28%	29%	25%	14%	11%	15%	8%	13%	19%
ANHYDRITE	%	17%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
QUALITIES														
CIQ (<= 0.5% FIcon<1000)	Unit													
Tonnage	Ton	-	38,575,328	38,966,887	33,559,865	37,996,156	31,594,759	36,723,673	35,250,650	22,083,946	20,229,914	13,854,677	9,800,468	10,311,655
Cu	%	-	0.629	0.643	0.629	0.655	0.625	0.663	0.559	0.524	0.509	0.470	0.399	0.350
Ag	Gr/Tn	-	4.187	4.283	4.660	6.302	5.174	4.930	4.950	4.894	4.424	4.027	3.563	3.291
Mo	%	-	0.024	0.016	0.030	0.030	0.014	0.045	0.046	0.055	0.030	0.032	0.027	0.019
ORE CONTAMINANTS														
As	%	-	0.010	0.008	0.007	0.007	0.012	0.009	0.006	0.006	0.005	0.006	0.005	0.004
Zn	%	-	0.083	0.126	0.111	0.229	0.263	0.149	0.078	0.136	0.148	0.110	0.242	0.354
F	ppm	-	2,208.580	1,897.781	1,976.471	2,405.857	2,384.648	2,348.998	1,725.783	1,772.219	1,793.850	1,790.972	1,566.190	1,394.564
MgO	%	-	8.020	9.134	8.472	10.497	12.726	9.854	7.543	7.515	9.690	7.808	10.777	11.690
As in Conc	%	-	0.152	0.100	0.100	0.149	0.241	0.104	0.202	0.256	0.230	0.293	0.344	0.358
Zn in Conc	%	-	2.412	3.482	3.170	6.289	7.252	4.062	2.598	4.283	4.622	3.746	7.496	10.667
F in Conc	ppm	-	437.887	336.571	352.882	320.563	256.763	355.952	319.871	280.996	222.790	287.528	200.000	200.000
MgO in Conc	%	-	2.150	1.723	1.679	1.557	1.344	1.581	1.536	1.292	1.070	1.326	1.000	1.000
Ascon <= 0.5% FIcon >=1000	Unit													
Tonnage	Ton	-	553,740	213,666	326,765	813,437	266,503	262,702	658,225	231,376	13,137	13,025	12,803	7,699
Cu	%	-	0.856	1.179	1.565	1.377	0.836	1.796	1.490	1.336	1.361	1.395	1.239	0.960
Ag	Gr/Tn	-	4.059	5.598	8.705	8.641	5.229	7.347	7.490	7.404	7.280	7.532	6.720	5.271
Mo	%	-	0.024	0.016	0.030	0.030	0.014	0.045	0.046	0.055	0.030	0.032	0.027	0.019
ORE CONTAMINANTS														
As	%	-	0.022	0.011	0.019	0.014	0.015	0.018	0.014	0.014	0.016	0.015	0.014	0.011
Zn	%	-	0.092	0.084	0.172	0.145	0.285	0.080	0.089	0.100	0.144	0.151	0.154	0.158
F	ppm	-	2,642.029	2,467.422	3,318.113	3,540.864	3,538.009	3,240.258	3,709.311	4,737.740	3,327.656	3,466.257	3,496.938	3,551.698
MgO	%	-	11.227	7.700	9.204	10.523	11.995	8.980	10.217	12.301	10.109	10.360	11.212	12.734
As in Conc	%	-	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Zn in Conc	%	-	1.707	0.500	1.231	1.295	6.965	0.500	0.500	0.500	1.238	1.296	1.951	3.122
F in Conc	ppm	-	1,065.188	1,071.873	1,101.179	1,101.572	1,108.810	1,141.679	1,137.433	1,144.599	1,108.798	1,116.496	1,102.537	1,077.455
MgO in Conc	%	-	7.333	6.693	6.051	6.433	6.890	6.025	6.013	5.266	6.435	6.382	6.450	6.569
0.5% < Ascon <= 1.0%	Unit													
Tonnage	Ton	-	10,360,239	10,736,757	14,014,543	16,869,811	18,289,707	15,439,561	19,527,343	18,258,900	14,513,989	17,222,072	20,340,261	24,960,938
Cu	%	-	0.584	0.490	0.488	0.490	0.482	0.491	0.452	0.390	0.391	0.375	0.334	0.310
Ag	Gr/Tn	-	6.283	5.944	6.737	7.818	6.462	6.006	6.647	5.418	5.163	4.739	5.047	4.865
Mo	%	-	0.015	0.013	0.013	0.014	0.010	0.017	0.015	0.019	0.010	0.013	0.008	0.006
ORE CONTAMINANTS														
As	%	-	0.027	0.025	0.023	0.018	0.021	0.021	0.018	0.015	0.017	0.017	0.015	0.014
Zn	%	-	0.215	0.178	0.179	0.439	0.303	0.162	0.102	0.121	0.134	0.128	0.289	0.378
F	ppm	-	2,086.187	1,650.947	1,777.910	2,004.622	1,729.140	1,701.705	1,677.699	1,677.089	1,596.189	1,570.690	1,703.295	1,475.562
MgO	%	-	9.546	7.815	6.066	12.231	10.419	6.272	5.193	6.546	7.185	5.236	9.501	9.989
As in Conc	%	-	0.711	0.774	0.765	0.692	0.719	0.713	0.722	0.693	0.704	0.724	0.723	0.718
Zn in Conc	%	-	6.220	5.586	5.684	12.615	8.961	5.170	3.778	4.463	4.787	4.651	9.096	11.554
F in Conc	ppm	-	312.354	211.851	240.673	200.000	200.000	251.207	228.655	200.000	200.000	271.570	200.000	200.000
MgO in Conc	%	-	1.790	1.005	1.000	1.000	1.000	1.102	1.000	1.000	1.000	1.207	1.102	1.119
1.0% < Ascon <= 1.5%	Unit													
Tonnage	Ton	-	3,182,982	4,889,542	6,952,837	3,925,124	6,129,695	6,326,823	5,632,852	18,165,021	25,251,123	28,869,545	28,585,740	20,029,206
Cu	%	-	0.588	0.478	0.468	0.443	0.451	0.481	0.477	0.424	0.376	0.380	0.378	0.359
Ag	Gr/Tn	-	9.195	9.501	8.905	13.155	8.387	8.176	9.422	7.322	6.106	5.872	5.950	6.168
Mo	%	-	0.015	0.011	0.015	0.012	0.009	0.016	0.018	0.020	0.013	0.012	0.010	0.008
ORE CONTAMINANTS														
As	%	-	0.042	0.036	0.036	0.026	0.035	0.037	0.034	0.030	0.024	0.023	0.024	0.024
Zn	%	-	0.252	0.229	0.175	0.398	0.173	0.147	0.153	0.136	0.124	0.121	0.145	0.189
F	ppm	-	2,098.585	1,416.178	1,560.483	1,787.390	1,665.967	1,608.875	1,676.565	1,869.611	1,756.794	1,789.690	1,775.233	1,699.794
MgO	%	-	9.223	7.636	3.695	10.915	6.945	5.128	4.349	5.970	6.377	6.609	7.130	7.783
As in Conc	%	-	1.212	1.222	1.225	1.184	1.201	1.208	1.187	1.079	0.940	0.904	0.912	0.958
Zn in Conc	%	-	7.349	7.203	5.778	12.060	5.769	4.935	5.183	4.829	4.630	4.520	5.173	6.418
F in Conc	ppm	-	234.177	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000	207.044	200.000	200.000
MgO in Conc	%	-	1.309	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Ascon > 1.5%	Unit													
Tonnage	Ton	-	1,645,120	3,772,200	7,195,994	2,615,284	5,769,337	3,297,240	980,930	3,480,757	2,041,838	2,090,682	3,310,729	6,910,502
Cu	%	-	0.605	0.555	0.500	0.464	0.689	0.525	0.652	0.427	0.352	0.344	0.365	0.298
Ag	Gr/Tn	-	13.923	16.008	15.913	18.039	18.079	14.594	15.920	11.411	9.428	10.227	8.391	6.532
Mo	%	-	0.017	0.012	0.014	0.011	0.010	0.013	0.016	0.030	0.015	0.010	0.009	0.009
ORE CONTAMINANTS														
As	%	-	0.078	0.081	0.067	0.062	0.105	0.065	0.065	0.061	0.060	0.066	0.074	0.067
Zn	%	-	0.261	0.296	0.270	0.678	0.182	0.158	0.324	0.255	0.233	0.191	0.216	0.179
F	ppm	-	1,963.395	1,487.396	1,510.838	1,677.185	1,867.999	1,753.428	1,670.577	2,018.480	1,417.851	1,434.787	1,346.794	1,133.841
MgO	%	-	6.597	6.508	3.431	10.242	8.513	4.864	3.841	5.133	3.820	4.345	3.314	2.095
As in Conc	%	-	2.254	2.485	2.209	2.227	2.927	2.069	1.938	2.007	1.983	2.175	2.275	2.113
Zn in Conc	%	-	7.817	9.084	8.599	15.000	5.633	5.448	9.426	8.219	7.817	6.793	7.257	6.423
F in Conc	ppm	-	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000
MgO in Conc	%	-	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

TETRA TECH

Tabla 9-4: Plan de Producción LOM Toromocho, Continuación

ORE TO CRUSHER	Units	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
TONNAGE	Ton	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	62,220,000	62,050,000	62,050,000	62,050,000	54,869,718
Cu	%	0.306	0.313	0.328	0.346	0.391	0.375	0.404	0.443	0.375	0.366	0.351	0.374
Ag	g/t	4.793	5.082	5.579	5.601	5.940	5.469	5.165	4.921	4.273	3.950	4.321	5.833
Mo	%	0.006	0.006	0.006	0.008	0.012	0.016	0.020	0.022	0.015	0.019	0.023	0.022
ORE CONTAMINANTS													
As	%	0.020	0.020	0.019	0.019	0.017	0.014	0.010	0.013	0.015	0.016	0.011	0.012
Zn	%	0.221	0.209	0.223	0.228	0.267	0.165	0.148	0.141	0.105	0.081	0.085	0.100
F	ppm	1,479	1,488	1,479	1,516	1,488	1,509	1,769	2,133	1,759	1,704	1,618	1,619
MgO	%	8.614	8.652	8.975	9.013	9.007	8.034	8.244	8.666	6.803	5.340	4.483	4.825
As in Conc	%	0.866	0.869	0.867	0.842	0.730	0.659	0.513	0.526	0.650	0.681	0.597	0.645
Zn in Conc	%	7.408	7.072	7.420	7.472	8.352	5.688	5.087	4.748	4.017	3.399	3.596	3.974
F in Conc	ppm	200	205	200	200	200	202	230	229	240	269	272	275
MgO in Conc	%	1.207	1.244	1.207	1.111	1.002	1.025	1.108	1.018	1.006	1.083	1.125	1.179
ADITIONAL INFORMATION													
Hardness	ratio	2.66	2.66	2.62	2.62	2.63	2.63	2.65	2.58	2.65	2.72	2.85	2.79
Blastability Index	ratio	18.79	18.61	17.90	17.27	17.01	17.59	18.33	17.99	19.24	20.02	21.09	20.09
XRD TALC	%	2.28	2.19	2.20	2.42	3.01	2.01	2.11	3.15	2.28	1.84	1.17	0.98
Ratox	%	10.42	10.31	9.02	9.12	9.86	7.63	6.30	6.98	8.24	6.82	4.80	5.47
Fe	%	7.46	7.32	6.89	7.01	7.64	6.65	7.15	9.35	7.78	6.86	5.13	5.48
Recovery Cu	%	82.24	82.27	82.38	82.28	82.77	82.73	82.61	82.51	82.48	84.01	87.02	86.42
Recovery Ag	%	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00	72.00
Recovery Mo	%	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00	66.00
Cu Concentrate Tonnage	Ton	698,787	715,041	753,262	738,563	835,277	803,608	869,395	952,855	846,930	794,463	790,027	781,341
Cu in Concentrate	%	24	24	24	24	24	24	24	24	24	24	24	24
Ag in Conc	g/t	304	315	335	348	337	309	275	240	237	229	255	303
Mo in Conc	%	19	19	19	19	19	19	19	19	19	19	19	19
INP	$/ton	7.834	8.257	9.226	10.247	12.623	12.653	14.563	16.026	12.251	12.457	12.962	14.332
ALTERATION													
INTRUSIVE A	%	28%	27%	24%	28%	26%	29%	28%	29%	44%	56%	65%	58%
INTRUSIVE B	%	18%	18%	21%	21%	22%	20%	19%	12%	15%	14%	14%	14%
HORNFELS	%	17%	18%	19%	15%	7%	13%	10%	0%	5%	3%	2%	6%
SKARN ACTINOLITE TREMOLITE	%	21%	22%	19%	16%	11%	16%	23%	27%	17%	13%	7%	12%
SKARN SERPENTINE MAGNETITE	%	16%	15%	17%	22%	34%	23%	19%	31%	19%	12%	10%	9%
ANHYDRITE	%	0%	0%	0%	0%	0%	1%	0%	0%	1%	2%	1%	1%

QUALITIES

CIQ (<= 0.5% FIcon<1000)	Unit												
Tonnage	Ton	11,599,310	11,969,509	13,838,314	16,535,910	24,465,724	27,169,448	37,962,728	41,903,316	26,395,000	23,713,560	26,328,816	23,872,429
Cu	%	0.312	0.329	0.377	0.421	0.488	0.429	0.456	0.484	0.484	0.444	0.408	0.436
Ag	Gr/Tn	2.834	3.088	3.604	4.001	4.667	4.376	4.761	4.474	3.876	3.498	3.178	3.528
Mo	%	-	-	-	-	0.035	0.019	0.022	0.025	0.048	0.046	0.046	-
ORE CONTAMINANTS													
As	%	0.003	0.004	0.005	0.007	0.007	0.003	0.004	0.008	0.005	0.005	0.003	0.003
Zn	%	0.134	0.138	0.195	0.344	0.383	0.173	0.155	0.142	0.094	0.069	0.061	0.056
F	ppm	1,431.942	1,429.452	1,480.670	1,529.140	1,668.634	1,740.225	1,969.837	2,322.565	2,121.697	1,962.749	1,688.837	1,617.414
MgO	%	10.357	10.628	12.863	14.350	13.820	11.003	9.695	10.368	9.120	6.991	5.571	4.978
As in Conc	%	0.384	0.382	0.369	0.363	0.277	0.288	0.300	0.331	0.239	0.272	0.278	0.256
Zn in Conc	%	4.954	4.998	6.356	10.155	10.944	5.610	5.041	4.579	3.267	2.733	2.659	2.422
F in Conc	ppm	200.000	200.000	200.000	200.000	200.000	200.000	242.373	234.666	261.660	297.766	317.961	337.559
MgO in Conc	%	1.121	1.194	1.100	1.000	1.000	1.031	1.151	1.000	1.000	1.148	1.292	1.410
Ascon <= 0.5% FIcon >=1000	Unit												
Tonnage	Ton	6,838	6,268	3,925	2,638	24,824	131,963	309,050	392,312	69,310	105,056	13,440	2,143
Cu	%	0.300	0.300	0.300	0.300	0.615	0.526	0.482	0.631	0.645	0.686	2.014	0.300
Ag	Gr/Tn	1.845	1.845	1.845	1.845	4.264	3.896	3.487	3.782	3.983	3.627	5.159	1.845
Mo	%	-	-	-	-	0.035	0.019	0.022	0.025	0.048	0.046	0.046	-
ORE CONTAMINANTS													
As	%	0.005	0.005	0.005	0.005	-	0.002	0.000	0.001	0.012	0.013	0.019	0.005
Zn	%	0.170	0.170	0.170	0.170	0.070	0.053	0.035	0.053	0.067	0.067	0.142	0.170
F	ppm	3,681.225	3,681.225	3,681.225	3,681.225	2,220.835	3,840.854	5,129.593	5,499.513	5,607.021	5,011.229	2,580.461	3,681.225
MgO	%	16.331	16.331	16.331	16.331	5.901	9.571	7.962	7.859	7.146	6.958	10.450	16.331
As in Conc	%	0.366	0.366	0.366	0.366	0.100	0.108	0.117	0.100	0.200	0.154	0.100	0.366
Zn in Conc	%	5.890	5.890	5.890	5.890	2.116	1.999	1.690	1.572	1.903	1.720	0.500	5.890
F in Conc	ppm	1,017.963	1,017.963	1,017.963	1,017.963	1,007.516	1,096.365	1,061.268	1,091.554	1,078.604	1,084.063	1,076.387	1,017.963
MgO in Conc	%	6.851	6.851	6.851	6.851	6.643	6.187	4.096	3.837	3.728	4.284	5.790	6.851
0.5% < Ascon <= 1.0%	Unit												
Tonnage	Ton	26,680,371	26,269,438	27,051,542	26,551,025	23,277,972	25,593,882	18,737,311	14,339,567	20,987,922	25,833,328	26,902,241	19,318,729
Cu	%	0.267	0.272	0.295	0.308	0.327	0.302	0.316	0.362	0.283	0.303	0.302	0.296
Ag	Gr/Tn	4.014	4.090	4.492	5.142	5.439	5.169	5.561	5.403	3.590	3.519	4.247	4.919
Mo	%	0.005	0.005	0.006	0.008	0.014	0.014	0.016	0.020	0.013	0.014	0.021	0.022
ORE CONTAMINANTS													
As	%	0.012	0.012	0.013	0.013	0.013	0.010	0.010	0.013	0.014	0.014	0.012	0.011
Zn	%	0.252	0.180	0.209	0.196	0.216	0.175	0.144	0.142	0.094	0.077	0.087	0.099
F	ppm	1,372.318	1,375.109	1,402.091	1,481.219	1,396.094	1,314.300	1,360.243	1,711.151	1,443.665	1,502.287	1,529.426	1,550.616
MgO	%	8.453	8.237	8.796	8.153	7.144	6.823	6.594	5.786	4.917	4.137	3.395	4.159
As in Conc	%	0.702	0.704	0.723	0.719	0.716	0.674	0.656	0.673	0.713	0.699	0.688	0.695
Zn in Conc	%	8.330	6.420	7.102	6.763	7.216	6.218	5.372	5.108	4.054	3.514	3.845	4.209
F in Conc	ppm	200.000	211.336	200.000	200.000	200.000	200.000	200.000	200.000	237.061	269.866	250.481	243.316
MgO in Conc	%	1.427	1.487	1.423	1.259	1.000	1.000	1.000	1.000	1.010	1.049	1.000	1.000
1.0% < Ascon <= 1.5%	Unit												
Tonnage	Ton	17,837,547	18,232,386	15,146,528	13,784,739	9,319,301	4,843,947	3,547,099	3,322,187	10,698,640	8,406,641	7,342,419	8,886,811
Cu	%	0.359	0.358	0.346	0.324	0.303	0.323	0.280	0.300	0.320	0.344	0.326	0.367
Ag	Gr/Tn	6.226	6.433	6.827	6.852	7.668	6.866	6.050	6.659	5.503	5.299	6.447	8.715
Mo	%	0.006	0.006	0.007	0.010	0.014	0.016	0.017	0.017	0.009	0.013	0.018	0.018
ORE CONTAMINANTS													
As	%	0.025	0.025	0.026	0.026	0.028	0.030	0.028	0.029	0.026	0.030	0.026	0.024
Zn	%	0.245	0.288	0.250	0.186	0.147	0.106	0.100	0.142	0.159	0.135	0.144	0.184
F	ppm	1,724.511	1,717.458	1,650.759	1,617.131	1,308.515	1,160.959	1,427.587	1,498.361	1,627.257	1,637.060	1,673.477	1,777.594
MgO	%	9.633	9.589	8.108	6.458	4.334	2.429	2.937	3.358	6.597	5.844	4.995	6.474
As in Conc	%	0.964	0.992	1.043	1.085	1.209	1.187	1.163	1.178	1.041	1.082	1.079	1.042
Zn in Conc	%	7.908	9.079	8.139	6.536	5.636	4.421	4.394	5.440	5.761	4.998	5.382	6.430
F in Conc	ppm	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.092	200.000	200.000
MgO in Conc	%	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Ascon > 1.5%	Unit												
Tonnage	Ton	5,925,934	5,572,400	6,009,691	5,345,688	4,962,179	4,310,760	1,493,812	2,262,618	3,899,128	3,991,416	1,463,084	2,789,606
Cu	%	0.311	0.329	0.319	0.363	0.375	0.526	0.481	0.362	0.277	0.353	0.342	0.410
Ag	Gr/Tn	7.825	9.626	11.878	9.602	11.334	12.620	8.701	7.796	7.262	6.596	15.595	22.711
Mo	%	0.009	0.009	0.010	0.013	0.017	0.026	0.025	0.018	0.011	0.024	0.027	0.025
ORE CONTAMINANTS													
As	%	0.071	0.071	0.063	0.073	0.064	0.079	0.097	0.077	0.061	0.071	0.059	0.057
Zn	%	0.183	0.237	0.285	0.132	0.164	0.129	0.149	0.137	0.088	0.069	0.184	0.210
F	ppm	1,307.496	1,388.634	1,385.210	1,383.749	1,359.045	1,521.955	1,898.082	1,655.821	1,299.651	1,521.770	1,678.770	1,605.097
MgO	%	2.850	3.287	3.008	3.361	2.815	2.763	4.744	3.337	1.839	2.216	2.293	2.853
As in Conc	%	2.250	2.288	2.214	2.304	2.134	2.339	2.691	2.321	2.028	2.161	2.245	2.364
Zn in Conc	%	6.561	8.039	9.494	5.107	6.029	4.568	5.017	5.132	4.152	3.289	6.947	7.795
F in Conc	ppm	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000	212.744	200.000	200.000
MgO in Conc	%	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Tabla 9-5: Detalle Plan de Minado LOM Toromocho

Mine Plan		Total	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
From Mine to Crusher															
Tonnage	Ton	1,141,217,036	43,694,399.0	54,031,928.8	56,673,196.2	59,658,510.7	60,662,752.8	62,050,000.0	62,050,000.0	62,050,000.0	45,342,758.2	28,203,334.7	19,839,056.5	9,190,413.9	23,114,445.9
Cu	%	0.471	0.622	0.621	0.603	0.575	0.604	0.573	0.599	0.529	0.466	0.457	0.422	0.351	0.309
Ag	Gr/Tn	5.757	6.927	5.168	5.768	6.960	7.750	7.071	6.052	6.090	6.057	5.292	4.608	5.091	5.319
Mo	%	0.017	0.017	0.020	0.018	0.017	0.018	0.016	0.020	0.015	0.022	0.009	0.014	0.004	0.004
ORE CONTAMINANTS															
As	%	0.017	0.027	0.017	0.018	0.020	0.014	0.025	0.018	0.013	0.017	0.013	0.016	0.023	0.025
Zn	%	0.179	0.164	0.124	0.157	0.154	0.319	0.259	0.152	0.096	0.136	0.132	0.081	0.560	0.520
F	ppm	1,779.283	2,005.980	2,176.269	1,778.048	1,828.231	2,240.612	2,077.353	2,084.596	1,726.351	1,777.909	1,643.828	1,605.909	1,136.969	1,114.399
MgO	%	7.854	8.427	8.383	8.672	6.836	10.991	11.080	8.212	6.483	6.391	7.605	4.123	10.781	9.706
As in Conc	%	0.614	0.687	0.380	0.447	0.597	0.434	0.725	0.467	0.472	0.646	0.528	0.615	0.895	1.020
Zn in Conc	%	5.656	4.742	3.583	4.551	4.683	8.989	7.457	4.474	3.277	4.586	4.461	3.217	15.000	15.000
F in Conc	ppm	241.838	265.913	396.129	256.882	251.551	201.860	200.000	293.592	279.125	232.333	200.000	304.957	200.000	200.000
MgO in Conc	%	1.094	1.202	2.011	1.279	1.001	1.000	1.000	1.238	1.172	1.000	1.000	1.140	1.000	1.000
ADITIONAL INFORMATION															
Hardness	ratio	2.656	2.664	2.636	2.667	2.694	2.558	2.565	2.656	2.817	2.674	2.660	2.887	2.501	2.476
Blastability Index	ratio	18.631	18.417	18.166	19.591	19.977	17.566	17.991	18.773	21.355	18.042	18.502	21.947	17.286	16.521
XRD TALC	%	2.395	3.027	3.543	2.593	1.907	4.408	4.456	2.891	0.824	1.841	1.904	0.593	1.472	1.913
Ratox	%	7.226	9.347	8.896	8.855	7.148	6.347	8.041	6.867	5.076	4.702	6.252	6.416	11.529	10.679
Fe	%	7.768	8.517	7.794	9.369	9.505	9.051	10.915	9.437	6.135	8.311	9.033	4.797	6.695	7.537
Recovery Cu	%	82.347	79.056	82.211	81.136	83.239	81.577	77.979	82.900	86.923	85.076	82.432	86.697	77.614	76.941
Recovery Ag	%	71.836	67.708	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	18,413,413	894,662.200	1,148,826.4	1,155,653.7	1,189,698.7	1,244,666.5	1,154,511.4	1,284,093.7	1,188,936.6	749,351.1	442,927.0	302,576.5	104,360.1	228,641.8
Cu in Concentrate	%	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000
Ag in Conc	Gr/Tn	264.624	229.055	175.014	203.677	251.288	271.945	273.638	210.573	228.857	263.883	242.622	217.545	322.810	387.162
Mo in Conc	%	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000
INP	$/Tn	15.585	-	23.195	21.925	21.207	22.944	19.998	22.581	19.832	16.843	14.158	13.505	11.386	9.307
ALTERATION															
INTRUSIVE A	%	37%	31%	33%	37%	40%	18%	20%	38%	61%	52%	39%	66%	1%	6%
INTRUSIVE B	%	14%	6%	4%	6%	13%	7%	9%	9%	5%	10%	21%	22%	36%	32%
HORNFELS	%	8%	10%	14%	6%	5%	15%	10%	6%	4%	4%	1%	2%	14%	20%
SKARN ACTINOLITE TREMOLITE	%	19%	13%	33%	29%	25%	32%	32%	22%	16%	21%	15%	2%	7%	6%
SKARN SERPENTINE MAGNETITE	%	22%	23%	17%	22%	17%	29%	29%	25%	14%	13%	25%	9%	43%	37%
ANHYDRITE	%	1%	17%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
TOTAL ORE FROM STOCK															
Tonnage	Ton	375,451,395	1,308,035	285,481.2	1,905,855.8	2,391,494.3	1,557,059.2	-	-	-	16,877,241.8	33,846,665.3	42,210,943.5	52,859,586.1	39,105,554.1
Cu	%	0.343	0.571	0.420	0.420	0.420	0.375	-	-	-	0.417	0.393	0.386	0.369	0.345
Ag	Gr/Tn	4.949	6.558	6.210	6.210	6.210	4.535	-	-	-	6.328	5.575	5.614	4.927	4.636
Mo	%	0.017	0.010	0.010	0.010	0.010	0.010	-	-	-	0.012	0.012	0.011	0.044	0.040
ORE CONTAMINANTS															
As	%	0.019	0.08	0.030	0.030	0.030	0.015	-	-	-	0.025	0.021	0.021	0.020	0.019
Zn	%	0.153	0.12	0.100	0.100	0.100	0.108	-	-	-	0.144	0.143	0.142	0.150	0.156
F	ppm	1,669.420	1,228.24	2,083.700	2,083.700	2,083.700	2,306.592	-	-	-	1,850.281	1,784.365	1,770.075	1,793.348	1,722.549
MgO	%	8.015	8.07	6.240	6.240	6.240	10.698	-	-	-	7.400	7.528	7.500	7.846	8.080
As in Conc	%	0.818	-	1.014	1.014	1.014	0.644	-	-	-	0.917	0.819	0.828	0.822	0.813
Zn in Conc	%	5.464	-	3.823	3.823	3.823	4.102	-	-	-	5.007	5.024	5.043	5.320	5.539
F in Conc	ppm	204.369	-	275.509	275.509	275.509	234.445	-	-	-	206.738	210.592	206.352	208.923	206.836
MgO in Conc	%	1.040	-	1.000	1.000	1.000	1.094	-	-	-	1.005	1.015	1.000	1.017	1.038
ADITIONAL INFORMATION															
Hardness	ratio	2.727	2.82	2.769	2.120	1.602	2.444	-	-	-	2.849	2.783	2.790	2.729	2.714
Blastability Index	ratio	19.393	-	17.738	13.123	9.846	16.054	-	-	-	20.536	19.742	19.817	19.380	19.323
Tonnage	Ton	1,516,668,431	45,002,434	54,317,410.0	58,579,052.0	62,050,005.0	62,219,812.0	62,050,000.0	62,050,000.0	62,050,000.0	62,220,000.0	62,050,000.0	62,050,000.0	62,050,000.0	62,220,000.0
Cu	%	0.439	0.620	0.620	0.597	0.569	0.598	0.573	0.599	0.529	0.453	0.422	0.398	0.366	0.331
Ag	Gr/Tn	5.590	6.916	5.174	5.783	6.931	7.669	7.071	6.052	6.090	6.130	5.447	5.293	5.407	5.209
Mo	%	0.015	0.017	0.020	0.018	0.017	0.018	0.016	0.020	0.015	0.019	0.011	0.012	0.009	0.007
ORE CONTAMINANTS															
As	%	0.017	0.03	0.017	0.018	0.021	0.014	0.025	0.018	0.013	0.019	0.017	0.019	0.021	0.021
Zn	%	0.172	0.16	0.124	0.155	0.152	0.314	0.259	0.152	0.096	0.138	0.138	0.123	0.211	0.291
F	ppm	1,752.086	1,983.37	2,175.782	1,787.992	1,838.078	2,242.263	2,077.353	2,084.596	1,726.351	1,797.540	1,720.487	1,717.587	1,696.130	1,496.624
MgO	%	7.894	8.42	8.371	8.593	6.813	10.983	11.080	8.212	6.483	6.664	7.563	6.420	8.281	8.684
As in Conc	%	0.666	0.66	0.384	0.471	0.621	0.448	0.726	0.473	0.481	0.722	0.687	0.760	0.833	0.890
Zn in Conc	%	5.613	4.59	3.584	4.528	4.649	8.669	7.457	4.485	3.290	4.701	4.768	4.459	6.936	9.183
F in Conc	ppm	263.441	856.02	401.196	296.200	296.619	285.412	232.806	309.027	287.061	232.261	207.623	242.878	200.186	200.109
MgO in Conc	%	1.190	0.80	2.050	1.503	1.394	1.411	1.200	1.391	1.358	1.120	1.024	1.131	1.035	1.048
ADITIONAL INFORMATION															

CALIDAD

CIQ (<= 0.5% Flcon<1000)

ORE TO CRUSHER FROM STOCK # 1 (Baden) INP>1.62 and %Cu>=0.5	Unit		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Cu	%	0.343	0.571	0.42	0.42	0.42	0.37	-	-	-	0.42	0.39	0.39	0.37	0.34
Ag	Gr/Tn	4.949	6.558	6.21	6.21	6.21	4.54	-	-	-	6.33	5.58	5.61	4.93	4.64
Mo	%	0.017	0.010	0.01	0.01	0.01	0.01	-	-	-	0.01	0.01	0.01	0.04	0.04
ORE CONTAMINANTS															
As	%	0.019	0.082	0.03	0.03	0.03	0.01	-	-	-	0.03	0.02	0.02	0.02	0.02
Zn	%	0.153	0.118	0.10	0.10	0.10	0.11	-	-	-	0.14	0.14	0.14	0.15	0.16
F	ppm	1,669.420	1,228.240	2,083.70	2,083.70	2,083.70	2,306.59	-	-	-	1,850.28	1,784.36	1,770.07	1,793.35	1,722.55
MgO	%	8.015	8.073	6.24	6.24	6.24	10.70	-	-	-	7.40	7.53	7.50	7.85	8.08
As in Conc	%	0.818	-	1.014	1.01	1.01	0.64	-	-	-	0.92	0.82	0.83	0.82	0.81
Zn in Conc	%	5.464	-	3.823	3.82	3.82	4.10	-	-	-	5.01	5.02	5.04	5.32	5.54
F in Conc	ppm	204.369	-	275.509	275.51	275.51	234.44	-	-	-	206.74	210.59	206.35	208.92	206.84
MgO in Conc	%	1.040	-	1.000	1.00	1.00	1.09	-	-	-	1.00	1.02	1.00	1.02	1.04
ADITIONAL INFORMATION															
Hardness	ratio	2.727	2.824	2.769	2.120	1.602	2.444	-	-	-	2.849	2.783	2.790	2.729	2.714
Blastability Index	ratio	19.393	-	17.738	13.123	9.846	16.054	-	-	-	20.536	19.742	19.817	19.380	19.323
XRD TALC	%	2.274	3.300	1.430	1.430	1.430	3.874	-	-	-	2.353	2.200	2.189	2.304	2.323
Ratox	%	9.855	14.192	10.470	10.470	10.470	10.395	-	-	-	8.748	8.712	8.577	9.451	9.989
Fe	%	7.280	8.636	6.520	6.520	6.520	9.636	-	-	-	7.120	7.137	7.074	6.597	6.799
Recovery Cu	%	78.769	-	83.492	83.492	83.492	76.359	-	-	-	81.723	81.383	81.459	80.822	79.592
Recovery Ag	%	71.749	-	72.000	72.000	72.000	72.000	-	-	-	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	65.770	-	66.000	66.000	66.000	66.000	-	-	-	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	4,245,863	-	4,246.5	28,349.600	35,573.500	20,665.200	-	-	-	239,100.000	449,950.600	553,220.100	658,402.800	449,519.700
Cu in Concentrate	%	23.914	-	24.000	24.000	24.000	24.000	-	-	-	24.000	24.000	23.987	23.993	24.000
Ag in Conc	Gr/Tn	323.098	-	300.587	300.585	300.585	243.804	-	-	-	316.944	303.019	309.202	317.214	323.920
Mo in Conc	%	18.934	-	19.000	19.000	19.000	19.000	-	-	-	19.000	19.000	19.000	19.000	19.000
INP	$/Tn	10.069	-	14.0	14.0	14.0	12.0	-	-	-	14.3	13.1	12.9	11.8	10.3
ALTERATION															
INTRUSIVE A	%	48%	0%	0%	0%	0%	0%	0%	0%	0%	77%	72%	73%	57%	46%
INTRUSIVE B	%	14%	0%	100%	100%	100%	100%	0%	0%	0%	6%	7%	7%	17%	19%
HORNFELS	%	11%	0%	0%	0%	0%	0%	0%	0%	0%	6%	7%	7%	8%	11%
SKARN ACTINOLITE TREMOLITE	%	17%	0%	0%	0%	0%	0%	0%	0%	0%	5%	7%	5%	10%	16%
SKARN SERPENTINE MAGNETITE	%	9%	0%	0%	0%	0%	0%	0%	0%	0%	6%	7%	8%	8%	9%
ANHYDRITE	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
TOTAL ORE TO STOCK															
Tonnage	Ton	292,550,493	**63,963,711.2**	**42,624,205.9**	**41,134,972.3**	**47,076,875.0**	**25,428,444.4**	**19,871,137.8**	**42,649,611.8**	**9,801,534.3**	**-**	**-**	**-**	**-**	**-**
Cu	%	0.312	0.360	0.328	0.283	0.275	0.295	0.294	0.324	0.254	-	-	-	-	-
Ag	Gr/Tn	4.549	4.970	4.199	4.050	5.255	5.169	3.972	4.146	3.347	-	-	-	-	-
Mo	%	0.008	0.010	0.007	0.009	0.005	0.006	0.008	0.007	0.005	-	-	-	-	-
ORE CONTAMINANTS															
As	%	0.013		0.02	0.02	0.02	0.01	0.02	0.01	0.01	-	-	-	-	-
Zn	%	0.116		0.14	0.12	0.17	0.26	0.12	0.12	0.07	-	-	-	-	-
F	ppm	1,148.831		1,762.80	1,280.49	1,383.35	1,461.48	1,438.74	1,451.22	1,582.43	-	-	-	-	-
MgO	%	5.814		8.60	6.13	7.14	9.70	7.71	6.83	5.62	-	-	-	-	-
As in Conc	%	0.630		0.80	0.93	0.86	0.79	0.84	0.68	0.59	-	-	-	-	-
Zn in Conc	%	4.284		5.10	4.70	6.26	8.60	4.70	4.72	3.49	-	-	-	-	-
F in Conc	ppm	169.706		272.39	200.47	200.29	200.05	200.00	207.48	250.15	-	-	-	-	-
MgO in Conc	%	0.952		1.63	1.00	1.23	1.44	1.00	1.01	1.01	-	-	-	-	-
ADITIONAL INFORMATION															
Hardness	ratio	2.143		2.707	2.703	2.683	2.696	2.788	2.846	2.925	-	-	-	-	-
Blastability Index	ratio	15.606		19.688	19.714	18.891	18.851	20.934	21.342	22.490	-	-	-	-	-
XRD TALC	%	1.499		2.586	1.277	1.611	3.168	2.254	1.559	0.810	-	-	-	-	-
Ratox	%	6.981		8.658	11.144	8.459	9.468	8.894	7.377	8.621	-	-	-	-	-
Fe	%	5.304		7.260	6.393	6.501	6.501	7.265	7.163	5.924	-	-	-	-	-
Recovery Cu	%	63.308		80.214	81.063	80.939	78.400	80.497	83.103	83.593	-	-	-	-	-
Recovery Ag	%	56.258		72.000	72.000	72.000	72.000	72.000	72.000	72.000	-	-	-	-	-
Recovery Mo	%	51.570		66.000	66.000	66.000	66.000	66.000	66.000	66.000	-	-	-	-	-
Cu Concentrate Tonnage	Ton	1,571,185		287,816	259,986	292,061	144,607	139,750	351,013	95,953	-	-	-	-	-
Cu in Concentrate	%	16.429		21.216	21.071	21.075	21.351	20.850	20.837	20.104	-	-	-	-	-
Ag in Conc	Gr/Tn	220.416		245.494	268.942	359.843	347.167	253.276	232.455	228.614	-	-	-	-	-
Mo in Conc	%	14.846		19.000	19.000	19.000	19.000	19.000	19.000	19.000	-	-	-	-	-
ALTERATION															
INTRUSIVE A	%	33%		38%	37%	28%	28%	51%	61%	73%	0%	0%	0%	0%	0%
INTRUSIVE B	%	13%		13%	31%	24%	12%	10%	6%	6%	0%	0%	0%	0%	0%
HORNFELS	%	15%		24%	11%	24%	35%	10%	11%	6%	0%	0%	0%	0%	0%
SKARN ACTINOLITE TREMOLITE	%	6%		10%	5%	14%	6%	6%	6%	4%	0%	0%	0%	0%	0%
SKARN SERPENTINE MAGNETITE	%	12%		15%	15%	10%	19%	22%	16%	11%	0%	0%	0%	0%	0%
ANHYDRITE	%	0%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
REHANDLE FROM STOCK TO ORE (5% from direct ore min	Ton	55,652,195	-	2,715,870.5	2,928,952.6	3,102,500.3	3,110,990.6	3,102,500.0	3,102,500.0	3,102,500.0	2,267,137.9	1,410,166.7	998,606.8	713,981.4	1,330,651.0
REHANDLE WASTE (Copaycocha)	Ton	19,326,349		46,925	1,150,313	-	4,806	-	-	-	-	-	1,397,682	3,878,613	7,453,328
REHANDLE WASTE (Buenaventura)	Ton	2,790,970		439,131	316,035	-	-	-	-	-	-	311,308	1,724,496	-	-
DIRECT WASTE	Ton	802,006,554		28,024,653	24,242,022	17,768,788	38,588,157	41,745,972	25,883,781	58,559,316	68,572,835	67,927,772	65,255,042	58,885,418	46,434,950
TOTAL WASTE															
Tonnage	**Ton**	**844,681,940**	20,558,066	28,510,709	25,708,371	17,768,788	38,592,963	41,745,972	25,883,781	58,559,316	68,572,835	68,239,079	68,377,221	62,764,032	53,888,278
TOTAL PRODUCTION															
Tonnage	**Ton**	**2,361,350,371**	65,560,500	82,828,119	84,287,423	79,818,793	100,812,775	103,795,972	87,933,781	120,609,316	130,792,835	130,289,079	130,427,221	124,814,032	116,108,278
TOTAL MINED PER MONTH															
Tonnage	**Ton**	**2,278,449,468**	128,216,176	125,166,844	123,516,539	124,504,174	124,684,160	123,667,110	130,583,393	130,410,850	113,915,593	96,442,414	88,216,277	71,954,446	77,002,724
TOTAL MOVED PER MONTH															
Tonnage	**Ton**	**2,709,553,058**	129,524,211	128,168,195	128,351,348	129,998,168	129,352,210	126,769,610	133,685,893	133,513,350	133,059,973	131,699,246	131,425,827	125,528,013	117,438,929
S.R.		**0.47**	0.30	0.29	0.26	0.16	0.44	0.51	0.25	0.82	1.10	1.10	1.10	1.01	0.87

Tabla 9-6: Detalle Plan de Minado LOM Toromocho (Continuación)

Mine Plan		Total	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
From Mine to Crusher														
Tonnage	Ton	1,141,217,036	15,667,447.6	19,741,798.3	35,601,619.4	44,443,197.0	61,760,395.8	62,050,000.0	62,050,000.0	62,220,000.0	44,321,767.5	51,413,060.5	54,958,707.0	40,428,246.2
Cu	%	0.471	0.306	0.331	0.345	0.363	0.391	0.375	0.404	0.443	0.403	0.379	0.357	0.399
Ag	Gr/Tn	5.757	5.337	6.117	6.309	6.003	5.949	5.469	5.165	4.921	4.143	3.817	4.286	6.275
Mo	%	0.017	0.006	0.005	0.007	0.009	0.012	0.016	0.020	0.022	0.019	0.022	0.025	0.028
ORE CONTAMINANTS														
As	%	0.017	0.025	0.024	0.021	0.020	0.017	0.014	0.010	0.013	0.014	0.016	0.010	0.010
Zn	%	0.179	0.399	0.312	0.269	0.255	0.268	0.165	0.148	0.141	0.083	0.065	0.076	0.078
F	ppm	1,779.283	1,261.925	1,360.861	1,429.622	1,504.076	1,483.588	1,508.626	1,768.770	2,133.433	1,845.057	1,736.540	1,627.255	1,645.811
MgO	%	7.854	9.442	9.341	9.456	9.287	8.993	8.034	8.244	8.666	6.194	4.722	3.987	3.573
As in Conc	%	0.614	1.034	0.997	0.909	0.854	0.731	0.660	0.514	0.525	0.587	0.655	0.569	0.587
Zn in Conc	%	5.656	12.151	9.792	8.622	8.139	8.371	5.688	5.086	4.748	3.303	2.902	3.311	3.320
F in Conc	ppm	241.838	200.000	200.000	200.000	200.000	200.000	200.000	214.218	211.309	247.356	287.166	268.905	240.527
MgO in Conc	%	1.094	1.000	1.000	1.000	1.000	1.000	1.000	1.002	1.000	1.000	1.000	1.000	1.000
ADITIONAL INFORMATION														
Hardness	ratio	2.656	2.508	2.535	2.542	2.575	2.628	2.632	2.651	2.585	2.630	2.719	2.867	2.823
Blastability Index	ratio	18.631	16.708	16.717	16.692	16.373	17.022	17.589	18.332	17.992	19.128	20.122	21.288	20.286
XRD TALC	%	2.395	2.293	1.999	2.150	2.485	3.001	2.015	2.105	3.147	2.283	1.753	1.029	0.516
Ratox	%	7.226	10.150	9.912	7.933	8.568	9.860	7.625	6.297	6.984	7.337	6.061	4.067	3.675
Fe	%	7.768	6.994	6.608	6.320	6.741	7.623	6.651	7.154	9.351	7.826	6.689	4.803	4.698
Recovery Cu	%	82.347	77.853	78.601	80.546	80.260	79.302	81.880	82.345	80.015	83.037	85.456	88.250	89.052
Recovery Ag	%	71.836	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000	72.000
Recovery Mo	%	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	18,413,413	155,743.8	213,748.8	412,639.5	539,014.0	798,002.3	794,887.4	860,817.8	918,512.4	617,871.9	693,615.9	721,437.1	598,216.4
Cu in Concentrate	%	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000
Ag in Conc	Gr/Tn	264.624	386.556	406.754	391.929	356.350	331.520	307.393	268.045	240.019	213.998	203.687	235.065	305.326
Mo in Conc	%	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000
INP	$/Tn	15.585	7.834	8.257	9.226	10.247	12.623	12.653	14.563	16.026	12.251	12.457	12.962	14.332
ALTERATION														
INTRUSIVE A	%	37%	8%	11%	17%	25%	26%	29%	28%	29%	47%	60%	69%	67%
INTRUSIVE B	%	14%	30%	27%	26%	24%	22%	20%	19%	12%	15%	15%	14%	14%
HORNFELS	%	8%	23%	25%	22%	15%	7%	13%	10%	0%	0%	1%	1%	3%
SKARN ACTINOLITE TREMOLITE	%	19%	8%	14%	14%	11%	11%	16%	23%	27%	14%	10%	5%	7%
SKARN SERPENTINE MAGNETITE	%	22%	31%	24%	21%	26%	34%	23%	19%	31%	23%	12%	10%	9%
ANHYDRITE	%	1%	0%	0%	0%	0%	0%	0%	0%	0%	1%	3%	1%	1%
TOTAL ORE FROM STOCK														
Tonnage	Ton	375,451,395	46,382,552.4	42,308,201.7	26,448,380.6	17,776,803.0	289,604.2	-	-	-	17,728,232.5	10,636,939.5	7,091,293.0	14,441,472.0
Cu	%	0.343	0.306	0.305	0.305	0.305	0.360	-	-	-	0.305	0.305	0.305	0.305
Ag	Gr/Tn	4.949	4.569	4.590	4.596	4.596	3.990	-	-	-	4.596	4.596	4.596	4.596
Mo	%	0.017	0.008	0.006	0.006	0.006	0.010	-	-	-	0.006	0.006	0.006	0.006
ORE CONTAMINANTS														
As	%	0.019	0.017	0.017	0.017	0.017	0.010	-	-	-	0.017	0.017	0.017	0.017
Zn	%	0.153	0.161	0.161	0.161	0.161	0.110	-	-	-	0.161	0.161	0.161	0.161
F	ppm	1,669.420	1,552.021	1,546.787	1,545.056	1,545.056	2,379.160	-	-	-	1,545.056	1,545.056	1,545.056	1,545.056
MgO	%	8.015	8.335	8.330	8.328	8.328	12.150	-	-	-	8.328	8.328	8.328	8.328
As in Conc	%	0.818	0.809	0.809	0.809	0.809	0.523	-	-	-	0.809	0.809	0.809	0.809
Zn in Conc	%	5.464	5.806	5.803	5.803	5.803	4.193	-	-	-	5.803	5.803	5.803	5.803
F in Conc	ppm	204.369	200.302	200.071	200.000	200.000	221.075	-	-	-	200.000	200.000	200.000	200.000
MgO in Conc	%	1.040	1.073	1.073	1.073	1.073	1.125	-	-	-	1.073	1.073	1.073	1.073
ADITIONAL INFORMATION														
Hardness	ratio	2.727	2.714	2.713	2.717	2.717	2.371	-	-	-	2.717	2.717	2.717	2.717
Blastability Index	ratio	19.393	19.499	19.500	19.525	19.525	14.411	-	-	-	19.525	19.525	19.525	19.525
Tonnage	Ton	1,516,668,431	62,050,000.0	62,050,000.0	62,050,000.0	62,220,000.0	62,050,000.0	62,050,000.0	62,050,000.0	62,220,000.0	62,050,000.0	62,050,000.0	62,050,000.0	54,869,718.1
Cu	%	0.439	0.306	0.313	0.328	0.346	0.391	0.375	0.404	0.443	0.375	0.366	0.351	0.374
Ag	Gr/Tn	5.590	4.793	5.082	5.579	5.601	5.940	5.469	5.165	4.921	4.273	3.950	4.321	5.833
Mo	%	0.015	0.006	0.006	0.006	0.008	0.012	0.016	0.020	0.022	0.015	0.019	0.023	0.022
ORE CONTAMINANTS														
As	%	0.017	0.020	0.020	0.019	0.019	0.017	0.014	0.010	0.013	0.015	0.016	0.011	0.012
Zn	%	0.172	0.221	0.209	0.223	0.228	0.267	0.165	0.148	0.141	0.105	0.081	0.085	0.100
F	ppm	1,752.086	1,478.773	1,487.633	1,478.825	1,515.785	1,487.768	1,508.626	1,768.770	2,133.433	1,759.344	1,703.715	1,617.861	1,619.293
MgO	%	7.894	8.614	8.652	8.975	9.013	9.007	8.034	8.244	8.666	6.803	5.340	4.483	4.825
As in Conc	%	0.666	0.866	0.869	0.867	0.842	0.730	0.659	0.513	0.526	0.650	0.681	0.597	0.645
Zn in Conc	%	5.613	7.408	7.072	7.420	7.472	8.352	5.688	5.087	4.748	4.017	3.399	3.596	3.974
F in Conc	ppm	263.441	200.090	204.882	200.052	200.035	200.323	201.906	230.214	228.968	239.746	268.779	272.129	275.131
MgO in Conc	%	1.190	1.207	1.244	1.207	1.111	1.002	1.025	1.108	1.018	1.006	1.083	1.125	1.179
ADITIONAL INFORMATION														

CALIDAD

CIQ (<= 0.5% Flcon<1000)	Unit													
ORE TO CRUSHER FROM STOCK # 1 (Baden) INP>1.62 and %Cu>=0.5			2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Cu	%	0.343	0.31	0.31	0.30	0.30	0.36	-	-	-	0.30	0.30	0.30	0.30
Ag	Gr/Tn	4.949	4.57	4.59	4.60	4.60	3.99	-	-	-	4.60	4.60	4.60	4.60
Mo	%	0.017	0.01	0.01	0.01	0.01	0.01	-	-	-	0.01	0.01	0.01	0.01
ORE CONTAMINANTS														
As	%	0.019	0.02	0.02	0.02	0.02	0.01	-	-	-	0.02	0.02	0.02	0.02
Zn	%	0.153	0.16	0.16	0.16	0.16	0.11	-	-	-	0.16	0.16	0.16	0.16
F	ppm	1,669.420	1,552.02	1,546.79	1,545.06	1,545.06	2,379.16	-	-	-	1,545.06	1,545.06	1,545.06	1,545.06
MgO	%	8.015	8.33	8.33	8.33	8.33	12.15	-	-	-	8.33	8.33	8.33	8.33
As in Conc	%	0.818	0.81	0.81	0.81	0.81	0.52	-	-	-	0.81	0.81	0.81	0.81
Zn in Conc	%	5.464	5.81	5.80	5.80	5.80	4.19	-	-	-	5.80	5.80	5.80	5.80
F in Conc	ppm	204.369	200.30	200.07	200.00	200.00	221.08	-	-	-	200.00	200.00	200.00	200.00
MgO in Conc	%	1.040	1.07	1.07	1.07	1.07	1.13	-	-	-	1.07	1.07	1.07	1.07
ADITIONAL INFORMATION														
Hardness	ratio	2.727	2.714	2.713	2.717	2.717	2.371	-	-	-	2.717	2.717	2.717	2.717
Blastability Index	ratio	19.393	19.499	19.500	19.525	19.525	14.411	-	-	-	19.525	19.525	19.525	19.525
XRD TALC	%	2.274	2.282	2.277	2.275	2.275	4.670	-	-	-	2.275	2.275	2.275	2.275
Ratox	%	9.855	10.512	10.498	10.494	10.494	10.370	-	-	-	10.494	10.494	10.494	10.494
Fe	%	7.280	7.618	7.658	7.668	7.668	10.650	-	-	-	7.668	7.668	7.668	7.668
Recovery Cu	%	78.769	77.130	77.093	77.085	77.085	72.405	-	-	-	77.085	77.085	77.085	77.085
Recovery Ag	%	71.749	72.000	72.000	72.000	72.000	72.000	-	-	-	72.000	72.000	72.000	72.000
Recovery Mo	%	65.770	66.000	66.000	66.000	66.000	66.000	-	-	-	66.000	66.000	66.000	66.000
Cu Concentrate Tonnage	Ton	4,245,863	458,376.800	417,219.300	260,638.400	175,183.400	3,692.500	-	-	-	174,704.800	104,822.900	69,881.900	142,315.000
Cu in Concentrate	%	23.914	24.000	24.000	24.000	24.000	24.000	-	-	-	24.000	24.000	24.000	24.000
Ag in Conc	Gr/Tn	323.098	335.831	335.801	335.830	335.830	225.315	-	-	-	335.830	335.830	335.830	335.830
Mo in Conc	%	18.934	19.000	19.000	19.000	19.000	19.000	-	-	-	19.000	19.000	19.000	19.000
INP	$/Tn	10.069	7.9	7.9	7.9	7.9	11.3	-	-	-	7.9	7.9	7.9	7.9
ALTERATION														
INTRUSIVE A	%	48%	34%	34%	34%	34%	0%	0%	0%	0%	34%	34%	34%	34%
INTRUSIVE B	%	14%	14%	13%	13%	13%	100%	0%	0%	0%	13%	13%	13%	13%
HORNFELS	%	11%	15%	15%	15%	15%	0%	0%	0%	0%	15%	15%	15%	15%
SKARN ACTINOLITE TREMOLITE	%	17%	26%	26%	26%	26%	0%	0%	0%	0%	26%	26%	26%	26%
SKARN SERPENTINE MAGNETITE	%	9%	11%	11%	11%	11%	0%	0%	0%	0%	11%	11%	11%	11%
ANHYDRITE	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
TOTAL ORE TO STOCK														
Tonnage	Ton	292,550,493	-	-	-	-	-	-	-	-	-	-	-	-
Cu	%	0.312	-	-	-	-	-	-	-	-	-	-	-	-
Ag	Gr/Tn	4.549	-	-	-	-	-	-	-	-	-	-	-	-
Mo	%	0.008	-	-	-	-	-	-	-	-	-	-	-	-
ORE CONTAMINANTS														
As	%	0.013	-	-	-	-	-	-	-	-	-	-	-	-
Zn	%	0.116	-	-	-	-	-	-	-	-	-	-	-	-
F	ppm	1,148.831	-	-	-	-	-	-	-	-	-	-	-	-
MgO	%	5.814	-	-	-	-	-	-	-	-	-	-	-	-
As in Conc	%	0.630	-	-	-	-	-	-	-	-	-	-	-	-
Zn in Conc	%	4.284	-	-	-	-	-	-	-	-	-	-	-	-
F in Conc	ppm	169.706	-	-	-	-	-	-	-	-	-	-	-	-
MgO in Conc	%	0.952	-	-	-	-	-	-	-	-	-	-	-	-
ADITIONAL INFORMATION														
Hardness	ratio	2.143	-	-	-	-	-	-	-	-	-	-	-	-
Blastability Index	ratio	15.606	-	-	-	-	-	-	-	-	-	-	-	-
XRD TALC	%	1.499	-	-	-	-	-	-	-	-	-	-	-	-
Ratox	%	6.981	-	-	-	-	-	-	-	-	-	-	-	-
Fe	%	5.304	-	-	-	-	-	-	-	-	-	-	-	-
Recovery Cu	%	63.308	-	-	-	-	-	-	-	-	-	-	-	-
Recovery Ag	%	56.258	-	-	-	-	-	-	-	-	-	-	-	-
Recovery Mo	%	51.570	-	-	-	-	-	-	-	-	-	-	-	-
Cu Concentrate Tonnage	Ton	1,571,185	-	-	-	-	-	-	-	-	-	-	-	-
Cu in Concentrate	%	16.429	-	-	-	-	-	-	-	-	-	-	-	-
Ag in Conc	Gr/Tn	220.416	-	-	-	-	-	-	-	-	-	-	-	-
Mo in Conc	%	14.846	-	-	-	-	-	-	-	-	-	-	-	-
ALTERATION														
INTRUSIVE A	%	33%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
INTRUSIVE B	%	13%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
HORNFELS	%	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
SKARN ACTINOLITE TREMOLITE	%	6%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
SKARN SERPENTINE MAGNETITE	%	12%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ANHYDRITE	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
REHANDLE FROM STOCK TO ORE (5% from direct ore min	Ton	55,652,195	798,387.9	990,619.8	1,780,081.0	2,222,159.9	3,102,500.0	3,102,500.0	3,102,500.0	3,111,000.0	2,216,088.4	2,570,653.0	2,747,935.4	2,021,412.3
REHANDLE WASTE (Copaycocha)	Ton	19,326,349	1,102,405	2,572,821	-	-	1,202,469	516,986	-	-	-	-	-	-
REHANDLE WASTE (Buenaventura)	Ton	2,790,970	-	-	-	-	-	-	-	-	-	-	-	-
DIRECT WASTE	Ton	802,006,554	21,359,045	19,016,733	23,528,563	16,135,151	22,325,674	21,840,348	20,516,773	20,418,769	20,878,365	21,929,296	22,316,403	29,852,728
TOTAL WASTE														
Tonnage	Ton	**844,681,940**	22,461,450	21,589,554	23,528,563	16,135,151	23,528,143	22,357,333	20,516,773	20,418,769	20,878,365	21,929,296	22,316,403	29,852,728
TOTAL PRODUCTION														
Tonnage	Ton	**2,361,350,371**	84,511,450	83,639,554	85,578,563	78,355,151	85,578,143	84,407,333	82,566,773	82,638,769	82,928,365	83,979,296	84,366,403	84,722,446
TOTAL MINED PER MONTH														
Tonnage	Ton	**2,278,449,468**	38,128,897	41,331,353	59,130,182	60,578,348	85,288,539	84,407,333	82,566,773	82,638,769	65,200,132	73,342,356	77,275,110	70,280,974
TOTAL MOVED PER MONTH														
Tonnage	Ton	**2,709,553,058**	85,309,838	84,630,174	87,358,644	80,577,311	88,680,643	87,509,833	85,669,273	85,749,769	85,144,453	86,549,949	87,114,338	86,743,859
S.R.		**0.47**	0.36	0.35	0.38	0.26	0.38	0.36	0.33	0.33	0.34	0.35	0.36	0.54

10 ESTIMACIÓN DE RESERVAS

La estimación de las Reservas Minerales se basa en el plan minero a largo plazo y a nivel operacional fase-banco, mediante el empleo del software *Minesight y SP2* elaborado por MCP, lo que implica que existe un proceso de optimización previo al desarrollo del plan, a través de una planificación operativa minera con ley de corte variable y plan minero 2020. El nivel de Reservas Minerales Probadas más Probables, al 31 de diciembre de 2019, alcanza los 1,516.7 Mt, con ley de 0.439% TCu, 0.015% Mo y 5.59 g/t de Ag. El detalle por Categoría se presenta en la Tabla 10-1.

Tabla 10-1: Declaración de Reservas Minerales

Declaración de Reservas Mineras - 31/Dic/2019
Minera Chinalco Perú - Mina Toromocho
Topografía de 31 Dic. 2019

	Tonelaje	Grado			Metal Contenido		
	ktms	TCu (%)	Mo (%)	Ag (g/t)	Cu (Mlb)	Mo (Mlb)	Ag (koz)
In Pit Sulfuros							
Probado	479,548	0.503	0.016	5.32	5,321	170	81,984
Probable	969,741	0.405	0.015	5.62	8,666	312	175,150
Reserva In Pit Sulfuros	1,449,289	0.438	0.015	5.52	13,987	483	257,134
Stock de Sulfuros (Inicial)							
Probado	67,380	0.463	0.010	7.09	688	15	15,359
Probable							
Reserva Stock de Sulfuros	67,380	0.463	0.010	7.09	688	15	15,359
Reservas de Sulfuro							
Probado	546,928	0.498	0.015	5.54	6,009	186	97,344
Probable	969,741	0.405	0.015	5.62	8,666	312	175,150
Total Reserva de Sulfuros	**1,516,668**	**0.439**	**0.015**	**5.59**	**14,675**	**498**	**272,493**

Nota:

1.- Incorpora reservas plan minero 2020 realizado por MCP

2.- La ley de corte para los minerales alimentados directamente desde la mina es de Income Net of Process (INP)> 1.62 US$/t

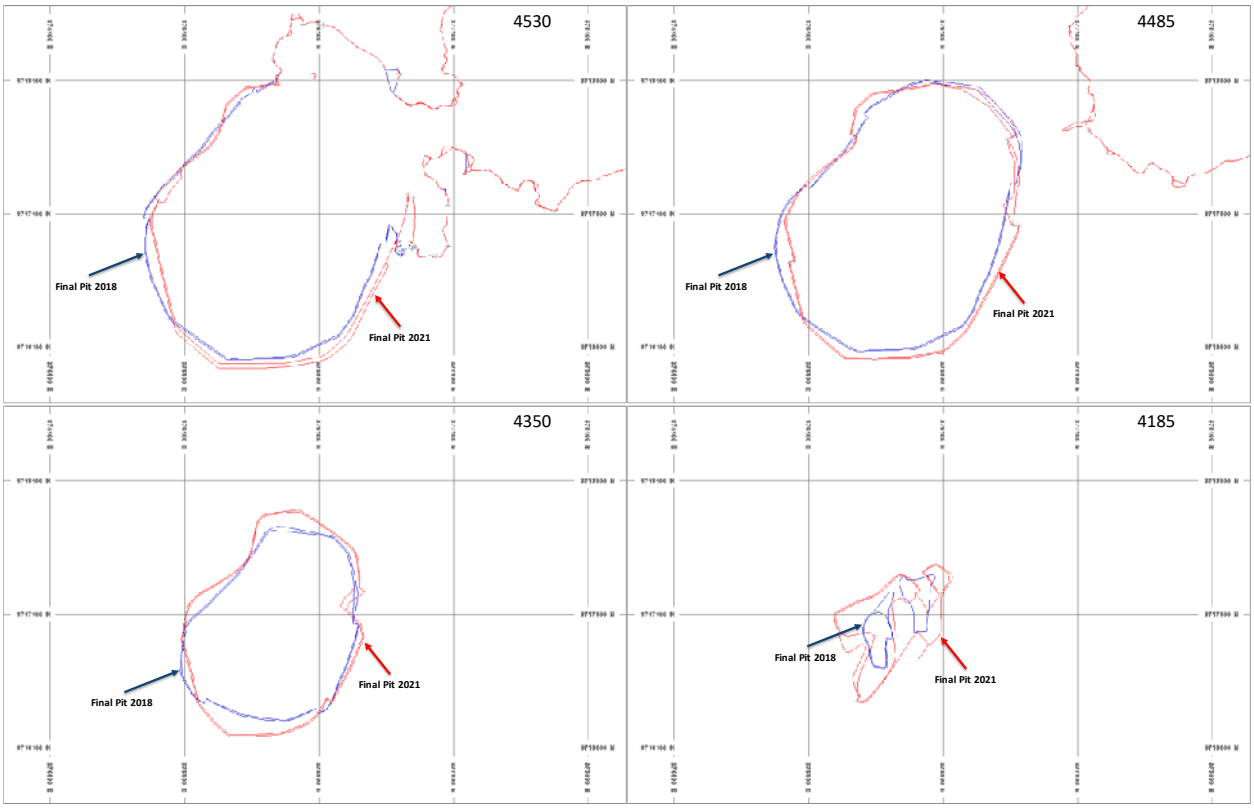
3.- La ley de corte para los minerales enviados a Stock es de Income Net of Process (INP)> 2.32 US$/t

4.- Los minerales con alto contenido de Arsénico están considerados como reservas minerales.

5.- El stock inicial no considera los stocks inpit ya que están informados en las fases.

Las diferencias volumétricas entre el pit final de la evaluación actual versus la declaración de reservas del año 2018, se puede apreciar en las siguientes vistas en planta de algunas elevaciones representativas. Donde el color rojo representa la geometría del pit, mientras que las líneas azules corresponden al pit final de la ingeniería del 2018.

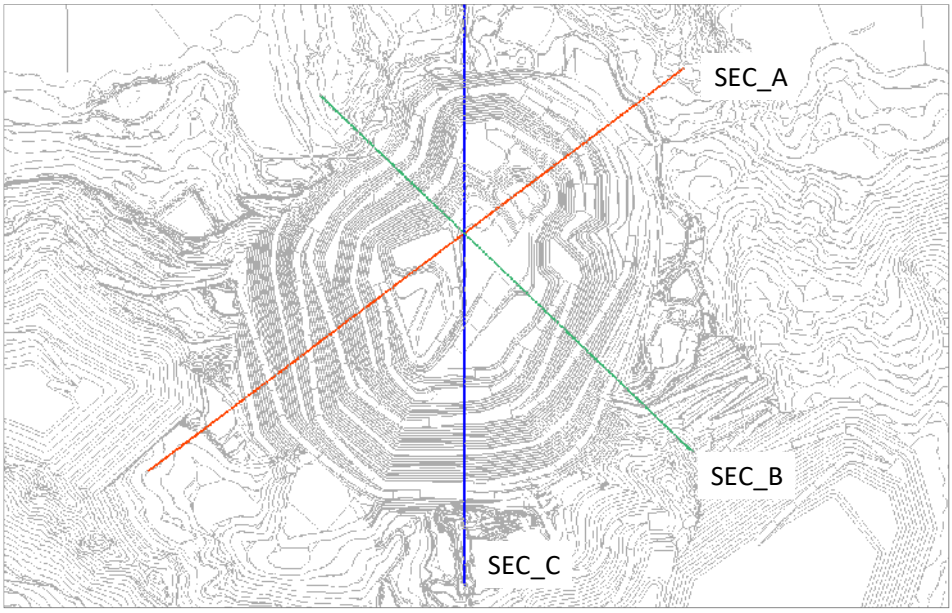
Figura 10-1: Vista en Planta Comparación de Pit Final



Las diferencias volumétricas de la comparación anterior en las vistas planimétricas muestras el mayor tamaño del pit actual, con las orientaciones tomadas en base de la actual valorización de bloques del nuevo modelo geológico.

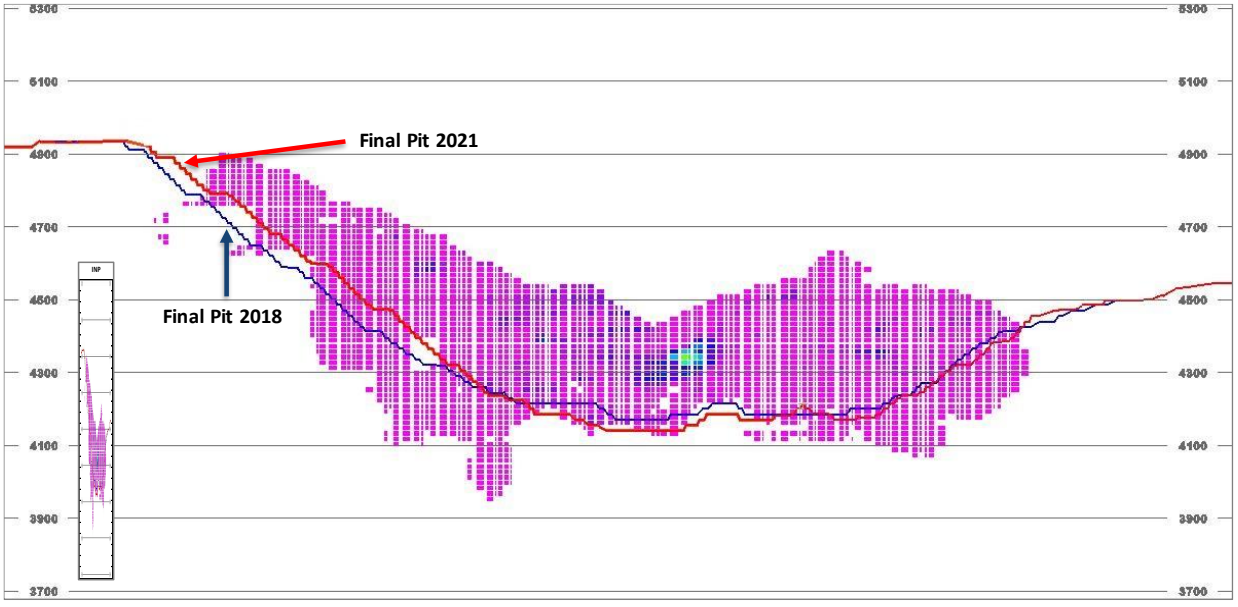
La **Figura 10-2**, muestra la orientación de 3 secciones verticales, realizadas para comparar los pit finales de la ingeniería actual versus la del 2018.

Figura 10-2: Definición de Secciones



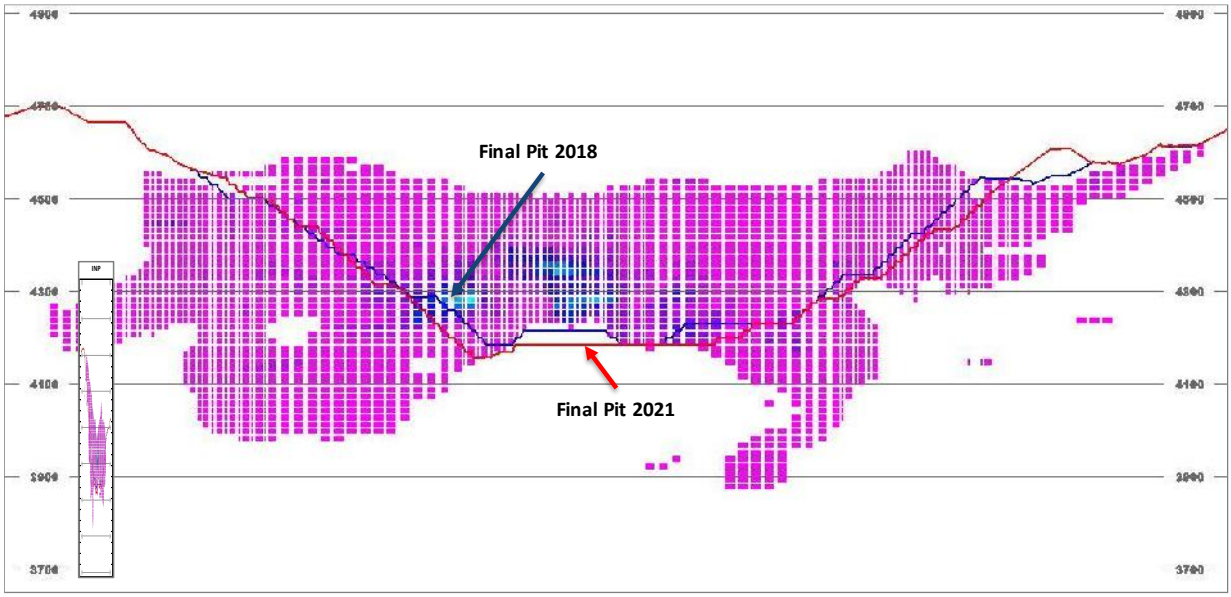
La sección A de la Figura 10-3, muestra que el pit actual deja mineral en el sector sureste principalmente por el límite de minado y por el cambio en los ángulos de diseño del sector, gana mineral de fondo y hacia la orientación noreste.

Figura 10-3: Sección A



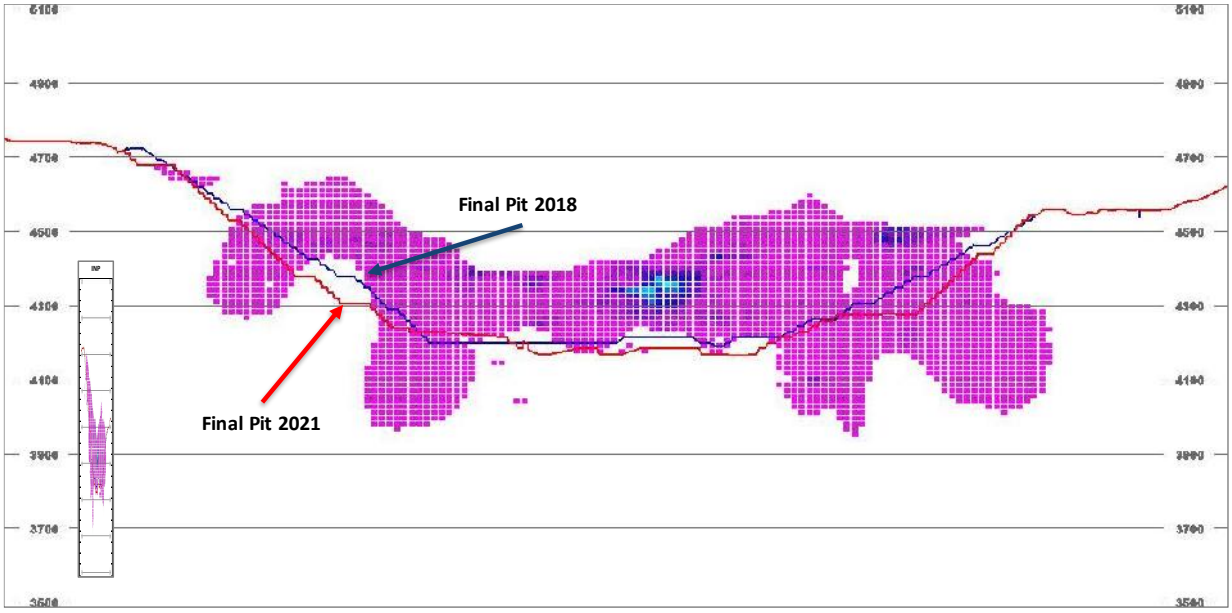
La sección B, indicada en la Figura 10-4, mantiene la geometría hacia el sector noroeste de la mina, aportando mineral en el fondo y en dirección sureste.

Figura 10-4: Sección B



La sección C señalada en la **Figura 10-5**, es de dirección norte sur, mostrando que el pit final aporta mineral en la zona norte por los cambios de ángulos de ese sector y tiene aporte en la zona Sur.

Figura 10-5: Sección C



11 DETERMINACIÓN DE CAPEX-OPEX

Para la estimación de los gastos de capital y costo de operación en la presente ingeniería, se recopila la información disponible en el actual plan minero, tanto en los parámetros de rendimiento, como de disponibilidades y otros KPIs, generados durante la presente revisión.

Se revisa la estructura de gastos y costos del actual plan de minado informados por Chinalco Perú y estos parámetros son utilizados en la generación del LOM.

El modelo generado para la estimación de los costos captura los parámetros de equipos, rendimientos y disponibilidades aportadas por Minera Chinalco Perú, para este estudio.

Además, incorpora la estimación de la dotación mina y los gastos de administración estimados a partir de la información disponible.

El mantenimiento de equipos principales y auxiliares se establece a partir de la información disponible y complementada con la base de datos del consultor.

11.1 Disponibilidad de Equipos

La disponibilidad utilizada, se sustenta en la estimación del plan quinquenal actualmente vigente y se proyecta hasta el fin de la mina de manera plana, asumiendo una disponibilidad promedio para cada equipo según corresponda. En el caso de los equipos de carguío la disponibilidad media es de 84.7%. Las disponibilidades son indicadas en porcentajes de acuerdo con cada periodo, expresadas en miles como se muestra en la Tabla 11-1 y Tabla 11-2.

TETRA TECH

Tabla 11-1: Disponibilidad de Equipos Mineros Principales

Phisical Availability	Period	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Main Equipment													
Shovel CAT 7495 (SH01)	%	85.7%	87.4%	86.3%	86.8%	84.9%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%
Shovel CAT 7495 (SH02)	%	77.8%	85.9%	85.2%	83.4%	76.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%
Shovel CAT 7495 (SH03)	%	87.7%	79.5%	85.9%	84.2%	79.8%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%
Loader L2350 (LT01)	%	61.5%	60.2%	59.1%	60.5%	76.1%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%
Loader L2350 (LT02)	%	61.5%	60.2%	59.1%	60.5%	76.1%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%
Loader L2350 (LT03)	%	79.2%	77.5%	76.4%	77.8%	76.0%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%
Truck CAT 797F 400 tc	%	84.6%	85.0%	85.4%	85.2%	85.2%	83.0%	83.0%	83.0%	83.0%	83.0%	83.0%	83.0%
Truck KOM 980	%	89.0%	89.1%	89.0%	89.2%	87.5%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%
Drill PV-351	%	85.8%	87.3%	86.2%	86.5%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%
Drill CAT MD6640	%	85.8%	87.3%	86.2%	86.5%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%
Drill Roc-L8	%	85.8%	87.3%	86.2%	86.5%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%

Phisical Availability	Period	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Main Equipment													
Shovel CAT 7495 (SH01)	%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%
Shovel CAT 7495 (SH02)	%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%
Shovel CAT 7495 (SH03)	%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%
Loader L2350 (LT01)	%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%
Loader L2350 (LT02)	%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%
Loader L2350 (LT03)	%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%	78.3%
Truck CAT 797F 400 tc	%	83.0%	83.0%	83.0%	83.0%	83.0%	83.0%	83.0%	83.0%	83.0%	83.0%	83.0%	83.0%
Truck KOM 980	%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%
Drill PV-351	%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%
Drill CAT MD6640	%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%
Drill Roc-L8	%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%	83.3%

Tabla 11-2: Disponibilidad de Equipos Mineros Auxiliares

Phisical Availability	Period	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
ANCILLARY																									
Bulldozer CAT D10T	%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%	90.3%
Bulldozer CAT D11T	%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%	88.5%
Bulldozer KOM D475A	%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%	94.6%
Wheeldozer CAT 854K	%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%	94.9%
Wheeldozer KOM WD900	%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%	93.6%
Motor grader CAT 24M	%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%
Water Truck CAT 777F WT	%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%	78.9%
Excavator CAT 390DL	%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%
Front Loader CAT 992K	%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%
Truck CAT 777 F-G	%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%	71.8%
Compactor CAT CS76	%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%	99.3%
Lowbot Truck CAT793B	%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%	86.0%
Manipulator Cable Trucks CAT 988	%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%	75.0%
Excavator CAT 374	%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%
Excavator KOM WB93R	%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%	94.1%
Miniloader BOBCAT	%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%
Platform Trucks / Crane	%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%
Cable Trucks FMA	%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%
Loader CAT 930K	%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%	98.6%
Luminaries	%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%

La estimación de la utilización efectiva para cada equipo por periodo se muestra en la Tabla 11-3.

Tabla 11-3: Utilización Efectiva de Equipos Mineros

Effective Utilization	Period	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Main Equipment																									
Shovel CAT 7495 (SH01)	%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%
Shovel CAT 7495 (SH02)	%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%
Shovel CAT 7495 (SH03)	%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%	82.1%
Loader L2350 (LT01)	%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%
Loader L2350 (LT02)	%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%
Loader L2350 (LT03)	%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%	62.8%
Truck CAT 797F 400 tc	%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%
Truck KOM 980	%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%
Drill PV-351	%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%	66.9%
Drill CAT MD6640	%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%	80.2%
Drill Roc-L8	%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%
ANCILLARY																									
Bulldozer CAT D10T	%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%	75.5%
Bulldozer CAT D11T	%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%	55.0%
Bulldozer KOM D475A	%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%	28.0%
Wheeldozer CAT 854K	%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%	35.2%
Wheeldozer KOM WD900	%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%	66.3%
Motor grader CAT 24M	%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%	93.0%
Water Truck CAT 777F WT	%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%	45.8%
Excavator CAT 390DL	%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%
Front Loader CAT 992K	%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Truck CAT 777 F-G	%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%
Compactor CAT CS76	%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%
Lowbot Truck CAT793B	%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%	6.7%
Manipulator Cable Trucks CAT 988	%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Excavator CAT 374	%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%
Excavator KOM WB93R	%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%
Miniloader BOBCAT	%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%	65.0%
Platform Trucks / Crane	%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%
Cable Trucks FMA	%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Loader CAT 930K	%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%
Luminaries	%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%

11.2 Equipos en la Operación

Los equipos actualmente en operación son los indicados en la Tabla 11-4.

Tabla 11-4: Equipos Actualmente en Operación

LOADING		
Shovel CAT 7495 73 yd³	(un)	3
Loader L2350 50 yd³	(un)	3
Total	**(un)**	6

HAULING		
CAT 797 F	(un)	29
KOM 980 E	(un)	4

DRILLING		
PV351	(un)	4
MD6640	(un)	2
Roc L8 y D65	(un)	3
Total	**(un)**	9

SUPPORT		
Bulldozer CAT D10T	Unit	3
Bulldozer CAT D11T	Unit	3
Bulldozer KOM D475A	Unit	2
Wheeldozer CAT 854K	Unit	4
Wheeldozer KOM WD900	Unit	2
Motor grader CAT 24M	Unit	5

SERVICES		
Water Truck CAT 777F WT	Unit	4
Excavator CAT 390DL	Unit	3
Front Loader CAT 992K	Unit	1
Truck CAT 777 F-G	Unit	6
Compactor CAT CS76	Unit	1
Lowboy CAT793B	Unit	1
Cables Manipulator CAT 988	Unit	1
Excavator CAT 374	Unit	1
Excavator KOM WB93R	Unit	1
Miniloader BOBCAT	Unit	1
Platform Trucks / Crane	Unit	1
Cable Trucks FMA	Unit	2
Loader CAT 930K	Unit	1
Luminaries	Unit	15

11.3 Vida Útil de Equipos

La vida útil de los equipos ha sido recomendada por Tetra Tech Chile basados en Benchmarking del consultor para mineras de similares características y condiciones de operación, la estimación se basa en la cantidad de horas-horómetro que se acumulan para cada equipo hasta alcanzar la curva de inflexión en la disponibilidad y uso de operación. La Tabla 11-5, muestra el número de horas de servicio que fueron ocupadas por los equipos antes de ser dados de baja.

Tabla 11-5: Vida Útil de Equipos

Equipment	Useful Life
Shovel CAT 7495 73 yd³	120,000
Shovel CAT 7495 62 yd³	120,000
Loader L2350 50 yd³	60,000
Truck CAT 797F 400 tc	80,000
Drill PV-351	75,000
Drill MD6640	70,000
Drill Roc-L8	40,000
Bulldozer CAT D10T	45,000
Bulldozer CAT D11T	45,000
Bulldozer KOM D475A	45,000
Wheeldozer CAT 854K	45,000
Wheeldozer KOM WD900	45,000
Motor grader CAT 24M	45,000
Water Truck CAT 777F WT	80,000
Excavator CAT 390DL	35,000
Front Loader CAT 992K	60,000
Truck CAT 777 F-G	60,000

Equipment	Useful Life
Compactor CAT CS76	45,000
Camión Remolcador CAT793B	60,000
Manipulador de Cables CAT988	30,000
Excavator CAT 374	20,000
Excavator KOM W B93R	20,000
Minicargador BOBCAT	30,000
Camión Plataforma / Grúa	30,000
Camión Cablero	40,000
Loader CAT 930K	40,000
Luminarias	42,000
Hoppers CAT 797F 400 tc	32,000
Dipper CAT 7495 73 yd³	25,000
Dipper CAT 7495 62 yd³	25,000
Rock Bucket Loader L2350 50yd³	12,500
Bulldozer D10T Blade	42,000
Bulldozer D11T Blade	42,000
Bulldozer KOM D475A Blade	42,000

11.4 Índices Operacionales

La metodología de cálculo de flota de equipos mineros se basa en los índices de operación ASARCO, los cuales se describen a continuación en la Tabla 11-6.

Tabla 11-6: Tiempos ASARCO

<table>
<tr><td colspan="6">TIEMPO NOMINAL</td></tr>
<tr><td colspan="4" rowspan="2">TIEMPO DISPONIBLE</td><td colspan="2">MANTENIMIENTO</td></tr>
<tr><td>MANT. PROGRAMADO</td><td>MANT. NO PROGRAMADO</td><td>OTROS</td></tr>
<tr><td colspan="3" rowspan="2">TIEMPO OPERATIVO</td><td colspan="2">RESERVA</td><td></td></tr>
<tr><td>FACTOR EXTERNO</td><td>CONDICIÓN OPERATIVA</td><td></td></tr>
<tr><td rowspan="2">TIEMPO EFECTIVO</td><td colspan="2">DEMORA</td><td></td><td></td><td></td></tr>
<tr><td>DEMORA PROGRAMADA</td><td>DEMORA NO PROGRAMADA</td><td></td><td></td><td></td></tr>
</table>

Nominal: Tiempo calendario de operación de la faena (turno, día, año).

Disponible: Tiempo en el cual el equipo está en condiciones mecánicas adecuadas para realizar la labor para la cual fue diseñado.

Mantenimiento: Tiempo comprendido desde el momento que el equipo no es operable en su función de diseño, ya sea por defecto o fallas en sus sistemas electromecánicos o por haber sido entregado a reparación y/o mantenimiento, hasta que el equipo está en un área de trabajo o estacionamiento, y en condiciones de operación. El tiempo de mantenimiento se divide en Programada y No Programada (imprevistos).

Operativo: Tiempo en el cual el equipo está disponible con operador y en condiciones de ser usado.

Reservas: Son las horas en que el equipo o instalación, estando en condiciones electromecánicas de cumplir con su objetivo, no se utiliza por motivos tales como: falta de operador o por no ser requerido en el programa o plan de trabajo.

Efectivo: Tiempo en el cual el equipo está operando y realizando la función para la cual fue diseñado.

Demoras Programadas: Corresponde al tiempo en que el equipo está detenido debido a las actividades de cambio de turno y colación del operador.

Demoras No Programadas: Corresponde al tiempo en que el equipo está detenido debido a situaciones operacionales no programadas o imprevistas, tales como abastecimiento de petróleo, huella obstruida, espera en pala, espera en chancado, espera por tronadura, etc.

Disponibilidad: Fracción porcentual del tiempo nominal que el equipo se encuentra en condiciones mecánicas de operar.

$$\textbf{Disponibilidad \%} = \frac{\text{Tiempo Disponible}}{\text{Tiempo Nominal}} \times 100$$

Utilización: o utilización operativa, es la fracción porcentual, del tiempo Disponible que el equipo se encuentra operativo.

$$\textbf{Utilización \%} = \frac{\text{Tiempo Operativo}}{\text{Tiempo Disponible}} \times 100$$

Utilización Efectiva: Es la fracción porcentual del tiempo disponible, en la que el equipo se encuentra efectivamente operando (Sin pérdidas operacionales)

$$\textbf{Utilización Efectiva \%} = \frac{\text{Tiempo Efectivo}}{\text{Tiempo Disponible}} \times 100$$

Pérdidas Operacionales %: Fracción porcentual del tiempo disponible, en la cual el equipo está operativo, pero sin producción, como es tiempo de cola, esperando camión, etc.

$$\textbf{Pérdidas Operacionales \% =} \quad \frac{\text{Tiempo Pérdidas Operacionales}}{\text{Tiempo Disponible}} \times 100$$

Reserva %: Es la fracción porcentual de tiempo disponible en la que el equipo se encuentra en estatus reservas, es decir, sin operador, condición climática, corte de energía externo a la Mina, sin frente, etc.

$$\textbf{Reserva \% =} \quad \frac{\text{Tiempo Reservas}}{\text{Tiempo Disponible}} \times 100$$

En el proceso de cálculo de la flota de equipos se debe considerar la siguiente información de entrada: vida de la mina, tiempo de reserva, movimiento de materiales, malla de perforación, perfiles de transporte, restricciones en dimensiones generales de operación, altura de bancos, pendientes, tecnología disponible, factores operacionales (días de trabajo, sistemas de turnos, índices operacionales, etc.), rendimientos y costos estimados.

11.5 Rendimientos de Equipos

El rendimiento de los equipos proporcionado por Chinalco es el actualmente en uso como criterio de planificación en el plan minero 2020, que es el señalado en la Tabla 11-7. para los equipos de carguío.

Tabla 11-7: Rendimiento de Carguío

Shovel CAT 7495 73 yd³	t/h op	5,800
Loader L2350 50 yd³	t/h op	2,100

De la tabla se aprecia que el rendimiento definido para el cargador frontal es de los más bajos para este tipo de equipos dentro de la industria, de manera que realizando una buena gestión de mantenimiento este podría aumentar su rendimiento potencialmente al doble.

El rendimiento para el transporte considera las especificaciones del camión Caterpillar 797F y Komatsu 980E, equipos relativamente equivalentes. En el caso de los equipos CAT serán utilizados hasta su baja y los equipos nuevos a incorporar serán KOM 980 E. Los parámetros de velocidad por tramos informados por MCP, los cuales se resumen en la Tabla 11-8.

Tabla 11-8: Velocidad de Camiones

TRUCKS		CAT 797F	KOM980
Max. Loading Capacity	t	371	392
Horiz. Speed Loaded	km/h	33.06	33.06
Uphill Speed Loaded	km/h	9.98	9.98
Downhill Speed Loaded	km/h	13.59	13.59
Horiz. Speed Empty	km/h	43.68	43.68
Uphill Speed Empty	km/h	12.10	12.10
Downhill Speed Empty	km/h	29.26	29.26
Switchback Speed	km/h	15.00	15.00

La perforación, considera el rendimiento promedio en el plan minero 2020, para la producción en el caso del precorte el rendimiento es de benchmarking del consultor, como se muestra en la Tabla 11-9. Es ideal para mejorar la estimación de perforación contar con rendimiento diferenciados por tipo de dureza de los materiales.

Tabla 11-9: Rendimientos de Perforación

		UNITA	UNITB	UHORN	USKAT	USKSM	UYANH
Driller (PIT VIPER 351)	effec. m/h	38.0	36.0	42.0	53.0	63.0	63.0
Driller (CAT MD6640)	effec. m/h	35.0	36.0	42.0	53.0	63.0	63.0
Driller (ROC L8)	effec. m/h	30.0	35.0	34.6	51.0	62.0	62.0

La determinación de los equipos auxiliares considera el tamaño actual de la flota, la cual es parametrizada en función al número de equipos principales y tonelajes extraídos. Esta parametrización se utiliza además para estimar los equipos auxiliares para el resto del plan minero. El criterio asignado se indica a continuación:

- Bulldozer D10, considera 1 equipo por cada desmonte activo.
- Bulldozer D11, considera 1 equipo por cada 3 equipos de carguío, más 1 equipo de interferencia, más 0.5 equipos en otros trabajos.
- Wheeldozer 854K, considera 1 equipo por cada 2 equipos de carguío, más 1 equipo de interferencia, más 0.5 equipos en otros trabajos.
- Motoniveladoras, considera 1 equipo por cada 7 camiones, más 0.5 en otros trabajos.
- Camión Aljibe CAT-777GF WT, asume el mismo criterio empleado en la motoniveladora.
- La excavadora y camión remolcador, se asume un equipo por Mina.

Para el caso de los equipos Compactadores, se asumen el criterio de acuerdo con el movimiento del plan minero, siendo para el Roller CS76, un equipo por cada camino activo con un máximo de 2 y para el Roller CS56, un equipo por mina.

11.6 Factor de Carga de Voladura

El factor de carga utilizado para la voladura considera el diámetro y tipo de perforación entre 12 ¼" y 10 5/8" para la producción y de 5 pulgada para los pozos de precorte, desglosado por su clasificación de dureza e índice Bi. El factor de carga se presenta que la Tabla 11-10.

Tabla 11-10: Factor de Carga

Tipo de Material	Factor de Potencia	Factor de Carga
UINTA	0.79	889
UINTB	0.38	375
UHORN	0.38	375
USKAT	0.20	375
USKSM	0.35	227
UYANH	0.18	301

11.7 Distancias de Transporte

La medición de distancias de transporte para el plan minero operativo es realizada por MCP mediante el software *Minehaul,* el cual considera las diferentes rutas de transporte desde cada uno de los bancos de las fases, a los diferentes destinos según sea el caso de análisis, además incorpora las distancias de los materiales enviados a stock desde la mina y los materiales con doble manejo desde stock a proceso.

Dado lo significativo que es la componente de transporte en horizontal, pendiente (subiendo) y gradiente (bajando) para el cálculo de flota de camiones, esta componente es incorporada para cada uno de los materiales por separado en el modelo de estimación.

Las distancias de transporte determinadas y reportadas con *MineHaul* para el plan minero operativo, consideran la alimentación máxima de 170 ktpd, como es señalado en el Gráfico 11-1, en la que se muestra la distancia media ponderada por tramo. En el Gráfico 11-2, se muestra la distancia media ponderada por tipo de material.

Gráfico 11-1: Distancia por Tramo Plan Minero Operativo

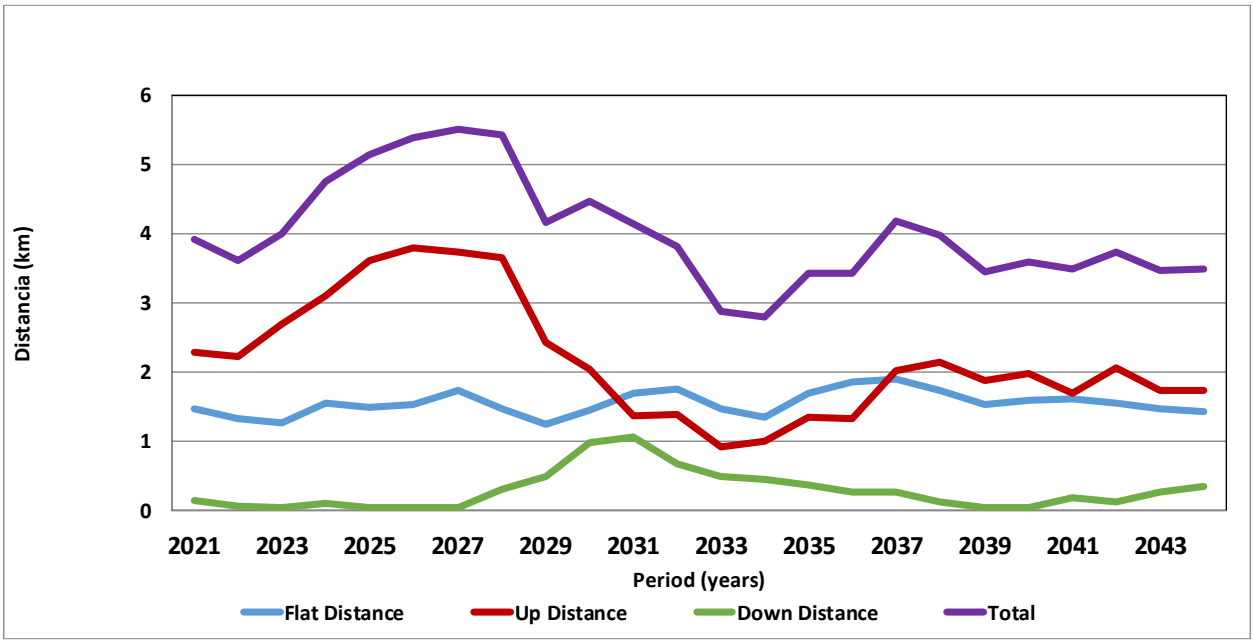


Gráfico 11-2: Distancia por Tipo de Material Plan Minero Operativo

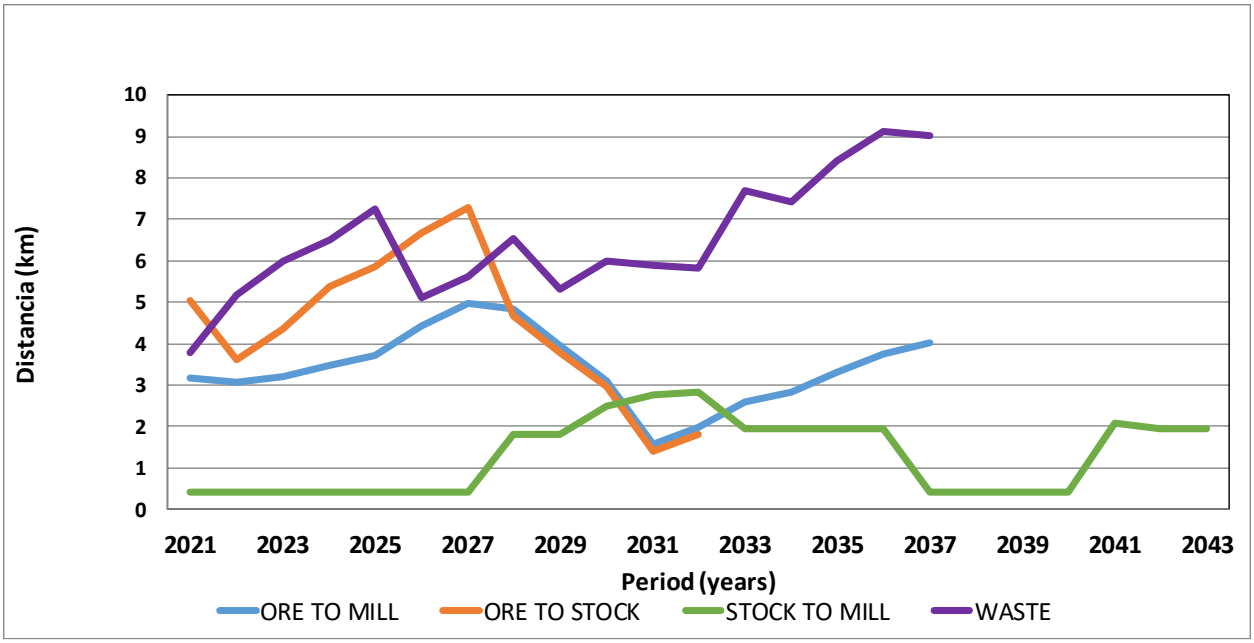
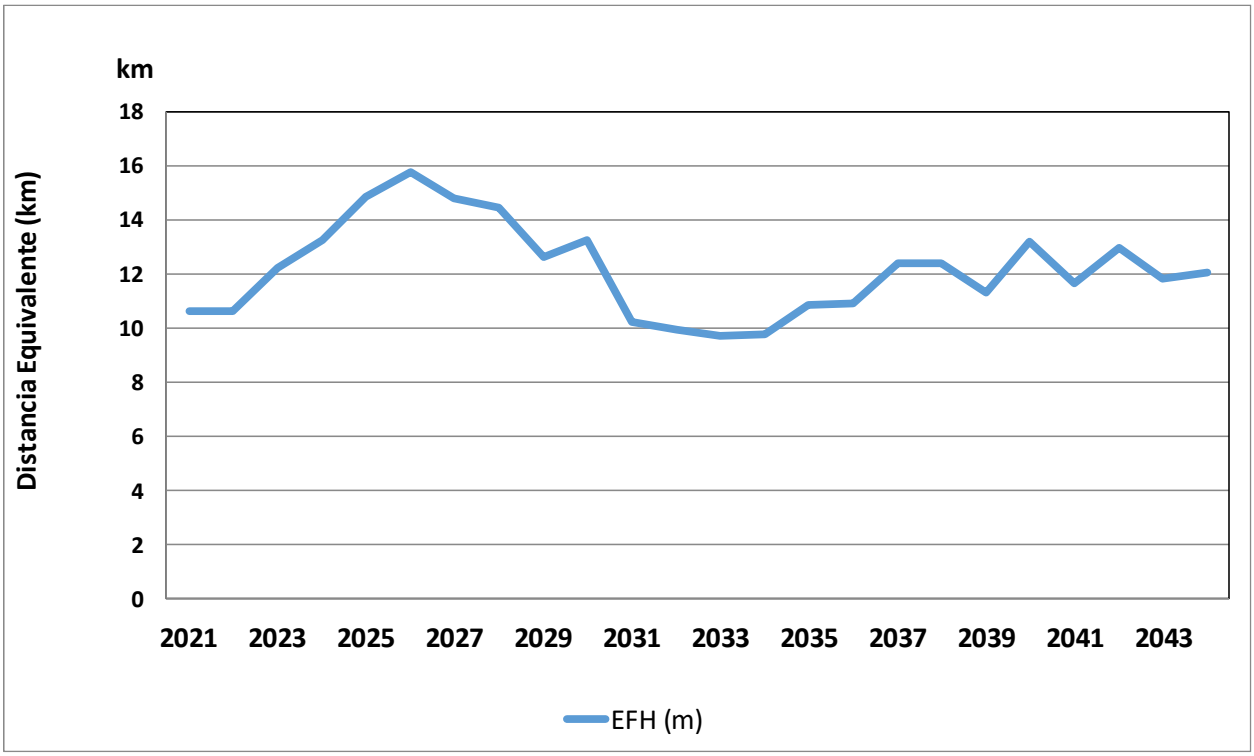


Gráfico 11-3: Distancia Equivalente Plan Minero Operativo



La distancia equivalente EFH para el LOM como promedio es de 13.37 Km, el perfil de distancia se muestra en la Tabla 11-11.

Tabla 11-11: Distancia Equivalente

EFH	Unit	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Equivalent Distance	km	10.65	10.63	12.26	13.27	14.87	15.76	14.81	14.44	12.66	13.25	10.25	9.94

EFH	Unit	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Equivalent Distance	km	9.75	9.76	10.86	10.91	12.42	12.40	11.32	13.20	11.68	12.99	11.86	12.05

La distancia media ponderada para el plan minero operativo, a una razón máxima de 370 ktpd es de 4,127 m y es indicado en la Tabla 11-12.

TETRA TECH

Tabla 11-12: Distancias de Transporte Plan Minero Operativo

Summary of Mine Movement by Period													
Year	Unit	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
ORE TO MILL													
Total	km	3.18	3.06	3.21	3.48	3.72	4.41	4.96	4.84	3.97	3.11	1.58	1.97
Flat Distance	km	1.26	1.18	1.07	1.19	1.13	1.20	1.39	1.24	1.29	1.24	1.14	1.13
Up Distance	km	1.71	1.79	2.08	2.20	2.54	3.16	3.51	3.32	2.04	1.60	0.34	0.78
Down Distance	km	0.21	0.09	0.06	0.10	0.06	0.06	0.06	0.28	0.64	0.28	0.11	0.06
ORE TO STOCK													
Total	km	5.03	3.62	4.35	5.37	5.86	6.68	7.27	4.65	3.77	2.96	1.39	1.81
Flat Distance	km	1.72	1.36	1.39	1.80	1.84	1.81	1.91	1.21	1.27	1.21	1.10	1.11
Up Distance	km	3.16	2.21	2.94	3.51	4.00	4.84	5.34	3.21	1.92	1.53	0.24	0.70
Down Distance	km	0.15	0.04	0.02	0.05	0.02	0.02	0.02	0.22	0.59	0.22	0.04	-
STOCK TO MILL													
Total	km	0.42	0.42	0.42	0.42	0.42	0.42	0.42	1.79	1.79	2.48	2.76	2.82
Flat Distance	km	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.36	0.36	0.53	0.77	0.71
Up Distance	km	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.27	0.32
Down Distance	km	0.18	0.18	0.18	0.18	0.18	0.18	0.18	1.22	1.22	1.74	1.73	1.79
WASTE													
Total	km	3.80	5.17	5.98	6.49	7.24	5.09	5.62	6.54	5.32	6.00	5.88	5.81
Flat Distance	km	1.63	1.77	1.75	2.05	1.94	2.00	2.15	1.92	1.70	2.10	2.55	2.80
Up Distance	km	2.13	3.38	4.23	4.34	5.30	3.06	3.45	4.56	3.60	3.24	2.51	2.68
Down Distance	km	0.04	0.01	0.00	0.11	0.01	0.04	0.03	0.06	0.02	0.66	0.83	0.33
TOTAL													
Total	km	3.92	3.62	4.00	4.75	5.15	5.39	5.52	5.42	4.16	4.48	4.14	3.81
Flat Distance	km	1.48	1.34	1.26	1.55	1.50	1.53	1.74	1.46	1.25	1.45	1.70	1.76
Up Distance	km	2.29	2.22	2.70	3.11	3.62	3.80	3.73	3.64	2.42	2.05	1.36	1.38
Down Distance	km	0.15	0.06	0.04	0.09	0.04	0.05	0.05	0.32	0.49	0.98	1.07	0.66

Summary of Mine Movement by Period													
Year	Unit	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
ORE TO MILL													
Total	km	2.60	2.83	3.29	3.75	4.00	3.98	4.41	4.62	4.98	5.13	5.60	6.77
Flat Distance	km	1.39	1.42	1.60	1.77	1.61	1.41	1.55	1.61	1.88	1.69	1.70	2.03
Up Distance	km	1.15	1.35	1.63	1.92	2.16	2.52	2.79	2.95	3.05	3.38	3.85	4.66
Down Distance	km	0.06	0.06	0.06	0.06	0.24	0.06	0.08	0.06	0.06	0.06	0.06	0.09
ORE TO STOCK													
Total	km	2.43	2.68	3.12	3.57	3.83	3.82	4.24	4.43	4.81	4.97	5.44	6.61
Flat Distance	km	1.37	1.41	1.57	1.74	1.58	1.38	1.52	1.58	1.85	1.67	1.67	2.00
Up Distance	km	1.06	1.27	1.55	1.83	2.07	2.43	2.69	2.85	2.96	3.30	3.76	4.58
Down Distance	km	-	-	-	-	0.18	-	0.02	-	-	-	-	0.03
STOCK TO MILL													
Total	km	1.96	1.96	1.96	1.96	0.42	0.42	0.42	0.42	2.08	1.96	1.96	1.96
Flat Distance	km	0.55	0.55	0.55	0.55	0.03	0.03	0.03	0.03	0.59	0.55	0.55	0.55
Up Distance	km	0.38	0.38	0.38	0.38	0.21	0.21	0.21	0.21	0.40	0.38	0.38	0.38
Down Distance	km	1.03	1.03	1.03	1.03	0.18	0.18	0.18	0.18	1.10	1.03	1.03	1.03
WASTE													
Total	km	7.70	7.43	8.40	9.13	9.03	8.59	4.99	5.19	5.57	5.72	2.61	2.77
Flat Distance	km	3.44	2.87	3.25	3.70	2.93	2.85	1.72	1.78	2.05	1.87	1.28	1.11
Up Distance	km	3.63	3.98	4.46	4.75	5.30	5.28	3.25	3.41	3.51	3.86	0.35	0.89
Down Distance	km	0.63	0.58	0.69	0.69	0.80	0.46	0.02	-	-	-	0.98	0.77
TOTAL													
Total	km	2.88	2.80	3.43	3.44	4.19	3.98	3.45	3.60	3.49	3.74	3.47	3.49
Flat Distance	km	1.47	1.34	1.70	1.85	1.90	1.73	1.53	1.59	1.62	1.56	1.46	1.43
Up Distance	km	0.92	1.01	1.36	1.32	2.02	2.14	1.87	1.98	1.69	2.05	1.74	1.73
Down Distance	km	0.49	0.45	0.37	0.27	0.27	0.11	0.04	0.03	0.19	0.13	0.27	0.34

11.8 Cálculo de Flota

Con los parámetros de equipos anteriormente señalados, se realiza la determinación del cálculo de flota para los equipos mineros y de apoyo y servicios del LOM.

La metodología consiste en aplicar lo señalado en la Tabla 11-13, “Fórmula para el cálculo de equipos”, donde a los tonelajes movidos por el plan minero, se le incorpora la humedad.

En el caso de la perforación, a partir de los tonelajes húmedos in situ, se estiman los metros requeridos, dividiendo por el factor de perforación expresado en th/m. Para determinar las horas requeridas de los equipos de perforación, se divide el tonelaje por el rendimiento de la perforadora, que está expresada en m/h efectivas. Para el cálculo del número de equipos de perforación, se realiza el cálculo tal como lo indica la expresión de la Tabla 11-13.

En los equipos de carguío, los tonelajes húmedos (th) se dividen por el rendimiento del carguío (th/h efectivas), obteniendo las horas requeridas, luego se realiza lo expresado en la Tabla 11-13.

Para el requerimiento de camiones, se estima las horas requeridas, donde los tonelajes húmedos (th) transportados, son divididos por el rendimiento (th/h efectivas). El rendimiento es resultado de la capacidad del camión de transportar el material en una hora efectiva, de acuerdo con el perfil de transporte. Luego se determina el número de equipos, de acuerdo con lo expresado en la Tabla 11-13.

Tabla 11-13: Fórmulas para el Cálculo de Equipos

N° Equipos Nominales	=	Horas Efectivas Requeridas por Periodo (1) / Horas Efectivas por Equipo (2)	(h Efec.) / (h Efec/ Equipo)
Horas Efectivas Requeridas por Año (1)	=	Movimiento de Materiales del Periodo / Rendimiento Efectivo por Hora	(t) / (t/ h Efec.)
Horas Efectivas por Equipo (2)	=	N° de Días del Periodo x 24 x Utilización Efectiva en Base Nominal	(h Efec/ Equipo)

Los resultados obtenidos de la determinación de flota son mostrados en la Tabla 11-14 y la Tabla 11-15, en la cual, durante el año 2021, el cargador frontal aumentan en una unidad, producto del incremento en la producción, preparación del ramp-up por el incremento en la producción a 170

ktpd a realizarse durante el año 2021, además recuperar avance en el desarrollo de lastre y disminución gradual de la disponibilidad que afecta a la flota. Esta cantidad de equipos de carguío, se mantienen sin modificación hasta el año 2025, momento en el cual el plan minero disminuye el movimiento hasta agotar las reservas minerales durante el año 2044.

Para los camiones de extracción, se considera 29 equipos CAT 797F y 7 KOM 980, para completar 36 camiones requeridos por el plan, los cuales son incrementados hasta el año 2024 a 47 unidades hasta el 2026, se mantiene por 5 años con 51 camiones, momento en el cual comienza la mina a disminuir la relación de estéril mineral y el plan minero presenta un ajuste en el movimiento mina para mantener la alimentación en 170 ktpd desde el 2023 hasta agotar las reservas el 2044.

La flota de perforación se incrementa en una unidad, alcanzando un máximo de 5 equipos de producción y 2 unidades para precorte. Esta flota se mantiene hasta el 2036, periodo en el cual disminuye el material a perforar.

En cuanto a los equipos auxiliares se mantienen similares al número actual, salvo aquellos que se relacionan con el carguío y transporte (Bulldozer, motoniveladoras y regador) las que se ven incrementados en la misma proporción a la variación de equipos principales (Carguío y Transporte).

De la Figura 11-1 hasta la Figura 11-3, se muestran los gráficos del número de equipos por cada periodo.

Tabla 11-14: Resumen de Equipos Plan Minero Operativo Parte 1

Item	Unit	YEAR											
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
ANNUAL MOVEMENT	(kth)	128,168	128,351	129,998	129,352	126,770	133,686	133,513	133,060	131,699	131,426	125,528	117,439
MINE MOVEMENT	(kth/d)	351	352	356	353	347	366	366	364	361	360	344	321
EQUIVALET DISTANCE	(km)	10.65	10.63	12.26	13.27	14.87	15.76	14.81	14.44	12.66	13.25	10.25	9.94
HAULING													
CAT 797 F	(un)	29	29	29	29	29	29	28	28	28	28	18	13
KMS 980E	(un)	8	8	13	15	18	23	23	23	23	23	23	23
Total	(un)	37	37	42	44	47	52	51	51	51	51	41	36
LOADING													
Shovel CAT 7495 73 yd³	(un)	3	3	3	3	3	3	3	3	3	3	3	3
Loader L2350 50 yd³	(un)	3	3	3	3	3	3	3	3	3	3	3	2
Total	(un)	6	6	6	6	6	6	6	6	6	6	6	5
DRILLING													
PV351	(un)	4	4	4	4	4	4	4	4	3	3	2	2
MD6640	(un)	2	2	2	2	2	2	2	2	2	2	2	2
Roc L8 - D65	(un)	3	3	3	3	3	3	3	3	3	3	3	3
Total	(un)	9	9	9	9	9	9	9	9	8	8	7	7
SUPPORT													
Bulldozer CAT D10	(un)	3	3	3	3	3	3	3	3	3	3	3	3
Bulldozer CAT D11	(un)	3	3	3	3	3	3	3	3	3	3	3	3
Bulldozer KOM D475A	(un)	2	2	2	2	2	2	2	2	2	2	2	2
Wheeldozer CAT 854K	(un)	4	4	4	4	4	4	4	4	4	4	4	4
Wheeldozer KOM WD900	(un)	2	2	2	2	2	2	2	2	2	2	2	2
Motor grader CAT 24M	(un)	5	5	6	6	6	6	6	6	6	6	6	5
Water Truck CAT 777GF WT	(un)	4	4	5	5	5	5	5	5	5	5	5	4
Excavator CAT 390DL	(un)	3	3	3	3	3	3	3	3	3	3	3	3
Frontloader CAT 992K	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Truck CAT 777 F-G	(un)	6	6	6	6	6	6	6	6	6	6	6	5
Compactor CAT CS76	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Lowboy Truck CAT793B	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Cable Manipulator CAT 988	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Excavator CAT 374	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Excavator KOM WB93R	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Miniloader BOBCAT	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Platform Turcks/Crane	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Cable Truck	(un)	2	2	2	2	2	2	2	2	2	2	2	2
Loader CAT 930K	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Luminaries	(un)	15	15	15	15	15	15	15	15	14	14	13	12

Tabla 11-15: Resumen de Equipos Plan Minero Operativo Parte 2

Item	Unit	YEAR											
		2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
ANNUAL MOVEMENT	(kth)	85,310	84,630	87,359	80,577	88,681	87,510	85,669	85,750	85,144	86,550	87,114	86,744
MINE MOVEMENT	(kth/d)	234	232	239	220	243	240	235	234	233	237	239	237
EQUIVALET DISTANCE	(km)	9.75	9.76	10.86	10.91	12.42	12.40	11.32	13.20	11.68	12.99	11.86	12.05
HAULING													
CAT 797 F	(un)	13	13	13	13	13	13	13	13	13	13	13	13
KMS 980E	(un)	17	17	17	17	17	17	17	17	17	17	17	17
Total	(un)	30	30	30	30	30	30	30	30	30	30	30	30
LOADING													
Shovel CAT 7495 73 yd³	(un)	2	2	2	2	2	2	2	2	2	2	2	2
Loader L2350 50 yd³	(un)	2	2	2	2	2	2	2	2	2	2	2	2
Total	(un)	4	4	4	4	4	4	4	4	4	4	4	4
DRILLING													
PV351	(un)	2	2	2	2	2	2	2	2	2	2	2	2
MD6640	(un)	2	2	2	2	2	2	2	2	2	2	2	2
Roc L8 - D65	(un)	2	2	2	2	2	2	2	2	2	2	2	2
Total	(un)	6	6	6	6	6	6	6	6	6	6	6	6
SUPPORT													
Bulldozer CAT D10	(un)	3	3	3	3	3	3	3	3	3	3	3	3
Bulldozer CAT D11	(un)	2	2	2	2	2	2	2	2	2	2	2	2
Bulldozer KOM D475A	(un)	2	2	2	2	2	2	2	2	2	2	2	2
Wheeldozer CAT 854K	(un)	3	3	3	3	3	3	3	3	3	3	3	3
Wheeldozer KOM WD900	(un)	2	2	2	2	2	2	2	2	2	2	2	2
Motor grader CAT 24M	(un)	4	4	4	4	4	4	4	4	4	4	4	4
Water Truck CAT 777GF WT	(un)	3	3	3	3	3	3	3	3	3	3	3	3
Excavator CAT 390DL	(un)	2	2	2	2	2	2	2	2	2	2	2	2
Frontloader CAT 992K	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Truck CAT 777 F-G	(un)	4	4	4	4	4	4	4	4	4	4	4	4
Compactor CAT CS76	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Lowboy Truck CAT793B	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Cable Manipulator CAT 988	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Excavator CAT 374	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Excavator KOM WB93R	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Miniloader BOBCAT	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Platform Turcks/Crane	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Cable Truck	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Loader CAT 930K	(un)	1	1	1	1	1	1	1	1	1	1	1	1
Luminaries	(un)	11	11	11	11	11	11	11	11	11	11	11	11

Figura 11-1: Gráfico Número de Carguío y Perforación

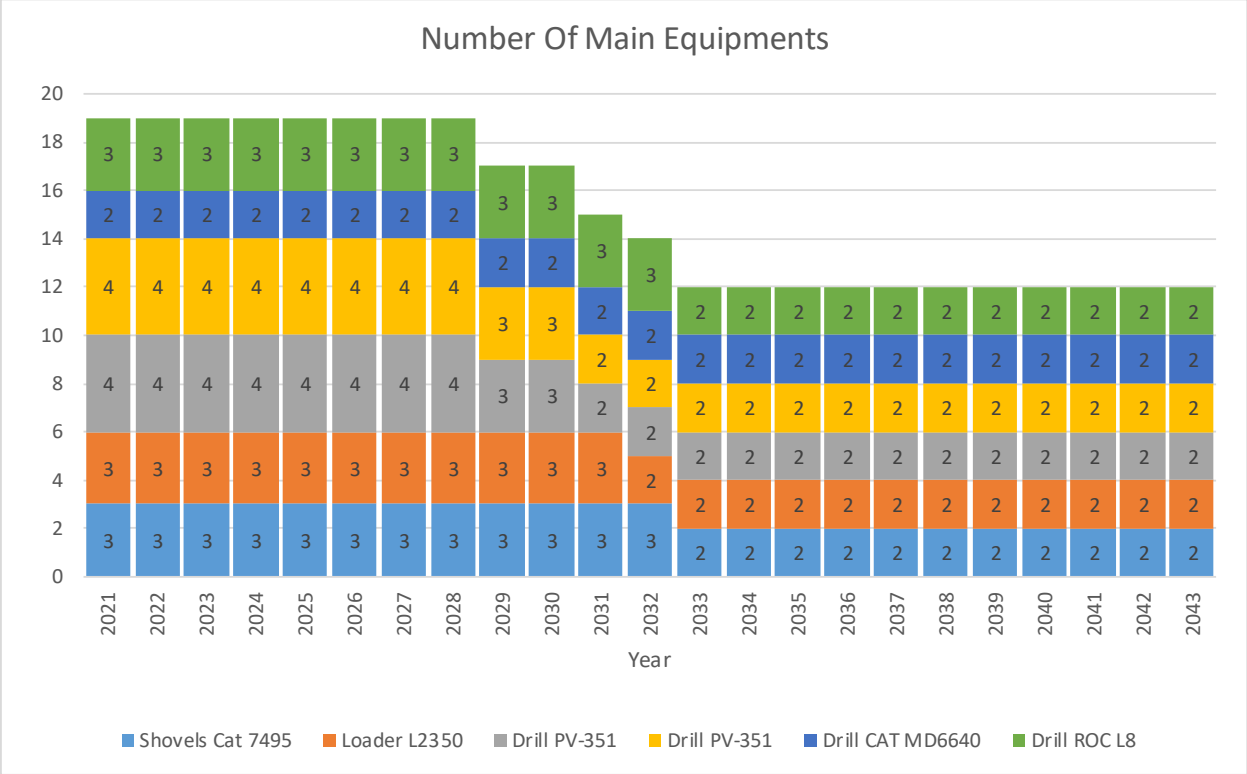


Figura 11-2: Gráfico de Movimiento Mina y Número de Camiones

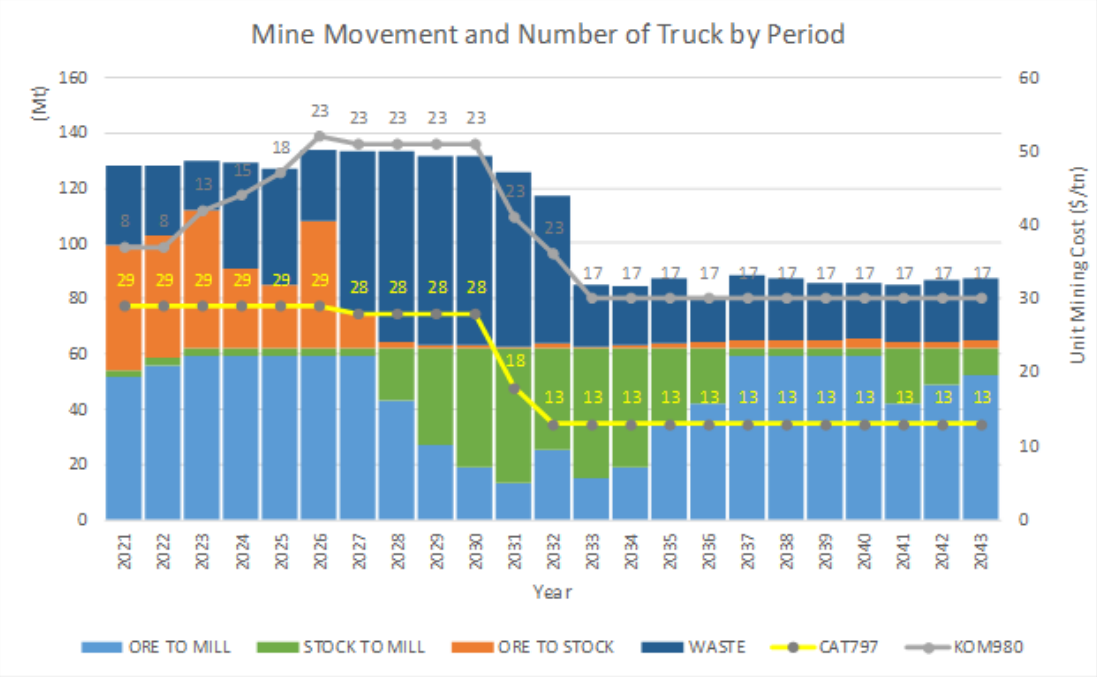
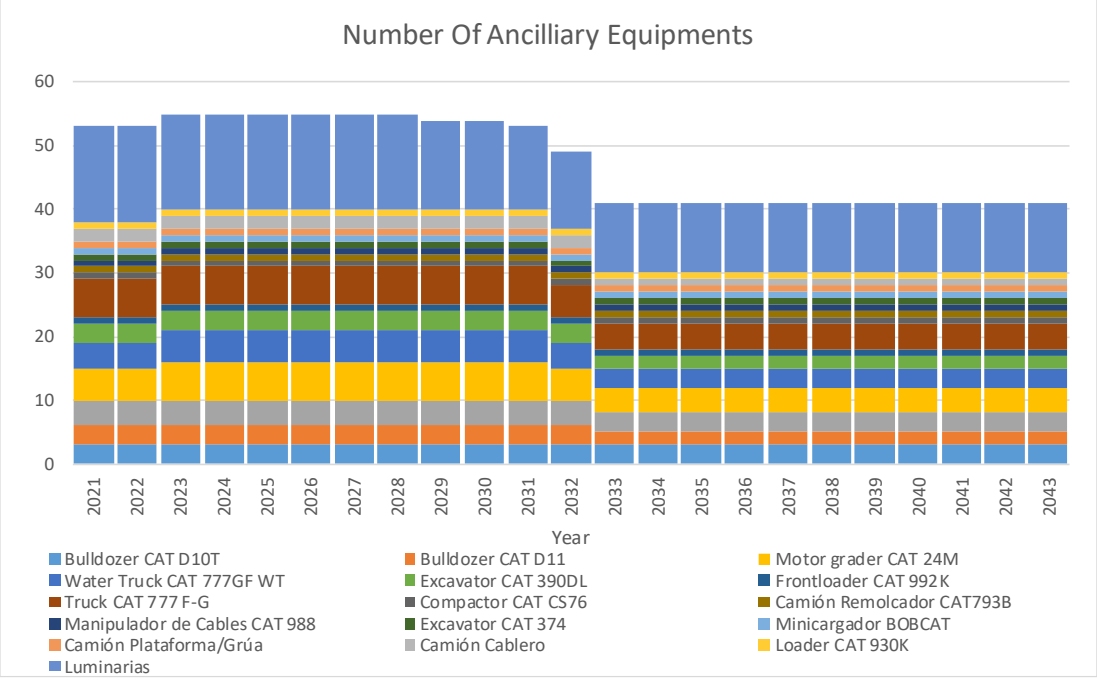


Figura 11-3: Gráfico del Números de Equipos Auxiliares



11.9 Determinación de la Dotación Mina

A partir de la determinación del número de equipos, se estima la dotación para operaciones mina, sin considerar el mantenimiento.

La determinación de la dotación considera las siguientes definiciones y aspectos:

- Administración, donde se considera la línea de dirección, supervisión o similares, tanto para las actividades relativas de la operación de la mina, mantención, administración de instalaciones, equipo de ingeniería, geología, gestión, control de calidad, topografía, perforación y tronadura.

- Operación, que considera los operadores necesarios para la operación del equipamiento minero, equipos auxiliares y de apoyo.

La estimación de dotaciones de administración es determinada de acuerdo con las necesidades del movimiento mina, considerando mantención propia y las diversas áreas que se relacionan en el funcionamiento minero.

El cálculo de la dotación directa arroja un ausentismo total de 13,7%, considerando para esto, 4 semanas de vacaciones de un total de 52 semanas al año, equivalente a 8.2%, además de 5.5% correspondiente a licencias médicas, capacitación y permisos en general. Este factor mostrado en la Tabla 11-16, es propuesto y debe ajustarse a la realidad del proyecto Toromocho.

Tabla 11-16: Ausentismo

DESGLOSE DEL AUSENTISMO		
Días año	365	
Días Vacaciones	30	8.2%
Días de Licencia	5	1.4%
Días de Capacitación	15	4.1%
Días de Permiso	0	0
Días de Falla	0	0
TOTAL		**13.7%**

La dotación de administración considerada para el proyecto es la señalada en la Tabla 11-17, que consiste en una dotación liviana y eficiente para el tamaño del movimiento programado.

TETRA TECH

Tabla 11-17: Administración

MINE EXECUTIVE OFFICER	N°	1
ADMINISTRATIVE ASSISTANT	N°	1
MINE COST HEAD	N°	4
COST ANALYIST	N°	3
SUPERINTENDENT OF TECHNICAL SERVICES	N°	1
SUPERINTENDENT OF MINE OPERATIONS	N°	1
SUPERINDENTENT OF OPERATIONAL SUPPORT	N°	1
GENERAL PLANNING HEAD	N°	1
SENIOR PLANNING SUPERVISOR	N°	2
PLANNING SUPERVISOR	N°	4
PRODUCTION CONTROL GENERAL HEAD	N°	1
PRODUCTION CONTROL SUPERVISOR	N°	2
DISPATCH SUPERVISOR	N°	2
PRODUCTION ANALYST	N°	2
TECHNICIANS	N°	2
GEOLOGY GENERAL HEAD	N°	2
GEOLOGY SUPERVISOR	N°	4
SAMPLER	N°	8
GENERAL GEOTECHNIQUE HEAD	N°	1
SENIOR GEOTECHNIQUE SUPERVISOR	N°	2
GEOTECHNIQUE SUPERVISOR	N°	3
GENERAL MINE HEAD	N°	1
GUARDMANSHIP HEAD	N°	1
ASSISTANT GUARDMANSHIP HEAD SUPERVISOR	N°	1
GUARDMANSHIP COORDINATOR	N°	1

GENERAL MINE HEAD	N°	1
GUARDMANSHIP HEAD	N°	1
ASSISTANT GUARDMANSHIP HEAD SUPERVISOR	N°	1
GUARDMANSHIP COORDINATOR	N°	1
IMPROVEMENT AND TRAINING HEAD	N°	1
IMPROVEMENT AND TRAINING ANALYST	N°	2
TRAINER	N°	3
GENERAL DRILLING AND BLASTING HEAD	N°	1
MINE DRILLING AND BLASTING SUPERVISOR	N°	1
QUARRY DRILLING AND BLASTING SUPERVISOR	N°	1
DRILLING COORDINATOR	N°	1
DRILLING AND BLASTING OPERATORS	N°	1
GENERAL HEAD OF ANCILLARY SERVICES	N°	1
ANCILLARY SERVICES SUPERVISOR	N°	2
ANCILLARY SERVICES COORDINATOR	N°	2
TOPOGRAPHY SUPERVISOR	N°	1
TOPOGRAPHERS	N°	2
ASSISTANTS	N°	2
MAINTENENCE SUPERINTENDENT	N°	1
MAINTENENCE HEAD	N°	7
MAINTENANCE SUPERVISOR	N°	15
ANALYIST/ASSISTANT	N°	15
MECHANICALS	N°	56
TOTAL	**N°**	**167**

Con los parámetros señalados anteriormente en el resumen de equipos y el factor de ausentismo, se estima la dotación para el escenario de estudio. Tabla 11-18, se muestra la dotación estimada para el plan minero operativo a 370 ktpd.

Tabla 11-18: Dotación Mine Plan Minero Operativo

Staffing	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Administration	167	167	167	167	167	167	167	167	167	167	167	167
Mine Operations												
Loading	22	22	22	22	24	24	24	24	24	24	24	20
Hauling	145	146	166	174	185	199	195	195	195	195	157	139
Drilling	36	36	36	36	36	36	36	36	32	32	28	28
Earth Movement	110	110	117	117	117	117	117	117	117	117	117	110
Support Services	71	71	71	71	71	71	71	71	71	71	71	68
Total	**551**	**552**	**579**	**587**	**600**	**614**	**610**	**610**	**606**	**606**	**564**	**532**

Staffing	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Administration	167	167	167	167	167	167	167	167	167	167	167	167
Mine Operations												
Loading	16	16	16	16	16	16	16	16	16	16	16	16
Hauling	116	116	116	116	116	116	116	116	116	116	116	116
Drilling	24	24	24	24	24	24	24	24	24	24	24	24
Earth Movement	89	89	89	89	89	89	89	89	89	89	89	89
Support Services	61	61	61	61	61	61	61	61	61	61	61	61
Total	**473**	**473**	**473**	**473**	**473**	**473**	**473**	**473**	**473**	**473**	**473**	**473**

11.10 Gasto de Capital (CAPEX)

En este punto se muestra la estimación de gasto de capital relativo a equipos mina, que se refiere a la adquisición y reemplazos de equipos mineros principales, de movimiento de tierra y servicio de apoyo a la operación. La determinación de flota de equipos se base en un modelo IP, asociado al movimiento de materiales del plan minero de largo plazo.

No está dentro del alcance de la estimación, las inversiones por movimientos de preproducción, infraestructura mina, instalaciones, como también la construcción de camino de accesos, obras tempranas, estudios y montos asociados a permisos medio ambientales.

11.11 Inversiones en Equipos

La inversión de equipos mina son estimadas en base a las flotas que son requeridas para el adecuado cumplimiento en el plan de movimiento de materiales, vida útil proyectada y precios según información aportada por Toromocho, que son señaladas en la Tabla 11-19.

Tabla 11-19: Precios para Equipos Mina

Item	Market Value KUS$	Model
Shovel CAT 7495 73 yd³	29,002	Electrical Shovel 73yd³ CAT 7495
Shovel CAT 7495 62 yd³	23,585	Electrical Shovel 73yd³ CAT 7495
Loader L2350 50 yd³	11,826	Le Torneau 2350, Wheel + TI technology
Truck CAT 797F 400 tc	5,256	KMS 980E with hopper and Wheel
Drill PV-351	5,378	PV 351 + TI Technology
Drill MD6640	5,378	CAT MD6640
Drill Roc-L8	966	Roc L8
Bulldozer CAT D10T	1,072	CAT D10
Bulldozer CAT D11T	2,206	CAT D11
Bulldozer KOM D475A	2,206	CAT D475A
Wheeldozer CAT 854K	1,794	CAT 854 K
Wheeldozer KOM WD900	1,794	KOM WD900
Motor grader CAT 24M	1,662	CAT 24M
Water Truck CAT 777F WT	1,541	CAT 777 GHT
Excavator CAT 390DL	295	CAT 390DL
Front Loader CAT 992K	295	CAT 374
Truck CAT 777 F-G	1,487	CAT 777
Compactor CAT CS76	115	CAT CS76
Lowboy CAT793B	2,695	CAT793B
Cable Manipulator CAT988	1,529	CAT 988
Excavator CAT 374	678	CAT374D L
Excavator KOM W B93R	678	KOM W B93R
Miniloader BOBCAT	80	BOBCAT T750
Platform Truck/ Crane	200	Mack Truck
Cable Truck	200	Mack Truck
Loader CAT 930K	2,109	CAT 930K
Luminaries	2	Luminaries Atlas QLT M10
Hoppers CAT 797F 400 tc	315	
Dipper CAT 7495 73 yd³	2,320	
Dipper CAT 7495 62 yd³	1,887	
Rock Bucket Loader L2350 50yd³	710	
Bulldozer D10T Blade	54	
Bulldozer D11T Blade	110	
Bulldozer KOM D475A Blade	110	

Junto con los precios de los equipos mineros, es recopilado el estado de las horas de horómetros de los equipos actualmente en uso, según información enviada por Toromocho, que se detalla en la Tabla 11-20.

TETRA TECH

Tabla 11-20: Horas Horómetros Iniciales

Equipment Type	Brand	Model	ID	HH
Drill	Atlas Copco	PV-351	PD101	34,145
Drill	Atlas Copco	PV-351	PD102	31,449
Drill	Atlas Copco	PV-351	PD103	33,942
Drill	CAT	MD6640	PD401	34,000
Drill	CAT	MD6640	PD402	34,000
Drill	CAT	MD6640	PD402	1,000
Drill	Atlas Copco	ROC-L8	PD201	25,026
Drill	Atlas Copco	ROC-L8	PD301	33,847
Drill	Atlas Copco	ROC-L8	PD302	30,501
Drill	Atlas Copco	D65	PD401	10,814
Drill	Atlas Copco	D65	PD402	7,305
Electric Shovel	CAT	7495	PL001	50,689
Electric Shovel	CAT	7495	PL002	50,710
Electric Shovel	CAT	7495	PL003	37,559
Front-end Loader	LeTourneau	L2350	CD101	38,731
Front-end Loader	LeTourneau	L2350	CD102	35,295
Front-end Loader	CAT	930K	CD103	14,023
Front-end Loader	CAT	992K	CD201	53,539
Haul Truck	CAT	797F	CM101	47,303
Haul Truck	CAT	797F	CM102	40,594
Haul Truck	CAT	797F	CM103	43,949
Haul Truck	CAT	797F	CM104	37,351
Haul Truck	CAT	797F	CM105	41,273
Haul Truck	CAT	797F	CM106	46,007
Haul Truck	CAT	797F	CM107	43,194
Haul Truck	CAT	797F	CM108	38,590
Haul Truck	CAT	797F	CM109	44,594
Haul Truck	CAT	797F	CM110	42,755
Haul Truck	CAT	797F	CM111	42,949
Haul Truck	CAT	797F	CM112	44,316
Haul Truck	CAT	797F	CM113	44,702
Haul Truck	CAT	797F	CM114	44,479
Haul Truck	CAT	797F	CM115	42,184
Haul Truck	CAT	797F	CM116	43,310
Haul Truck	CAT	797F	CM117	24,006
Haul Truck	CAT	797F	CM118	36,606
Haul Truck	CAT	797F	CM119	35,659
Haul Truck	CAT	797F	CM120	34,401
Haul Truck	CAT	797F	CM121	34,866
Haul Truck	CAT	797F	CM122	34,914
Haul Truck	CAT	797F	CM123	34,779
Haul Truck	CAT	797F	CM124	33,900
Haul Truck	CAT	797F	CM125	33,520
Haul Truck	CAT	797F	CM126	33,171
Haul Truck	CAT	797F	CM127	32,019
Haul Truck	CAT	797F	CM128	31,824
Haul Truck	CAT	797F	CM129	30,564
Haul Truck	CAT	797F	CM130	20,194
Haul Truck	CAT	797F	CM201	38,444
Haul Truck	CAT	797F	CM202	37,706
Haul Truck	CAT	797F	CM204	38,134
Haul Truck	CAT	797F	CM205	38,525

Equipment Type	Brand	Model	ID	HH
Haul Truck	CAT	797F	CM206	26,228
Haul Truck	CAT	797F	CM207	20,564
Haul Truck	KMS	980E	KM01	6,854
Haul Truck	KMS	980E	KM02	6,854
Haul Truck	KMS	980E	KM03	6,854
Haul Truck	KMS	980E	KM04	6,854
Excavator	CAT	390DL	EX101	25,933
Excavator	CAT	390DL	EX102	29,992
Excavator	CAT	390DL	EX103	32,248
Track Dozer	CAT	D10T	TO001	33,765
Track Dozer	CAT	D10T	TO002	42,364
Track Dozer	CAT	D10T	TO003	38,249
Track Dozer	CAT	D11T	TO004	38,638
Track Dozer	CAT	D11T	TO005	28,408
Track Dozer	CAT	D11T	TO006	40,391
Track Dozer	CAT	D11T	TO101	35,899
Track Dozer	CAT	D11T	TO102	32,080
Track Dozer	CAT	D11T	TO103	35,172
Grader	CAT	24M	MN101	35,566
Grader	CAT	24M	MN102	32,480
Grader	CAT	24M	MN103	36,067
Grader	CAT	24M	MN104	39,329
Grader	CAT	24M	MN201	23,697
Wheel Dozer	KOM	D475A	TR005	1,000
Wheel Dozer	KOM	D475A	TR006	1,000
Wheel Dozer	CAT	854K	TR001	33,397
Wheel Dozer	CAT	854K	TR002	43,719
Wheel Dozer	CAT	854K	TR003	45,346
Wheel Dozer	CAT	854K	TR004	42,000
Wheel Dozer	KOM	WD900	TR005	1,000
Wheel Dozer	KOM	WD900	TR006	1,000
Water Truck	CAT	777F C	CMA101	14,317
Water Truck	CAT	777F C	CMA102	17,251
Water Truck	CAT	777F C	CMA103	18,051
Water Truck	CAT	777F C	CMA104	16,325
Compactor	CAT	CS76	RD001	9,215
Compactor	CAT	CS56	RD003	8,208
Camión Remolcador	CAT	793B	LB001	7,454
Truck	CAT	777	TG001	30,000
Truck	CAT	777	TG002	30,000
Truck	CAT	777	TG003	30,000
Truck	CAT	777	TG004	30,000
Truck	CAT	777	TG005	30,000
Truck	CAT	777	TG006	30,000
Manipulador de Cables	x	x	x	10,000
Excavator	CAT	374	Ex001	10,000
Excavator	KOM	WB93R	Ex002	1,000
Minicargador	BOBCAT	x	x	10,000
Camión Plataforma/Grúa	x	x	x	10,000
Camión Cablero	x	x	1	1,000
Camión Cablero	x	x	2	1,000
Luminaria	x	x	x	1,000

Tabla 11-21: Perfil de Adquisiciones y Reemplazos Plan Minero Operativo

PERIOD	Investment Type	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	TOTAL
EQUIPMENT		kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$	kUS$
Shovels Cat 7495	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	-	-	-	-	-	-	-	58,004	-	-	-	-	-	-	-	-	-	-	-	58,004
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loader L2350	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	23,652	11,826	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35,477
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Drill PV-351	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	-	-	-	-	16,134	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16,134
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Drill CAT MD6640	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	-	10,756	-	-	-	-	-	-	-	-	-	-	-	10,756	-	-	-	-	-	21,512
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Drill ROC L8	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	-	-	-	-	966	-	966	966	-	-	-	-	-	-	-	-	-	-	-	2,897
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Truck CAT 797	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	-	-	52,559	15,768	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68,327
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Truck KOM 930	Acquisition	5,256	-	26,280	10,512	15,768	26,280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	84,095
	Replacement	-	-	-	-	-	-	5,256	-	-	-	-	-	-	-	5,256	-	-	-	26,280	10,512	-	-	-	-	47,303
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulldozer CAT D10T	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	1,072	2,144	-	-	-	-	-	-	1,072	2,144	-	-	-	-	-	-	1,072	2,144	-	-	-	-	-	9,648
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulldozer CAT D11	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	2,206	4,412	-	-	-	-	-	-	2,206	4,412	-	-	-	-	-	-	2,206	2,206	-	-	-	-	-	17,648
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulldozer KOM D475A	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,412	-	-	-	-	4,412
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wheeldozer CAT 854K	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	1,794	1,794	-	1,794	-	-	-	-	-	-	-	-	-	-	-	1,794	1,794	-	-	1,794	-	-	-	10,764
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wheeldozer KOM WD900	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Motor grader CAT 24M	Acquisition	-	-	1,662	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,662
	Replacement	-	4,986	1,662	1,662	-	-	-	4,986	3,324	1,662	-	-	-	4,986	1,662	-	-	-	-	4,986	1,662	-	-	-	31,578
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Truck CAT 777GF WT	Acquisition	-	-	1,541	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,541
	Replacement	-	-	-	-	4,623	-	-	-	1,541	4,623	-	-	-	-	-	4,623	-	-	-	-	-	4,623	-	-	20,033
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Excavator CAT 390DL	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	590	295	-	-	-	-	-	590	295	-	-	-	-	-	295	295	-	-	-	-	-	295	295	2,950
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Frontloader CAT 992K	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	295	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	295	-	-	-	-	590
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Truck CAT 777 F-G	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	-	-	-	-	-	-	-	5,948	-	-	-	-	-	-	-	-	-	-	-	5,948
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compactor CAT CS76	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lowboy Truck CAT 793B	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cable Manipulator CAT 988	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,529	-	-	-	-	-	-	-	1,529
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Excavator CAT 374	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	678	-	-	-	-	678	-	-	-	-	678	-	-	-	-	678	-	-	-	-	678	3,390
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Excavator KOM WB93R	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minloader BOBCAT	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	80	-	-	-	-	-	-	80	-	-	-	-	-	-	80	-	-	-	-	240
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Platform Trucks/Crane	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	200	-	-	-	-	-	-	200	-	-	-	-	-	-	200	-	-	-	-	600
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cable Trucks	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	-	-	-	-	-	-	200	-	-	-	-	-	-	-	-	-	-	200	-	400
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loader CAT 930K	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,109	-	-	-	-	-	2,109
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Luminaries	Acquisition	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Replacement	-	-	-	-	-	-	-	-	-	-	-	-	17	-	-	-	-	-	-	-	-	-	-	-	17
	Overhaul	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acquisition	**KUS$**	5,256	-	29,483	10,512	15,768	26,280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**87,298**
Replacement	**KUS$**	-	10,648	10,602	2,340	6,417	23,932	27,838	57,545	21,901	26,958	6,556	1,166	65,214	5,664	6,918	4,918	3,618	5,072	44,173	20,485	3,456	4,623	495	973	**361,510**
Overhaul	**KUS$**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
																										448,808
Subtotal	**KUS$**	5,256	10,648	40,085	12,852	22,185	50,211	27,838	57,545	21,901	26,958	6,556	1,166	65,214	5,664	6,918	4,918	3,618	5,072	44,173	20,485	3,456	4,623	495	973	448,808
Relevant Supplies	**KUS$**	13,181	13,181	13,181	13,497	13,497	13,812	13,812	13,812	13,497	13,812	13,181	12,157	9,521	9,206	9,521	9,206	9,521	9,521	9,521	9,521	9,521	9,411	9,411	9,521	274,022
VAN Estimate by Annual Periods	**kUS$**	**18,437**	**23,829**	**53,266**	**26,349**	**35,682**	**64,023**	**41,650**	**71,357**	**35,398**	**40,770**	**19,737**	**13,322**	**74,735**	**14,870**	**16,439**	**14,124**	**13,139**	**14,593**	**53,694**	**30,006**	**12,977**	**14,034**	**9,906**	**10,494**	
ACCRUED INVESTEMENTS	**kUS$**	**18,437**	**42,267**	**95,533**	**121,881**	**157,563**	**221,586**	**263,236**	**334,594**	**369,991**	**410,761**	**430,499**	**443,821**	**518,556**	**533,426**	**549,865**	**563,988**	**577,128**	**591,721**	**645,414**	**675,420**	**688,397**	**702,431**	**712,336**	**722,830**	
NOMINAL CAPEX	**kUS$**	**722,830**																								
VAC ITD 8%)	**kUS$**	**353,415**																								

La Tabla 11-21, muestra el perfil de adquisición y reemplazo de equipos mineros, los que alcanzan un valor nominal de 722,830 kUS$, que actualizados a una tasa de descuento del 8%, alcanzan un total de 353,415 kUS$ como valor actualizado de capital.

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Como resumen de la evaluación, se muestra la Tabla 11-22, el gasto de capital en equipos mineros para el plan minero operativo.

Tabla 11-22: Resumen Capex Plan Minero Operativo

CAPEX		
Adquisición	kUS$	87,298
Reemplazos	kUS$	361,510
Overhaul	kUS$	-
Repuestos Relevantes	kUS$	274,022
Capex Nominal	kUS$	**722,830**
VAC	kUS$	**353,415**

Total Movement	kt	**2,580,029**
Total Capex	US$/t	**0.280**

11.12 Gasto de Operación Mina (OPEX)

Utilizando el modelo de determinación de gastos por relaciones de Insumo–Producto (IP) desarrollado por Minera Chinalco (MCP) Mina Toromocho, se determinan los gastos y costos operacionales por elemento de gasto para cada actividad operativa, cuyo resultado considera algunas particularidades como:

- Los materiales movidos por el plan minero consideran una humedad promedio de 2.5%, los cuales están separados por tipo de material de acuerdo con su origen y destino, los que, a su vez, se separan en los extraídos desde la mina, de los que son extraídos desde stocks, esto para determinar los materiales que deben considerar perforación y tronadura.
- El modelo desarrollado, por MCP Mina Toromocho, en su funcionamiento, requiere del ingreso de precios unitarios de insumos, como son mostrados en la Tabla 11-23, en el cual se detalla los valores importantes en la estructura de costos de la mina como son: el precio del petróleo, energía, de neumáticos, precios de los aceros, además de los valores asignados a las remuneraciones de acuerdo a la estructura organizacional.
- El mantenimiento de los equipos mina, corresponde a mantenimiento propio, por tanto, dentro del costo está incluido la remuneración de la dotación de mantenimiento. La Tabla 11-24, muestra el costo de mantenimiento, estimado a partir de información del consultor en cuanto a los costos fijo por unidad anual, mientras que el costo variable está ajustado a los montos aportados por Minera Chinalco en su reporte de costos correspondiente al año 2019-2020.
- La estimación del Opex utiliza, los parámetros y consumos principales, los cuales están definidos en la Tabla 11-25, la cual está conformada por información proveniente de la base de dato del consultor y de MCP, para los equipos con los que cuenta la Operación en la mina Toromocho.

TETRA TECH

Tabla 11-23: Precios Unitarios e Insumos - Remuneraciones

Op. Un.	Ítem	Unidad	Value
CARGUÍO	Consumo Energía Pala CAT 7495 73yd³	US$/kWh	0.067
	Consumo Petroleo Pala L2350	US$/gln	2.870
	Rendimiento Neumáticos L2350	US$/unid.	106,286
TRANSPORTE	Consumo Horiz. Cargado	US$/gln	2.870
	Consumo Sub. Cargado	US$/gln	2.870
	Consumo Bajando Cargado	US$/gln	2.870
	Consumo Horiz. Vacío	US$/gln	2.870
	Consumo Sub. Vacío	US$/gln	2.870
	Consumo Bajando vacío	US$/gln	2.870
	Consumo Idle	US$/gln	2.870
	Consumo switch back	US$/gln	2.870
	Rendimiento Neumáticos	US$/unid.	50,439
PERFORACION	Consumo Energía PV-351	US$/kWh	0
	Rendimiento Tricono	US$/unid.	3,352
	Rendimiento Barra	US$/unid.	10,375
	Rendimiento Estabilizador	US$/unid.	2,350
	Rendimiento Anillo	US$/unid.	3,150
	Rendimiento Adaptadores	US$/unid.	1,240
	Rendimiento Amortiguadores	US$/unid.	36,810
	Consumo Agua	US$/lt	0.0024
	Consumo Petroleo Roc L8	US$/gln	3
	Rendimiento Barra	US$/unid.	1,665
	Rendimiento Broca	US$/unid.	895
	Rendimiento Martillo	US$/unid.	6,588
	Rendimiento Anillo	US$/unid.	-
	Rendimiento Adaptadores	US$/unid.	467
	Rendimiento Amortiguadores	US$/unid.	-
	Consumo Agua	US$/lt	0.0024
EQUIPOS AUXILIARES	Consumo Petroleo Bulldozer CAT D10T	US$/gln	2.870
	Consumo Petroleo Bulldozer CAT D11T	US$/gln	2.870
	Consumo Petroleo Bulldozer KOM D475A	US$/gln	2.870
	Consumo Petroleo Wheeldozer CAT 854K	US$/gln	2.870
	Consumo Petroleo Wheeldozer KOM WD900	US$/gln	3.870
	Consumo Petroleo Motor grader CAT 24M	US$/gln	2.870
	Consumo Petroleo Water Truck CAT 777F WT	US$/gln	2.870
	Consumo Petroleo Excavator CAT 390DL	US$/gln	2.870
	Consumo Petroleo Front Loader CAT 992K	US$/gln	2.870
	Consumo Petroleo Truck CAT 777 F-G	US$/gln	2.870
	Consumo Petroleo Compactor CAT CS76	US$/gln	2.870
	Consumo Petroleo Camión Remolcador CAT793B	US$/gln	2.870
	Consumo Petroleo Manipulador de Cables CAT988	US$/gln	2.870
	Consumo Petroleo Excavator CAT 374	US$/gln	2.870
	Consumo Petroleo Excavator KOM W B93R	US$/gln	3.870
	Consumo Petroleo Minicargador BOBCAT	US$/gln	2.870
	Consumo Petroleo Camión Plataforma / Grúa	US$/gln	2.870
	Consumo Petroleo Camión Cablero	US$/gln	2.870
	Consumo Petroleo Loader CAT 930K	US$/gln	2.870
	Consumo Petroleo Luminarias	US$/gln	2.870
	Rendimiento Neumáticos Wheeldozer CAT 854K	US$/unid.	26,279
	Rendimiento Neumáticos Wheeldozer KOM WD900	US$/unid.	17,360
	Rendimiento Neumáticos Motor grader CAT 24M	US$/unid.	7,000
	Rendimiento Neumáticos Water Truck CAT 777F WT	US$/unid.	10,951
	Rendimiento Neumáticos Front Loader CAT 992K	US$/unid.	26,279
	Rendimiento Neumáticos Truck CAT 777 F-G	US$/unid.	10,192
	Rendimiento Neumáticos Compactor CAT CS76	US$/unid.	2,500
	Rendimiento Neumáticos Camión Remolcador CAT793B	US$/unid.	35,000
	Rendimiento Neumáticos Manipulador de Cables CAT988	US$/unid.	21,597
	Rendimiento Neumáticos Minicargador BOBCAT	US$/unid.	1,800
	Rendimiento Neumáticos Camión Plataforma / Grúa	US$/unid.	2,000
	Rendimiento Neumáticos Camión Cablero	US$/unid.	2,000
	Rendimiento Neumáticos Loader CAT 930K	US$/unid.	5,516

SERVICES	Rate	Price
Blasting	US$/y	1,100,000
Emulsion	US$/t	425
ANFO	US$/t	404
Presplitting	US$/hole	45.55
Third-Party Services	US$/t	0.01
Others	US$/hh	11
% Expenses c/r Explosives Expenses	%	1.5%
Gravillag	US$/m³	0
Presplitting Height	m	17

Shovel CAT 7495 73 yd³	Rate	Price
Grease and lubricant expense	US$/h	47.08
Cable Expenditure,undercarriage.	US$/h	81.77
Hopper and G.E.T.	US$/h	106.10

Remunerations	Rate	Price
Employee	US$/y	20,659
Supervisor	US$/y	120,511
Executive	US$/y	172,158

TETRA TECH

Tabla 11-24: Costos de Mantenimiento de Equipos

COSTOS DE MANTENIMIENTO POR UNIDADES ANUALES			
ÍTEM	Unidades	Fijo x Unidad	Variable x HH
		US$/Un año	US$/hh
Mantenimiento Perforación PV351	US$/ Un Año	95,000	100.00
Mantenimiento Perforación Roc L8	US$/ Un Año	25,000	50.00
Mantenimiento Pala 62 yd3	US$/ Un Año	150,000	480.00
Mantenimiento Pala 73 yd3	US$/ Un Año	366,000	480.00
Mantenimiento CF 50 yd3	US$/ Un Año	211,000	317.36
Mantenimiento CAT 797F	US$/ Un Año	90,000	150.00
Mantenimiento KMS 930E	US$/ Un Año	90,000	150.00
Mantenimiento D10T	US$/ Un Año	35,000	50.00
Mantenimiento D11T	US$/ Un Año	35,000	50.00
Mantenimiento KOM D475A	US$/ Un Año	35,000	50.00
Mantenimiento 854K	US$/ Un Año	35,000	50.00
Wheeldozer KOM WD900	US$/ Un Año	35,000	50.00
Mantenimiento 24M	US$/ Un Año	35,000	50.00
Mantenimiento CAT 777 WT	US$/ Un Año	35,000	20.00
Mantenimiento Excavator (CAT 390DL)	US$/ Un Año	45,000	40.00
Mantenimiento Front Loader CAT 992K	US$/ Un Año	30,000	40.00
Mantenimiento Truck CAT 777 F-G	US$/ Un Año	30,000	40.00
Mantenimiento Compactor CAT CS76	US$/ Un Año	30,000	40.00
Mantenimiento Camión Remolcador CAT793B	US$/ Un Año	30,000	40.00
Mantenimiento Manipulador de Cables	US$/ Un Año	30,000	40.00
Mantenimiento Excavator CAT 374	US$/ Un Año	30,000	40.00
Mantenimiento Excavator KOM WB93R	US$/ Un Año	30,000	40.00
Mantenimiento Minicargador BOBCAT	US$/ Un Año	30,000	40.00
Mantenimiento Camión Plataforma / Grúa	US$/ Un Año	30,000	40.00
Mantenimiento Camión Cablero	US$/ Un Año	30,000	40.00
Mantenimiento Loader CAT 930K	US$/ Un Año	30,000	40.00
Mantenimiento Luminarias	US$/ Un Año	1,500	1.00

TETRA TECH

Tabla 11-25: Parámetros de Consumo de Equipos

Op. Un.	Item	Unit	Value
CARGUÍO	Power Shovel CAT 7495 73yd³	kWh/h	1,115
	Oil Shovel L2350	gln/hr	100
	Rendimiento Neumáticos L2350	hr/ unidad	4,000
TRANSPORTE	Horiz Loaded Consumption	gln/hr	68.00
	Consumo Sub. Cargado	gln/hr	105.00
	Consumo Bajando Cargado	gln/hr	45.00
	Consumo Horiz. Vacío	gln/hr	55.00
	Consumo Sub. Vacío	gln/hr	80.00
	Consumo Bajando vacío	gln/hr	45.00
	Consumo Idle	gln/hr	60.00
	Consumo switch back	gln/hr	60.00
	Performance Tires	hr/ unidad	5,000
PERFORACION	Consumo Energía PV-351	kWh/h	850
	Rendimiento Tricono	m	3,500
	Rendimiento Barra	m	70,000
	Rendimiento Estabilizador	m	27,000
	Rendimiento Anillo	m	60,000
	Rendimiento Adaptadores	m	70,000
	Rendimiento Amortiguadores	m	120,000
	Consumo Agua	lt / hr	180
	Consumo Petroleo Roc L8	gln / hr	25
	Rendimiento Barra	m	12,000
	Rendimiento Broca	m	1,250
	Rendimiento Martillo	m	8,000
	Rendimiento Anillo	m	-
	Rendimiento Adaptadores	m	8,000
	Rendimiento Amortiguadores	m	-
	Consumo Agua	lt / hr	90
EQUIPOS AUXILIARES	Consumo Petroleo Bulldozer CAT D10T	gln / hr	15
	Consumo Petroleo Bulldozer CAT D11T	gln / hr	15
	Consumo Petroleo Bulldozer KOM D475A	gln / hr	15
	Consumo Petroleo Wheeldozer CAT 854K	gln / hr	20
	Consumo Petroleo Wheeldozer KOM WD900	gln / hr	20
	Consumo Petroleo Motor grader CAT 24M	gln / hr	9.5
	Consumo Petroleo Water Truck CAT 777F WT	gln / hr	20
	Consumo Petroleo Excavator CAT 390DL	gln / hr	10
	Consumo Petroleo Front Loader CAT 992K	gln / hr	60
	Consumo Petroleo Truck CAT 777 F-G	gln / hr	50
	Consumo Petroleo Compactor CAT CS76	gln / hr	5
	Consumo Petroleo Camión Remolcador CAT793B	gln / hr	60
	Consumo Petroleo Manipulador de Cables CAT988	gln / hr	10
	Consumo Petroleo Excavator CAT 374	gln / hr	4
	Consumo Petroleo Excavator KOM W B93R	gln / hr	5
	Consumo Petroleo Minicargador BOBCAT	gln / hr	4
	Consumo Petroleo Camión Plataforma / Grúa	gln / hr	10
	Consumo Petroleo Camión Cablero	gln / hr	10
	Consumo Petroleo Loader CAT 930K	gln / hr	20
	Consumo Petroleo Luminarias	gln / hr	0.1
	Rendimiento Neumáticos Wheeldozer CAT 854K	horas	5,000
	Rendimiento Neumáticos Wheeldozer KOM WD900	horas	5,000
	Rendimiento Neumáticos Motor grader CAT 24M	horas	5,000
	Rendimiento Neumáticos Water Truck CAT 777F WT	horas	5,000
	Rendimiento Neumáticos Front Loader CAT 992K	horas	5,000
	Rendimiento Neumáticos Truck CAT 777 F-G	horas	5,000
	Rendimiento Neumáticos Compactor CAT CS76	horas	5,000
	Rendimiento Neumáticos Camión Remolcador CAT793B	horas	5,000
	Rendimiento Neumáticos Manipulador de Cables CAT988	horas	5,000
	Rendimiento Neumáticos Minicargador BOBCAT	horas	5,000
	Rendimiento Neumáticos Camión Plataforma / Grúa	horas	5,000
	Rendimiento Neumáticos Camión Cablero	horas	5,000
	Rendimiento Neumáticos Loader CAT 930K	horas	5,000

11.13 Costo Mina Plan Minero Operativo

En la Tabla 11-26, se resume el gasto y costo mina obtenido para el plan minero operativo a 370 ktpd de movimiento y 170 ktpd de alimentación a chancador, el cual muestra un costo de 1.742 US$/tn, para un movimiento de 2,580,029 ktn y una distancia media ponderada de 4,127 km. Siendo los costos relevantes el transporte, la voladura, carguío y administración.

Tabla 11-26: Resumen de Gasto y Costo Mina Plan Minero

CONSUMO POR ELEMENTO	Unidades	Valores
Materiales	MUS$	869.346
Combustible	MUS$	1,321.459
Servicios de Terceros	MUS$	69.431
Remuneraciones	MUS$	179.299
Abastecimiento de Energía	MUS$	63.451
Abastecicmiento de Agua	MUS$	88.636
Mantenimiento	MUS$	1,319.111
Otros	MUS$	116.456
Administración	MUS$	470.528
TOTAL	MUS$	4,498
TOTAL	US$/t	1.742

TOTAL MINA POR OPERACIONES UNITARIAS	Unidades	Valores
Perforación	MUS$	154.069
Voladura	MUS$	567.909
Carguío	MUS$	493.360
Transporye	MUS$	2,248.570
Movimiento de Tierra	MUS$	530.075
Soporte y Apoyo	MUS$	33.207
Servivios de Terceros (Equipos Auxiliares)	MUS$	0.000
Administración	MUS$	470.528
TOTAL	MUS$	4,498

COSTO MINA PROMEDIO	Unidades	Costo
Perforación	US$/tn	0.060
Voladura	US$/tn	0.220
Carguío	US$/tn	0.191
Transporye	US$/tn	0.871
Movimiento de Tierra	US$/tn	0.205
Soporte y Apoyo	US$/tn	0.013
Servicios de Terceros (Equipos Auxiliares)	US$/tn	0.000
Administración	US$/tn	0.182
TOTAL	US$/th	1.742
Costo Mina (Sin Transporte)	US$/th	0.871

De la tabla anterior, se elaboran los gráficos circulares, representando la distribución del costo mina por actividad u operación unitaria. En la Figura 11-4, se representa la distribución del costo unitario de cada una de las operaciones unitarias, incluyendo el costo por remuneraciones y administración. En la Figura 11-5, se representa el gasto total de la mina por elemento, del cual se aprecia que los gastos mayores son de mantenimiento y combustible con 29% del gasto total.

Figura 11-4: Distribución del Costo Mina por Operaciones Unitarias

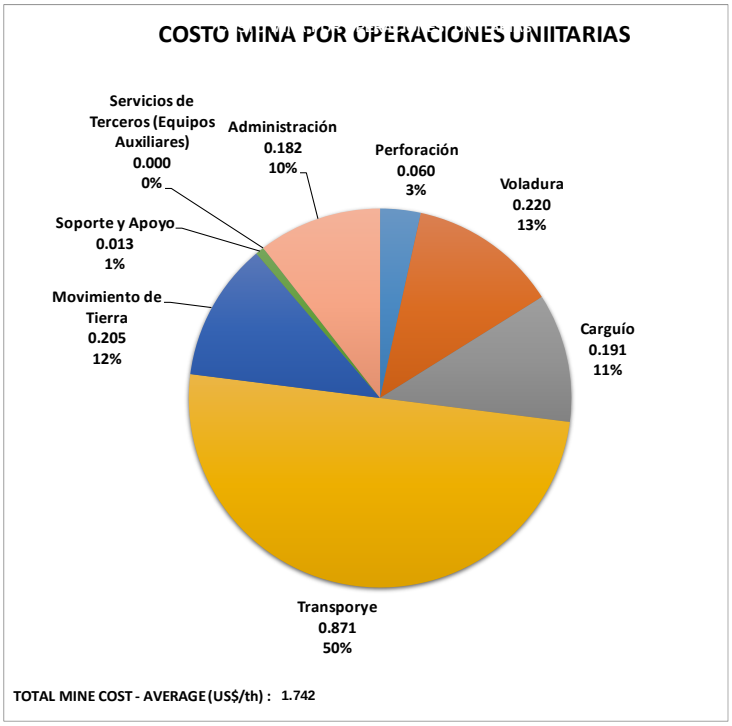
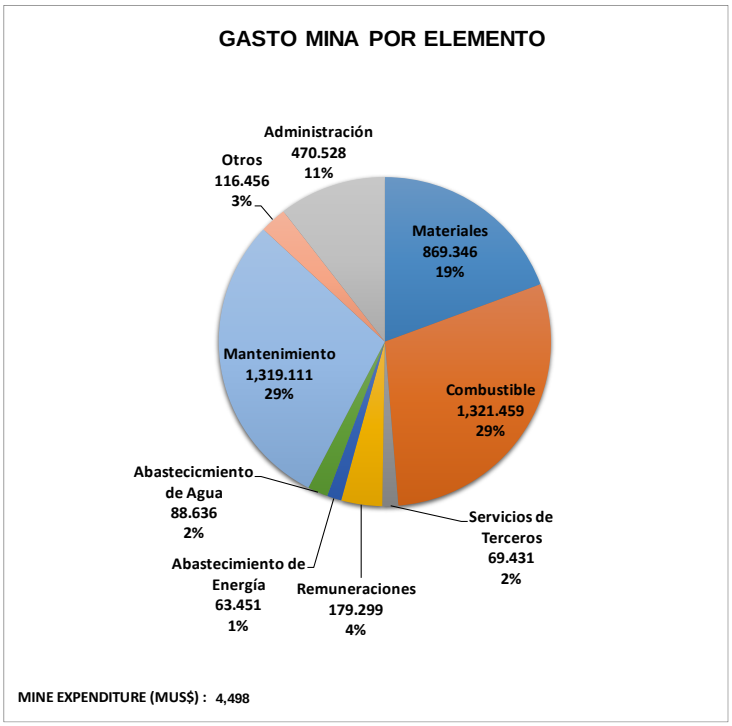


Figura 11-5: Distribución de Gasto Mina por Elemento



La Tabla 11-27, muestra el perfil del gasto y estimación del costo de operación mina por cada periodo (año), de acuerdo con el movimiento que realiza la mina, los equipos y recursos utilizados.

Tabla 11-27: Perfil de Costo Mina por Elemento y Actividad

TOTAL MINA POR ELEMENTO	Unidad	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Materiales	MUS$	45.06	43.36	50.70	53.04	46.95	51.81	48.27	45.91	42.21	42.03	33.98	32.24	20.74	21.38	29.26	27.94	32.93	31.93	30.64	31.14	26.26	27.68	27.19	26.70
Combustibles	MUS$	59.00	59.09	65.67	69.05	74.06	80.83	77.08	75.97	69.34	71.75	56.96	50.20	38.76	38.43	41.98	38.60	45.97	45.33	41.80	46.26	42.65	46.03	43.26	43.39
Servicios de Terceros	MUS$	3.73	3.44	3.68	3.83	3.45	3.63	3.53	3.21	3.30	3.19	2.81	2.86	2.03	2.08	2.44	2.41	2.88	2.67	2.83	2.81	2.35	2.26	2.01	2.00
Remuneraciones	MUS$	7.93	7.95	8.51	8.68	8.95	9.23	9.15	9.15	9.07	9.07	8.20	7.54	6.32	6.32	6.32	6.32	6.32	6.32	6.32	6.32	6.32	6.32	6.32	6.32
Abastecimiento																									
Energía eléctrica	MUS$	3.15	3.24	3.55	3.56	2.81	3.14	2.86	3.14	2.86	2.86	2.58	2.59	1.80	1.80	2.40	2.41	2.40	2.40	2.40	2.41	2.13	2.13	2.40	2.41
Agua	MUS$	4.74	4.74	4.75	4.76	4.74	4.74	4.74	4.76	4.74	4.74	4.74	3.17	3.16	3.16	3.17	3.17	3.17	3.17	3.17	3.17	3.16	3.16	1.59	0.01
Mantenimiento y Servicios	MUS$	59.55	59.86	64.22	66.61	68.85	74.87	72.08	72.57	69.14	72.16	61.13	54.34	42.32	41.77	44.26	41.18	45.61	44.87	42.45	45.20	43.15	44.67	43.87	44.39
Others and Fixed	MUS$	5.91	6.07	6.11	6.10	5.79	6.08	6.02	5.90	5.64	5.55	5.32	5.40	3.46	3.50	3.81	3.83	4.09	4.08	4.06	4.07	3.82	3.91	4.00	3.93
Administration	MUS$	19.59	19.59	20.02	20.19	20.47	20.89	20.82	20.82	20.79	20.79	19.90	19.46	18.93	18.93	18.93	18.93	18.93	18.93	18.93	18.93	18.93	18.93	18.93	18.93
TOTAL	MUS$	**208.69**	**207.35**	**227.22**	**235.82**	**236.06**	**255.23**	**244.54**	**241.43**	**227.09**	**232.15**	**195.62**	**177.79**	**137.53**	**137.37**	**152.57**	**144.79**	**162.29**	**159.71**	**152.61**	**160.32**	**148.77**	**155.10**	**149.59**	**148.07**
TOTAL	US$/t	**1.63**	**1.62**	**1.75**	**1.82**	**1.86**	**1.91**	**1.83**	**1.81**	**1.72**	**1.76**	**1.55**	**1.51**	**1.61**	**1.62**	**1.75**	**1.80**	**1.83**	**1.83**	**1.78**	**1.87**	**1.75**	**1.79**	**1.72**	**1.71**

TOTAL MINA POR ACTIVIDAD	Unidad	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Perforación	MUS$	8.665	8.472	9.102	9.211	7.286	8.424	7.198	7.902	6.817	6.661	5.277	5.338	3.876	3.929	5.669	5.667	6.148	6.019	6.124	6.133	4.724	4.645	5.398	5.385
Voladura	MUS$	32.017	30.322	36.041	37.562	30.371	33.430	30.978	28.299	25.741	24.255	19.698	20.347	11.480	12.308	19.401	19.363	22.873	22.091	21.703	21.229	16.718	17.509	17.441	16.731
Carguío	MUS$	24.204	24.512	24.316	24.406	25.065	25.831	25.807	25.875	25.795	25.812	23.984	20.603	16.703	16.452	17.116	14.585	17.116	16.673	16.143	16.031	16.247	16.550	16.661	16.872
Transporte	MUS$	97.46	97.71	110.49	117.12	125.62	138.72	131.80	130.53	120.00	126.69	99.52	88.54	65.99	65.20	70.91	65.66	76.68	75.45	69.16	77.41	71.61	77.77	73.85	74.68
Equipos Auxiliares y de Apoyo	MUS$	25.159	25.159	25.671	25.736	25.671	26.354	26.354	26.421	26.354	26.354	25.671	21.935	19.359	19.359	19.359	19.399	19.359	19.359	19.359	19.399	19.359	18.517	16.128	14.284
Servicios	MUS$	1.585	1.585	1.585	1.588	1.585	1.585	1.585	1.588	1.579	1.579	1.573	1.570	1.185	1.185	1.185	1.187	1.185	1.185	1.185	1.187	1.185	1.180	1.180	1.187
SUB TOTAL	MUS$	**189**	**188**	**207**	**216**	**216**	**234**	**224**	**221**	**206**	**211**	**176**	**158**	**119**	**118**	**134**	**126**	**143**	**141**	**134**	**141**	**130**	**136**	**131**	**129**
SUB TOTAL	US$/tn	**1.475**	**1.463**	**1.594**	**1.667**	**1.701**	**1.753**	**1.676**	**1.656**	**1.561**	**1.602**	**1.395**	**1.346**	**1.390**	**1.399**	**1.530**	**1.562**	**1.617**	**1.609**	**1.560**	**1.649**	**1.525**	**1.573**	**1.500**	**1.489**
Adm. Mina	MUS$	19.594	19.594	20.020	20.195	20.467	20.893	20.816	20.816	20.795	20.795	19.902	19.456	18.932	18.932	18.932	18.932	18.932	18.932	18.932	18.932	18.932	18.932	18.932	18.932
TOTAL	MUS$	**209**	**207**	**227**	**236**	**236**	**255**	**245**	**241**	**227**	**232**	**196**	**178**	**138**	**137**	**153**	**145**	**162**	**160**	**153**	**160**	**149**	**155**	**150**	**148**
TOTAL	US$/tn	**1.628**	**1.616**	**1.748**	**1.823**	**1.862**	**1.909**	**1.832**	**1.812**	**1.719**	**1.759**	**1.553**	**1.512**	**1.612**	**1.623**	**1.747**	**1.797**	**1.830**	**1.825**	**1.781**	**1.870**	**1.747**	**1.792**	**1.717**	**1.707**

COSTOS UNITARIOS	Unidad	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Perforación	US$/tn	0.068	0.066	0.070	0.071	0.057	0.063	0.054	0.059	0.052	0.050	0.042	0.045	0.045	0.046	0.065	0.070	0.069	0.069	0.071	0.072	0.055	0.054	0.062	0.062
Voladura	US$/tn	0.250	0.236	0.277	0.290	0.240	0.250	0.232	0.212	0.195	0.184	0.156	0.173	0.135	0.145	0.222	0.240	0.258	0.252	0.253	0.248	0.196	0.202	0.200	0.193
Carguío	US$/tn	0.189	0.191	0.187	0.189	0.198	0.193	0.193	0.194	0.195	0.196	0.190	0.175	0.196	0.194	0.196	0.181	0.193	0.191	0.188	0.187	0.191	0.191	0.191	0.195
Transporte	US$/tn	0.760	0.761	0.850	0.905	0.991	1.038	0.987	0.980	0.908	0.960	0.790	0.753	0.774	0.770	0.812	0.815	0.865	0.862	0.807	0.903	0.841	0.899	0.848	0.861
Equipos Auxiliares y de Apoyo	US$/tn	0.196	0.196	0.197	0.199	0.202	0.197	0.197	0.198	0.199	0.200	0.204	0.186	0.227	0.229	0.222	0.241	0.218	0.221	0.226	0.226	0.227	0.214	0.185	0.165
Servicios	US$/tn	0.012	0.012	0.012	0.012	0.013	0.012	0.012	0.012	0.012	0.012	0.012	0.013	0.014	0.014	0.014	0.015	0.013	0.014	0.014	0.014	0.014	0.014	0.014	0.014
Adm. Mina	US$/tn	0.153	0.153	0.154	0.156	0.161	0.156	0.156	0.156	0.157	0.158	0.158	0.165	0.222	0.224	0.217	0.235	0.213	0.216	0.221	0.221	0.222	0.219	0.217	0.218
Total	US$/tn	**1.628**	**1.616**	**1.748**	**1.823**	**1.862**	**1.909**	**1.832**	**1.812**	**1.719**	**1.759**	**1.553**	**1.512**	**1.612**	**1.623**	**1.747**	**1.797**	**1.830**	**1.825**	**1.781**	**1.870**	**1.747**	**1.792**	**1.717**	**1.707**
Costos sin Transporte	US$/tn	**0.868**	**0.854**	**0.898**	**0.918**	**0.871**	**0.872**	**0.844**	**0.832**	**0.810**	**0.799**	**0.763**	**0.759**	**0.839**	**0.853**	**0.935**	**0.982**	**0.965**	**0.963**	**0.974**	**0.967**	**0.906**	**0.894**	**0.869**	**0.846**

La Tabla 11-28 muestra el perfil de costos obtenidos de la evaluación, desglosados en fijos y variables.

Tabla 11-28: Perfil de Costos Fijos y Variables

	Unidad	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Costo Fijo	US$/tn	0.214	0.214	0.220	0.225	0.234	0.229	0.228	0.229	0.229	0.229	0.222	0.224	0.279	0.282	0.273	0.296	0.269	0.272	0.278	0.278	0.280	0.275	0.272	0.273
Costo Variable	US$/tn	1.414	1.402	1.528	1.599	1.628	1.680	1.604	1.583	1.490	1.530	1.331	1.287	1.333	1.341	1.474	1.501	1.561	1.553	1.503	1.592	1.467	1.517	1.445	1.434
Costo Total	US$/tn	1.628	1.616	1.748	1.823	1.862	1.909	1.832	1.812	1.719	1.759	1.553	1.512	1.612	1.623	1.747	1.797	1.830	1.825	1.781	1.870	1.747	1.792	1.717	1.707

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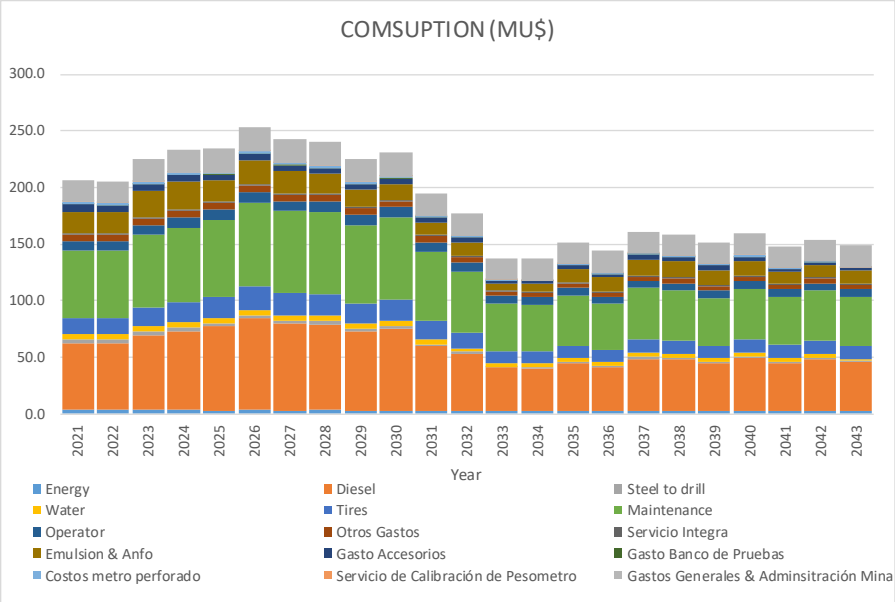
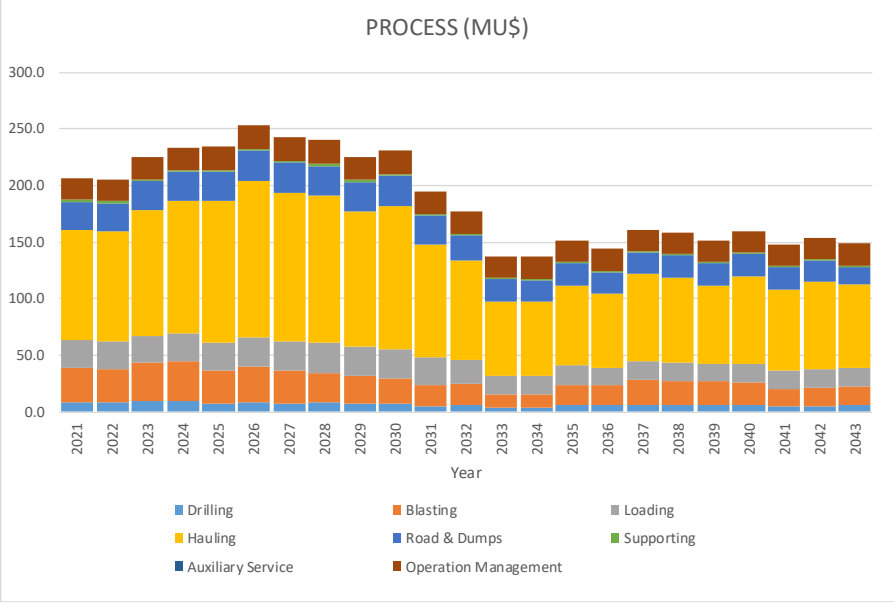
La Figura 11-6, muestra el perfil total del gasto mina por período de elemento consumibles como energía, petróleo, agua, neumáticos, etc.

Figura 11-6: Gasto por Materiales



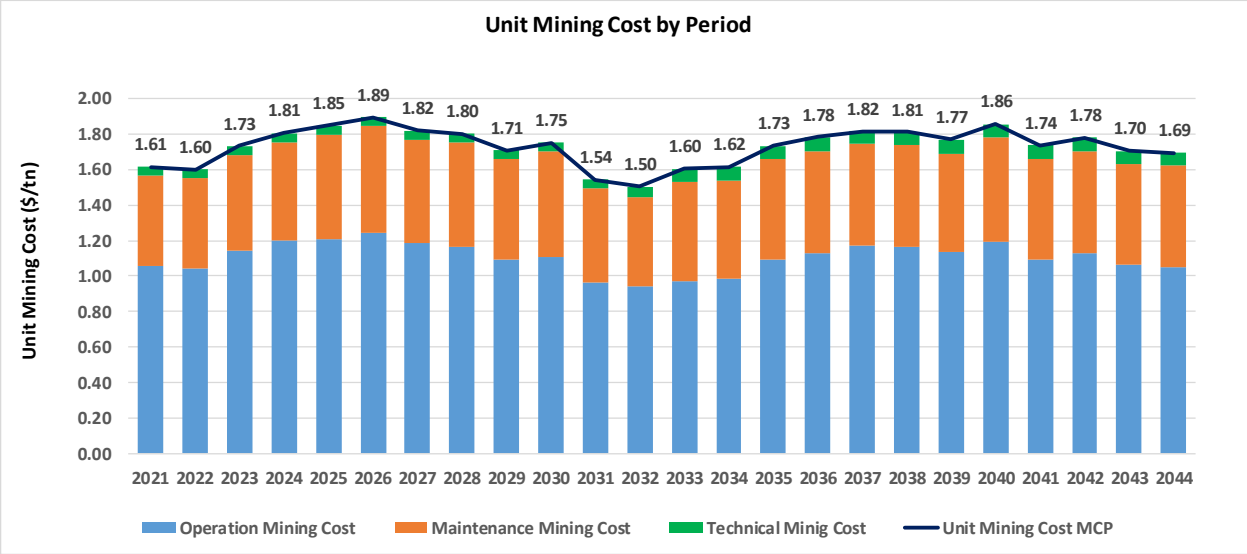
En la Figura 11-7, se muestra el perfil de gasto mina por operaciones unitarias como perforación, carguío, transporte, etc.

Figura 11-7: Gasto Mina por Operaciones Unitarias



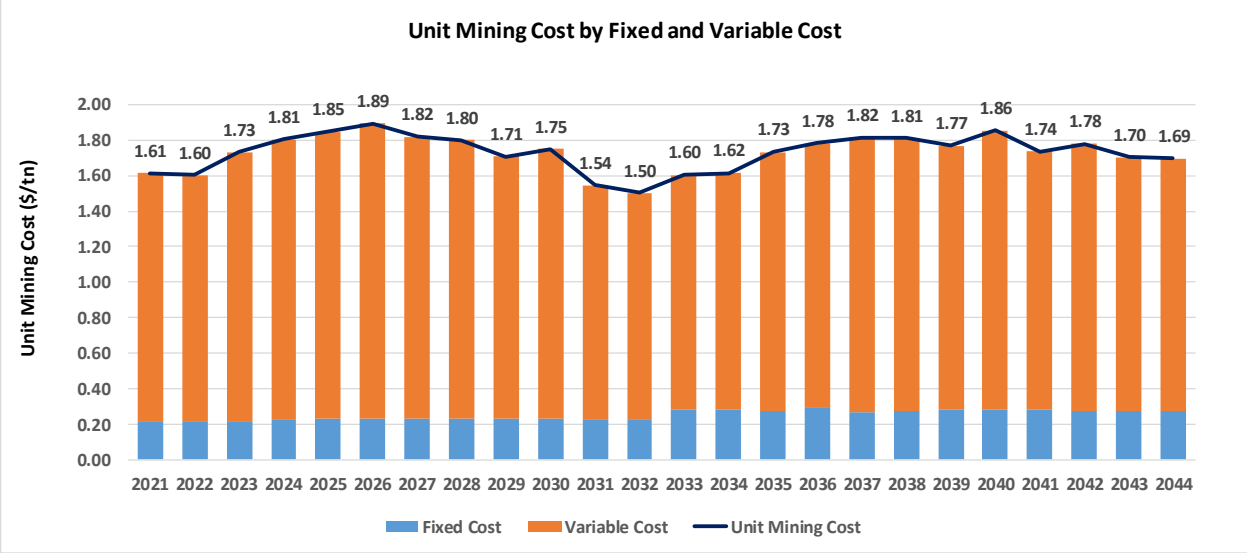
En la Figura 11-8, se muestra el perfil de costo mina por operaciones unitarias, desglosadas por operación, mantenimiento y servicios técnicos.

Figura 11-8: Costos Mina por Unidad de Operación



La Figura 11-9, muestra el perfil de costo mina desglosado entre fijo y variable.

Figura 11-9: Costos Fijo y Variables



La **Tabla 11-29**, muestra el resumen de tonelaje de explosivos desglosados en Emulsión y Nitrato de amonio, de acuerdo con los factores de carga de los pozos según los parámetros de voladura definidos para el desarrollo del presente LOM, separados por cada periodo.

Tabla 11-29: Resumen Tonelaje de Explosivos por Periodos

Emulsion		Total	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
UINTA	Ton	110,927	2,460	2,952	14,081	19,192	6,578	5,974	1,797	1,622	1,532	4,435	3,852	3,006
UINTB	Ton	142,533	4,063	7,887	7,139	4,091	7,244	9,729	10,101	11,169	2,854	558	249	878
UHORN	Ton	277,769	24,582	18,116	15,219	9,882	6,331	15,107	5,920	16,977	19,330	16,795	13,585	13,298
USKAT	Ton	59,764	680	583	4,406	7,513	6,927	4,464	12,161	1,737	3,711	2,217	676	1,228
USKSM	Ton	47,202	3,068	4,316	1,540	3,458	7,095	3,114	4,826	990	393	2,053	2,491	3,072
UYANH	Ton	2,717	-	-	-	-	-	-	-	-	-	-	-	-
Total	Ton	**640,913**	**34,854**	**33,855**	**42,385**	**44,135**	**34,175**	**38,389**	**34,805**	**32,495**	**27,821**	**26,059**	**20,853**	**21,481**

Nitrate		Total	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
UINTA	Ton	44,688	991	1,189	5,673	7,732	2,650	2,407	724	653	617	1,787	1,552	1,211
UINTB	Ton	57,420	1,637	3,177	2,876	1,648	2,918	3,919	4,069	4,499	1,150	225	100	354
UHORN	Ton	111,901	9,903	7,298	6,131	3,981	2,550	6,086	2,385	6,839	7,787	6,766	5,473	5,357
USKAT	Ton	24,076	274	235	1,775	3,027	2,791	1,798	4,899	700	1,495	893	272	495
USKSM	Ton	19,016	1,236	1,739	620	1,393	2,858	1,255	1,944	399	159	827	1,004	1,237
UYANH	Ton	1,095	-	-	-	-	-	-	-	-	-	-	-	-
Total	Ton	**258,196**	**14,041**	**13,639**	**17,075**	**17,780**	**13,768**	**15,465**	**14,022**	**13,091**	**11,208**	**10,498**	**8,401**	**8,654**

Emulsion		Total	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
UINTA	Ton	110,927	3,270	3,872	10,727	10,612	5,681	5,106	1,744	79	219	390	164	1,581
UINTB	Ton	142,533	657	910	2,992	3,898	3,675	7,517	4,216	4,802	6,105	10,197	16,954	14,648
UHORN	Ton	277,769	6,222	5,761	7,238	6,080	7,975	8,695	15,589	17,322	11,987	7,581	3,999	4,180
USKAT	Ton	59,764	839	1,173	1,447	1,564	4,978	1,618	1,017	220	38	227	75	264
USKSM	Ton	47,202	1,026	1,345	326	685	3,097	1,886	963	617	144	532	78	84
UYANH	Ton	2,717	-	-	-	-	-	637	181	-	-	1,376	524	-
Total	Ton	**640,913**	**12,015**	**13,061**	**22,731**	**22,839**	**25,406**	**25,459**	**23,710**	**23,039**	**18,493**	**20,302**	**21,793**	**20,758**

Nitrate		Total	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
UINTA	Ton	44,688	1,318	1,560	4,322	4,275	2,288	2,057	702	32	88	157	66	637
UINTB	Ton	57,420	265	367	1,205	1,570	1,480	3,028	1,699	1,934	2,459	4,108	6,830	5,901
UHORN	Ton	111,901	2,507	2,321	2,916	2,449	3,213	3,503	6,280	6,978	4,829	3,054	1,611	1,684
USKAT	Ton	24,076	338	473	583	630	2,006	652	410	88	15	91	30	106
USKSM	Ton	19,016	413	542	131	276	1,248	760	388	249	58	214	31	34
UYANH	Ton	1,095	-	-	-	-	-	256	73	-	-	554	211	-
Total	Ton	**258,196**	**4,840**	**5,262**	**9,157**	**9,201**	**10,235**	**10,256**	**9,552**	**9,282**	**7,450**	**8,179**	**8,780**	**8,362**

La **Tabla 11-30**, muestra el resumen de neumáticos totales por cada periodo requeridos por el LOM, los que están desglosados por tipo de equipos.

Tabla 11-30: Resumen Total de Neumáticos por Periodos

Equipment	Unit	Total	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Loading														
L2350 50 yd³	Unit	**211**	11	10	10	10	12	12	12	12	12	12	10	5
Hauling														
CAT797	Unit	**3116**	193	195	195	196	196	190	183	184	183	181	116	84
KOM980	Unit	**2685**	57	56	86	102	121	161	151	149	128	154	152	152
Road & Dumps														
Wheeldozer 854	Unit	**192**	9	9	9	9	9	9	9	9	9	9	9	9
KOM WD900	Unit	**24**	1	1	1	1	1	1	1	1	1	1	1	1
CAT24M	Unit	**1108**	45	45	55	55	55	64	64	64	64	64	55	46
WT CAT 777F-G	Unit	**551**	29	29	29	30	29	29	29	30	29	29	29	20
CAT 992K	Unit	**72**	3	3	3	3	3	3	3	3	3	3	3	3
Truck CAT 777F-G	Unit	**262**	13	13	13	13	13	13	13	13	13	13	13	11
Support Equipment														
CAT CS76	Unit	**24**	1	1	1	1	1	1	1	1	1	1	1	1
Lowboy CAT 793B	Unit	**24**	1	1	1	1	1	1	1	1	1	1	1	1
Cable Manipulator CAT 988	Unit	**72**	3	3	3	3	3	3	3	3	3	3	3	3
MiniLoader BOBCAT	Unit	**96**	4	4	4	4	4	4	4	4	4	4	4	4
Platform Truck/ Crane	Unit	**144**	6	6	6	6	6	6	6	6	6	6	6	6
Cable Trucks FMA	Unit	**168**	9	9	9	9	9	9	9	9	9	9	9	9
Loader CAT 930K	Unit	**48**	2	2	2	2	2	2	2	2	2	2	2	2

Equipment	Unit	Total	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Loading														
L2350 50 yd³	Unit	**211**	7	7	8	4	8	7	7	6	7	7	7	8
Hauling														
CAT797	Unit	**3116**	85	85	85	85	85	85	85	85	85	85	85	85
KOM980	Unit	**2685**	91	88	102	85	112	108	91	112	100	114	105	108
Road & Dumps														
Wheeldozer 854	Unit	**192**	7	7	7	7	7	7	7	7	7	7	7	7
KOM WD900	Unit	**24**	1	1	1	1	1	1	1	1	1	1	1	1
CAT24M	Unit	**1108**	36	36	36	36	36	36	36	36	36	36	36	36
WT CAT 777F-G	Unit	**551**	20	20	20	20	20	20	20	20	20	20	10	0
CAT 992K	Unit	**72**	3	3	3	3	3	3	3	3	3	3	3	3
Truck CAT 777F-G	Unit	**262**	9	9	9	9	9	9	9	9	9	9	9	9
Support Equipment														
CAT CS76	Unit	**24**	1	1	1	1	1	1	1	1	1	1	1	1
Lowboy CAT 793B	Unit	**24**	1	1	1	1	1	1	1	1	1	1	1	1
Cable Manipulator CAT 988	Unit	**72**	3	3	3	3	3	3	3	3	3	3	3	3
MiniLoader BOBCAT	Unit	**96**	4	4	4	4	4	4	4	4	4	4	4	4
Platform Truck/ Crane	Unit	**144**	6	6	6	6	6	6	6	6	6	6	6	6
Cable Trucks FMA	Unit	**168**	5	5	5	5	5	5	5	5	5	5	5	5
Loader CAT 930K	Unit	**48**	2	2	2	2	2	2	2	2	2	2	2	2

12 ANÁLISIS DE CAPACIDAD DE RELAVERA

En el año 2019 la empresa HATCH desarrolló, para Minera Chinalco-Perú, un nuevo Plan de Disposición de Relaves que presenta detalles anuales para llegar a disponer un total de 1,381.5 MT de relaves, equivalente a 959 Mm³ entre relaves espesados, relaves filtrados, y relaves ultra espesados. De la información disponible se aprecia que se está trabajado en aumentar la capacidad del depósito para el tonelaje requerido por el plan minero LOM2020, sin embargo, a la fecha de emisión del presente, no se cuenta con más información a firme, de tal forma que la comparación y análisis será al estudio realizado por Hatch del 2019. Por tanto, la comparación será con el estudio del 2019.

La Tabla 12-1, muestra el resumen de la estimación de la capacidad del tranque de relave diseñado por HATCH

Tabla 12-1: Resumen Capacidad de Relavera Diseño HATCH

Año Disponible	Descripción	Producción Mineral		Producción de Relaves	
		Mt	tpd	Mt	tpd
1	2019	42.8	117,200	42.2	115,676
2	2020	48.8	133,600	48.1	131,863
3	2021	62.1	170,000	61.2	167,790
4	2022	62.1	170,000	61.2	167,790
5	2023	62.1	170,000	61.2	167,790
6	2024	62.1	170,000	61.2	167,790
7	2025	62.1	170,000	61.2	167,790
8	2026	62.1	170,000	61.2	167,790
9	2027	62.1	170,000	61.2	167,790
10	2028	62.1	170,000	61.2	167,790
11	2029	62.1	170,000	61.2	167,790
12	2030	62.1	170,000	61.2	167,790
13	2031	62.1	170,000	61.2	167,790
14	2032	62.1	170,000	61.2	167,790
15	2033	62.1	170,000	61.2	167,790
16	2034	62.1	170,000	61.2	167,790
17	2035	62.1	170,000	61.2	167,790
18	2036	62.1	170,000	61.2	167,790
19	2037	62.1	170,000	61.2	167,790
20	2038	62.1	170,000	61.2	167,790
21	2039	31.0	170,000	30.2	165,584
Total		**1,400**		**1,381**	

El plan minero LOM 2020, propone producir 1,683 Mt de relave, en comparación a la capacidad determinada por Hatch de 1,381.5 Mt, constatando que se mantiene el déficit en cuanto a su capacidad del relave en 303 Mt. Este déficit representa el 18% del total. La Tabla 12-2, muestra la nueva capacidad del tranque requerido para contener todos los relaves proyectados por el LOM 2020 (Fases SET F)

Tabla 12-2: Capacidad Relavera Plan Minero LOM 2020

Año Disponible	Descripción	Producción Mineral		Producción de Relaves		Volume
		Mt	tpd	Mt	tpd	Mm³
1	2020	45.0	122,957	44.0	120,193	30.55
2	2021	54.3	148,815	53.1	145,469	36.87
3	2022	58.6	160,491	57.3	156,882	39.77
4	2023	62.1	170,000	60.7	166,178	42.12
5	2024	62.2	169,999	60.8	166,177	42.24
6	2025	62.0	170,000	60.7	166,178	42.12
7	2026	62.0	170,000	60.7	166,178	42.12
8	2027	62.1	170,000	60.7	166,178	42.12
9	2028	62.2	170,000	60.8	166,178	42.24
10	2029	62.0	170,000	60.7	166,178	42.12
11	2030	62.1	170,000	60.7	166,178	42.12
12	2031	62.1	170,000	60.7	166,178	42.12
13	2032	62.2	170,000	60.8	166,178	42.24
14	2033	62.1	170,000	60.7	166,178	42.12
15	2034	62.0	170,000	60.7	166,178	42.12
16	2035	62.1	170,000	60.7	166,178	42.12
17	2036	62.2	170,000	60.8	166,178	42.24
18	2037	62.0	170,000	60.7	166,178	42.12
19	2038	62.1	170,000	60.7	166,178	42.12
20	2039	62.0	170,000	60.7	166,178	42.12
21	2040	62.2	170,000	60.8	166,178	42.24
22	2041	62.1	170,000	60.7	166,178	42.12
23	2042	62.1	170,000	60.7	166,178	42.12
24	2043	62.0	169,536	60.7	165,724	42.12
25	2044	54.9	150,328	53.6	146,948	37.25
Total		**1,721**		**1,683**		**1,169**

Lo anterior implica que existe un déficit de aproximadamente 210 Mm³ de material de empréstito comparado con el proyecto inicial, cifra que deberá ser ratificada por una actualización del estudio de HATCH (aumento en la capacidad de almacenamiento del actual tranque de relaves) y por la búsqueda de materiales de empréstito desde la misma cantera actual, analizando los materiales que están en el fondo de la cantera o buscar una nueva que aporte la cantidad y calidad de materiales requeridos para completar la capacidad del tranque de relaves.

13 CÁLCULO DE VIDA ÚTIL DE LA OPERACIÓN

De acuerdo con lo solicitado por Minera Chinalco Perú, la vida útil de la Mina Toromocho se estima en 25 años. En conformidad a las reservas minerales comprobadas y declaradas en el actual plan minero que cubre los periodos 2020 hasta el año 2044.

Lo anterior se ratifica con la siguiente expresión:

$$Vida\ Útil\ (Años) = \frac{Reservas\ Minerales\ (Toneladas)}{Extracción\ de\ mineral\ (ton\ /\ día)\ \cdot\ N\ (días\ /\ año)}$$

$$Vida\ Útil\ (Años) = \frac{1{,}516{,}668.395\ (kt)}{166.085\ (kt\ /\ día)\ \cdot\ 365\ (días\ /\ año)} = 25.02 \approx 25\ Años$$

Donde:

- Reservas Minerales, corresponde a las reservas probadas más probables de mineral a la concentradora.
- Extracción de mineral, es la extracción promedio de mineral de la planta concentradora según su capacidad de diseño, que resulta de dividir el total de reservas (del proceso principal que es la concentradora), por el total de días de producción, a partir del año 2020 hasta el 2044.
- N, es la cantidad efectiva de días de operación de la planta en un año.

14 CUELLOS DE BOTELLA Y RIESGOS DEL PLAN DE MINADO

- La capacidad de diseño del tranque de relaves tiene un déficit de al menos 18% respecto a la capacidad requerida para el LOM-2020.
- Es necesario disponer de mayor área para la ubicación de lastre y acopio de stocks temporales de mineral, especialmente si aumentan las reservas minerales por las nuevas campañas infill que aporten mayores reservas al plan minero.
- Mayor definición en las restricciones de infraestructuras que limitan el crecimiento del pit y aumento de reservas minerales. Se necesario un análisis más profundo para levantar algunas restricciones si fuese el caso y así aumentar las reservas del actual LOM-2020.
- Cambios en la secuencia de desarrollo de la mina podría impactar el cumplimiento del perfil de leyes de alimentación a la planta y el compromiso de la producción de cobre, especialmente en el quinquenio 2021-2026.
- Oxidación de los sulfuros en los stockpiles de mediana y baja ley, lo que podría bajar la recuperación del Cu contenido en estos minerales.
- El aumento de los niveles de talco y el Ratox en los minerales, podría impactar la recuperación de la planta de proceso y modificar el plan de minado, perdiéndose cobre por menor recuperación.
- El no cumplimiento en las recuperaciones proyectadas, producto de la falta de información geometalúrgica.
- La planificación en periodos anuales tiende a suavizar el cumplimiento de las restricciones (promedios anuales), pero es probable que en un desarrollo de la planificación en períodos mensuales sea difícil de cumplir algunos periodos.
- La matriz de sustentabilidad de las reservas deja periodos del plan con demasiado mineral indicado (mayor a 40% durante 7 años, en los primeros 10 años de vida de la mina), lo que implica un menor nivel de confianza en las leyes comprometidas en el plan minero de ese período.
- Déficit superior a 306 millones de toneladas de material de empréstito en comparación con el proyecto inicial, un valor que debe ser ratificado por una actualización del estudio de HATCH (aumento de la capacidad de almacenamiento de la relavera actual) y la búsqueda de materiales de empréstito de la misma cantera actual o en un nuevo sector que aporte el material tanto en cantidad como en calidad requerida.

15 CONCLUSIONES Y RECOMENDACIONES

Una vez finalizado el estudio, Tetra Tech Chile concluye y recomienda lo siguiente:

- Para la determinación de las Reservas Minerales se emplearon herramientas computacionales y procedimientos de ingeniería estándares en la industria minera.
- El nivel de Reservas Minerales Probadas más Probables alcanza los 1,516.7 Mt, con ley de 0.439% TCu, 0.015% Mo y 5.59 g/t de Ag.
- Los Recursos Medidos e Indicados fueron valorizados como mineral para ser alimentados a la planta de proceso.
- Los Recursos Inferidos fueron considerado como lastre, con destino a Desmontes.
- Los minerales fueron enviados a proceso, con costos diferenciados de TC/RC, penalidades, de acuerdo con su contenido de As en la cabeza y en el concentrado, del mismo modo que otros contaminantes importantes en el proceso como Zn, Flúor y MGO.
- Las restricciones en la alimentación (por la proporción de minerales, por su componente litológica y de alteración) se cumple en la gran mayoría del plan, salvo cuando se realiza la reclamación en la etapa final del plan de minado, cuando la alimentación a planta es mayoritariamente desde los stocks.
- Durante la operación de la mina, en el corto plazo, se realizan pequeños acopios de minerales en distintos y variados espacios, sin embargo, se deberá simplificar el uso de los materiales de manera de mantener sólo los acopios declarados en el plan de minado.
- Las Reservas Minerales reportadas están basadas en un diseño minero de fases intermedias y en la construcción de un plan de minado de largo plazo, a nivel estratégico y a nivel operativo, empleando una secuencia económica en el consumo de las reservas.
- Se recomienda establecer un modelo de recuperación metalúrgica por tipo de mineral, y no efectuarlo por mezcla de minerales alimentados a la concentradora, mediante la elaboración de un modelo geometalúrgico.
- El plan minero desarrollado cubre los requerimientos planta actualmente establecidos para las mezclas solicitadas como son: % de Skarn Actinolita-Tremolita ≤ 40%, % Hornfels ≤ 30%, Skarn Serpentina Magnetita ≤ 30%, Talco ≤ 6%, Ratox ≤ 16% y % de As en la cabeza de ≤ 0.035%.
- La vida de la mina con las reservas actuales tiene una duración de 25 años.
- Se recomienda la adquisición de nuevas áreas para aumentar la capacidad de acopio de mineral (stock) y lastre, lo que implicaría optimizar de mejor forma el negocio a través de la política de ley de corte variable y además permitiría tener los espacios suficientes para el acopio de mineral y lastre en la eventualidad de aumentar las reservas minerales mediante campañas de sondajes infill y recategorización de estas.
- Para campañas infill actualizar el modelo geológico y de estimación de recursos solo en los sectores que se perforó los sondajes, evitando modificar todo el modelo de geológico.

- Mantener la secuencia de extracción del plan minero de largo plazo, evitando cambios en la planificación de corto plazo que impacten negativamente el perfil de leyes comprometidas en el quinquenio.
- Estudiar y presupuestar futuras campañas de sondajes infill con el objetivo de mejorar la categorización de recursos y el aumento de reservas minerales, especialmente en los contornos del pit.
- Los minerales de baja ley que están sobre la ley de corte marginal constituyen reservas, por lo tanto, se deben acopiar para ser procesados al final de la vida de la mina.
- Construir un modelo geo-metalúrgico para optimizar la recuperación de los diferentes materiales.
- El análisis de relavera implica que hay un déficit superior a 306 millones de m^3 de material de empréstito en comparación con el proyecto inicial, un valor que debe ser ratificado por una actualización del estudio HATCH (aumento de la capacidad de almacenamiento de la relavera actual) y la búsqueda de materiales de empréstito de la misma cantera actual, analizando los materiales que están en la parte inferior o buscando otro sector que proporcione la cantidad y calidad de materiales necesarios para completar la capacidad del muro de relaves.
- Estandarizar el proceso del LOM, que incorpore fechas límites para la entrega y tiempo de análisis de los Inputs, con tipo de información a entregar y responsables por área (disponibilidades físicas de los equipos, productividades históricas de los equipos, precios de largo plazo de los metales bases, capex para la expansión o reposición de instalaciones, costos de cierre de mina, etc.); calendarizando el proceso completo para un mejor cumplimiento de los objetivos del LOM.
- Introducir nuevos parámetros en la optimización del plan minero, como el uso del throughput por tipo de roca por ejemplo (US$/hr), en lugar de US$/ton (INP).
- Evaluar la posición del dique en la zona Buenaventura, ya que estaría a una distancia menor de 100 m, respecto a la pared del pit.
- Programar campaña de infill, pues la matriz de sustentabilidad de las reservas deja periodos del plan con demasiado mineral indicado (mayor a 40% durante 7 años, en los primeros 10 años de vida de la mina), lo que implica un menor nivel de confianza en las leyes comprometidas en el plan minero de ese período.
- Algunas infraestructuras deben ser removidas o cambiadas.
    - El Pique Central será impactada en el 2022, para ello el sistema de drenaje debe ser reubicado hacia el Pique Maria.
    - El AK15 será impactado en el 2021, para ello debe ser reubicado.
    - La planta de procesamiento de Argentum debe ser removido antes del 2022 para empezar el desmantelamiento y acondicionamiento para el minado.
    - La vía o camino de los equipos livianos que van al truck shop seria impactado en el 2029, pero estaría muy cerca de la zona de la fase 03.

- Para el Quinquenio se debe realizar un plan minero en periodos mensuales y trimestrales, ya que las restricciones podrían no ser completamente satisfechas.
- Estudiar las interferencias entre las fases, ya que las fases en desarrollo pueden ocasionar interrupciones o problemáticas de acceso a las zonas de mejor ley, que se encuentra por lo general en el fondo de las fases en producción.
- Evaluar Trade-off entre IPCC versus camiones, etc., para disminuir el número de camiones que se incrementan drásticamente a partir del 2024.
- Evaluar ampliación de la vida de la mina con minerales de la zona norte del rajo, ya sea mediante el trasladando la carretera central u otro método de explotación.
- Evaluar análisis marginal de fases en los anchos operativos de las últimas fases (F06, F08 y F09)
- Preparar por parte del área de mantenimiento los perfiles de disponibilidad física variables (anualmente) de acuerdo con el uso de los equipos y diferenciar entre equipos en uso y nuevos.

16 REFERENCIAS

(1) Modelo geológico Golder 2019, descripción de variables.
(2) Estudio Geotécnico Itasca Julio 2019.
(3) Plan de Minado Vigente 2019- 2020, versión 5.3
(4) Reporte del LOM2020(MCP) para TTM.pdf
(5) Presentación con la Estimación para Evaluación de Minerales, Jul 2017.
(6) Límites de concesiones, carretera central y contornos.
(7) Clasificación de minerales por alteración.
(8) Diseño de Depósito de Desmontes y Stocks.
(9) Fases vigentes.
(10) Orientaciones comerciales y lineamiento de comercialización.

ANEXO A

Fotos de Avance Mina por Período

Figura 16-1: Avance Mina Dic 2020

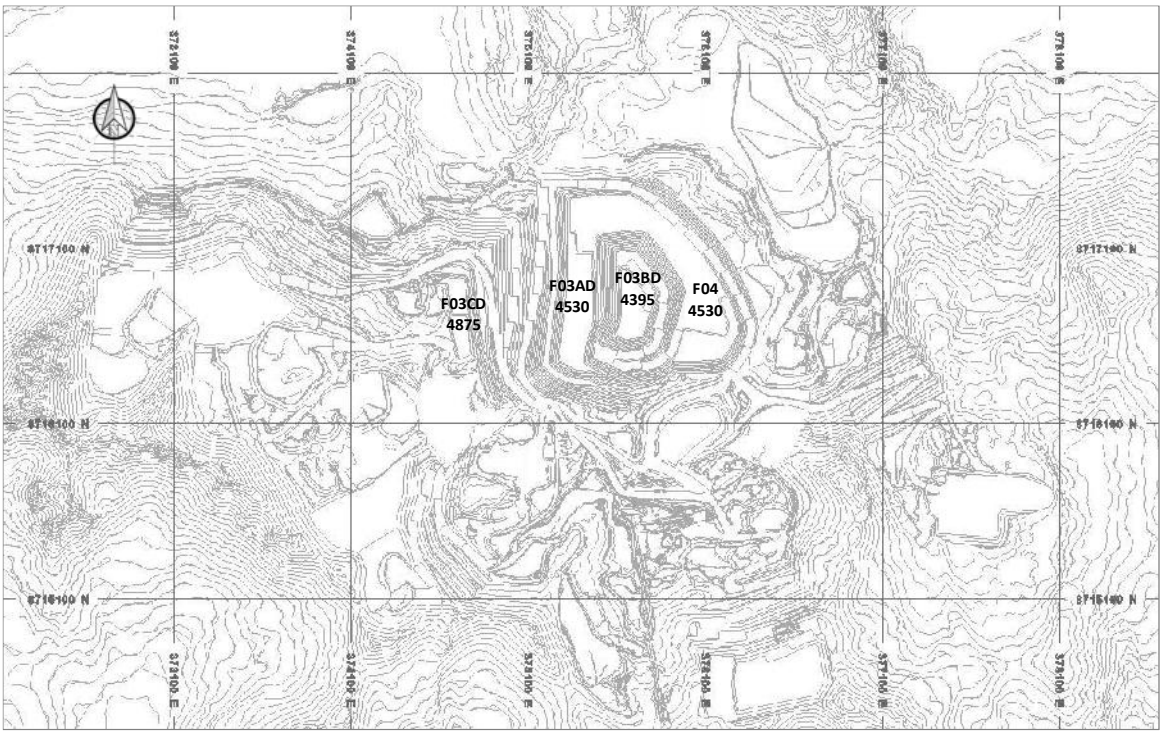


Figura 16-2: Avance Mina Dic 2021

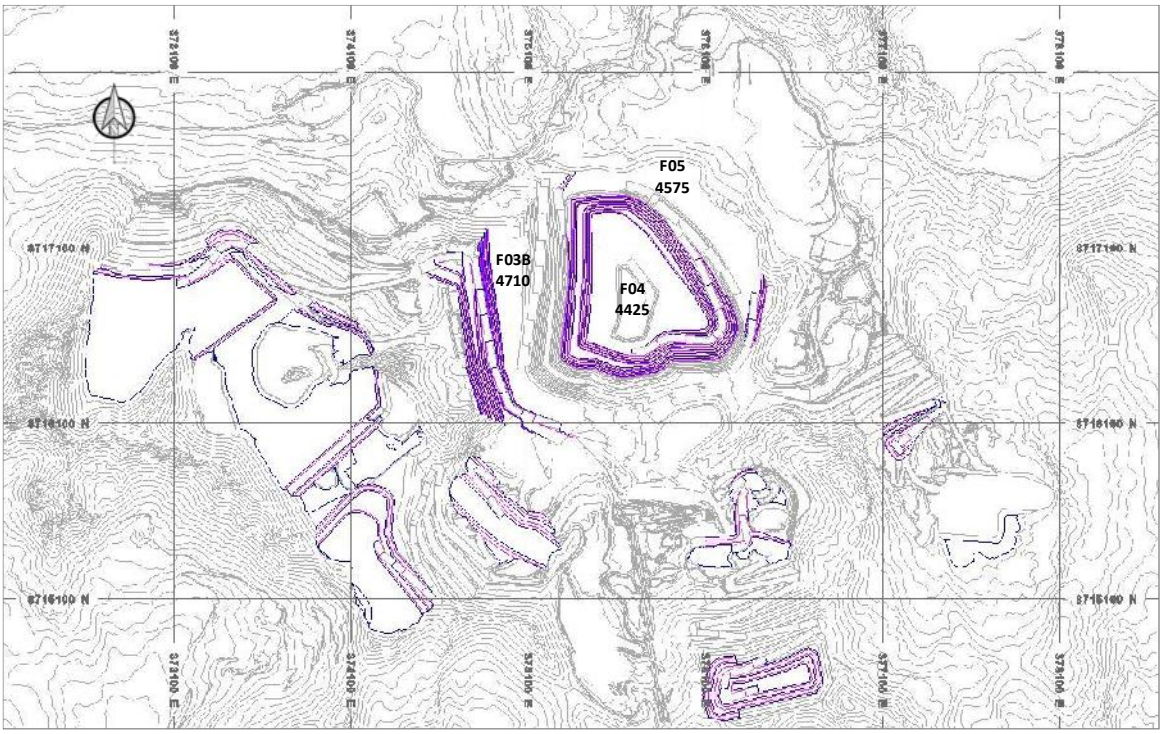


Figura 16-3: Avance Mina Dic 2022

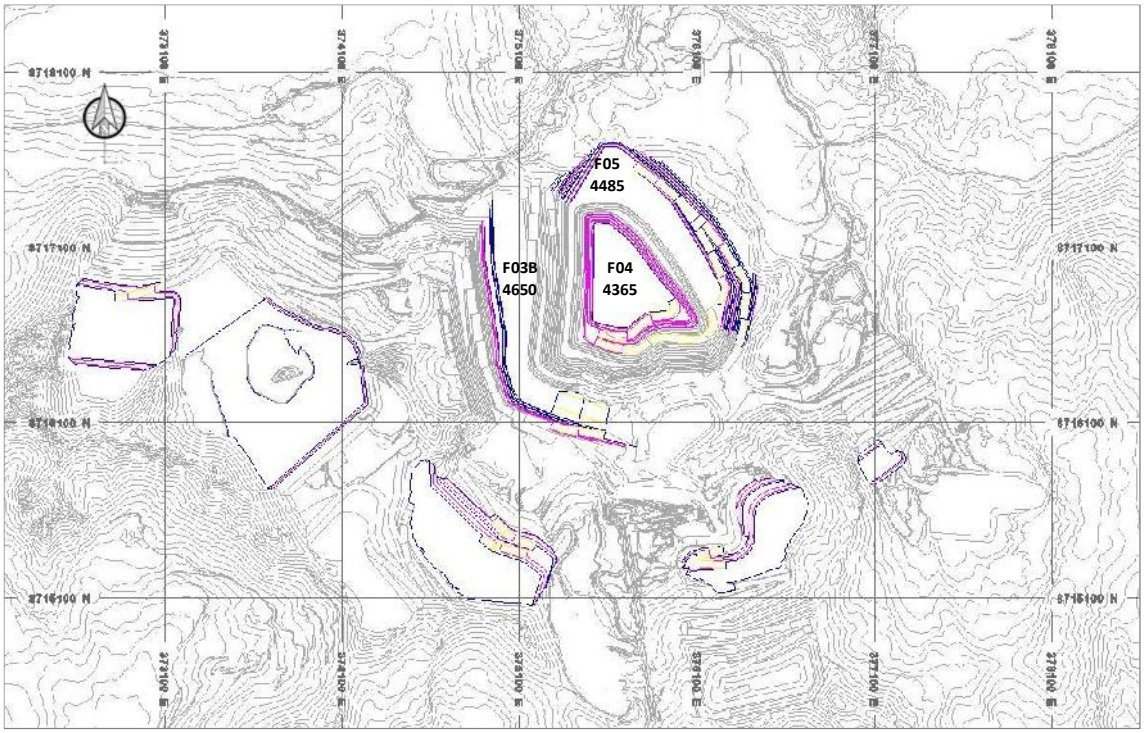


Figura 16-4: Avance Mina Dic 2023

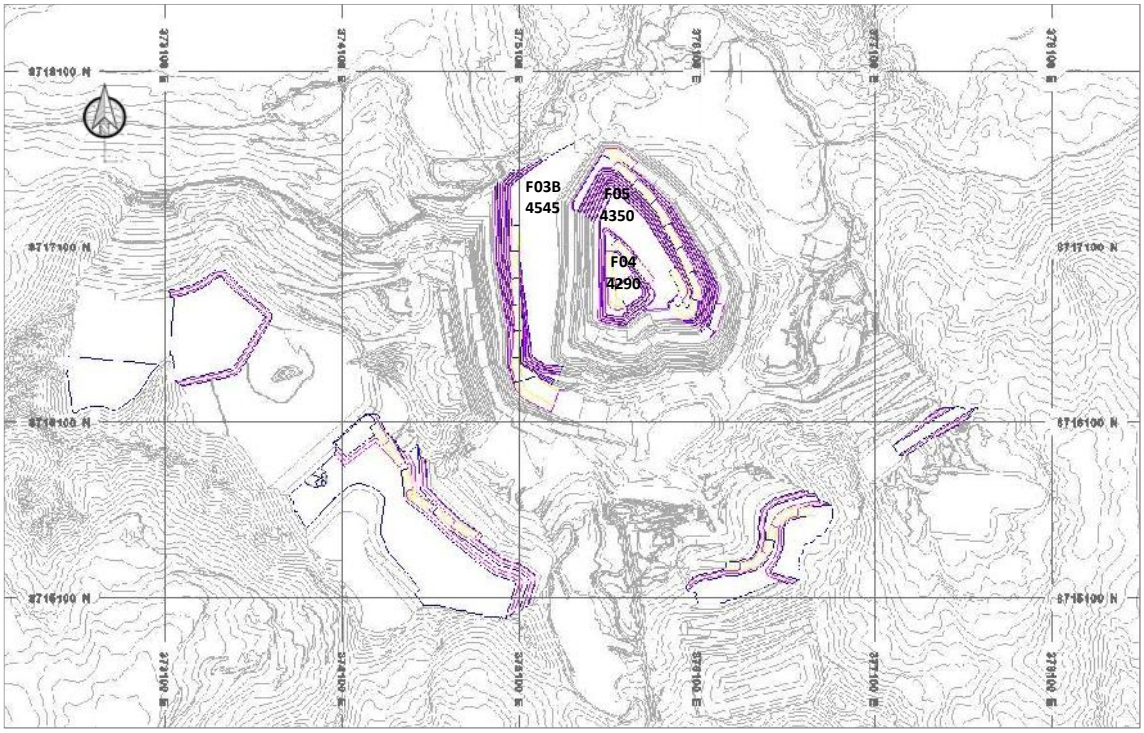


Figura 16-5: Avance Mina Dic 2024

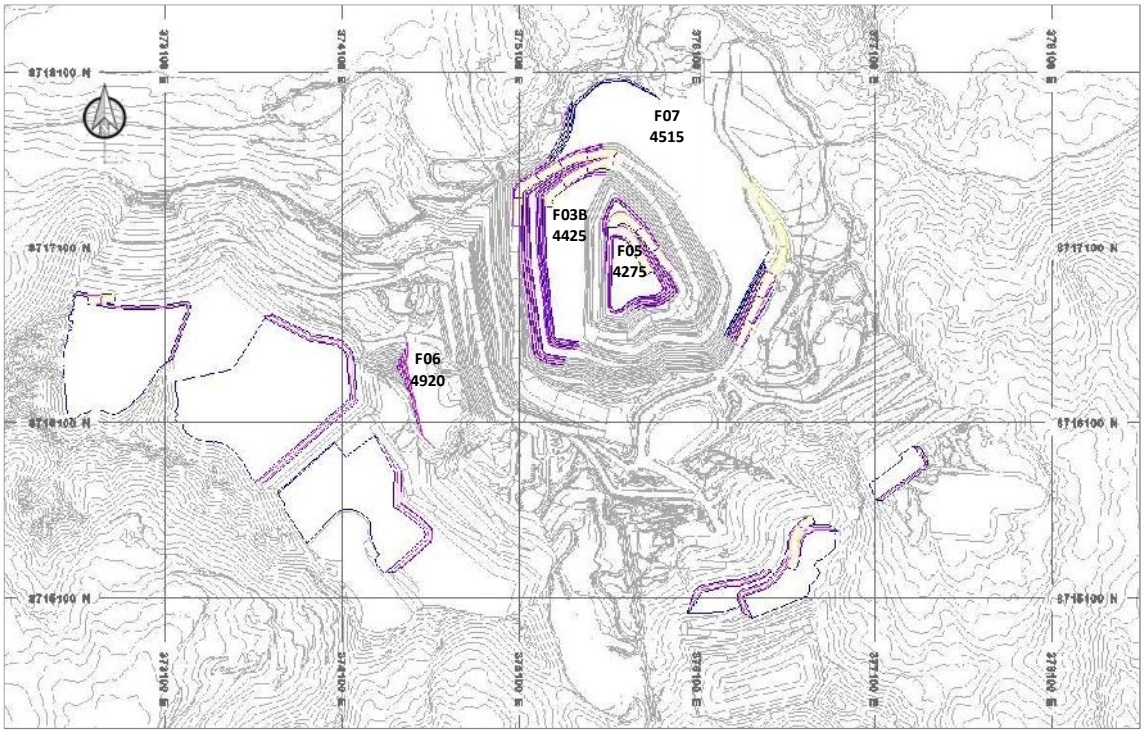


Figura 16-6: Avance Mina Dic 2025

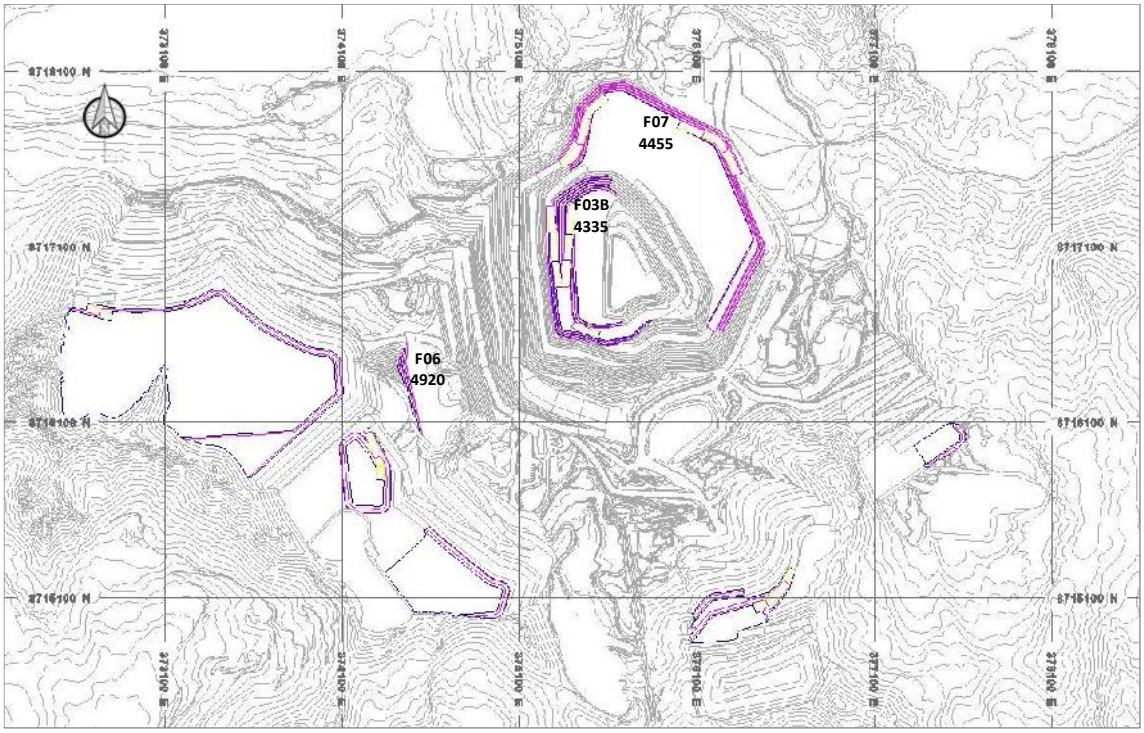


Figura 16-7: Avance Mina Dic 2026

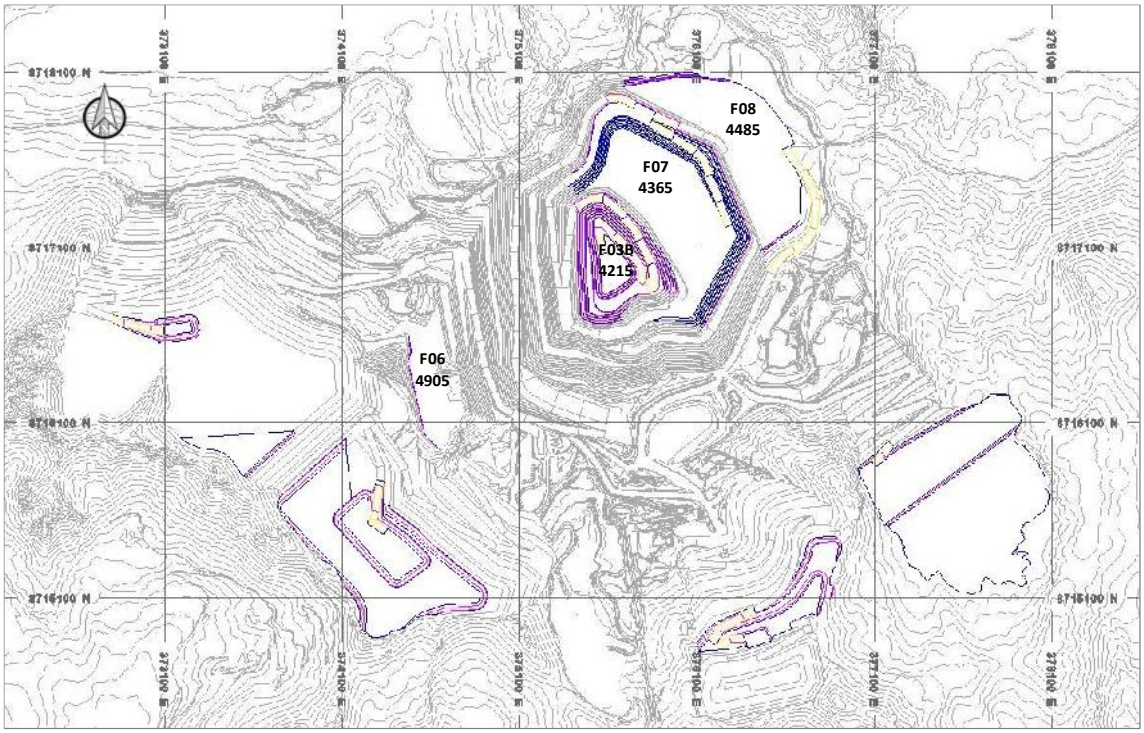


Figura 16-8: Avance Mina Dic 2027

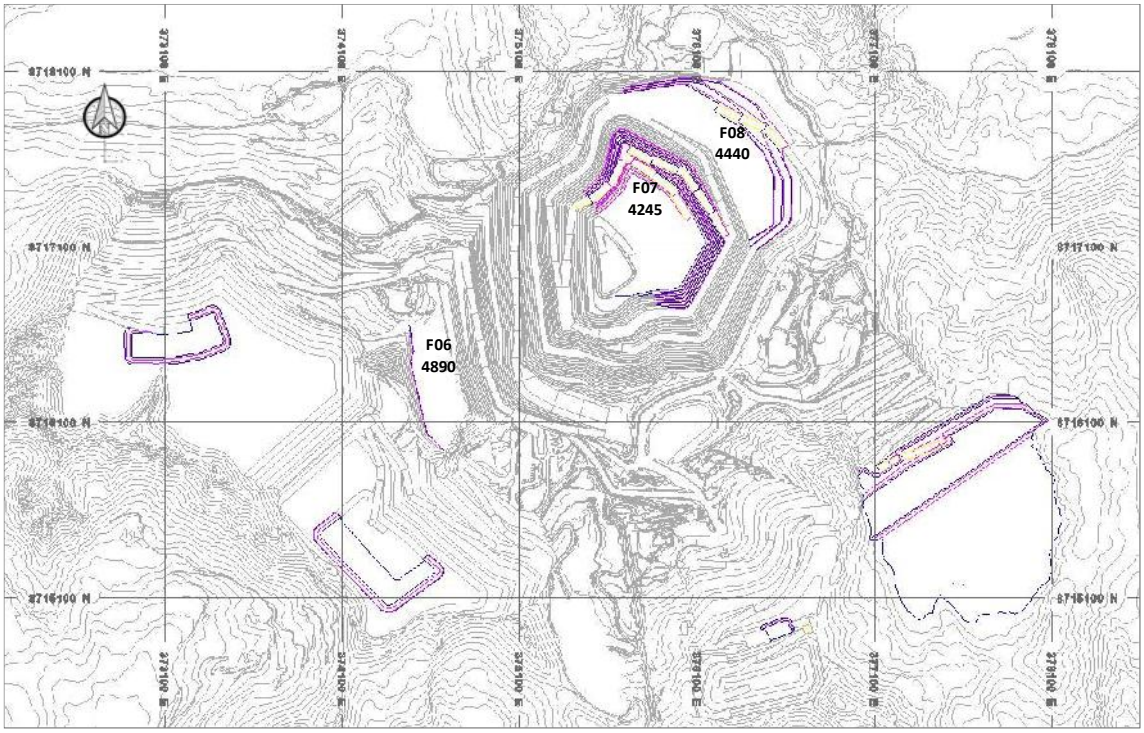


Figura 16-9: Avance Mina Dic 2028

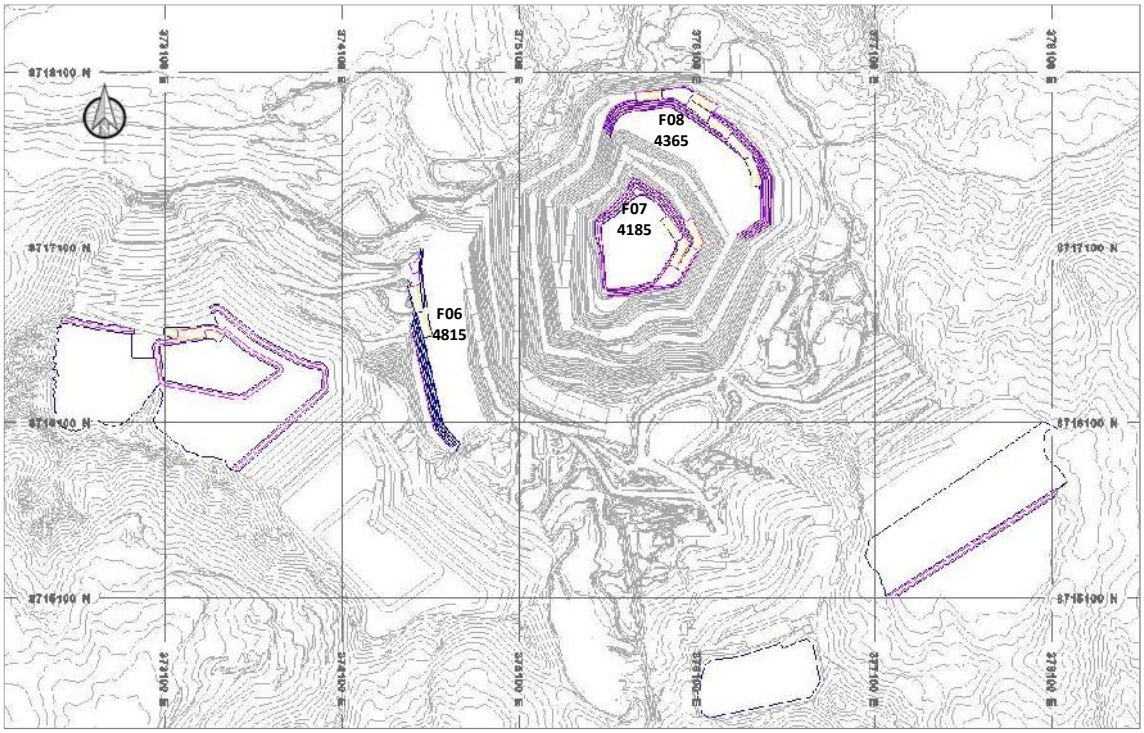


Figura 16-10: Avance Mina Dic 2029

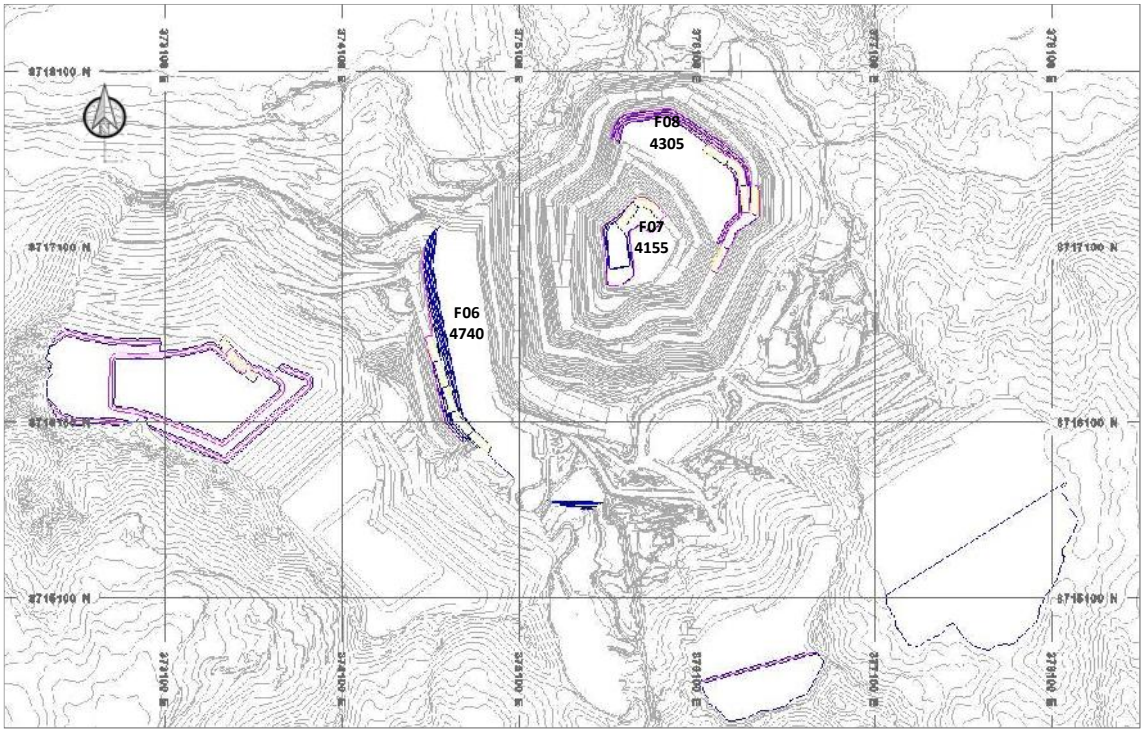


Figura 16-11: Avance Mina Dic 2030

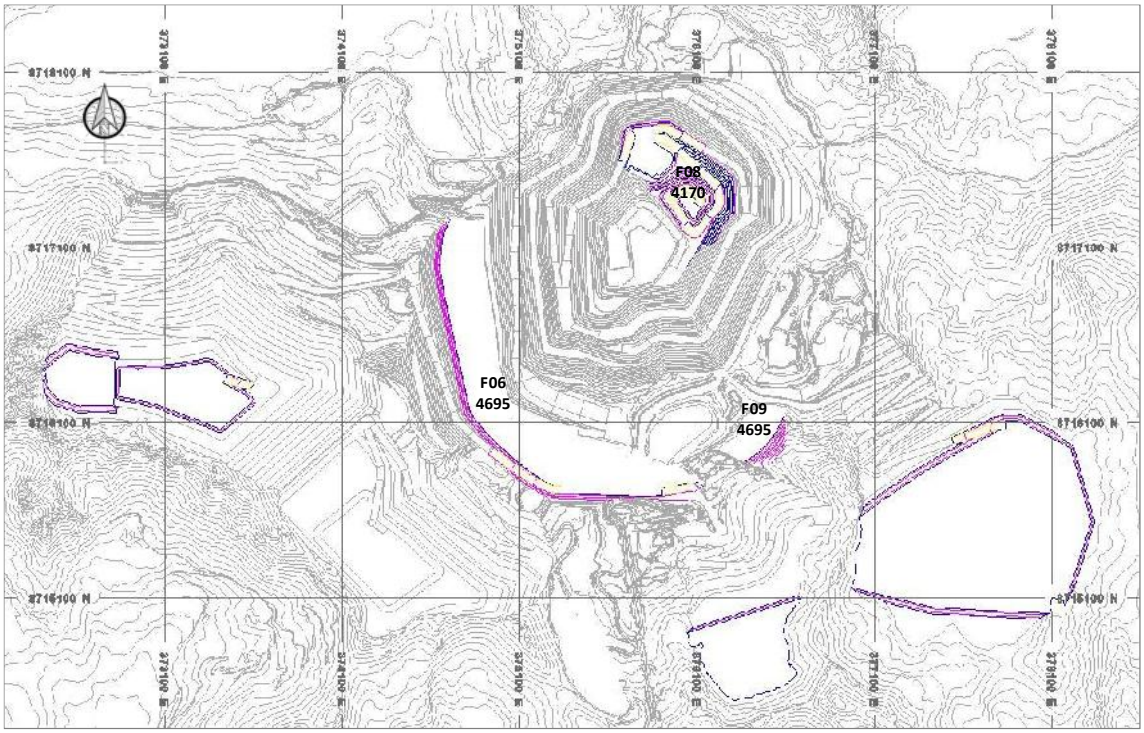


Figura 16-12: Avance Mina Dic 2031

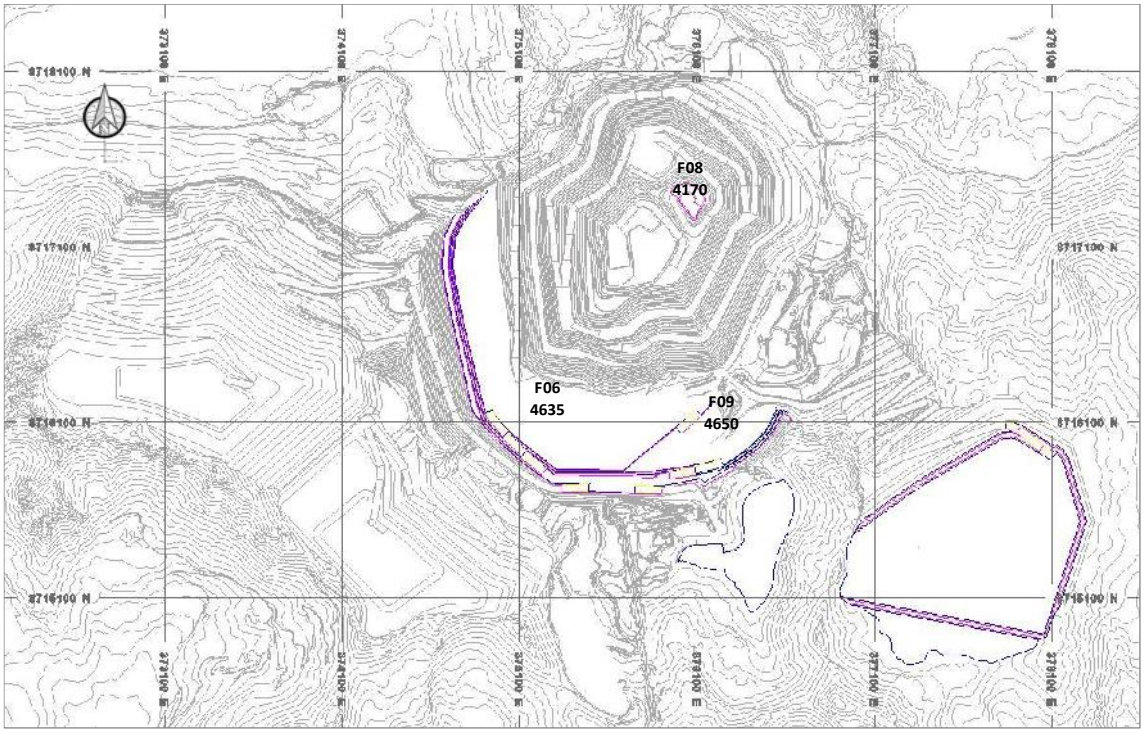


Figura 16-13: Avance Mina Dic 2032

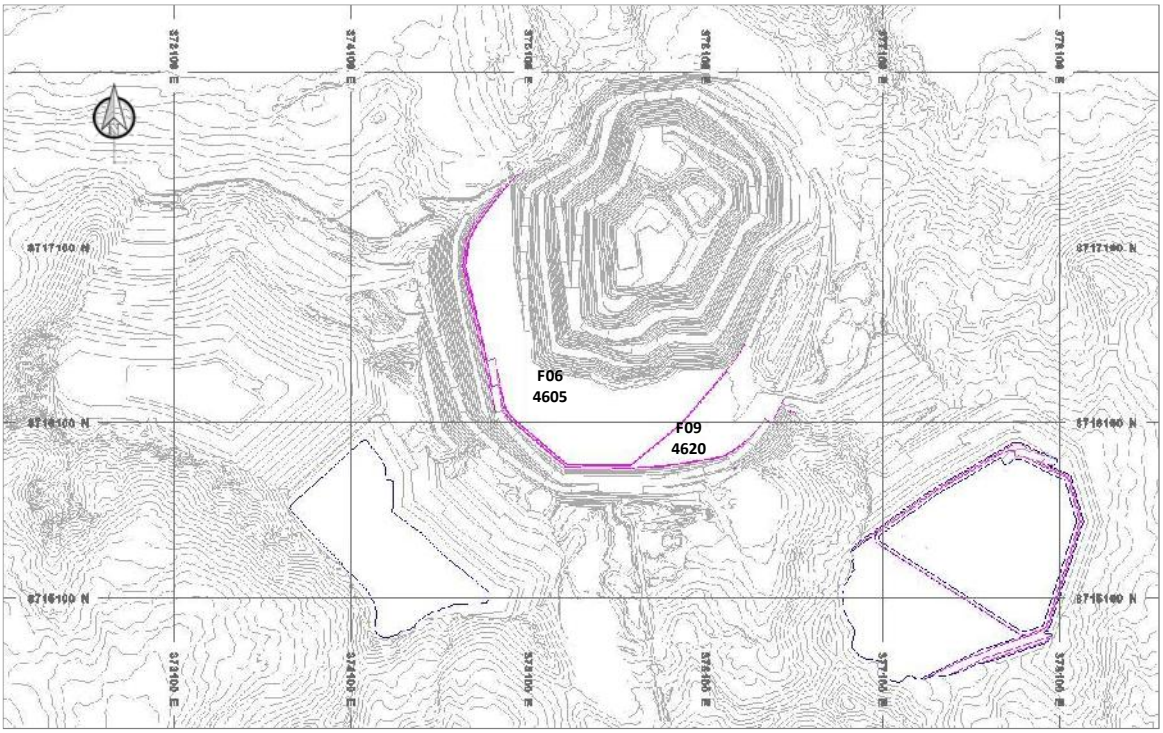


Figura 16-14: Avance Mina Dic 2033

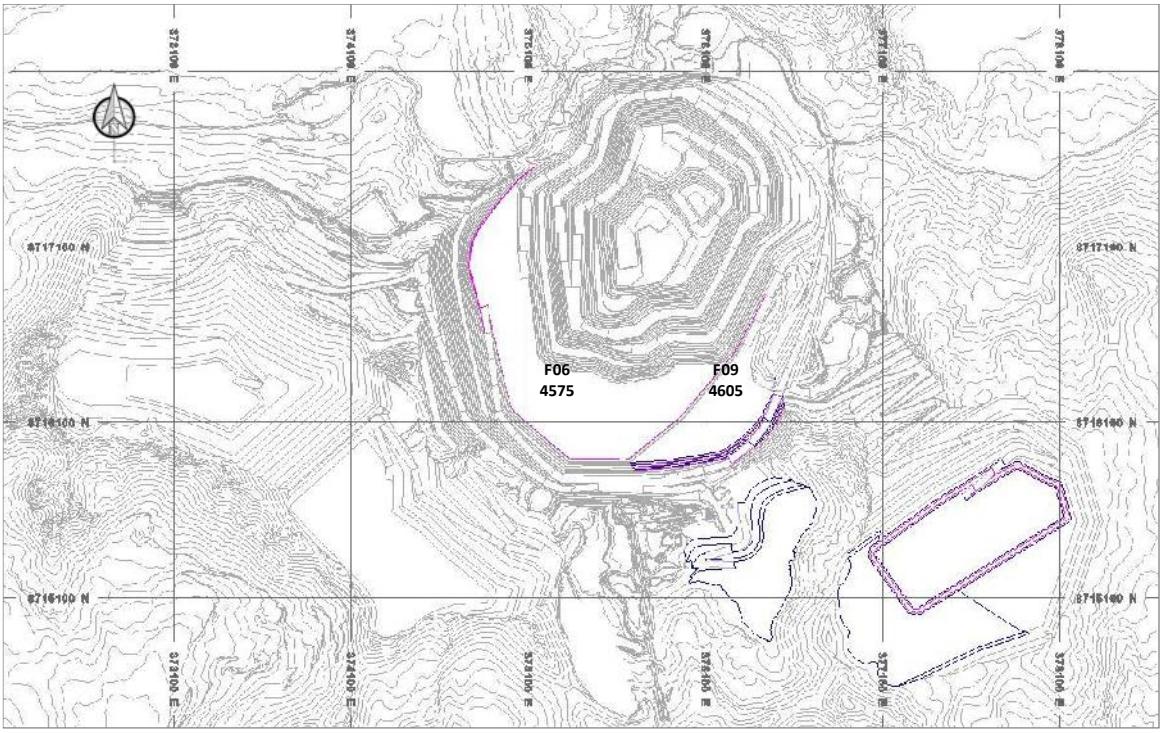


Figura 16-15: Avance Mina Dic 2034

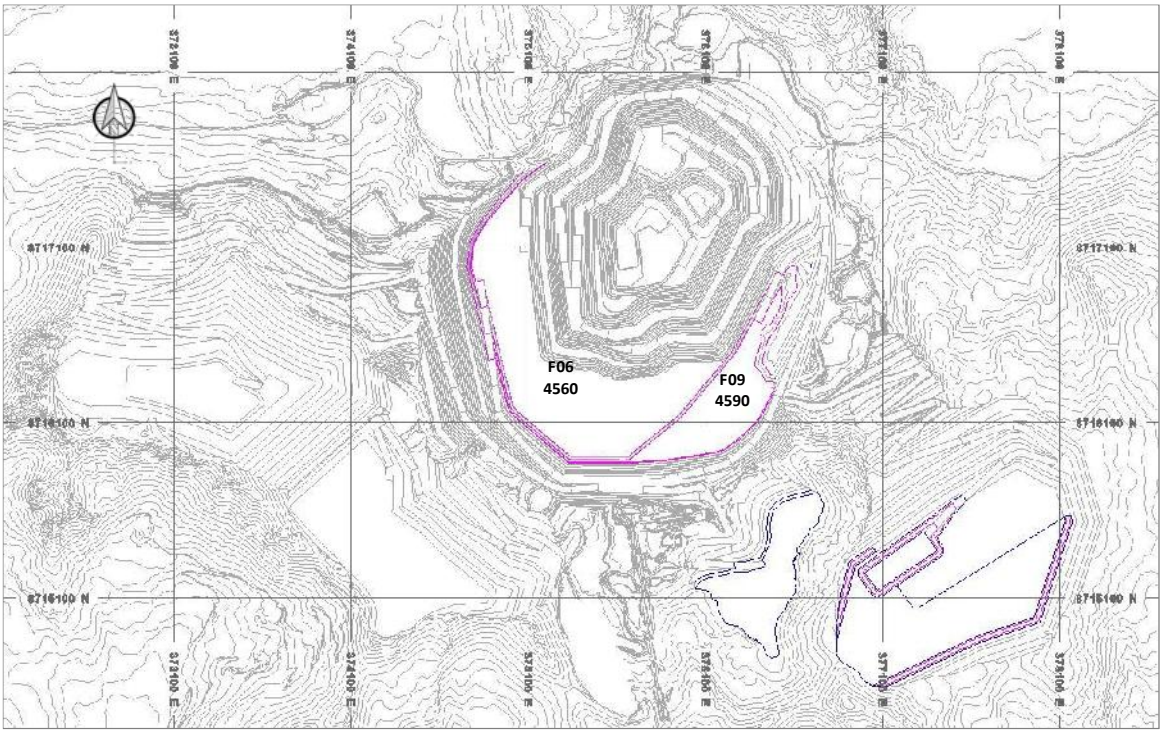


Figura 16-16: Avance Mina Dic 2035

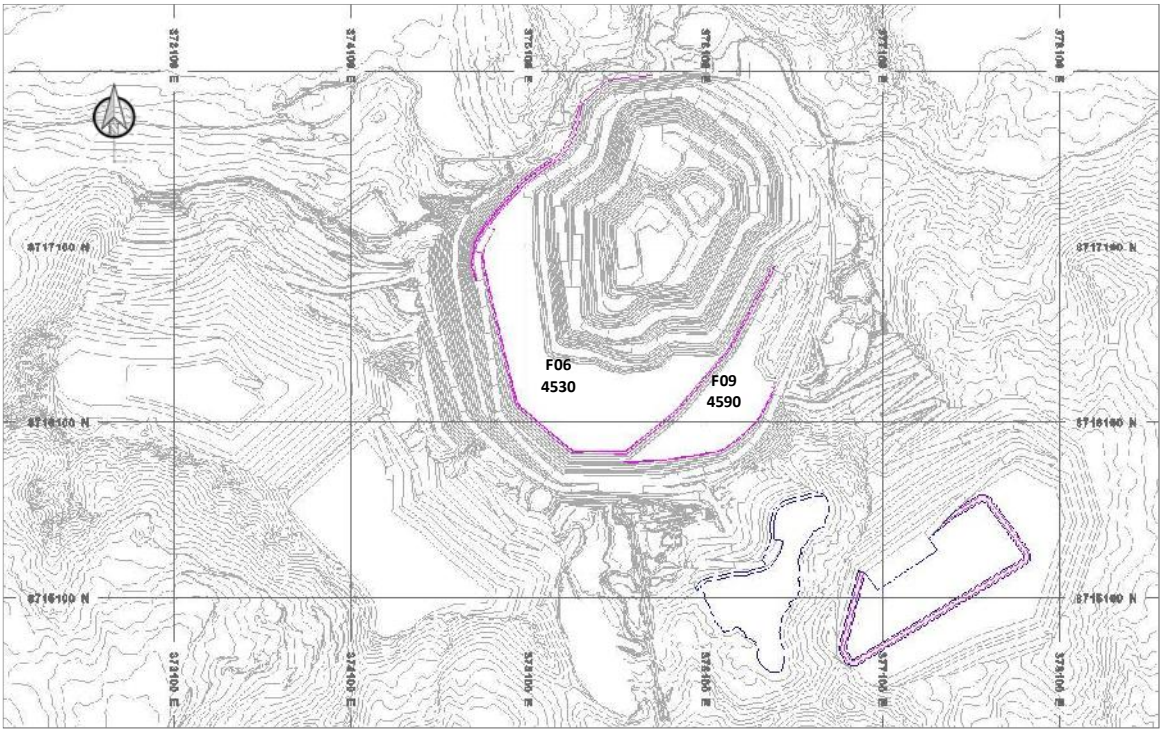


Figura 16-17: Avance Mina Dic 2036

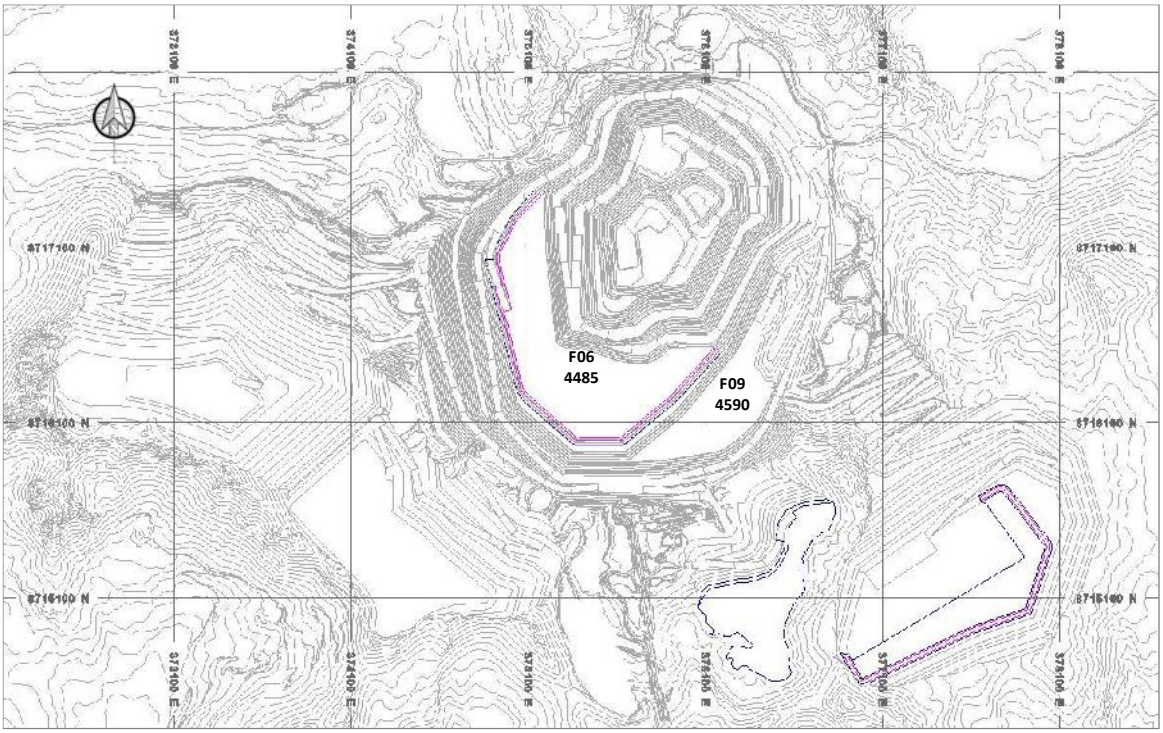


Figura 16-18: Avance Mina Dic 2037

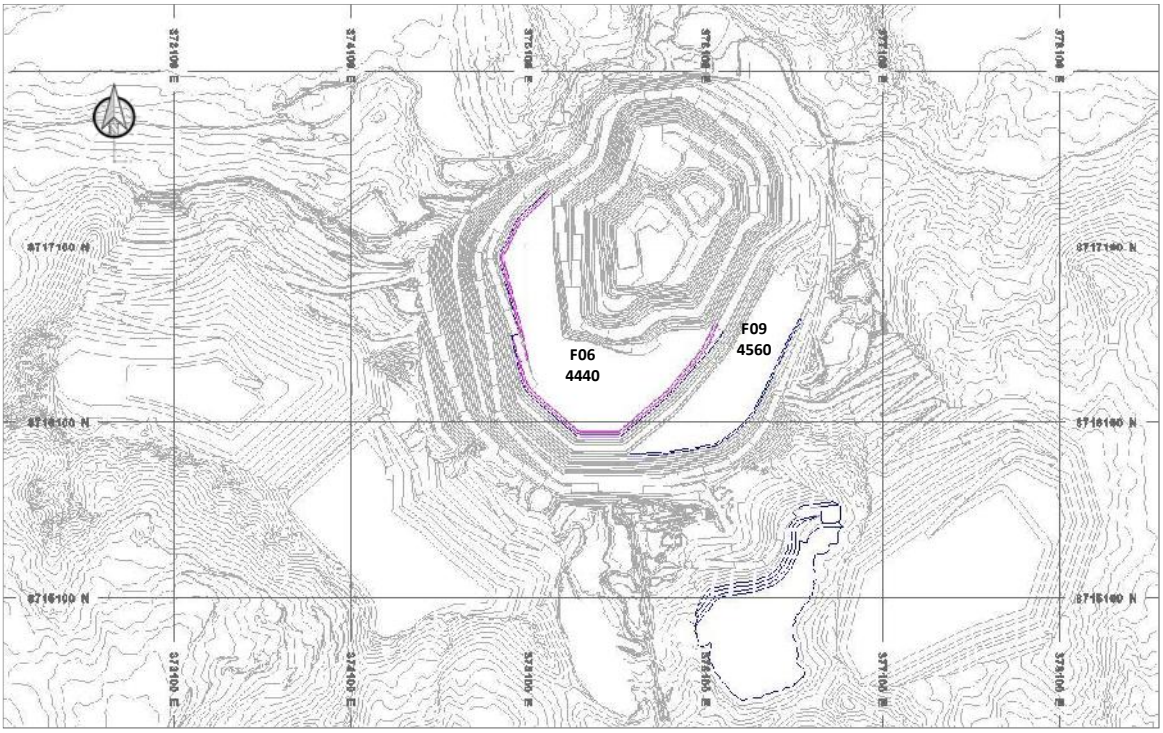


Figura 16-19: Avance Mina Dic 2038

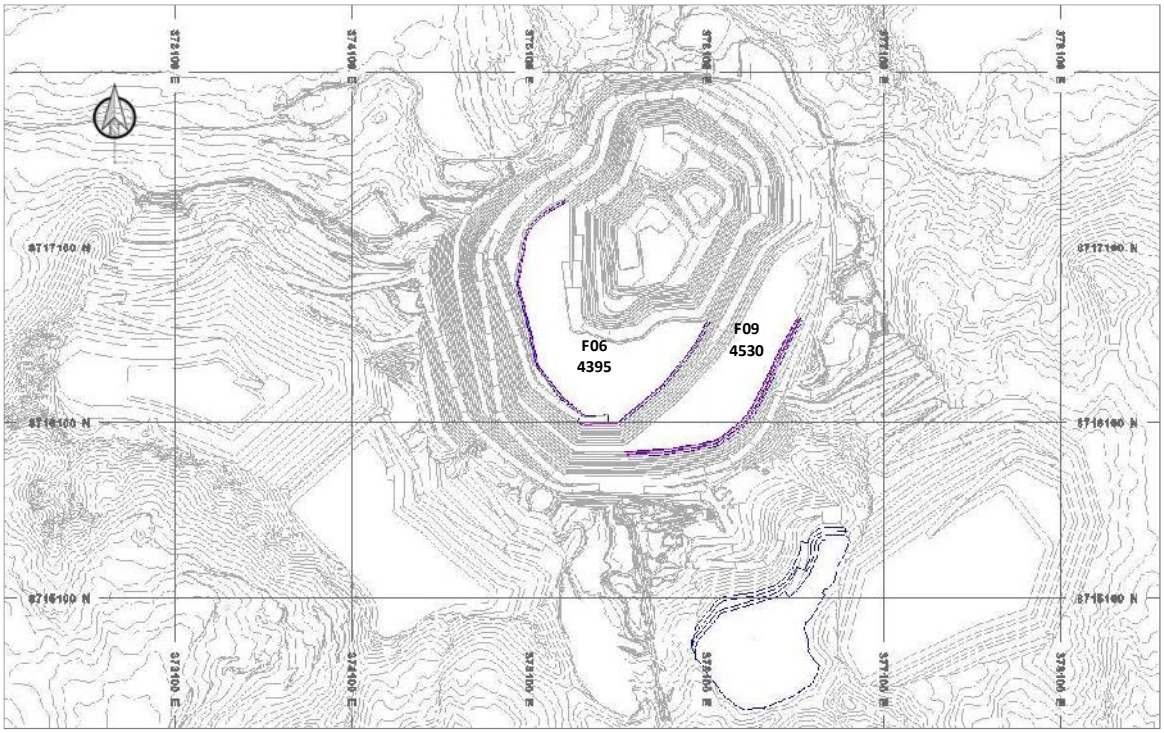


Figura 16-20: Avance Mina Dic 2039

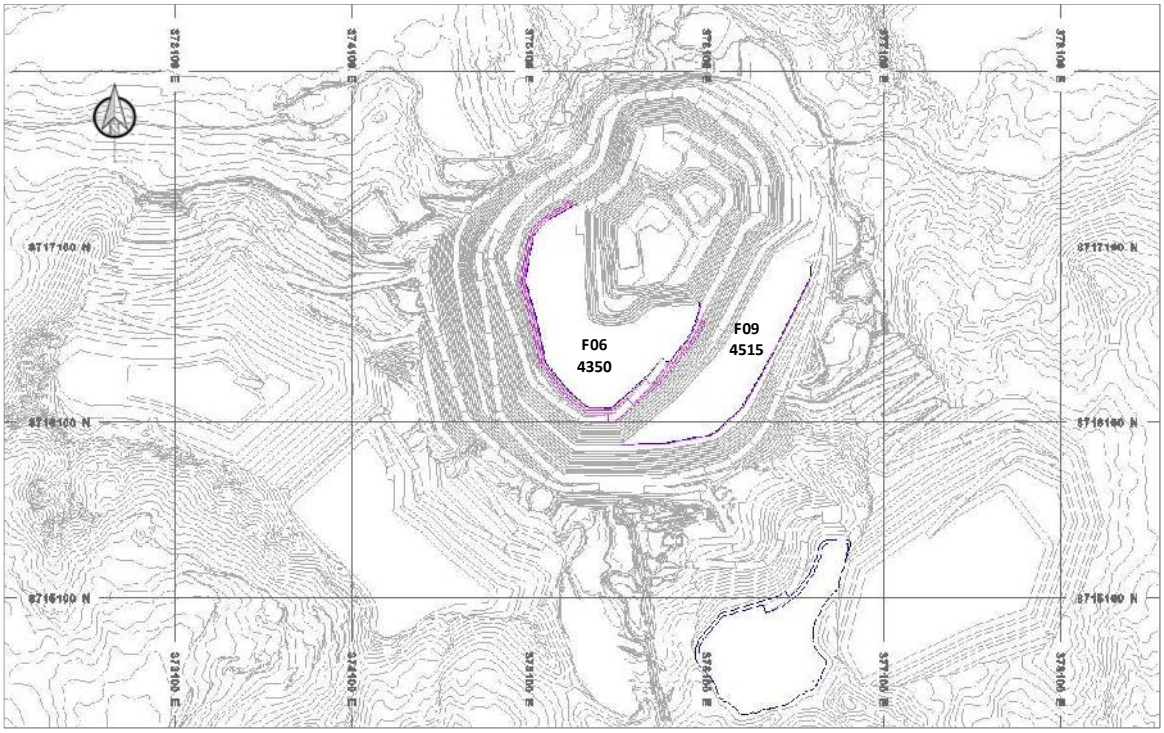


Figura 16-21: Avance Mina Dic 2040

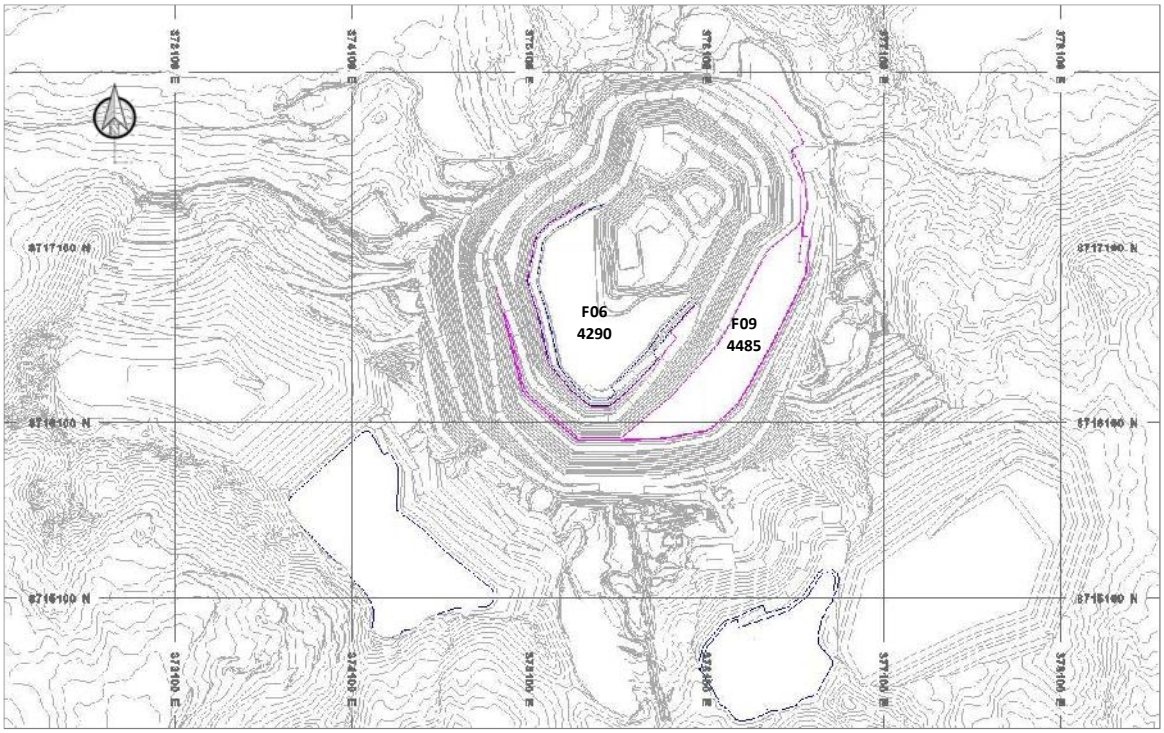


Figura 16-22: Avance Mina Dic 2041

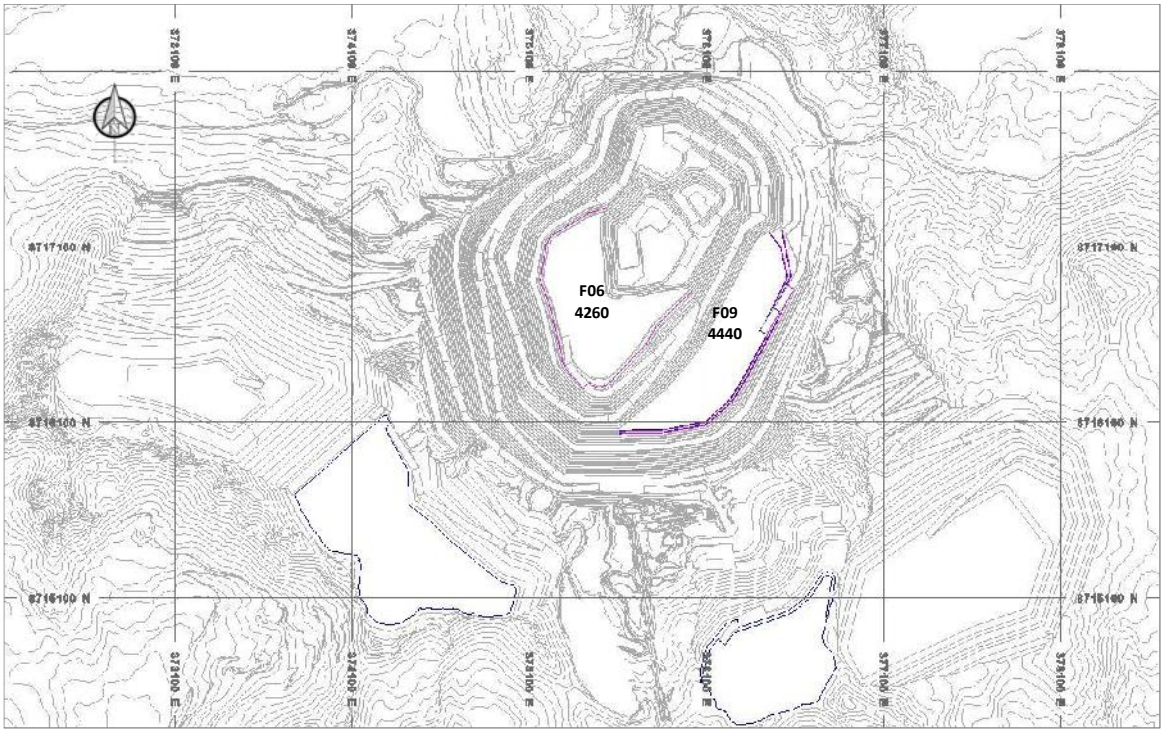


Figura 16-23: Avance Mina Dic 2042

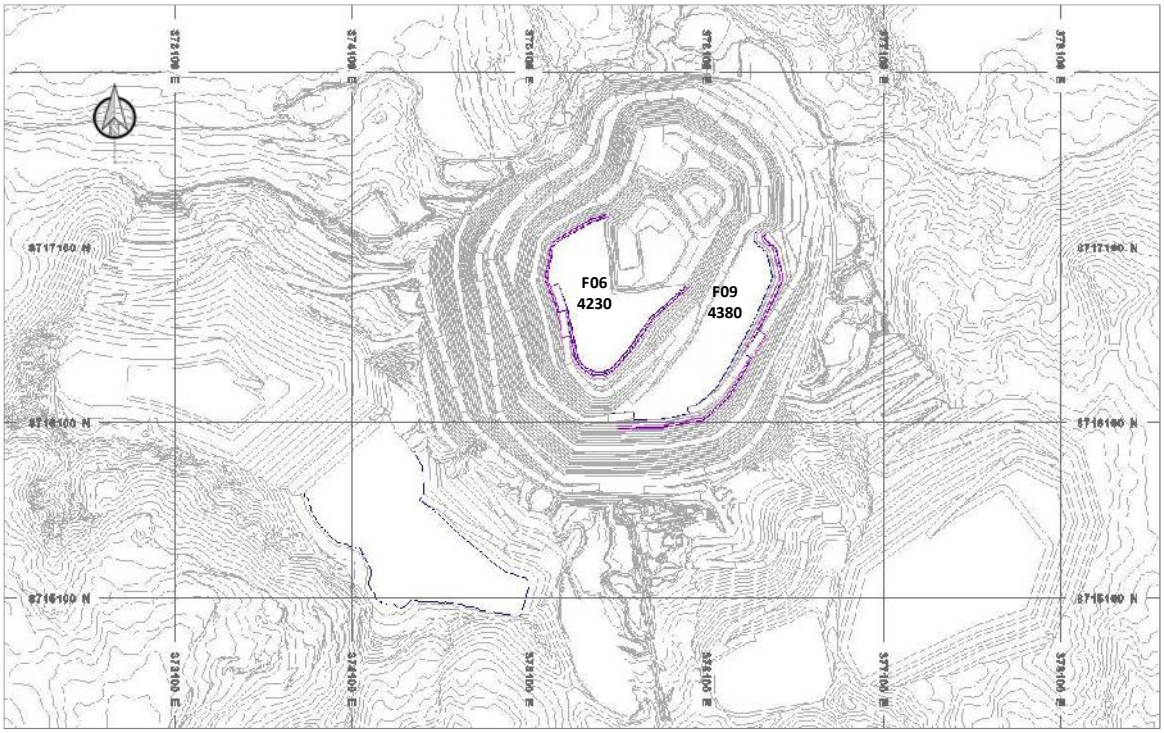


Figura 16-24: Avance Mina Dic 2043

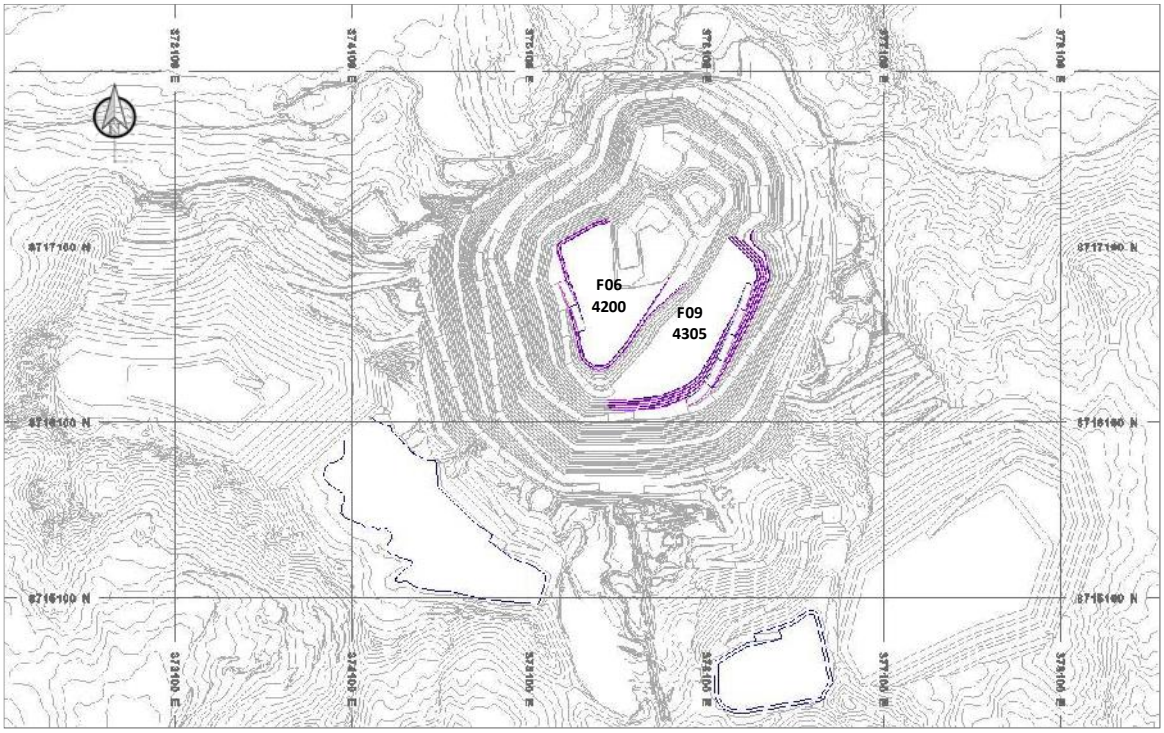


Figura 16-25: Avance Mina Dic 2044

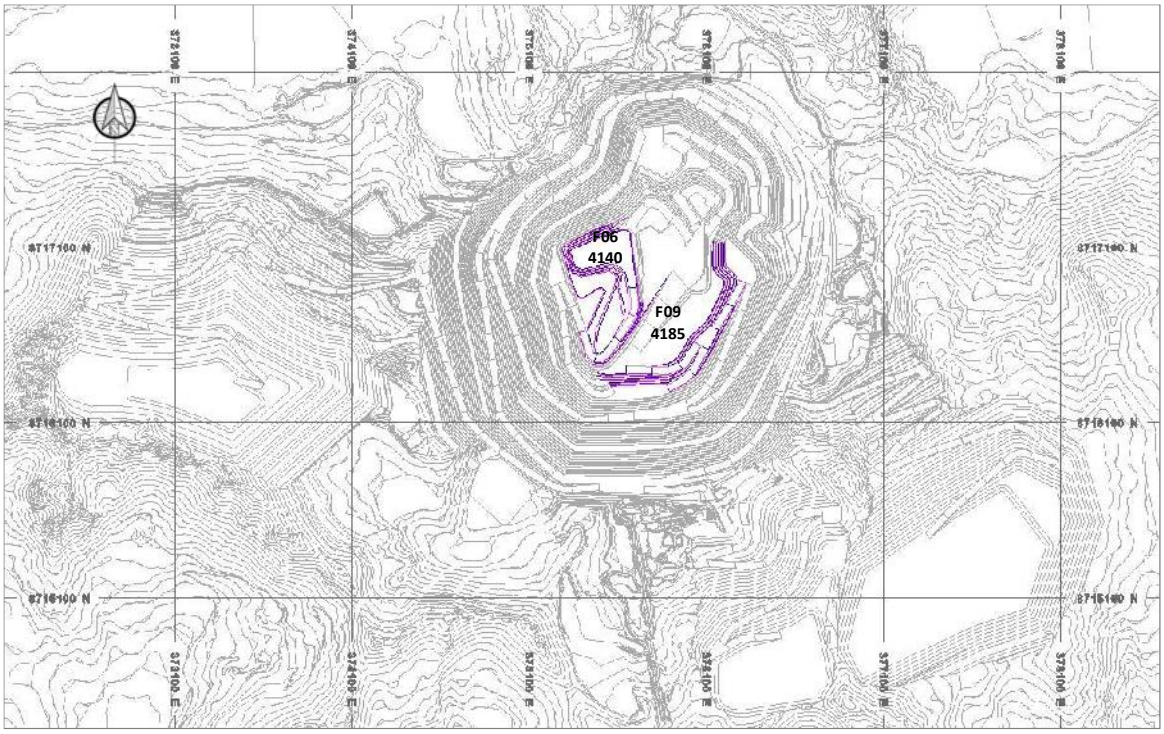
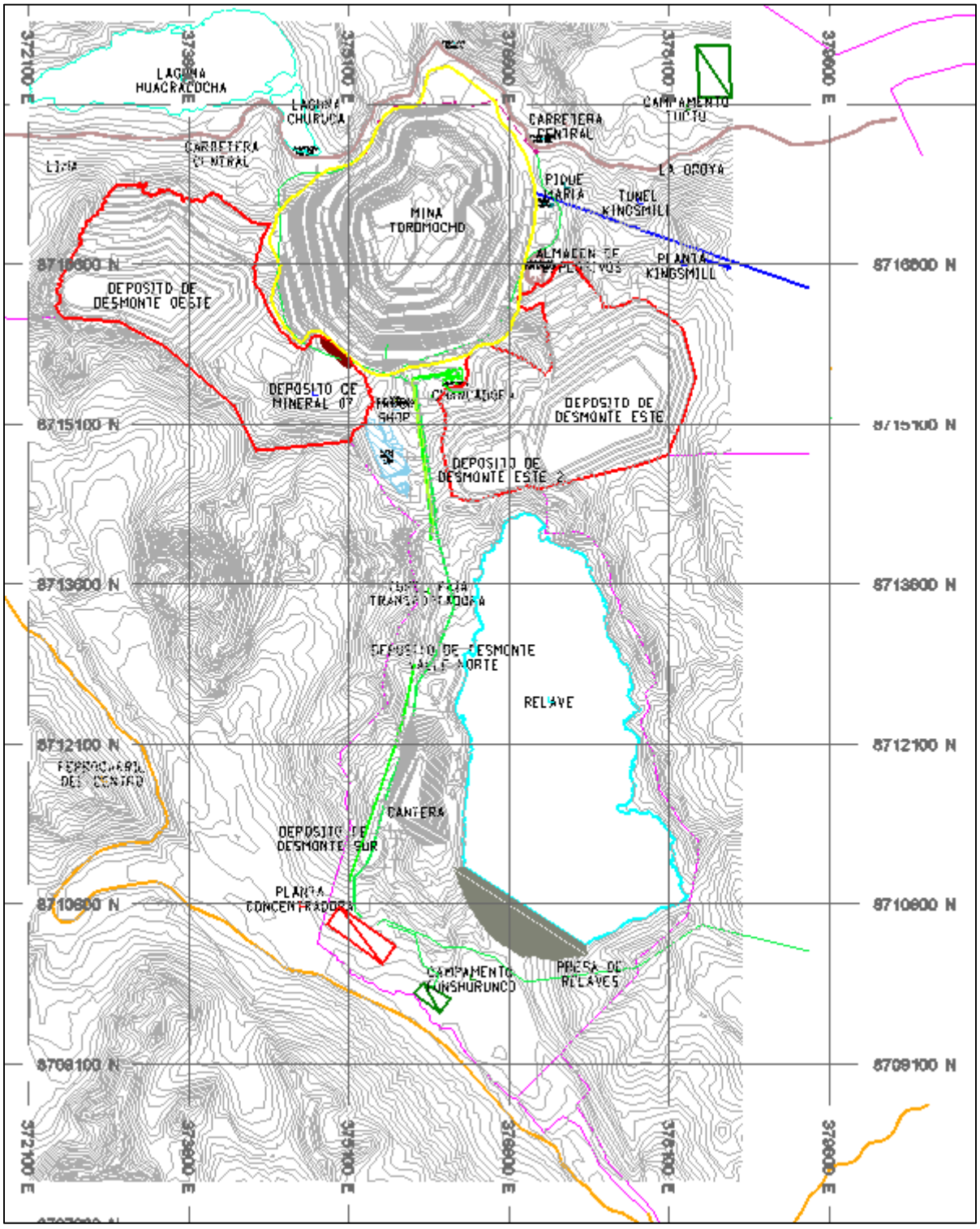


Figura 16-26: Plano General del Distrito



ANEXO B

Conciliación de Minerales 2019

CONCILIACION DE MINERALES

Introducción

Parte del encargo solicitado a Tetra Tech durante la presente ingeniería, fue desarrollar la conciliación de minerales para el período enero a julio del 2019. con el objeto de constatar las calidades, procedimientos y definiciones de estándares entre los minerales enviados a proceso, entre los modelos de corto plazo, largo plazo y la cantidad de cobre fino producido, con el enfoque a disminuir la incertidumbre entre la planificación o planeamiento y la operación.

Para esta actividad fue necesario contar con toda la base de datos de los minerales enviados a proceso, los tipos de calidades, las leyes de corte por los periodos a evaluar, la ley de los minerales a evaluar y los modelos predictivos de corto y largo plazo.

Estándar de la Industria

Lo comúnmente utilizado en la conciliación o reconciliación mina-planta son los siguientes estándares:

$$\textbf{F1} = \frac{\textbf{Grade Control Model (Prediction)}}{\textbf{Long Term Model (Prediction)}}$$

Mediación de la variabilidad entre el modelo de corto plazo o el modelo de control de ley (Predicción de las calidades de los minerales a enviar a proceso) y el modelo de Largo Plazo, que es una predicción más amplia del modelo de negocio de la compañía. Este método busca disminuir la incerteza entre el modelo de negocio con el modelo de corto plazo.

$$\textbf{F2} = \frac{\textbf{Process Production (Ore Process)}}{\textbf{Grade Control Model (Prediction)}}$$

Medición de la variabilidad entre el mineral procesado o recibido por la planta versus la predicción de calidades y grados de minerales programados en el corto plazo.

$$\textbf{F3} = \frac{\textbf{Process Productions (Concentrate)}}{\textbf{Long Term Model (Prediction)}}$$

Medición de la variabilidad entre los metales producidos reales versus la predicción definida en el modelo de negocios de la compañía (Modelo de Largo Plazo).

RESULTADOS CONCILIACIÓN

CONCILIACIÓN F1

Se cubican todos los polígonos o sólidos de las zonas alimentadas del periodo a conciliar con el modelo de corto plazo y largo plazo, replicando las definiciones de ley de corte de cada uno de los periodos y el desglose de calidades que serán necesarias comparar.

La cubicación se debe realizar con la ley de corte, condiciones y definiciones iguales a las consideradas en el instante que fueron enviadas a proceso.

Ore Control

	January	February	March	April	May	June	July	Total Period
Total Ore (t)	2,736,582	3,561,650	4,175,144	4,276,111	4,343,781	6,342,323	5,854,783	31,290,374
Total TCu_(%)	0.496	0.446	0.463	0.476	0.480	0.476	0.487	0.475
Total Mo_(%)	0.010	0.008	0.008	0.011	0.011	0.013	0.012	0.011
Total Ag_(g/t)	6.114	6.680	6.919	8.179	7.788	6.711	7.356	7.154
Total As_(%)	0.024	0.027	0.029	0.039	0.038	0.027	0.031	0.031
Total Zn_(%)	0.167	0.150	0.143	0.140	0.136	0.137	0.152	0.145
Total AsCon_(%)	0.610	0.731	0.783	1.030	0.999	0.711	0.764	0.808
Total ZnCon_(%)	5.983	5.920	5.945	5.368	5.322	4.961	5.524	5.502

Modelo de Largo Plazo

	January	February	March	April	May	June	July	Total Period
Total Ore (t)	3,399,939	3,410,441	4,468,517	4,338,882	5,361,249	6,767,285	6,234,585	33,980,900
Total TCu_(%)	0.480	0.426	0.395	0.438	0.502	0.497	0.504	0.469
Total Mo_(%)	0.014	0.009	0.008	0.014	0.012	0.013	0.011	0.012
Total Ag_(g/t)	5.716	5.230	5.853	5.031	5.660	5.078	6.836	5.667
Total As_(%)	0.018	0.018	0.024	0.021	0.023	0.019	0.029	0.022
Total Zn_(%)	0.100	0.109	0.114	0.067	0.122	0.084	0.120	0.102
Total AsCon_(%)	0.688	0.723	0.943	0.779	0.768	0.655	0.952	0.791
Total ZnCon_(%)	3.577	3.948	4.271	2.786	4.028	3.017	4.045	3.650

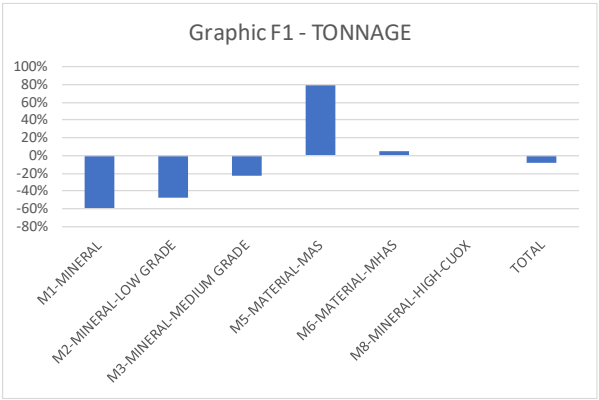
Diferencias

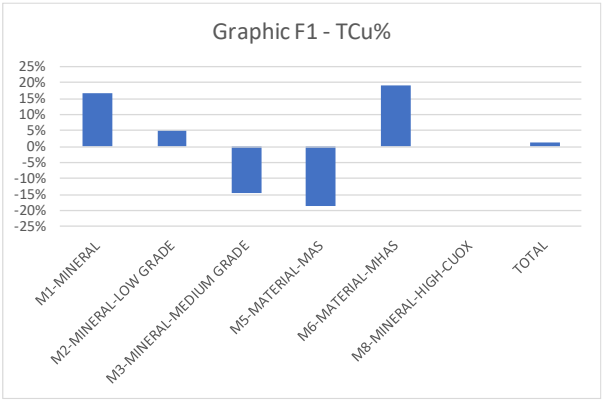
	January	February	March	April	May	June	July	Total Period
Total Ore (t)	-663,358	151,209	-293,373	-62,771	-1,017,468	-424,963	-379,802	-2,690,526
Total TCu_(%)	0.0	0.0	0.1	0.0	-0.0	-0.0	-0.0	0.0
Total Mo_(%)	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0
Total Ag_(g/t)	0.4	1.4	1.1	3.1	2.1	1.6	0.5	1.5
Total As_(%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Zn_(%)	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0
Total AsCon_(%)	-0.1	0.0	-0.2	0.3	0.2	0.1	-0.2	0.0
Total ZnCon_(%)	2.4	2.0	1.7	2.6	1.3	1.9	1.5	1.9

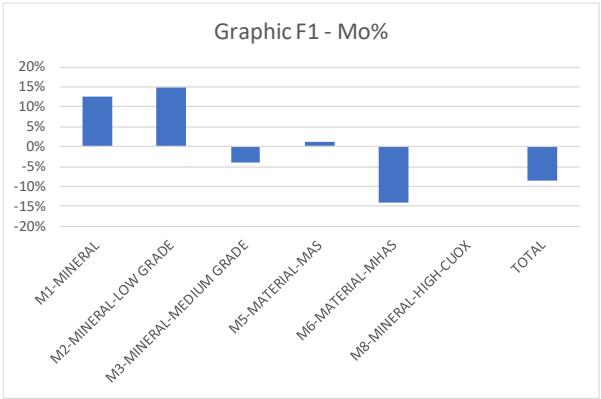
	January	February	March	April	May	June	July	Total Period
Total Ore (t)	-24%	4%	-7%	-1%	-23%	-7%	-6%	-9%
Total TCu_(%)	3%	4%	15%	8%	-5%	-4%	-4%	1%
Total Mo_(%)	-41%	-12%	-3%	-21%	-12%	-1%	8%	-9%
Total Ag_(g/t)	7%	22%	15%	38%	27%	24%	7%	21%
Total As_(%)	26%	35%	17%	47%	40%	29%	5%	28%
Total Zn_(%)	40%	27%	20%	52%	11%	39%	21%	29%
Total AsCon_(%)	-13%	1%	-20%	24%	23%	8%	-25%	2%
Total ZnCon_(%)	40%	33%	28%	48%	24%	39%	27%	34%

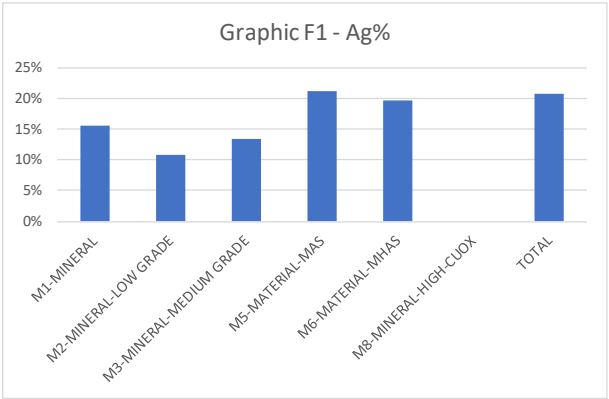
Desglosado por Calidad de Minerales

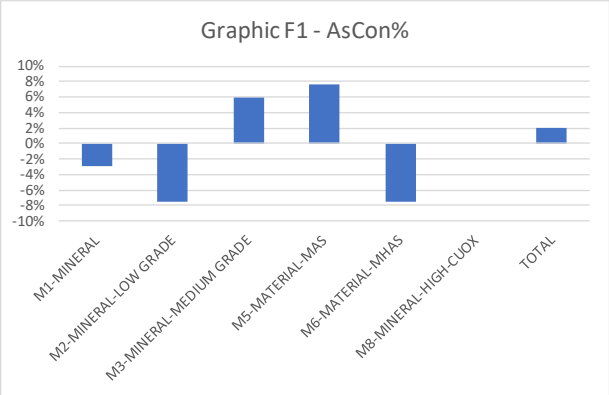
Mineral Type	Ore (t)	TCu_(%)	Mo_(%)	Ag_(g/t)	As_(%)	Zn_(%)	AsCon_(%)	ZnCon_(%)
M1-MINERAL	-59%	17%	13%	16%	27%	29%	-3%	29%
M2-MINERAL-LOW GRADE	-48%	5%	15%	11%	23%	9%	-7%	12%
M3-MINERAL-MEDIUM GRADE	-23%	-14%	-4%	13%	40%	-6%	6%	14%
M5-MATERIAL-MAS	79%	-19%	1%	21%	20%	11%	8%	7%
M6-MATERIAL-MHAS	5%	19%	-14%	20%	17%	36%	-8%	32%
M8-MINERAL-HIGH-CUOX								
TOTAL	-9%	1%	-9%	21%	28%	29%	2%	34%

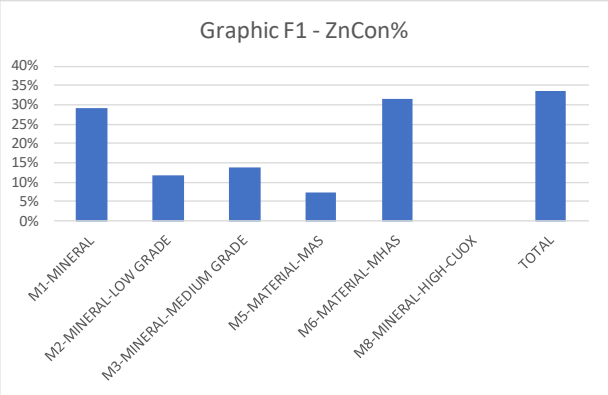


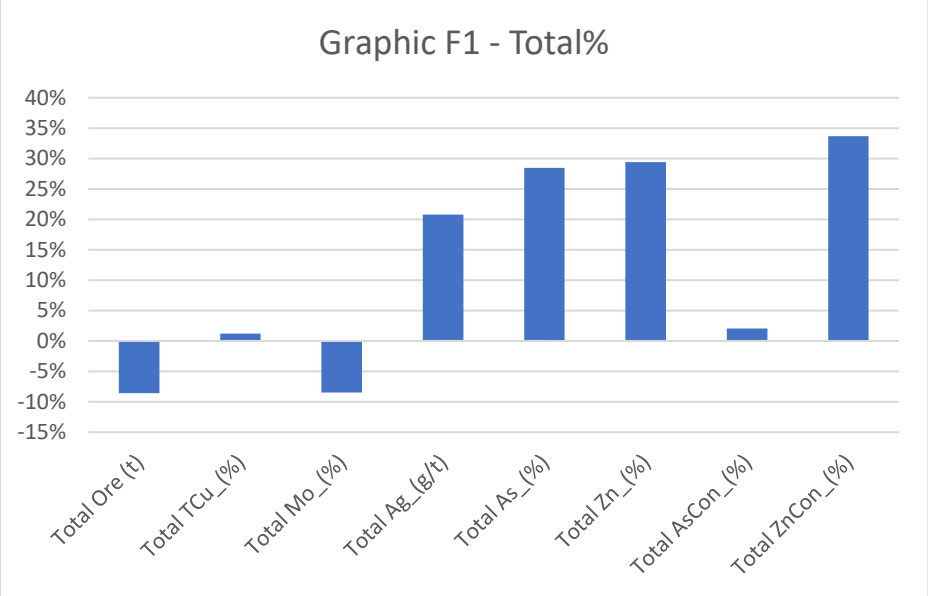












CONCLUSIÓN F1

- La variación en el total del mineral alimentado tiende a disminuir por debajo del 10% para el tonelaje y en cuanto a la ley de cobre es del 1%, sin embargo, al analizar en forma separada cada mes, se aprecia mayor dispersión, alcanzando incluso sobre el 20%.
- Esto muestra que mes a mes hay grandes variaciones producto de metodologías o relajos puntuales que en el global tienden a compensarse.
- En cuanto al desglose de los minerales por calidad se aprecia mayor dispersión, que hace necesario realizar procedimientos que tienda a uniformar criterios. En cuanto a la asignación de minerales por calidad.

CONCILIACIÓN F2

Se analiza la información de la planta, por alimentación por cada día, revisando los tonelajes y leyes, se agrupa y filtra de acuerdo con la metodología en cuanto a la clasificación de minerales por periodo y se contrarresta con el modelo de corto plazo.

Monthly Report

Item	January	February	March	April	May	June	July	Total
Total Tonne	2,574,885	2,917,273	3,487,875	4,211,958	4,935,220	6,869,094	5,990,820	30,987,126
Total TCU_(%)	0.594	0.498	0.503	0.527	0.567	0.527	0.528	0.534
Total Mo_(%)	0.013	0.008	0.008	0.013	0.012	0.013	0.012	0.01175
Total Ag_(g)	6.686	7.685	7.617	8.553	8.483	7.861	8.651	8.065
Total As_(%)	0.025	0.032	0.032	0.042	0.041	0.031	0.034	0.034
Total Zn_(%)	0.154	0.159	0.174	0.141	0.146	0.146	0.173	0.156
Total AsCon_(%)	0.546	0.759	0.798	0.994	0.984	0.729	0.771	0.809

Ore Control

Item	January	February	March	April	May	June	July	Total
Total Ore (t)	2,736,582	3,561,650	4,175,144	4,276,111	4,343,781	6,342,323	5,854,783	31,290,374
Total TCu_(%)	0.496	0.446	0.463	0.476	0.480	0.476	0.487	0.475
Total Mo_(%)	0.010	0.008	0.008	0.011	0.011	0.013	0.012	0.01076
Total Ag_(g/t)	6.114	6.680	6.919	8.179	7.788	6.711	7.356	7.154
Total As_(%)	0.024	0.027	0.029	0.039	0.038	0.027	0.031	0.031
Total Zn_(%)	0.167	0.150	0.143	0.140	0.136	0.137	0.152	0.145
Total AsCon_(%)	0.610	0.731	0.783	1.030	0.999	0.711	0.764	0.808
Total ZnCon_(%)	5.983	5.920	5.945	5.368	5.322	4.961	5.524	5.502

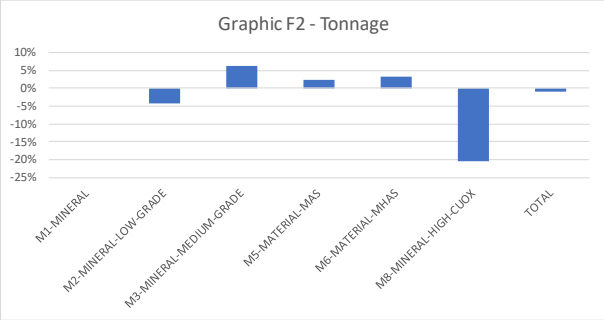
Diferencia

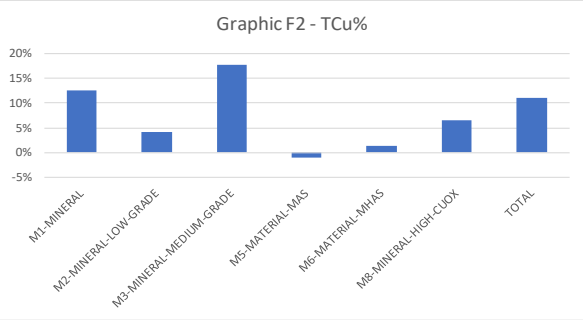
Item	January	February	March	April	May	June	July	Total
Total Ore (t)	-161,697	-644,376	-687,270	-64,153	591,439	526,772	136,037	-303,248
Total TCu_(%)	0.098	0.053	0.040	0.051	0.087	0.051	0.041	0.059
Total Mo_(%)	0.003	0.001	0.000	0.002	0.001	0.000	-0.000	0.00099
Total Ag_(g/t)	0.572	1.006	0.699	0.373	0.695	1.151	1.295	0.912
Total As_(%)	0.001	0.005	0.003	0.003	0.003	0.004	0.004	0.004
Total Zn_(%)	-0.014	0.009	0.031	0.001	0.010	0.009	0.020	0.011
Total AsCon_(%)	-0.064	0.028	0.015	-0.036	-0.015	0.018	0.008	0.002
Total ZnCon_(%)								

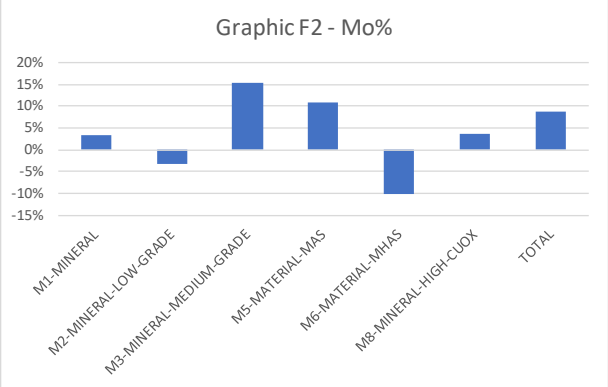
Item	January	February	March	April	May	June	July	Total
Total Ore (t)	-6%	-22%	-20%	-2%	12%	8%	2%	-1%
Total TCu_(%)	17%	11%	8%	10%	15%	10%	8%	11%
Total Mo_(%)	23%	7%	5%	15%	11%	1%	-3%	8%
Total Ag_(g/t)	9%	13%	9%	4%	8%	15%	15%	11%
Total As_(%)	5%	15%	10%	6%	6%	13%	11%	10%
Total Zn_(%)	-9%	6%	18%	1%	7%	6%	12%	7%
Total AsCon_(%)	-12%	4%	2%	-4%	-2%	3%	1%	0%

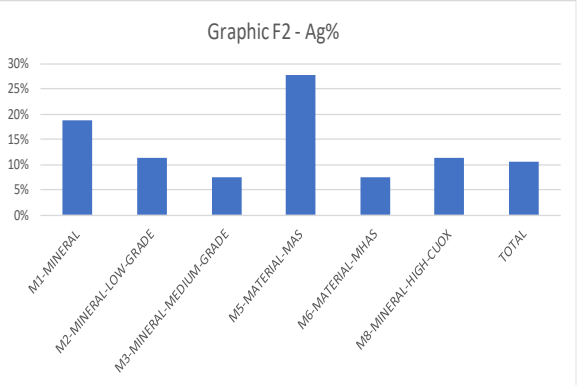
Desglosado por tipo de mineral

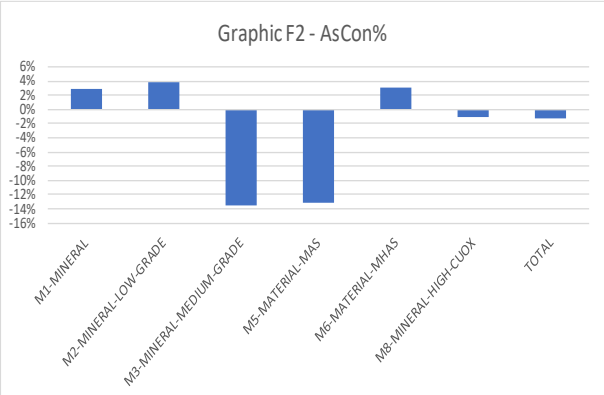
Mineral Type	Ore (t)	TCu_(%)	Mo_(%)	Ag_(g/t)	As_(%)	Zn_(%)	AsCon_(%)	ZnCon_(%)
M1-MINERAL	0%	13%	3%	19%	15%	17%	3%	0%
M2-MINERAL-LOW-GRADE	-4%	4%	-3%	11%	8%	12%	4%	0%
M3-MINERAL-MEDIUM-GRADE	6%	18%	15%	8%	9%	-3%	-14%	0%
M5-MATERIAL-MAS	2%	-1%	11%	28%	23%	-9%	-13%	0%
M6-MATERIAL-MHAS	3%	1%	-10%	7%	8%	6%	3%	0%
M8-MINERAL-HIGH-CUOX	-20%	6%	4%	11%	4%	16%	-1%	0%
TOTAL	-1%	11%	9%	11%	9%	7%	-1%	0%

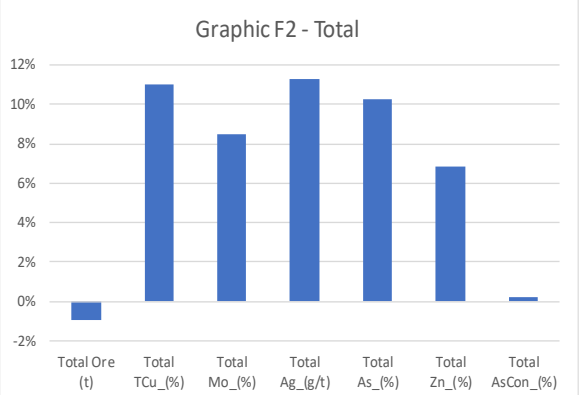












CONCLUSIÓN F2

- De la misma manera que en la conciliación de F1, en F2 La variación en el total del mineral alimentado tiende a disminuir por debajo del 1% para el tonelaje, sin embargo, la ley de cobre es del 11% y que al separar o filtrar por clasificación de tipo mineral esta desviación aumenta por sobre el 18%.
- Esto muestra que mes a mes hay grandes variaciones producto de la falta de metodologías pese que la información es abundante y con varios métodos de control.
- En cuanto al desglose de los minerales por calidad se aprecia mayor dispersión, que hace necesario realizar procedimientos que tienda a uniformar criterios en cuanto a la asignación de minerales por calidad.

CONCILIACIÓN F3

En esta metodología se cheque la información de los reportes de alimentación a planta para comprobar la consistencia de la información, chequeando con los diversos sistemas de control de la planta.

VPO MONTHLY

VPO MONTHLY

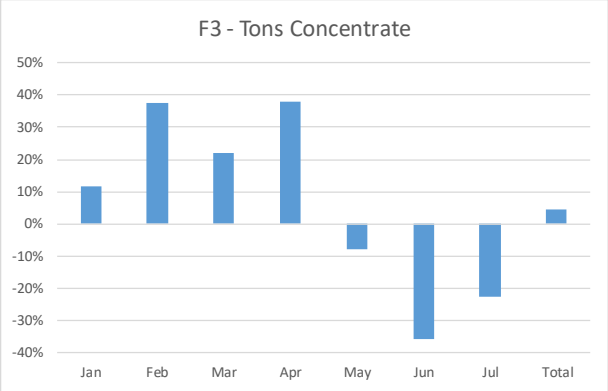
	unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Total
Tons crushed	DMT	2,182,645	2,914,733	2,803,940	3,169,828	3,205,836	3,178,900	3,000,258	20,456,142
Tons milled	DMT	2,310,096	3,202,106	2,499,148	3,192,604	3,181,795	3,178,476	3,205,968	20,770,194
Head Grade - Cu	%	0.645	0.551	0.504	0.698	0.669	0.650	0.600	0.619
Cu Recovery in Cu concentrate	%	82.92	79.00	79.49	78.09	77.74	80.26	77.10	79.06
Head Grade - Ag	g/t	5.71	5.96	5.83	7.04	7.36	7.41	8.54	6.91
Ag Recovery in Cu concentrate	%	67.63	66.38	65.95	70.12	68.97	67.79	67.25	67.79
Head Grade - Mo	&	0.019	0.013	0.009	0.013	0.013	0.014	0.011	0.01
Head Grade - Zn	%	0.092	0.120	0.112	0.108	0.104	0.118	0.146	0.12
Head Grade - As	%	0.021	0.024	0.028	0.039	0.039	0.031	0.038	0.03
Copper Concentrate Produced	DMT	54,524	61,777	45,967	82,968	75,973	77,489	70,445	469,143
Grade - Cu	%	22.65	22.55	21.77	20.98	21.79	21.39	21.06	21.67
Grade - Mo	%	0.025	0.013	0.009	0.022	0.029	0.035	0.034	0.02
Grade - Ag	g/t	163.6	205.1	209.0	189.9	212.5	205.9	261.3	207.73
Grade - Zn	%	2.726	4.480	4.527	3.214	3.289	3.503	4.951	3.77
Grade - As	%	0.481	0.740	0.917	0.882	1.084	0.841	1.239	0.90
Copper content	DMT	12,351	13,929	10,007	17,407	16,554	16,572	14,834	101,654
Silver content	oz	286,742	407,300	308,878	506,486	518,972	513,059	591,842	3,133,279

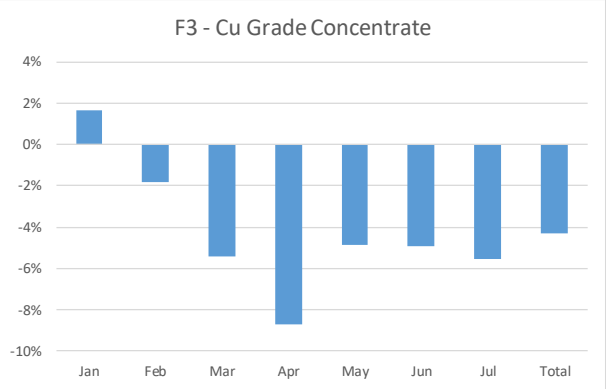
Modelo de Largo Plazo

		Jan	Feb	Mar	Apr	May	Jun	Jul	Total
Total Tonne	DMT	2,158,168	2,133,089	2,130,904	2,600,352	3,987,319	4,950,154	4,066,155	22,026,141
Head Grade - Cu	%	0.570	0.479	0.445	0.505	0.539	0.546	0.550	0.527
Head Grade - Mo	%	0.018	0.009	0.008	0.017	0.013	0.015	0.012	0.013
Head Grade - Ag	g	5.102	5.064	5.678	4.705	4.987	4.969	6.685	5.349
Head Grade - As	%	0.014	0.015	0.020	0.018	0.018	0.017	0.021	0.018
Head Grade - Zn	%	0.100	0.125	0.106	0.064	0.116	0.085	0.113	0.101
AsConc	%	0.459	0.569	0.772	0.602	0.571	0.521	0.683	0.592
ZnConc	%	3.180	4.145	3.845	2.408	3.703	2.852	3.674	3.359
Grade Cu Conc	%	0.223	0.230	0.230	0.228	0.228	0.224	0.222	0.226
Rec Cu	%	0.874	0.865	0.869	0.894	0.873	0.875	0.861	0.873
Rec Mo	%	0.554	0.453	0.490	0.574	0.501	0.558	0.521	0.525
Rec_Ag	g	0.733	0.712	0.719	0.749	0.727	0.725	0.702	0.723
Cu	DMT	10,751	8,837	8,245	11,731	18,758	23,646	19,243	101,214
Grade - Cu	%	22.27	22.96	22.95	22.81	22.84	22.43	22.22	22.60
Silver content	oz	259,335	247,128	279,888	294,425	465,019	573,229	613,524	2,732,548
Mo	DMT	216	83	88	255	250	407	246	1,524
Tons Concentrated		48,276	38,488	35,920	51,435	82,109	105,405	86,582	447,872

Diferencia

	Jan	Feb	Mar	Apr	May	Jun	Jul	Total
Dif% Tons Conc	11%	38%	22%	38%	-8%	-36%	-23%	5%
Dif% Grade Conc	2%	-2%	-5%	-9%	-5%	-5%	-6%	-4%





CONCLUSIÓN F3

En esta comparación se aprecia la gran variabilidad que hay por cada periodo hacia arriba y abajo, sin embargo, en el movimiento total tiende a disminuir.

De manera que es recomendable generar procedimientos que tiendan a disminuir las variaciones.

CONCLUSIONES Y RECOMENDACIONES FINALES

- Variaciones mayores por tipo de mineral
- Variaciones mayores en toneladas de Ag, As y Zn
- En los valores globales la diferencia se suaviza en bastante grado
- No existe suficiente información de leyes de corte por período para hacer un adecuado seguimiento y comparación de las diferencias
- Debe existir un procedimiento que regule y establezca el tipo de información y la forma de presentación de los resultados (tipo de material, rangos, límites, valores de corte, etc.)
- La clasificación de tipo de mineral debe ser estable y mantener durante el período de conciliación, para hacer válida la comparación en el periodo de tiempo (6 meses o más)

ANEXO 2-6
ESTUDIO TRADE OFF PLANTA CONCENTRADORA

JACOBS

MINERA CHINALCO PERU

Expansion Feasibility Study

APPENDIX D

TRADE OFF STUDIES

Project No CJ609

Volume 5

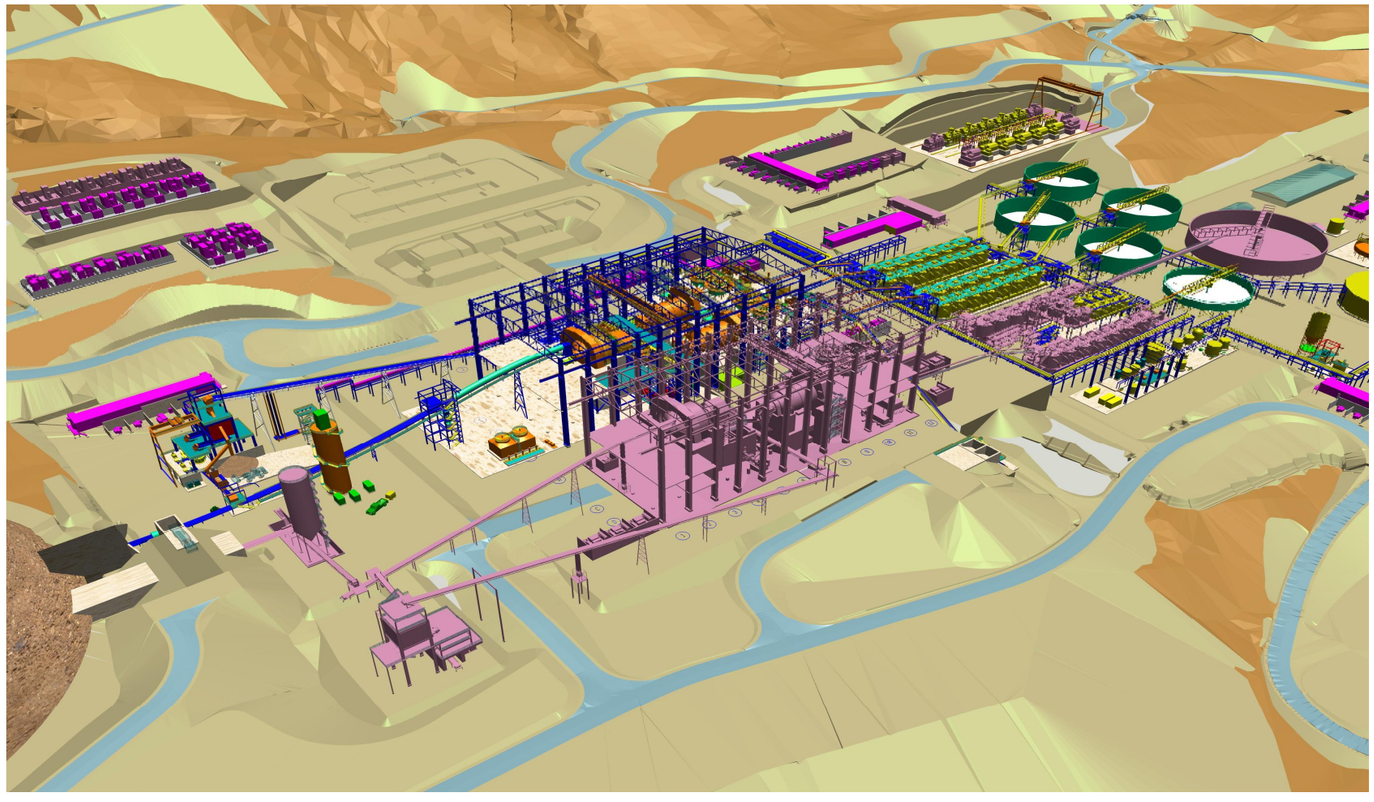
JACOBS

CHINALCO

MINERA CHINALCO PERU
Toromocho Project
Expansion Feasibility Study

VOLUME 5

- **APPENDIX D – TRADE OFF STUDIES**



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Aker Kvaerner

PERU COPPER INC.

Toromocho Project Feasibility Study

Ore Conveyor Trade-off Study

January 2007

Prepared for
Peru Copper, Inc.

Project No. R0521300
Report No. RP-02

AKER KVÆRNER™

Exhibit B

USE OF REPORT

This report was prepared for Peru Copper Inc. (Client) by Aker Kvaerner E&C, a Division of Aker Kvaerner Canada Inc. (Aker Kvaerner) pursuant to the contract agreement (Agreement) between the Client and Aker Kvaerner.

The report is based in whole or in part on information and data provided to Aker Kvaerner by Client and/or third parties.

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3-1 Design Criteria for Crushed Ore Conveying System
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1.0 INTRODUCTION

Peru Copper Inc. has retained the services of Aker Kvaerner to carry out a Definitive Feasibility Study (DFS) for the Toromocho Project in Peru. The project involves an open-pit mine, sulphide concentrator, heap leach/SX/EW facility and related infrastructure.

One of the first activities for the sulphide concentrator was to carry out a trade-off study on two options for conveying ore from the primary crusher to the concentrator. The two options are:

(a) Overland

(b) Tunnel.

This report presents the findings of the study including the preliminary process design information, capital cost estimate details and comparison of alternatives.

2.0 SCOPE OF WORK

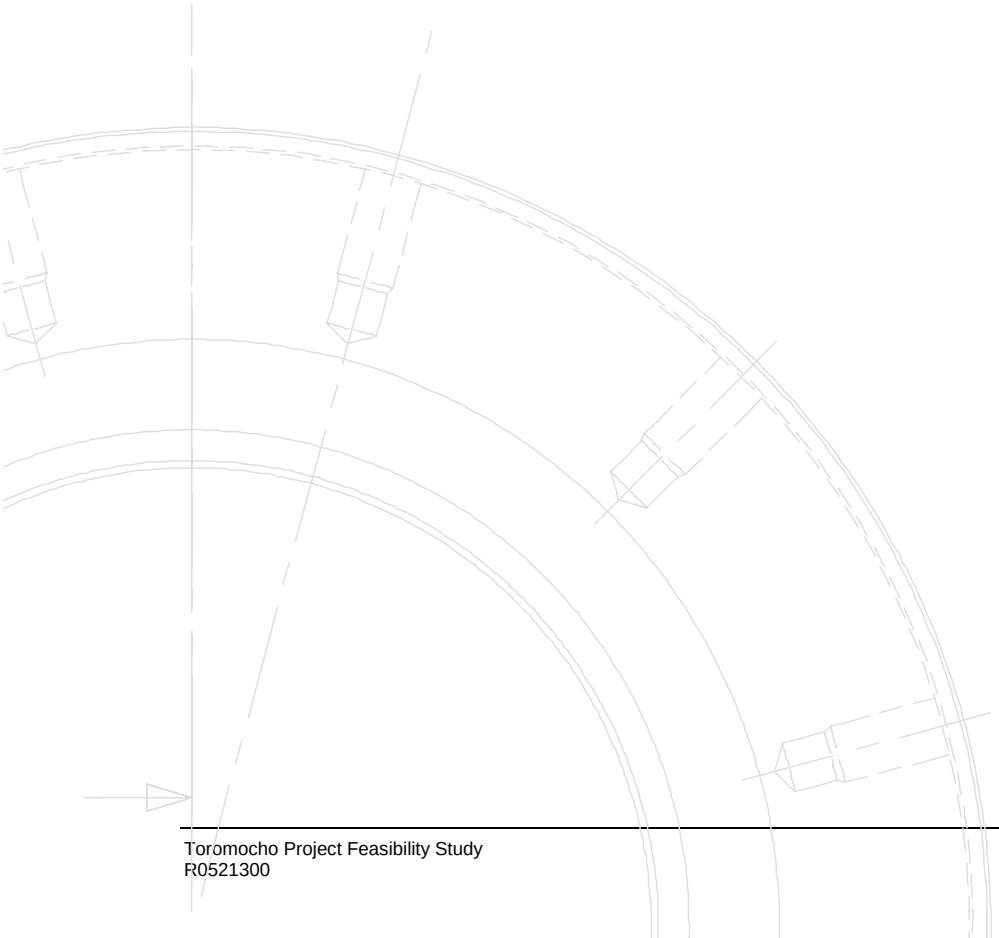
The objective of the Ore Conveyor Trade-off Study was to compare the following two ore conveying options:

(a) Overland

(b) Tunnel.

The scope of work is as follows:

- Develop a preliminary site plan showing both options
- Prepare equipment lists for each option
- Prepare order-of-magnitude capital cost estimates for each option
- Make a recommendation on the preferred option.



3.0 DESCRIPTION OF ALTERNATIVES

This document establishes design criteria for the crushed ore conveying system as shown in Table 3-1.

Table 3-1
Design Criteria for Crushed Ore Conveying System

Design capacity	100,000 tpd
	5750 tph
Duty cycle	365 days per year
	24 hours per day
	80 % availability
Ore feed characteristics	
Moisture	3 %
Crushed ore size	100 % under 200 mm (8 inch)
Bulk density	1.6 t/m^3
Specific gravity	2.7 t/m^3

The primary crushing is designed for one 100-kt/d Taylor 60 x 113 gyratory crusher.

The drawings for both options are provided in Appendix A.

The crushed ore will be delivered by 350-t trucks and feed the primary crusher. Crushed ore will be discharged into a 700-t capacity hopper. The budgetary quotation and design of the overland and underground conveyors is provided by the vendor, Conveyor Engineering Inc. The technical details for both options are shown in Appendix B, Mechanical Equipment List for Overland and Underground Conveyors.

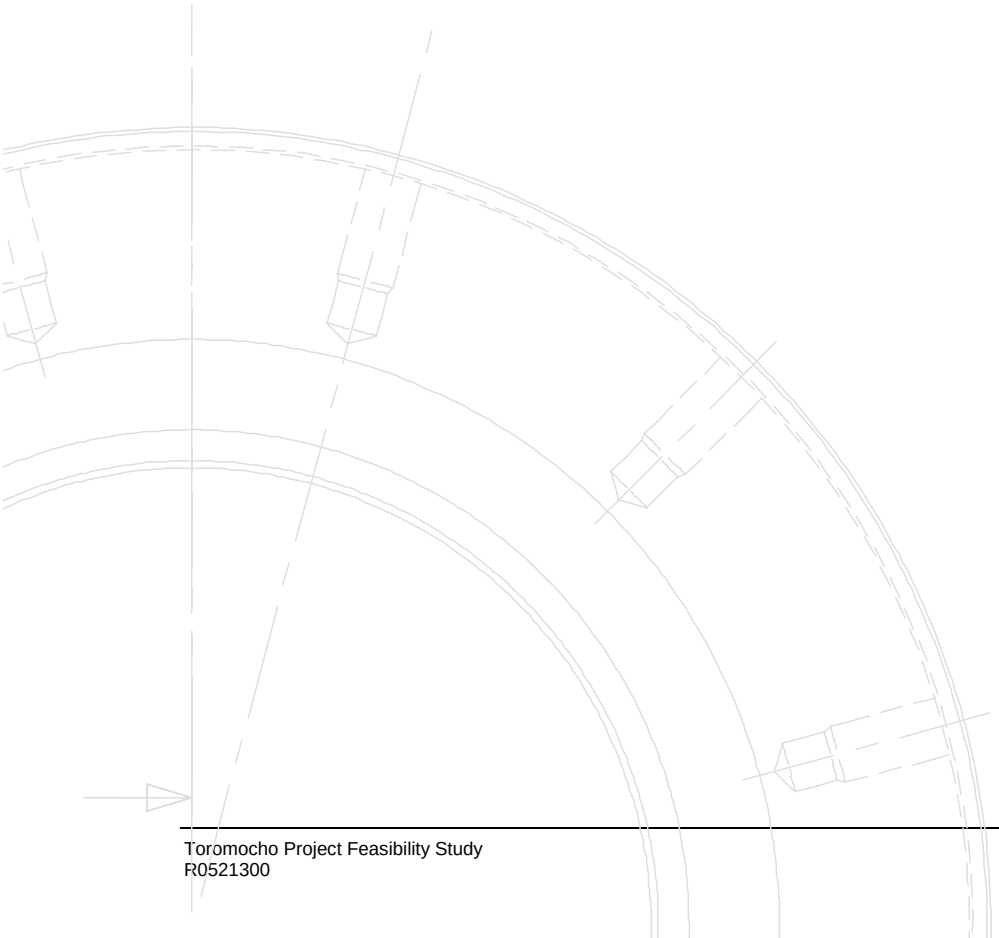
3.1 Overland Ore Conveying Option

The belt feeder will feed to a crushed ore transfer belt conveyor, which will discharge ore on to a 1,048-m long overland belt conveyor, No. 1. The ore will be transported further by the second 1,299-m long overland belt conveyor, No. 2, which will discharge the crushed product to the processing plant stockpile.

3.2 Tunnel Ore Conveying Option

The crushed ore belt feeder will feed to a transfer belt conveyor, which will discharge ore on to a 2,090-m long underground belt conveyor, which will transport ore directly to the processing plant stockpile.

The underground tunnel is 9.2 m by 4.5 m and approximately 1,800-m long and doesn't require a specific ventilation system for safety reasons since both ends of the tunnel are open. The underground tunnel is large enough to accommodate a front-end loader and maintain the conveyor along its length.



4.0 CAPITAL COST ESTIMATES

The trade-off study examined two options for conveying crushed ore. The first option is an overland conveyor from the primary crushing facility to the crushed ore stockpile. This option consists of two overland conveyors, approximately 1,048-m long and 1,299-m long respectively. The second option consists of a single conveyor in a tunnel, approximately 2,090-m long, from the primary crushing facility to the crushed ore stockpile.

Order-of-magnitude capital cost estimates were developed for the two options. The capital cost for the overland option is USD 18.6 million. The capital cost for the tunnel conveyor option is USD 33.3 million. The overland conveyor option is USD 14.6 million less expensive than the tunnel conveyor option.

The costs were developed in fourth quarter 2006 US dollars and are subject to the qualifications and exclusions listed below.

A budge quotation for the conveyors was obtained from Conveyor Engineering Inc. (refer to Appendix C).

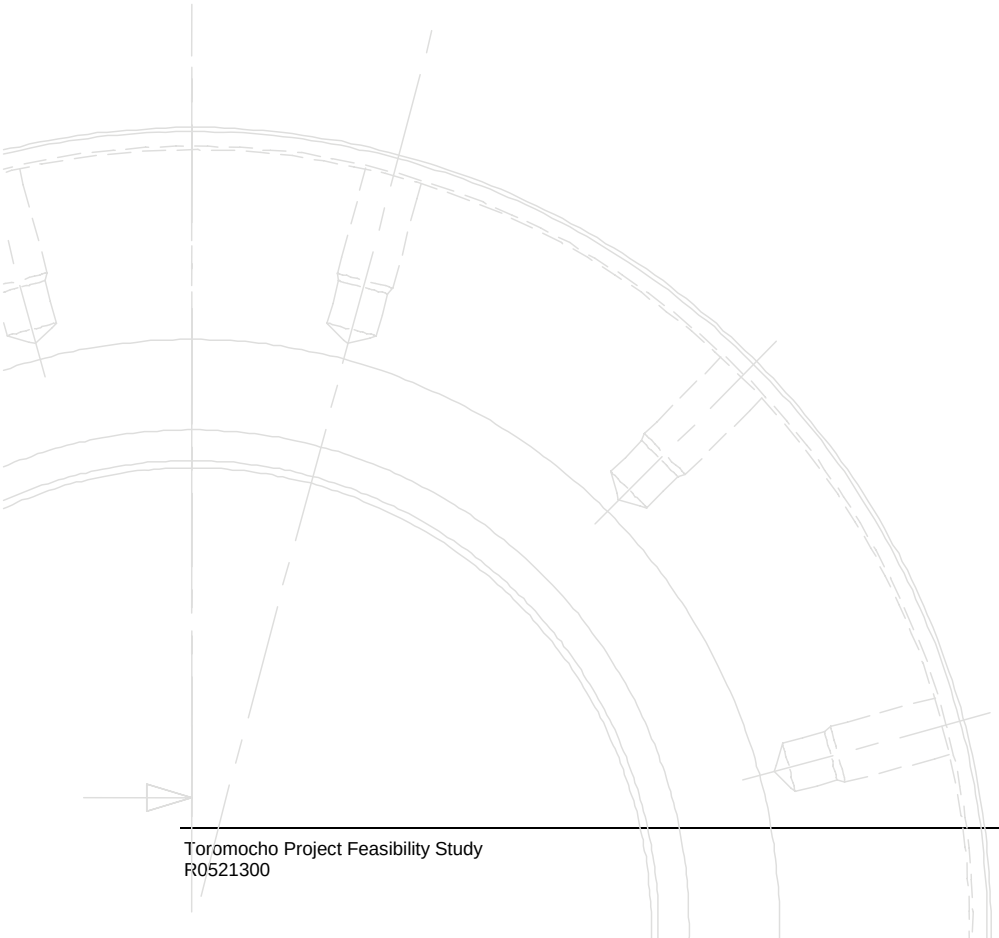
The direct capital costs for these options are summarized by commodity in Table 4-1.

Table 4-1 Summary Comparison

Commodity	**Overland**	**Tunnel**	**Variance**
Earthworks	7,196,000	22,722,000	15,525,500
Concrete	1,266,800	1,186,300	-80,500
Structural Steel	210,500	88,000	-122,500
Architectural	12,000	6,000	-6,000
Mechanical			
Conveyors	8,758,000	7,975,000	-783,000
Other	140,000	100,000	-40,000
Electrical	900,000	1,065,000	165,000
Instrumentation	140,000	70,000	-70,000
Piping (Fire Protection)		50,000	50,000
Total (Direct Cost)	18,623,800	33,2620,300	14,638,500

The following qualifications and exclusions to the capital cost estimate are:

- The feed conveyor from the primary crusher is excluded
- The substation at the Primary Crusher Facility is excluded
- Indirect costs are excluded
- Taxes and duties are excluded
- Tunnel size based on using a CAT 970G FEL for clean-out
- Contingency is excluded.



5.0 COMPARISON OF ALTERNATIVES

The comparison of the direct capital cost estimates for the two cases showed that the overland option was a significantly lower cost and so the decision was taken to choose this option for further work

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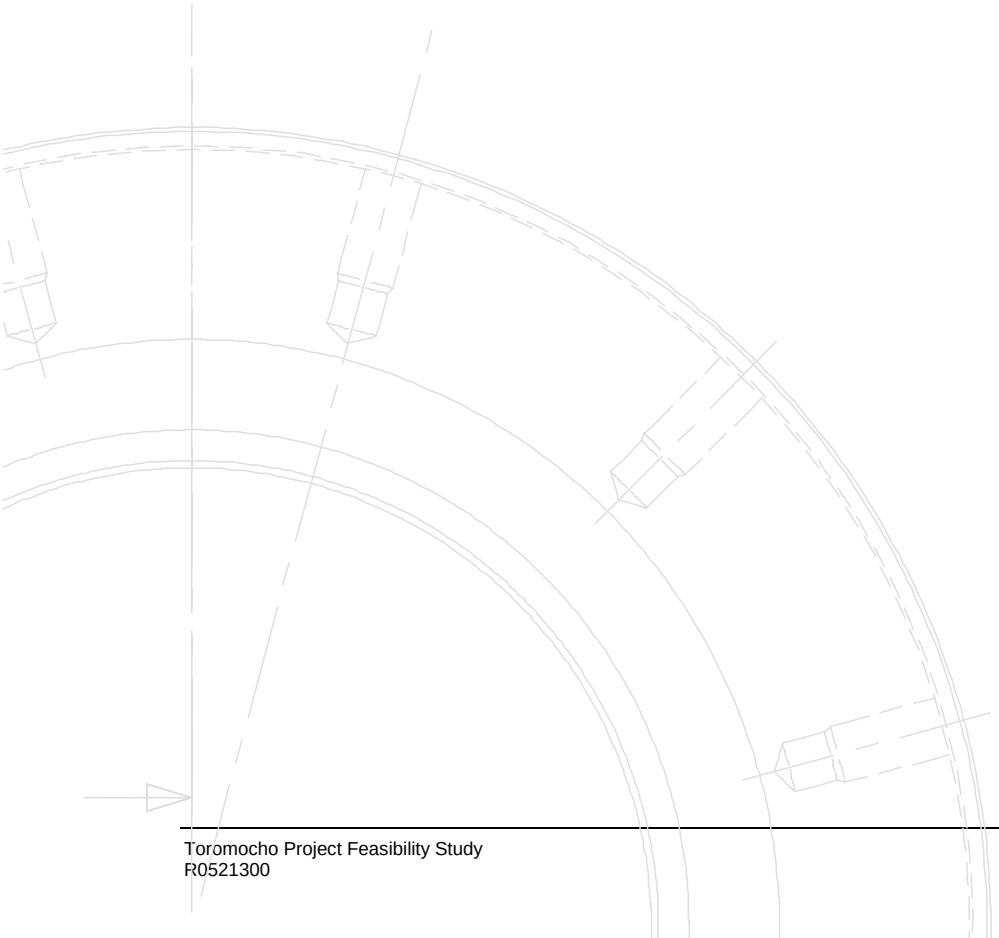
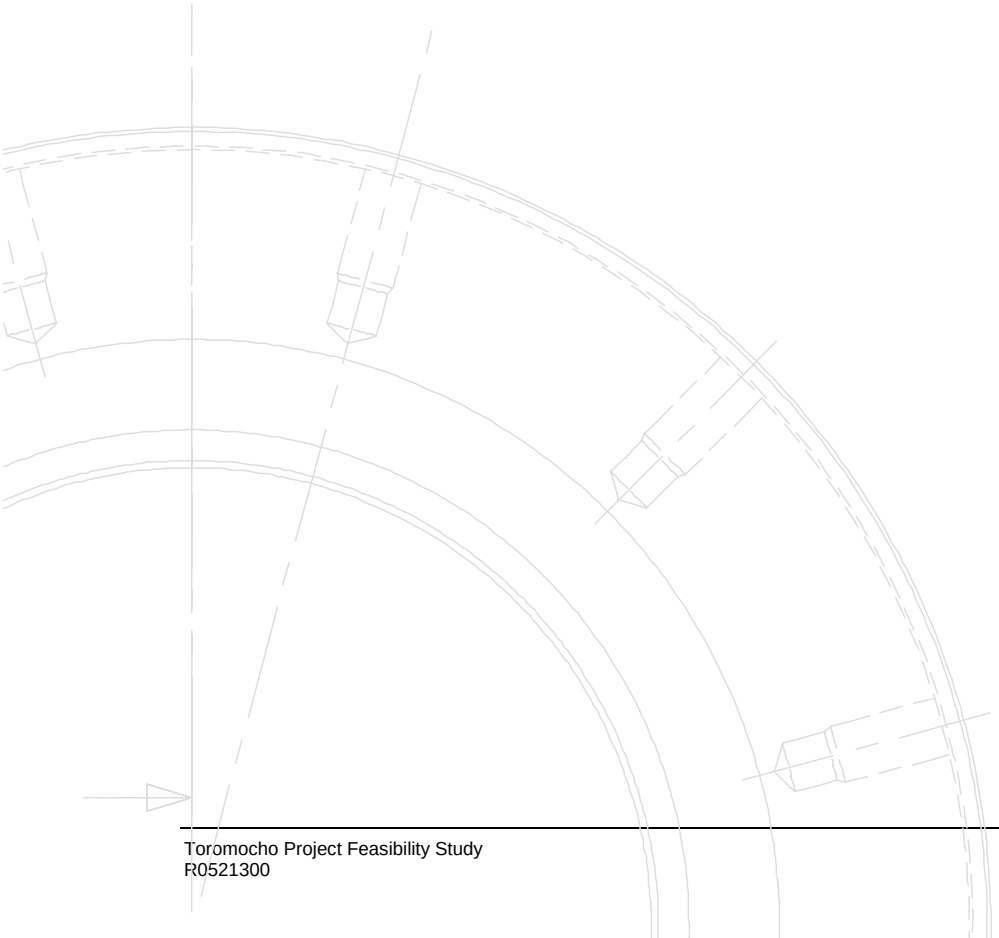
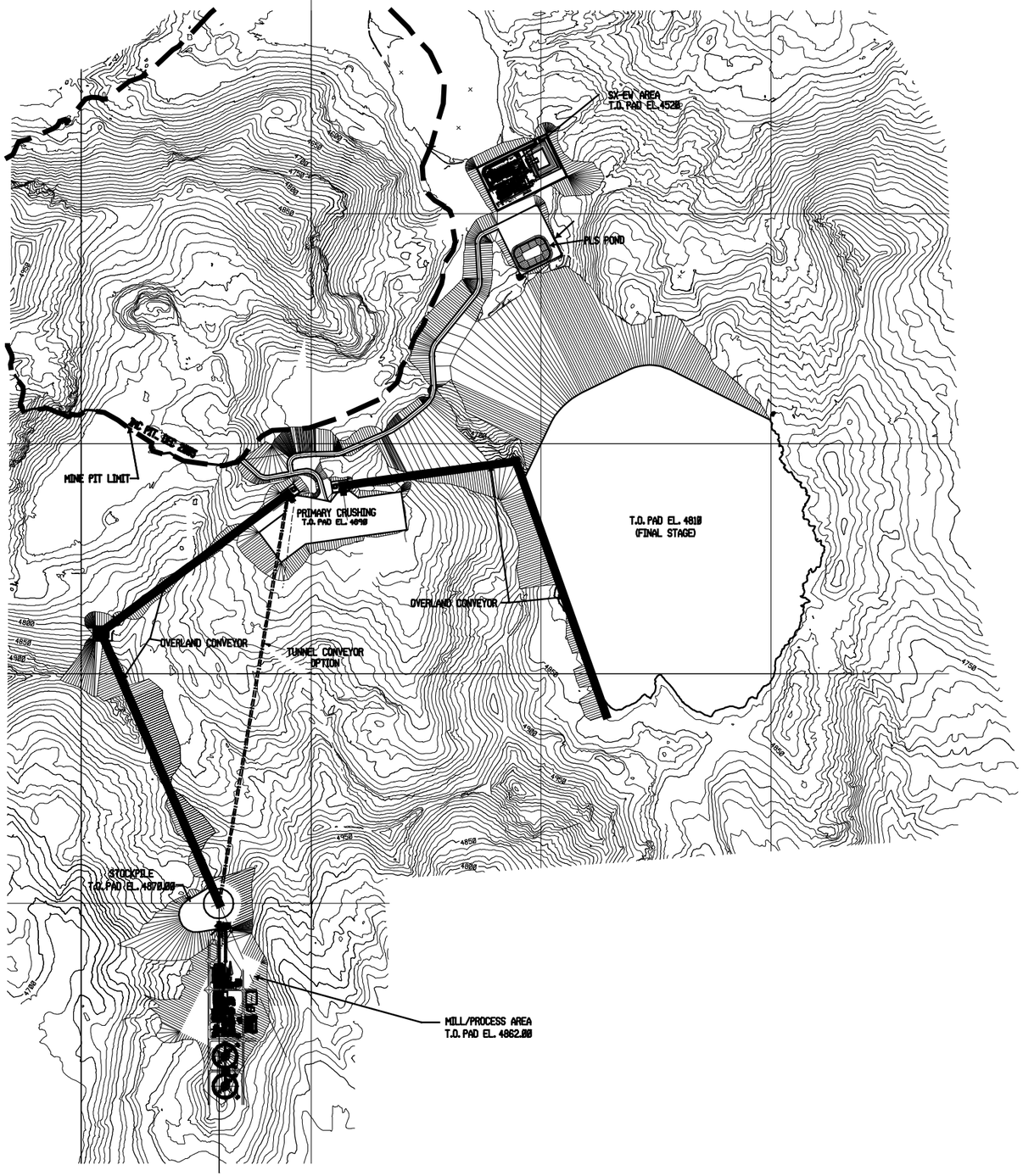


Appendix A - Drawings





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DRAWN			ENGINEERING		
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ISSUE	REV.	DATE
CLIENT APP'L		
QUOTATION		
CONSTRUCTION		

AKER KVÆRNER™
E&C Division
Toronto Canada

CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: PROPOSED SITE PLAN

SCALE | PROJ. NO. 180600 | REVISION

DRAWING NO. DWG- 000-G-001

DRAWING NO.

REFERENCE FILES:

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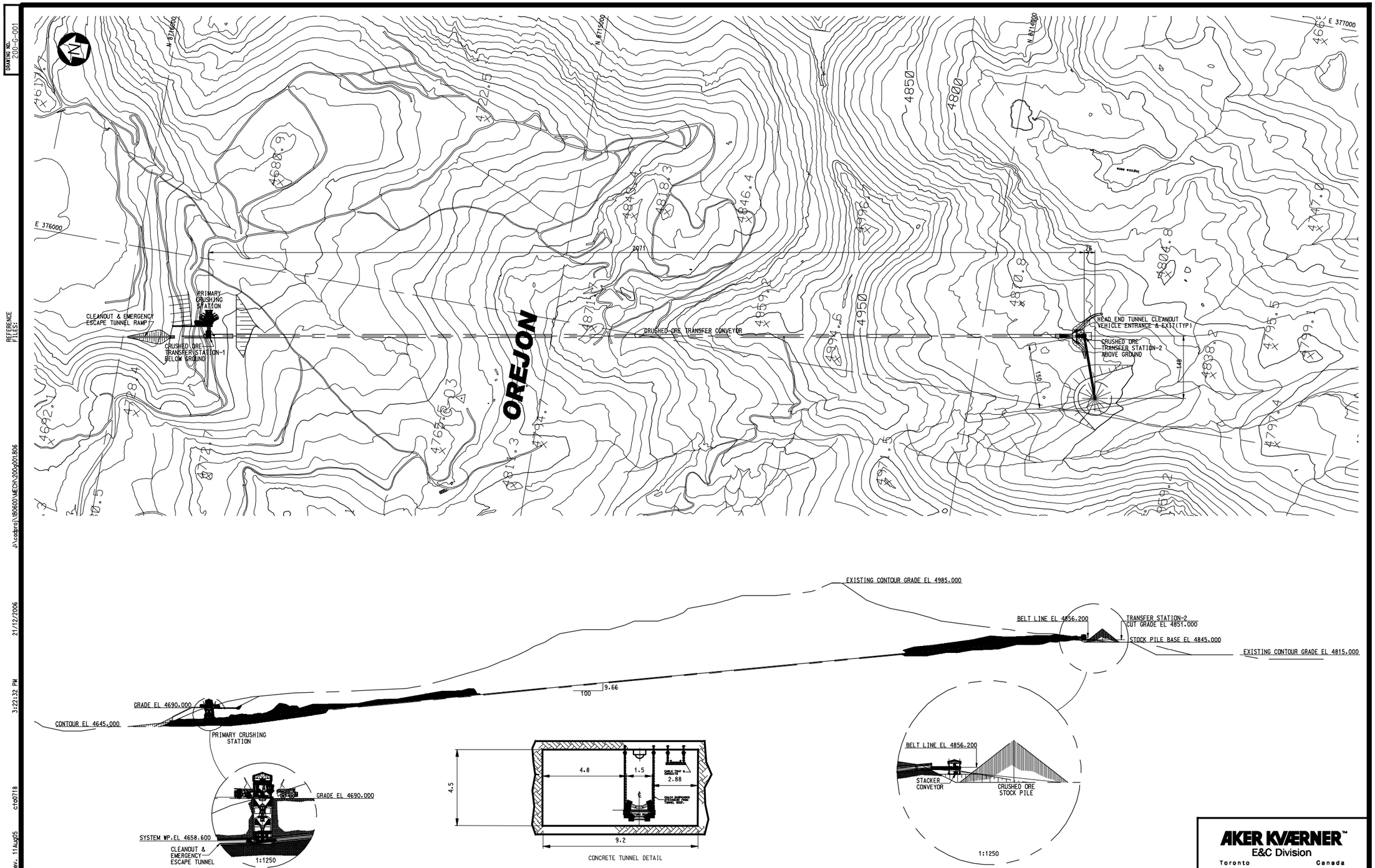

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REVISIONS

PREPARATION	BY	DATE	APPROVALS	BY	DATE
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ISSUE RECORD

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ISSUE	REV.	DATE
CLIENT APP'L		
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TOROMOCHO COPPER PROJECT-DFS

TITLE

TUNNEL OPTION CRUSHED ORE TRANSFER CONVEYOR ARRANGEMENT

AKER KVÆRNER™
E&C Division
Toronto Canada

SCALE 1:4000 | PROJ. NO. 180600 | REVISION

DRAWING NO.

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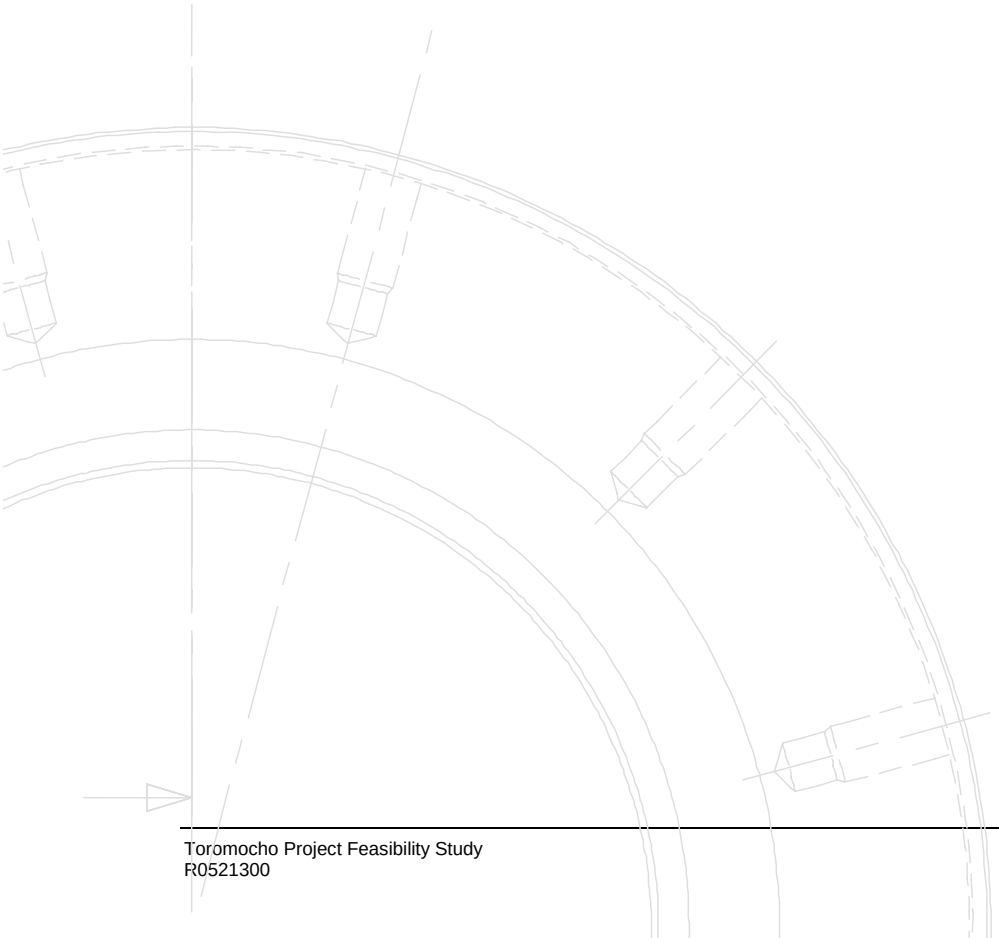
Appendix B – Mechanical Equipment List



Company: Peru Copper Inc. **MECHANICAL EQUIPMENT LIST** **Aker Kvaerner**

Project: Toromocho Copper Project
Case: 100,000 tpd

Crushed ore Overland Conveying system

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
		200	**Primary Crushing Area**					
A	200	CH-003	Crushed Ore Transfer Conveyor Discharge Chute Capacity 5208 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	200	CV-002	Crushed Ore Overland Conveyor # 1 Capacity 5208 t/h Belt width 1200 mm Length (Horiz. C to C) 1048 m Lift height 162.0 m Troughing angle 35 deg.	1	each	3730.0	3000.0	
A	200	CH-004	Crushed Ore Overland Conveyor # 1 Discharge Chute Capacity 5208 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	200	CV-003	Crushed Ore Overland Conveyor # 2 Capacity 5208 t/h Belt width 1200 mm Length (Horiz. C to C) 1299 m Lift height 88.0 m Troughing angle 35 deg.	1	each	2611.0	2500.0	
A	200	CH-005	Overland Conveyor # 2 Discharge Chute Capacity 5208 t/h	1	each			Carbon Steel Abrasion resistant plate lining
			Area total connected power Area total operating power			**6,341** **4,400**		

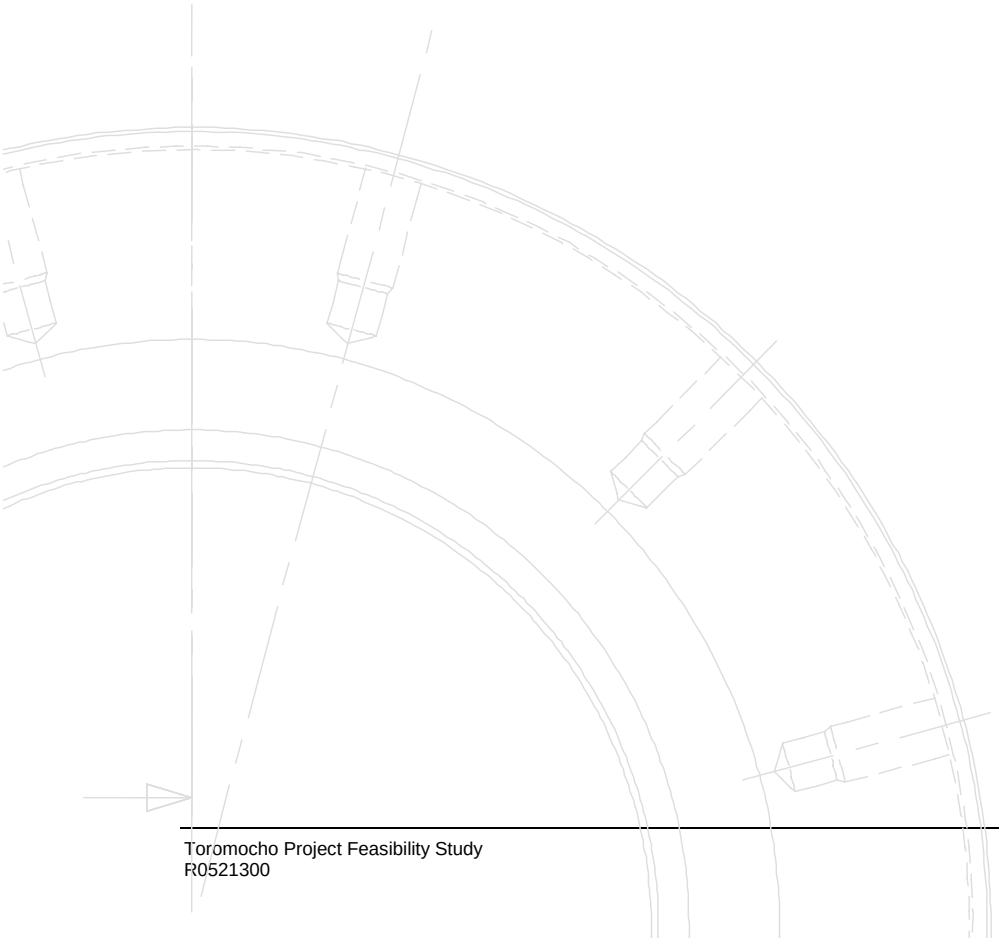
Crushed ore Underground Conveying system

Date: **21-Dec-06**
Rev. **A**

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
		200	**Primary Crushing Area**					
A	200	CH-003	Crushed Ore Transfer Conveyor Discharge Chute Capacity 5208 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	200	CV-001	Crushed Ore Underground Conveyor Capacity 5208 t/h Belt width 1200 mm Length (Horiz. C to C) 2090 m Lift height 197.0 m Troughing angle 35 deg.	1	each	5968.0	5000.0	
A	200	CH-004	Crushed Ore Underground Conveyor Discharge Chute Capacity 5208 t/h	1	each			Carbon Steel Abrasion resistant plate lining
			Area total connected power Area total operating power			**5,968** **4,000**		

002395

Appendix C – Quotation



				CONVEYOR ENGINEERING, INC.												
				Kvaerner Toronto												
				Peru Copper Toromocho	**SUMMARY-1A**											
				10837	**November 3, 2006**											
	Client	CEI		Overland Conveyor Options				SLOPE			TOTAL	TOTAL	TOTAL			
COST	Rev.	Run				TPH	BW	LGTH	LIFT	MTR	MECH	ELECT	STEEL	TOTAL	SELL	
CTR			Qty	Client Equip #	Description	(mtph)	(mm)	(mm)	(mm)	(kw)	WGT (kg)	WGT (kg)	WGT (kg)	WGT (kg)	$US	TAX
101	1	A	1	100-CV-001	Underground Single-Flight OLC	5208	1200	2090000	197000	5000	651,427	32,592	215,421	899,439	$5,872,679	$0
102	1	A	1	100-CV-002	Above Ground OLC #1	5208	1200	1048000	162000	3000	325,071	19,579	155,560	500,211	$3,195,797	$0
103	1	A	1	100-CV-003	Above Ground OLC #2	5208	1200	1299000	88000	2500	346,297	16,464	190,240	553,001	$3,189,555	$0
															$6,385,352	

002397

Aker Kvaerner

PERU COPPER INC.

Dry Tailings Scoping Study

February 2007

Prepared for
Peru Copper, Inc.

Project No. R0521300
Report No. RP-04

AKER KVÆRNER™

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APPENDICES:

Appendix A Drawings
Appendix B Mechanical Equipment List
Appendix C Engineering Calculations
Appendix D Quotations

1.0 INTRODUCTION

This report evaluates the storage of flotation tailings within the valley which is known as site # 3. Geotechnical investigation has determined that there are several major issues namely:

- Karst structures within the basin.
- Flow paths for liquids within the Karst.
- Unknown discharge points for containment of tailings solutions.

This report evaluates the order of magnitude cost associated with “dry” (filter cake) storage of tailings within site #3. Geotechnical and hydro geological factors are not considered for this order of magnitude estimate.

2.0 DESIGN CONCEPT AND CONCLUSION

The approach was to evaluate either belt filters or plate and frame filters. Two filter vendors were contacted in order to establish the approximate number of the largest commercially available filters for the 100000tpd duty. Delkor based their estimate for filtration rates on the La Copia project in Chile. They quoted 162m2 belt filters with the filtration rate adjusted from 4000 m at La Copia to 4700 m at Toromocho. The filter cake is estimated to be between 19% and 22% moisture by weight.

Industrial Process Machinery (IPM) was contacted to provide similar data for plate and frame pressure filters. IPM estimates that 42 filters having 100 chambers would be required. Sizing basis used was for the Glamis Project in which similar filters were used for tailings from a gold plant in Mexico.

Vacuum belt filters were selected based on an economic evaluation. The price quotation we received from Delkor for the 30 units belt filter was US$43,350,000 @US$1,445,000 per unit while for the plate and frame pressure filter quotation for the 42 units from IPM was US$88,200,000 @US$2,100,000 per unit. Aker Kvaerner believes that the benefit of the lower moisture obtained from pressure filters is not worth the much higher capital investment.

Economic evaluation of the two options demonstrates that belt filters are the most effective option. It is believed that the benefits derived from plate and frame filters, which will produce a lower moisture content than belt filters, is not justifiable and does not provide significant benefits hence its elimination as an option. The “dry” tailings approach is technically feasible but it has to be economically evaluated against the other methods of disposal, i.e. slurry tailings, paste tailings, etc.

3.0 DEPOSITION OF FILTER CAKE

The system comprises 30 belt filters @162 m^2 filters, conveyors for collection and stacking. Deposition of the tailings is by road trucks as shown on flow sheet SK-001, Tails Filtration and SK-002, Solid Tailings Disposal.

The filter cake will be discharged on two 72" wide belt collection conveyors operating at a velocity of 250 FPM and received by the 60" wide belt transfer conveyor running at a velocity of 650 FPM. The material is transferred to a 60" wide belt radial stacker conveyor. The radial stacker discharges the material in a kidney stockpile with capacity of six days storage. This stockpile is a surge to allow continuous discharge of the filter cake and continuous loading of trucks.

Truck loading / unloading cycle is estimated to take 15 minutes (using the longest traveling distance). Approximately 4 truck trips per hour.

Using Cat front loader 994F with loader bucket capacity of 36 m^3 and matching Cat truck 789C with 120 m^3 capacities will require 22 truck loads per hour.

Two front loaders will be required to load 22 trucks per hour (5 min. per truck).

Tailings will be discharged along the edge of the area designated for disposal and the landfill compactor Cat 826 H will spread and compact the filter cake material.

4.0 CAPITAL COST ESTIMATES

Budgetary equipment quotations for the mobile equipment and for the belt vacuum filter package were received from vendors, (Caterpillar and Delco). The balance of the CAPEX is factored for this order of magnitude estimate.

Capital Cost

			Capital $000,000's
1.0	DIRECT COST		
1.1	Plant Equipment		
1.1.1		Vacuum Filters Transfer Tanks	1.09
1.1.2		Vacuum Filters Transfer Agitators	.35
1.1.3		VBF Transfer Pumps	.31
1.1.4		VBF Feed Tanks	.51
1.1.5		VBF Feed Pumps	.66
1.1.6		VBF Tank Agitators	.49
1.1.7		VBF Package (30 units)	49.11
1.1.8		Collecting conveyors	2.29
1.1.9		Transfer Conveyor	1.13
1.1.10		Radial Stacker	1.18
		Sub-total 1.1	57.12
1.2	BUILDINGS		
1.2.1		Filter Structure	19.00
1.2.2		Electrical/Control/Office Building	.80
		Sub-total 1.2	19.80
1.3	CIVIL WORKS INCLUDES SITE PREPARATION		2.00
1.4	PIPING		11.85
1.5	ELECTRICAL & INSTRUMENTATION		7.90
1.6		FIELD painting touch up	.05
		TOTAL DIRECT COST	98.72

			Capital $000,000's
2.0	INDIRECT COSTS		
	2.1	Engineering & Procurement	7.90
	2.2	Construction Management	7.90
	2.3	Spare Parts	2.92
	2.4	Start –Up & Commissioning	2.00
		SUB-TOTAL INDIRECT COST 2.0	20.72
3.0	MOBILE EQUIPMENTS		
	3.1	CAT 994F Loader (2 units)	6.53
	3.2	CAT 789C Haul Trucks (6 units)	11.19
	3.3	A 826H Landfill Compactor (1 unit)	.81
		SUB-TOTAL MOBILE EQUIPMENTS 3.0	18.53

CAPEX SUMMARY

		Capital $000,000's
1.0	DIRECT COST	98.72
2.0	INDIRECT COST	20.72
3.0	MOBILE EQUIPMENTS	18.53
4.0	OWNER'S COST	2.00
	Sub-total Cost	139.97
5.0	CONTINGENCY at 25%	34.99
	TOTAL COST	174.96

5.0 OPERATING COST

5.1 Vacuum Belt Filtration

5.1.1 Labor

Labor	No		k$/y
Shift Foreman	4		120
Operators	16		378
Maintenance Foreman	1		30
Maintenance Planner	1		22
Millwrights/Pipe Filters	8		176
Electricians/Inst Tech	3		66
Superintendent	1		45
		Labor Subtotal	837

5.1.2 Power ($360 kW/y)

Drive	No	kW	k$/y
Filter Drive	22	75	594
Belt Support	44	11	174
Vacuum Pump	22	385	3049
Filtrate Pumps	44	11	174
Misc	1	100	36
	Power Subtotals	582	4027

Typical Power Draw is 80% (Assumption)

Power Costs Basis $/y (.8 x 4027) 3221

5.1.3 Consumables

	k$/y
Flocculant 30g/t at $4.40/kg	4343
Filter Media (cloth)	660 (Est)
Spare Parts at 6% of Capital (Filters)	3211
Subtotal, Consumables, $/y	8214

5.1.4 Belt Filter Summary

	K$/y
Labor	837
Power	3221
Consumables	8214
Total Operating Cost $/y	12,272

5.2 Belt Conveyors and Trucks

5.2.1 Labor

	No.		k$/y
Shift Foreman	4		120
Truck Operators	24		638
Loader Operators	8		190
Compactor Operator	4		95
Truck Spotter	4		72
Maintenance	3		66
		Total	1181

5.2.2 Power

Belt Conveyors = 694 kW-hr at $360/kW-hr/yr	250

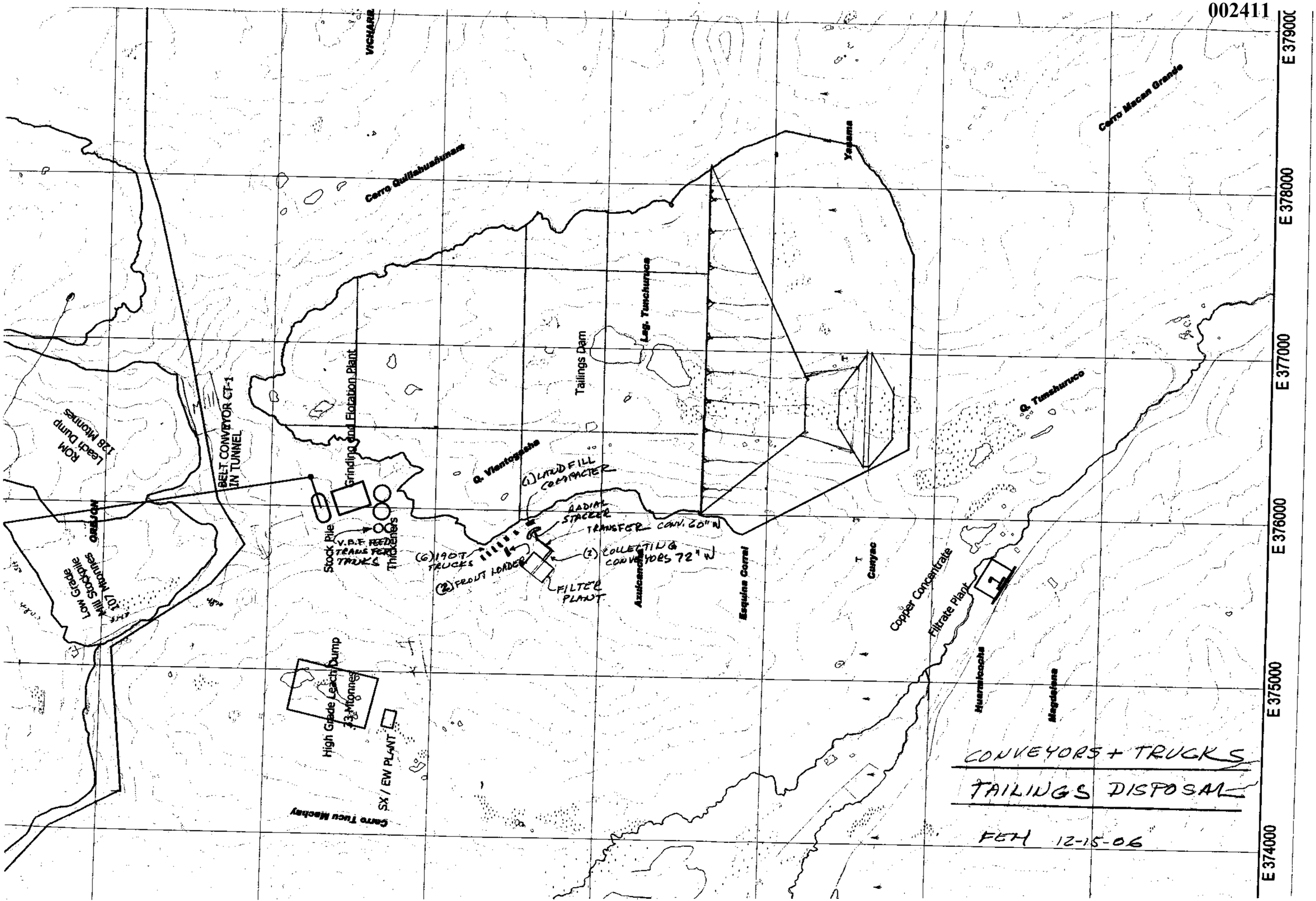
5.2.3 Mobile Equipments

Description	CAT 994F Loader	CAT 789C Trucks	CAT 826H Land Compactor
	(2 units)	(6 units)	(I unit)
Operation w/o Labor	$161/h (ea)	$160/h (ea)	$66/h
	k$/y	k$/y	k$/y
Assume 90% Operating Time			
Subtotals	2539	7568	520
		Total Mobile Equipment	10,627

OPEX SUMMARY

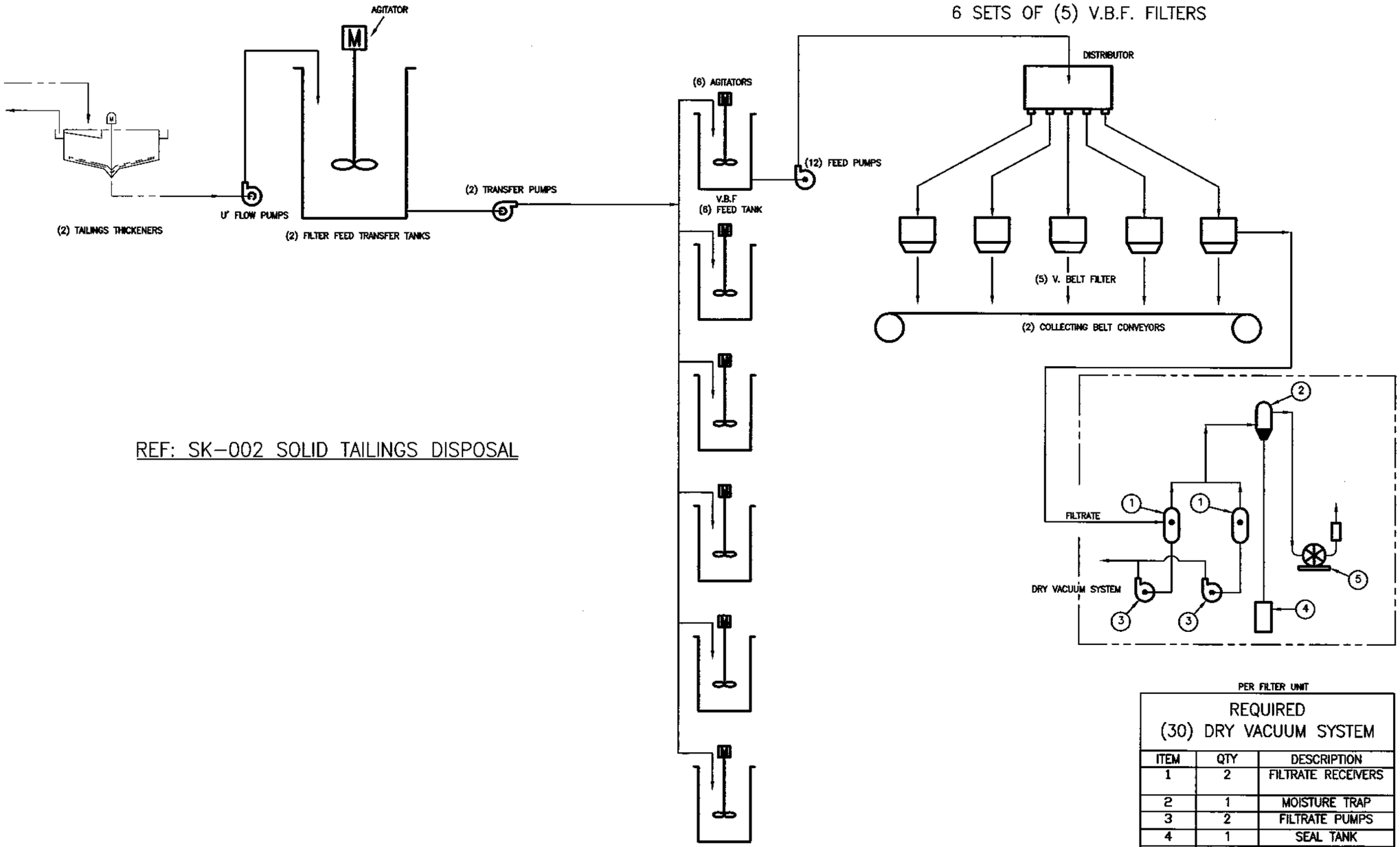
			K$/y
1.0	VACUUM BELT FILTRATION LABOR		837
2.0	VACUUM BELT FILTRATION POWER		3221
3.0	VACUUM BELT FILTRATION CONSUMABLES		8214
4.0	BELT CONVEYOR + TRUCKS LABOR		1181
5.0	BELT CONVEYOR POWER		250
6.0	MOBILE EQUIPMENT (Fuel, Tires, Maintenance)		10,627
		TOTAL	24,330

Appendix A - Drawings



VICHARR
Cerro Quillahuañunam
Cerro Macan Grande
Yanama
Lag. Tunchuruco
Tailings Dam
Grinding and Flotation Plant
BELT CONVEYOR CT-1 IN TUNNEL
ROM Leach Dump 128 Mtonnes
OREJON
Low Grade Mill Stockpile 107 Mtonnes
Stock Pile
V.B.F. FEED TRANSFER TANKS
Thickeners
Q. Vientogasha
(1) LANDFILL COMPACTER
RADIAL STACKER
TRANSFER CONV. 60" W
(6) 190T TRUCKS
(2) FRONT LOADER
(2) COLLECTING CONVEYORS 72" W
FILTER PLANT
Azulcancha
Esquina Corral
Cunyac
Copper Concentrate
Filtrate Plant
Q. Tunshuruco
Huamalcocha
Magdalena
High Grade Leach Dump 33 Mtonnes
SX / EW PLANT
Cerro Tucu Machay
E 374000
E 375000
E 376000
E 377000
E 378000
E 379000
CONVEYORS + TRUCKS
TAILINGS DISPOSAL
FEH 12-15-06

DRAWING No. SK-001



REF: SK-002 SOLID TAILINGS DISPOSAL

PER FILTER UNIT

REQUIRED
(30) DRY VACUUM SYSTEM

ITEM	QTY	DESCRIPTION
1	2	FILTRATE RECEIVERS
2	1	MOISTURE TRAP
3	2	FILTRATE PUMPS
4	1	SEAL TANK
5	1	VACUUM PUMP

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AKER KVÆRNER™ METALS, Inc.
Tucson, Arizona

PERU COPPER INC.

REFERENCES		REVISIONS						REVISIONS					
DWG. NO.	TITLE	NO.	DESCRIPTION	BY	CHK'D	APPROVED	DATE	NO.	DESCRIPTION	BY	CHK'D	APPROVED	DATE
SK-002	SOLID TAILINGS DISPOSAL												

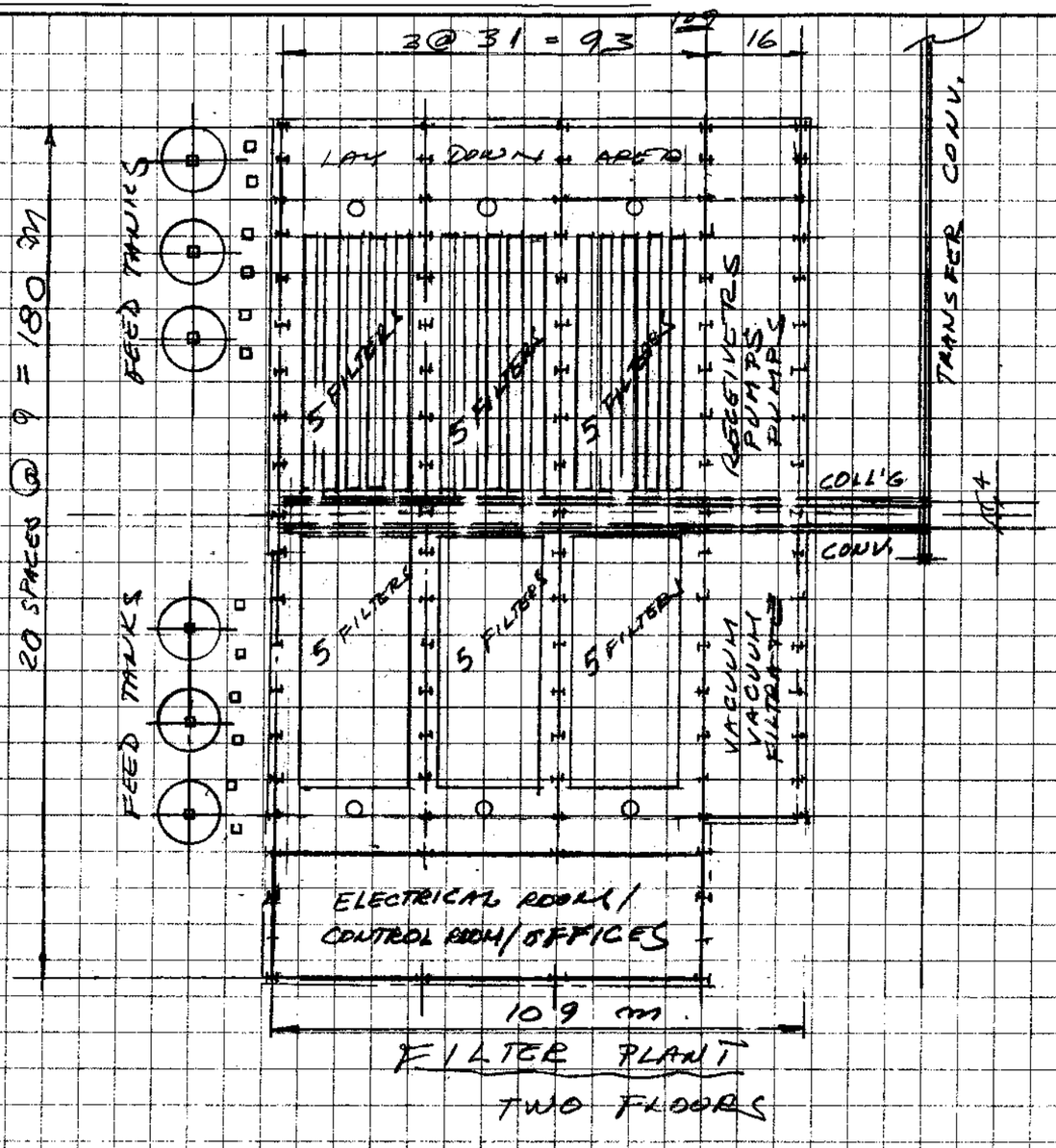
SCALE: NONE	SHEET SIZE: A1	PROJECT: TOROMOCHO FEASIBILITY STUDY
DRAWN BY: JF	DATE: 01/17/07	AREA:
CHECKED BY:	DATE:	TITLE: TAILS FILTRATION
ENGINEERED BY:	DATE:	JOB NO. R0521300
APPROVED BY:	DATE:	DWG NO. SK001.DWG
		REVISION: 0
		DWG. NO. SK-001

Size A1 wood bdr.dwg
Rev. 11/2/06

Aker Kvaerner Metals, Inc.

CALCULATION SHEET

BY FEM DATE 12-15-06 SUBJECT TAILINGS SHEET NO. ____ OF ____
CHKD. ____ DATE ____ FILTER PLANT JOB NO. R0521300



EQUIPMENT

A. (30) EA HORIZONTAL BELT VACUUM FILTER. 150 m² 3.2 m W x 55 L

B. (4) BRIDGE CRANES

C. (6) FEED TANKS

C1 (6) FEED TANK AGITATORS

C2 (12) FEED PUMPS

D. (30) VACUUM PUMP

E. (6) DISTRIBUTORS

F. (60) FILTRATE RECEIVER

G. (60) FILTRATE PUMPS

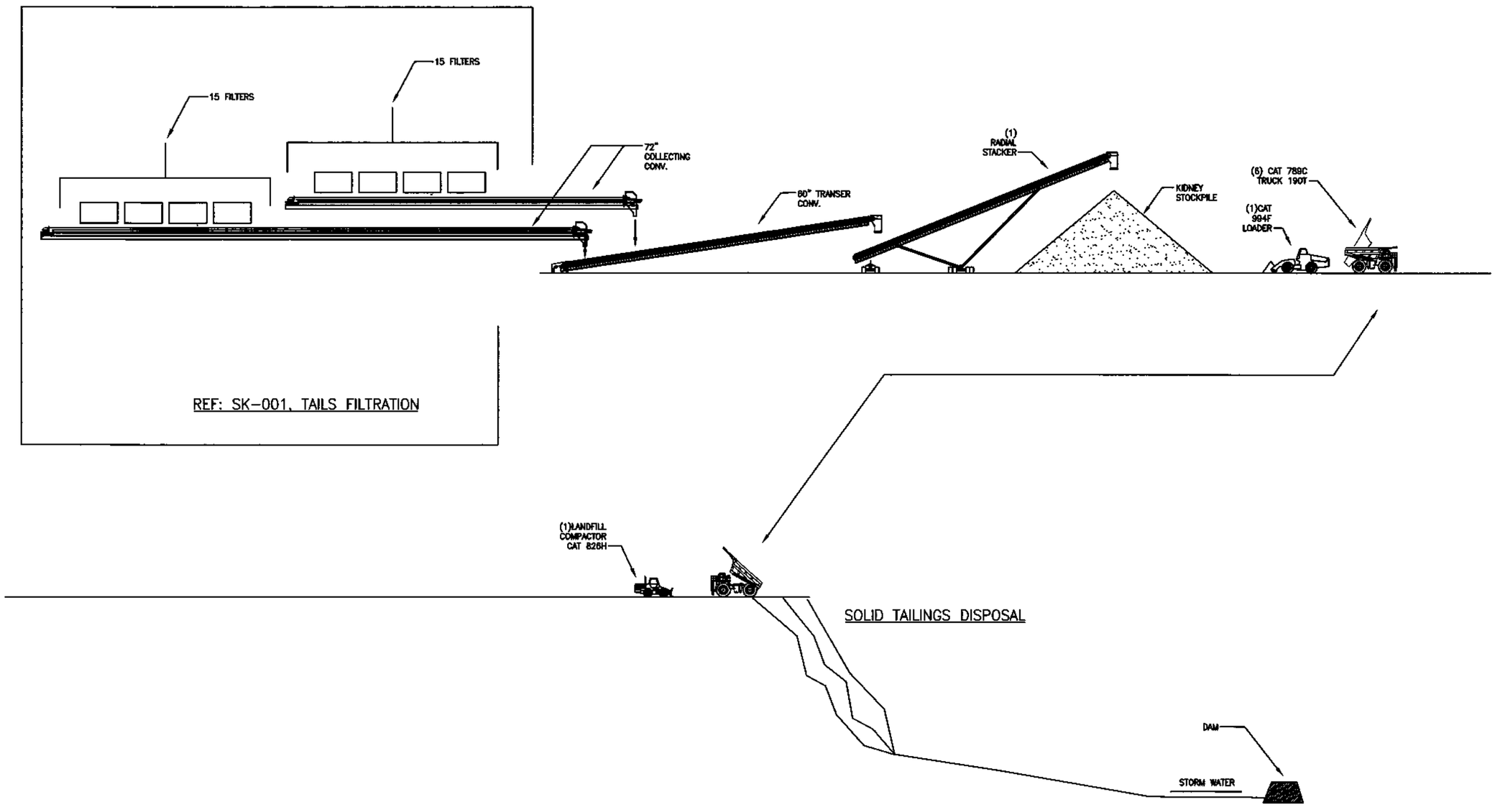
H. (2) COLLECTING CONVEYORS 72" W @ 750 FPM

I. ELECTRICAL ROOM CONTROL ROOM OFFICES

J. (30) MOISTURE PROBE

K. (30) MANIFOLD C.S / R. LINED

DRAWING No. SK-002



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DWG. NO.	TITLE	NO.	DESCRIPTION	BY	CHK'D	APPROVED	DATE	NO.	DESCRIPTION	BY	CHK'D	APPROVED	DATE
SK-001	TAILS FILTRATION												

SCALE: 1:25	SHEET SIZE: A1	PERU COPPER INC.	PROJECT: TOROMOCHO FEASIBILITY STUDY
DRAWN BY: JF	DATE: 01/15/07		AREA:
CHECKED BY:	DATE:		TITLE: SOLID TAILINGS DISPOSAL
ENGINEERED BY:	DATE:		1 OF 1
APPROVED BY:	DATE:		JOB NO. 521300
			CAD NO. SK002.DWG
			DWG. NO. SK-002

TOLERANCES: FRACTIONS ± DECIMALS ± ANGLES ±

Appendix B – Mechanical Equipment List

AKER KVÆRNER™

EQUIPMENT LIST

ITEM	QUANTITY
1. Vacuum Filter Transfer Tanks, 50 ft x 50 ft high	2
2. Vacuum Filter Transfer Agitators	2
3. VBF Transfer Pumps	3
4. VBF Feed Tanks, 20 ft x 20 ft high	6
5. VBF Feed Pumps	12
6. VBF Tank Agitators	6
7. VBF Package	30
8. Collecting Conveyors, 72 inch x 170 meters long	2
9. Transfer Conveyor, 60 inch x 200 meters long	1
10.Radial Stacker, 60 inch x 50 meters long	1
11. CAT 994F Loaders	2
12. CAT 789C Haul Trucks	6
13. CAT 826H Landfill Compactor	1

.

Machines
» Articulated Trucks
» Backhoe Loaders
» Cold Planers
» Compactors
» Feller Bunchers
» Forest Machines
» Forwarders
» Harvesters
» Hydraulic Excavators
» Knuckleboom Loaders
» Material Handlers
» Motor Graders
» Multi Terrain Loaders
» Off Highway Tractors
» Off Highway Trucks
» Paving Equipment
» Pipelayers
» Road Reclaimers
» Scrapers
» Skid Steer Loaders
» Skidders
» Soil Stabilizers
» Telehandlers
» Track Loaders
» Track-Type Tractors
» Underground Mining
» Wheel Dozers
» Wheel Excavators
» **Wheel Loaders**

994F WHEEL LOADERS

— Select a Model —

Overview **Specifications** **Benefits & Features** **Standard Equipment** **Attachments / Work Tools**

SPECIFICATIONS

Engine	Units: US | **Metric**
Net Power	1463 hp
Engine Model	Cat® 3516B HD EUI
Gross Power	1577 hp
Net Power - EEC 80/1269	1463 hp
Net Power - ISO 9249	1463 hp
Net Power - SAE J1349	1447 hp
Bore	6.7 in
Stroke	8.5 in
Displacement	4875 in3
Peak Torque @ 1100 rpm	6289 lb ft
Torque Rise	32 %
Rated Speed	1600 RPM
Operating Specifications	
Operating Weight	430858 lb
Rated Payload - Standard	38 tons
Rated Payload - High-Lift	35 tons
Rated Payload - Super High Lift	35 tons
Bucket Capacity Range	14-36m3 18.5-47yd3
Cat Truck Match - Standard	785C, 789C
Cat Truck Match - High-Lift	789C, 793C
Cat Truck Match - Super High Lift	789C, 793C
Articulation Angle	40 Degrees
Buckets	
Bucket Capacities	14 - 36m3 18.5 - 47yd3
Transmission	
Transmission Type	Cat planetary power shift
Forward 1	4.8 mph
Forward 2	8.3 mph
Forward 3	14 mph
Reverse 1	5.3 mph
Reverse 2	8.2 mph
Reverse 3	15.4 mph

CONFIGUR
Customize y
meet your n
→ Configure

LOCATE YC
Get in touch
dealer for m
→ Locate Yo

994F WHEEI

Downloa
Brochure (1

Direct Drive - Forward 1	Lock - up disabled
Direct Drive - Forward 2	8.5 mph
Direct Drive - Forward 3	14.9 mph
Direct Drive - Reverse 1	5.3 mph
Direct Drive - Reverse 2	8.4 mph
Direct Drive - Reverse 3	16 mph

Axles

Maximum Single-Wheel Rise and Fall	26.65 in
Front	Fixed
Rear	Trunnion
Oscillation Angle	10 Degrees

Hydraulic Cycle Time

Rackback	5.5 Seconds
Raise	11.3 Seconds
Dump	3.1 Seconds
Lower Float Down (Empty)	3.5 Seconds
Power Down	6.7 Seconds

Hydraulic System - Steering

Steering System - Circuit	Closed
Steering System - Pump	Piston, variable displacement
Max Flow @ 1710 rpm (6900 kpa) (2x)	234 gal/min
Relief Valve Setting - Steering	4500 psi
Number of Steering Pumps	2

Service Refill Capacities

Fuel Tank	1013 gal
Cooling System	129 gal
Crankcase	75.5 gal
Transmission	92 gal
Differentials and Final Drives - Front	164 gal
Differentials and Final Drives - rear	164 gal
Differential/Final Drives (each)	164 gal
Hydraulics - Lift/Tilt	103 gal
Hydraulics - Brake Cooling	9 gal
Hydraulics - Steering/Brake	55 gal
Pump Drive - Front	2 gal
Hydraulic System (including tank)	235.91 gal

Cab

Air Conditioning

Cab - ROPS/FOPS	SAE J1394, SAE J11040 APR88, ISO 3471-1:1986, ISO 3471:1994
Sound Performance	ISO 6394:1998
Vibration	EC 89/392 EEC

Brakes

Brakes	SAE J1473 OCT 90, ISO 3450:1992

Hydraulic System - Lift/Tilt

Lift/Tilt System - Circuit	Open
Lift/Tilt System - Pump	3x Piston, fixed displacement
Lift/Tilt - Pump	1x Variable, Piston
Max Flow at 1710 rpm (3x)	362 gal/min
Relief Valve Setting - Lift/Tilt	4750 psi
Cylinders - Lift/Tilt	Double-acting
Lift Cylinder - Bore	13 in
Lift Cylinder - Stroke	65.4 in
Tilt Cylinder - Bore	10.5 in
Tilt Cylinder - Stroke	44.9 in
Number of Lift/Tilt Pumps	4
Number of Lift Cylinders	2
Number of Tilt Cylinders	2

Hydraulic System - Pilot

Pilot System - Circuit	Closed
Pilot System - Pump	Gear
Max Flow at 1710 rpm	40.7 gal/min
Relief Valve Setting - Pilot	348 psi
Number of Pilot Pumps	1

Dimensions*

Height to Top of Exhaust Stacks	22.93 ft
Height to Top of ROPS/FOPS	22.1 ft
Height to Top of Hood	15.86 ft
Ground Clearance	2.66 ft
Reach at Max. Lift/Dump - Std	7.58 ft
Overall Height Bucket Raised - Std	35.87 ft
Length - Rear Axle to Bumper	14.95 ft
Wheel Base Length	21 ft
Overall Length - Std	64.06 ft
Hinge Pin Height at Full Lift - Std	26.76 ft
Length with Bucket on Ground	664.45 in

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- » Cold Planers
- » Compactors
- » Feller Bunchers
- » Forest Machines
- » Forwarders
- » Harvesters
- » Hydraulic Excavators
- » Knuckleboom Loaders
- » Material Handlers
- » Motor Graders
- » Multi Terrain Loaders
- » Off Highway Tractors
- » **Off Highway Trucks**
- » Paving Equipment
- » Pipelayers
- » Road Reclaimers
- » Scrapers
- » Skid Steer Loaders
- » Skidders
- » Soil Stabilizers
- » Telehandlers
- » Track Loaders
- » Track-Type Tractors
- » Underground Mining
- » Wheel Dozers
- » Wheel Excavators
- » Wheel Loaders

789C OFF HIGHWAY TRUCKS

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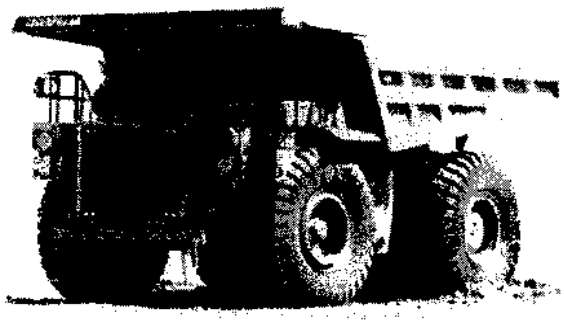
Overview **Specifications** **Benefits & Features** **Standard Equipment**

OVERVIEW



789C OFF HIGHWAY TRUCKS

The 789C Mining Truck is engineered for performance, designed for comfort, and built to last. Developed specifically for high production mining and hauling applications, the 789C Mining Truck keeps material moving at high volume to lower your cost-per-ton. Rugged construction creates a durable machine. Easy maintenance procedures ensure high reliability and long life with low operating costs.

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Units: | **Metric**

SPECIFICATIONS

Net Power	1770.15 hp
Net Power - SAE J1349	1771 hp
Rated Power	1750 RPM

BENEFITS & FEATURES

Power Train - Engine
The Cat 3516B EUI engine is built for power, reliability and efficiency for superior performance in the toughest applications.
→ **Learn More**

Power Train - Transmission
Cat mechanical power train delivers more power to the ground for greater productivity and lower operating costs.
→ **Learn More**

Engine/Power Train Integration
Electronically combines critical power train components to work more intelligently and to optimize overall truck performance.
→ **Learn More**

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Machines

» Articulated Trucks
» Backhoe Loaders
» Cold Planers
» Compactors
» Feller Bunchers
» Forest Machines
» Forwarders
» Harvesters
» Hydraulic Excavators
» Knuckleboom Loaders
» Material Handlers
» Motor Graders
» Multi Terrain Loaders
» Off Highway Tractors
» **Off Highway Trucks**
» Paving Equipment
» Pipelayers
» Road Reclaimers
» Scrapers
» Skid Steer Loaders
» Skidders
» Soil Stabilizers
» Telehandlers
» Track Loaders
» Track-Type Tractors
» Underground Mining
» Wheel Dozers
» Wheel Excavators
» Wheel Loaders

789C OFF HIGHWAY TRUCKS

— Sele

Overview **Specifications** **Benefits & Features** **Standard Equipment**

SPECIFICATIONS

Engine	Units: US | **Metric**
Net Power	1770.15 hp
Net Power - SAE J1349	1771 hp
Rated Power	1750 RPM
Engine Model	Cat® 3516B EUI
Net Power - ISO 9249	1791 hp
Net Power - 80/1269/EEC	1791 hp
Bore	6.7 in
Stroke	7.5 in
Displacement	4211 in3
Gross Power - SAE J1995	1900 hp
Operating Specifications	
Nominal Payload Capacity	195 tons
Top Speed - Loaded	32.7 mph
Body Capacity (SAE 2:1)	137 yd3
Maximum Capacity	174.2 tons
Maximum Capacity	Custom
Maximum Capacity Struck (SAE)	120.33 yd3
Maximum Capacity Struck (SAE)	flat floor
Steer Angle	36 Degrees
Turning Radius - Front	90.1 ft
Raise Time	19 Seconds
Lower Time	17.3 Seconds
Turning Circle Clearance Diameter	99.1 ft
Weights - Approximate	
Gross Machine Operating Weight	700000 lb
Chassis Weight	218300 lb
Body Weight Range	26 800 - 29 950 kg, 59,000 - 71,500 lb
Operating Weight - Empty	299100.8 lb
Transmission	
Forward 1	7.2 mph
Forward 2	9.8 mph
Forward 3	13.2 mph
Forward 4	17.8 mph

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Forward 5	24.2 mph
Forward 6	32.7 mph
Reverse	6.5 mph
Final Drives	
Differential Ratio	2.35:1
Planetary Ratio	10.83:1
Total Reduction Ratio	25.46:1
Suspension	
Effective Cylinder Stroke - Front	4 in
Effective Cylinder Stroke - Rear	3.5 in
Brakes	
Brake Surface - Front	12662 in2
Brake Surface - Rear	18024 in2
Standards	SAE J1473 OCT90 ISO 3450:1996
Body Hoists	
Pump Flow - High Idle	193 gal/min
Relief Valve Setting - Raise	2500 psi
Body Raise Time - High Idle	18.9 Seconds
Body Lower Time - Float	17.3 Seconds
Body Power Down - High Idle	15.6 Seconds
Approximate Weights - Dual Slope	
Gross Weight - Empty	310525 lb
Chassis	225500 lb
Body	59625 lb
Full Liner	20840 lb
Tail Extension	1700 lb
Side Boards	2860 lb
Approximate Weights - Flat Floor	
Gross Weight - Empty	299100 lb
Chassis	225400 lb
Body	66200 lb
Grid Liner	3300 lb
Rear Third Liner	4200 lb
Capacity - Dual Slope - 100% fill factor	
Struck	96 yd3
Heaped (SAE 2:1)	137 yd3
Capacity - Flat Floor - 100% fill factor	
Struck	102 yd3
Heaped (SAE 2:1)	158 yd3

Service Refill Capacities	
Fuel Tank	851 gal
Cooling System	175 gal
Crankcase	77 gal
Differentials and Final Drives	154 gal
Steering Tank	34 gal
Steering System (Includes Tank)	50 gal
Brake/Hoist Hydraulic Tank	140 gal
Brake/Hoist System (Includes Tank)	240 gal
Torque Converter/Transmission Sump	59 gal
Torque Converter/Transmission System (Includes Sump)	20 gal
Dimensions	
Height to Top of ROPS	18.03 ft
Overall Body Length	38.35 ft
Inside Body Length	26.75 ft
Overall Length	39.95 ft
Wheelbase	18.7 ft
Rear Axle to Tail	11.87 ft
Ground Clearance	3.85 ft
Dump Clearance	4.36 ft
Loading Height - Empty	17.08 ft
Inside Body Depth - Max	7.29 ft
Overall Height - Body Raised	39.05 ft
Operating Width	25.18 ft
Centerline Front Tire Width	17.81 ft
Engine Guard Clearance	3.92 ft
Outside Body Width	22.77 ft
Inside Body Width	21.33 ft
Front Canopy Height	20.18 ft
Rear Axle Clearance	4.02 ft
Centerline Rear Dual Tire Width	15.16 ft
Overall Tire Width	22.72 ft
ROPS	
ROPS Standards	.ISO 3471:1994
Sound	
Sound Standards	.ANSI/SAE J1166 MAY90
Steering	
Steering Standards	SAE J1511 OCT90 ISO 5010:1992
Tires	
Standard Tire	37.00-R57 (E4)

Weight Distributions - Approximate

Front Axle - Empty	47 %
Rear Axle - Empty	53 %
Front Axle - Loaded	33 %
Rear Axle - Loaded	67 %

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Appendix C – Engineering Calculation

CALCULO DE CORREA TRANSPORTADORA

REV. A

Proyecto	R0521300		
Tag Correa	CV-07	N° Documento	
Calculado por	FM	Fecha	1/4/2007
Revisado por		Fecha	

INFORMACION BASICA

Servicio			Heap Leach Stacking			
Material			Copper			
Tamaño máximo del mineral		pulgadas	6			
Densidad aparente		lb/ft3	111		1778	kg/m3
Humedad del mineral		%	12			
Capacidad nominal seca		TMPHs	2900			
Capacidad de diseño Humedas		TMPHh	3248		3573	STPHh
Angulo de reposo		grados	38			
Angulo de sobrecarga	alfa	grados	23			

GEOMETRIA

Sección 1 , Longitud	L1	m	42.60		139.76	ft
Sección 1 , Elevación	H1	m	3.50		11.48	ft
Sección 1 , Angulo 1	A1	grados	4.70		4.70	grados
Sección 2 , Longitud	L2	m	0.00		0.00	ft
Sección 2 , Elevación	H2	m	0.00		0.00	ft
Sección 2 , Angulo 2	A2	grados	0.00		0.00	grados
Longitud total de la correa		m	42.60		139.76	ft
Elevación total de la correa		m	3.50		11.48	ft
Ancho de la correa	b	pulgadas	42			
Peso de la correa	Wb	lb/ft	12			
Tipo y clase de polín			3 rod.CEMA E6	Diám.	6	in
Angulo de arteza	beta	grados	35			
Espaciado lado de carga	Si	ft	3			
Tipo de polín de retorno			Rodillo plano CEMA D6			
Espaciado lado retorno		ft	10			
Temperatura mínima		°C	22		71.6	°F

CALCULO DE LA VELOCIDAD DE LA CORREA

Sección de carga de la correa	At	m2	0.133	1.427	ft2
Capacidad equivalente		m3/h	795.6	8563.6	ft3/hr
Capacidad equivalente		TMPH	389.3	428.2	STPH
Velocidad requerida	VR	m/s	3.82	751.7	fpm
Velocidad seleccionada	V	m/s	4.70	925.2	fpm
Porcentaje de carga	Pc	%	81		
Peso del mineral	Wm	lb/ft	128.7		
Factor de flexión sección 1	Ky1		0.033		
Factor de flexión sección 2	Ky2		0.000		
Factor polin	Ai		1.5		
Factor fricción polín	Kx		0.596		
Factor por temperatura	Kt		1.00		

KVAERNER METALS — Programa desarrollado por Ricardo González M. - Octubre 1998

CALCULO DE CORREA TRANSPORTADORA

REV. A

Proyecto	R0521300		
Tag Correa	CV-07	N° Documento	
Calculado por	FM	Fecha	1/4/2007
Revisado por		Fecha	

CALCULO DE LA TENSION EFECTIVA

Sección 1

Tensión por fricción polines	L1KtKx	83.3	lbs
Tensión flexión correa vacía	L1KtKyWb	55.3	lbs
Tensión por flexión lado retorno	0.015L1KtWb	25.2	lbs
Tension por flexión del material	L1KyWm	593.6	lbs
Tensión para elevar el material	H1Wm	1478.0	lbs

Sección 2

Tensión por fricción polines	L2KtKx	0.0	lbs
Tensión flexión correa vacía	L2KtKyWb	0.0	lbs
Tensión por flexión lado retorno	0.015L2KtWb	0.0	lbs
Tension por flexión del material	L2KyWm	0.0	lbs
Tensión para elevar el material	H2Wm	0.0	lbs

(Tp) Tensión por flexión de la correa y por fricción en los descansos de las poleas

N° de poleas lado tenso (abraze 150° a 240°)	1		
N° de poleas lado flojo (abraze 150° a 240°)	3		
N° de otras poleas (abraze de menos de 150°)	0		
Tipo de correa a utilizar, goma =1/ acero =2	1		
Espesor de la correa aproximado	8		mm
Nota : (no considerar polea motriz)	Total poleas =	77.6	lbs

(Tsk) Resistencia en guarderas

Fricción entre guardera y correa	6	lbs/ft			
Coeficiente de fricción entre guardera y material	0.183				
Longitud de la guardera	6	m	19.69	ft	
Profundidad de contacto en la guardera	106.7	mm	4.20	in	
	Total guarderas =		181.8	lbs	

(Tam) Tensión para acelerar el material

899.2

(Tac) Resistencia de otros accesorios (raspadores, partidores, tripper, etc.)

3 lb*Wb*N° de raspadores + otros	Tac =	150	lbs

(Tc) Tensión de cizalle del material en la partida

2*Densidad*(2*B/3)^2*Lboca	Lboca =	0	m	0.0	ft
	Tc =			0.0	lbs

TENSION EFECTIVA TOTAL

3543.9 lbs

Potencia requerida por la correa			99.4	HP
Potencia accionamiento polea motriz			5.6	HP
Perdidas por transmisión %	6		6.3	HP
Potencia total en el eje motor	**83.0**	KW	**111.3**	HP
Motor eléctrico a instalar	**74.6**	KW	**100.0**	HP

KVAERNER METALS — Programa desarrollado por Ricardo González M. - Octubre 1998

CALCULO DE CORREA TRANSPORTADORA

REV. A

Proyecto	R0521300		
Tag Correa	Collection, filter cake	N° Documento	MEM-M-001
Calculado por	FM	Fecha	1/3/2007
Revisado por		Fecha	

INFORMACION BASICA

Servicio			filter cake collection			
Material			Tails, copper concentrator			
Tamaño máximo del mineral		pulgadas	1/8			
Densidad aparente		lb/ft3	100		1602	kg/m3
Humedad del mineral		%	18			
Capacidad nominal seca		TMPHs	2100			
Capacidad de diseño Humedas		TMPHh	2478		2726	STPHh
Angulo de reposo		grados	30			
Angulo de sobrecarga	alfa	grados	15			

GEOMETRIA

Sección 1 , Longitud	L1	m	170.00		557.74	ft
Sección 1 , Elevación	H1	m	0.00		0.00	ft
Sección 1 , Angulo 1	A1	grados	0.00		0.00	grados
Sección 2 , Longitud	L2	m	0.00		0.00	ft
Sección 2 , Elevación	H2	m	0.00		0.00	ft
Sección 2 , Angulo 2	A2	grados	0.00		0.00	grados
Longitud total de la correa		m	170.00		557.74	ft
Elevación total de la correa		m	0.00		0.00	ft
Ancho de la correa	b	pulgadas	72			
Peso de la correa	Wb	lb/ft	24			
Tipo y clase de polín			3 rod.CEMA E6	Diám.	6	in
Angulo de arteza	beta	grados	35			
Espaciado lado de carga	Si	ft	3			
Tipo de polín de retorno			Rodillo plano CEMA D6			
Espaciado lado retorno		ft	8			
Temperatura mínima		°C	22		71.6	°F

CALCULO DE LA VELOCIDAD DE LA CORREA

Sección de carga de la correa	At	m2	0.359	3.869	ft2
Capacidad equivalente		m3/h	2156.7	23215.7	ft3/hr
Capacidad equivalente		TMPH	1055.3	1160.8	STPH
Velocidad requerida	VR	m/s	1.19	234.8	fpm
Velocidad seleccionada	V	m/s	1.50	295.3	fpm
Porcentaje de carga	Pc	%	80		
Peso del mineral	Wm	lb/ft	307.7		
Factor de flexión sección 1	Ky1		0.035		
Factor de flexión sección 2	Ky2		0.000		
Factor polin	Ai		1.5		
Factor fricción polín	Kx		0.726		
Factor por temperatura	Kt		1.00		

KVAERNER METALS

Programa desarrollado por Ricardo González M. - Octubre 1998

CALCULO DE CORREA TRANSPORTADORA

REV. A

Proyecto	R0521300		
Tag Correa	Collection, filter cake	N° Documento	MEM-M-001
Calculado por	FM	Fecha	1/3/2007
Revisado por		Fecha	

CALCULO DE LA TENSION EFECTIVA

Sección 1

Tensión por fricción polines	L1KtKx	404.7	lbs
Tensión flexión correa vacía	L1KtKyWb	468.5	lbs
Tensión por flexión lado retorno	0.015L1KtWb	200.8	lbs
Tension por flexión del material	L1KyWm	6006.3	lbs
Tensión para elevar el material	H1Wm	0.0	lbs

Sección 2

Tensión por fricción polines	L2KtKx	0.0	lbs
Tensión flexión correa vacia	L2KtKyWb	0.0	lbs
Tensión por flexión lado retorno	0.015L2KtWb	0.0	lbs
Tension por flexión del material	L2KyWm	0.0	lbs
Tensión para elevar el material	H2Wm	0.0	lbs

(Tp) Tensión por flexión de la correa y por fricción en los descansos de las poleas

N° de poleas lado tenso (abraze 150° a 240°)		1	
N° de poleas lado flojo (abraze 150° a 240°)		3	
N° de otras poleas (abraze de menos de 150°)		0	
Tipo de correa a utilizar, goma =1/ acero =2		1	
Espesor de la correa aproximado		8	mm
Nota : (no considerar polea motriz)	Total poleas =	650.0	lbs

(Tsk) Resistencia en guarderas

Fricción entre guardera y correa		6	lbs/ft		
Coeficiente de fricción entre guardera y material		0.231			
Longuitud de la guardera		6	m	19.69	ft
Profundidad de contacto en la guardera		182.9	mm	7.20	in
	Total guarderas =			354.3	lbs

(Tam) Tensión para acelerar el material 218.9

(Tac) Resistencia de otros accesorios (raspadores, partidores, tripper, etc.)

3 lb*Wb*N° de raspadores + otros — Tac = 150 lbs

(Tc) Tensión de cizalle del material en la partida

2*Densidad*(2*B/3)^2*Lboca — Lboca = 0 m (0.0 ft)

Tc = 0.0 lbs

TENSION EFECTIVA TOTAL 8453.5 lbs

Potencia requerida por la correa			75.6	HP
Potencia accionamiento polea motriz			1.8	HP
Perdidas por transmisión %	6		4.6	HP
Potencia total en el eje motor	61.2	KW	82.1	HP
Motor eléctrico a instalar	74.6	KW	100.0	HP

KVAERNER METALS — Programa desarrollado por Ricardo González M. - Octubre 1998

CALCULO DE CORREA TRANSPORTADORA

REV. A

Proyecto	R0521300		
Tag Correa	Transfer Conveyor, filter cake	N° Documento	MEM-M-001
Calculado por	FM	Fecha	1/4/2007
Revisado por		Fecha	

INFORMACION BASICA

Servicio			filter cake collection			
Material			Tails, copper concentrator			
Tamaño máximo del mineral		pulgadas	1/8			
Densidad aparente		lb/ft3	100		1602	kg/m3
Humedad del mineral		%	18			
Capacidad nominal seca		TMPHs	4200			
Capacidad de diseño Humedas		TMPHh	4956		5452	STPHh
Angulo de reposo		grados	30			
Angulo de sobrecarga	alfa	grados	15			

GEOMETRIA

Sección 1 , Longitud	L1	m	200.00		656.17	ft
Sección 1 , Elevación	H1	m	3.50		11.48	ft
Sección 1 , Angulo 1	A1	grados	1.00		1.00	grados
Sección 2 , Longitud	L2	m	0.00		0.00	ft
Sección 2 , Elevación	H2	m	0.00		0.00	ft
Sección 2 , Angulo 2	A2	grados	0.00		0.00	grados
Longitud total de la correa		m	200.00		656.17	ft
Elevación total de la correa		m	3.50		11.48	ft
Ancho de la correa	b	pulgadas	60			
Peso de la correa	Wb	lb/ft	20			
Tipo y clase de polín			3 rod.CEMA E6	Diám.	6	in
Angulo de arteza	beta	grados	35			
Espaciado lado de carga	Si	ft	3			
Tipo de polín de retorno			Rodillo plano CEMA D6			
Espaciado lado retorno		ft	10			
Temperatura mínima		°C	22		71.6	°F

CALCULO DE LA VELOCIDAD DE LA CORREA

Sección de carga de la correa	At	m2	0.246	2.651	ft2
Capacidad equivalente		m3/h	1477.7	15906.3	ft3/hr
Capacidad equivalente		TMPH	723.0	795.3	STPH
Velocidad requerida	VR	m/s	3.48	685.5	fpm
Velocidad seleccionada	V	m/s	4.00	787.4	fpm
Porcentaje de carga	Pc	%	87		
Peso del mineral	Wm	lb/ft	230.8		
Factor de flexión sección 1	Ky1		0.025		
Factor de flexión sección 2	Ky2		0.000		
Factor polin	Ai		1.5		
Factor fricción polín	Kx		0.671		
Factor por temperatura	Kt		1.00		

KVAERNER METALS

Programa desarrollado por Ricardo González M. - Octubre 1998.

CALCULO DE CORREA TRANSPORTADORA

REV. A

Proyecto	R0521300		
Tag Correa	Transfer Conveyor, filter cake	N° Documento	MEM-M-001
Calculado por	FM	Fecha	1/4/2007
Revisado por		Fecha	

CALCULO DE LA TENSION EFECTIVA

Sección 1

Tensión por fricción polines	L1KtKx	440.0	lbs
Tensión flexión correa vacía	L1KtKyWb	328.1	lbs
Tensión por flexión lado retorno	0.015L1KtWb	196.9	lbs
Tension por flexión del material	L1KyWm	3785.5	lbs
Tensión para elevar el material	H1Wm	2649.8	lbs

Sección 2

Tensión por fricción polines	L2KtKx	0.0	lbs
Tensión flexión correa vacía	L2KtKyWb	0.0	lbs
Tensión por flexión lado retorno	0.015L2KtWb	0.0	lbs
Tension por flexión del material	L2KyWm	0.0	lbs
Tensión para elevar el material	H2Wm	0.0	lbs

(Tp) Tensión por flexión de la correa y por fricción en los descansos de las poleas

N° de poleas lado tenso (abraze 150° a 240°)		1	
N° de poleas lado flojo (abraze 150° a 240°)		3	
N° de otras poleas (abraze de menos de 150°)		0	
Tipo de correa a utilizar, goma =1/ acero =2		1	
Espesor de la correa aproximado		8	mm
Nota : (no considerar polea motriz)	Total poleas =	650.0	lbs

(Tsk) Resistencia en guarderas

Fricción entre guardera y correa	6	lbs/ft			
Coeficiente de fricción entre guardera y material	0.231				
Longuitud de la guardera	6	m	19.69	ft	
Profundidad de contacto en la guardera	152.4	mm	6.00	in	
	Total guarderas =		282.2	lbs	

(Tam) Tensión para acelerar el material 1167.7

(Tac) Resistencia de otros accesorios (raspadores, partidores, tripper, etc.)

3 lb*Wb*N° de raspadores + otros Tac = 150 lbs

(Tc) Tensión de cizalle del material en la partida

2*Densidad*(2*B/3)^2*Lboca Lboca = 0 m 0.0 ft

Tc = 0.0 lbs

TENSION EFECTIVA TOTAL 9650.0 lbs

Potencia requerida por la correa			230.3	HP
Potencia accionamiento polea motriz			4.8	HP
Perdidas por transmisión %	6		14.1	HP
Potencia total en el eje motor	185.9	KW	249.1	HP
Motor eléctrico a instalar	223.8	KW	300.0	HP

KVAERNER METALS — Programa desarrollado por Ricardo González M. - Octubre 1998

CALCULO DE CORREA TRANSPORTADORA

REV. A

Proyecto	R0521300		
Tag Correa	Radial Stacker	N° Documento	MEM-M-001
Calculado por	FM	Fecha	1/4/2007
Revisado por		Fecha	

INFORMACION BASICA

Servicio			filter cake stacking			
Material			Tails, copper concentrator			
Tamaño máximo del mineral		pulgadas	1/8			
Densidad aparente		lb/ft3	100		1602	kg/m3
Humedad del mineral		%	18			
Capacidad nominal seca		TMPHs	4200			
Capacidad de diseño Humedas		TMPHh	4956		5452	STPHh
Angulo de reposo		grados	30			
Angulo de sobrecarga	alfa	grados	15			

GEOMETRIA

Sección 1 , Longitud	L1	m	54.00		177.17	ft
Sección 1 , Elevación	H1	m	15.00		49.21	ft
Sección 1 , Angulo 1	A1	grados	15.52		15.52	grados
Sección 2 , Longitud	L2	m	0.00		0.00	ft
Sección 2 , Elevación	H2	m	0.00		0.00	ft
Sección 2 , Angulo 2	A2	grados	0.00		0.00	grados
Longitud total de la correa		m	54.00		177.17	ft
Elevación total de la correa		m	15.00		49.21	ft
Ancho de la correa	b	pulgadas	72			
Peso de la correa	Wb	lb/ft	24			
Tipo y clase de polín			3 rod.CEMA E6	Diám.	6	in
Angulo de arteza	beta	grados	35			
Espaciado lado de carga	Si	ft	3			
Tipo de polín de retorno			Rodillo plano CEMA D6			
Espaciado lado retorno		ft	8			
Temperatura mínima		°C	22		71.6	°F

CALCULO DE LA VELOCIDAD DE LA CORREA

Sección de carga de la correa	At	m2	0.359	3.869	ft2
Capacidad equivalente		m3/h	2156.7	23215.7	ft3/hr
Capacidad equivalente		TMPH	1055.3	1160.8	STPH
Velocidad requerida	VR	m/s	2.39	469.6	fpm
Velocidad seleccionada	V	m/s	3.00	590.6	fpm
Porcentaje de carga	Pc	%	80		
Peso del mineral	Wm	lb/ft	307.7		
Factor de flexión sección 1	Ky1		0.018		
Factor de flexión sección 2	Ky2		0.000		
Factor polin	Ai		1.5		
Factor fricción polín	Kx		0.726		
Factor por temperatura	Kt		1.00		

KVAERNER METALS

Programa desarrollado por Ricardo González M. - Octubre 1998

CALCULO DE CORREA TRANSPORTADORA

REV. A

Proyecto	R0521300		
Tag Correa	Radial Stacker	N° Documento	MEM-M-001
Calculado por	FM	Fecha	1/4/2007
Revisado por		Fecha	

CALCULO DE LA TENSION EFECTIVA

Sección 1

Tensión por fricción polines	L1KtKx	128.5	lbs
Tensión flexión correa vacía	L1KtKyWb	76.5	lbs
Tensión por flexión lado retorno	0.015L1KtWb	63.8	lbs
Tension por flexión del material	L1KyWm	981.2	lbs
Tensión para elevar el material	H1Wm	15141.8	lbs

Sección 2

Tensión por fricción polines	L2KtKx	0.0	lbs
Tensión flexión correa vacía	L2KtKyWb	0.0	lbs
Tensión por flexión lado retorno	0.015L2KtWb	0.0	lbs
Tension por flexión del material	L2KyWm	0.0	lbs
Tensión para elevar el material	H2Wm	0.0	lbs

(Tp) Tensión por flexión de la correa y por fricción en los descansos de las poleas

N° de poleas lado tenso (abraze 150° a 240°)		1	
N° de poleas lado flojo (abraze 150° a 240°)		3	
N° de otras poleas (abraze de menos de 150°)		0	
Tipo de correa a utilizar, goma =1/ acero =2		1	
Espesor de la correa aproximado		8	mm
Nota : (no considerar polea motriz)	Total poleas =	650.0	lbs

(Tsk) Resistencia en guarderas

Fricción entre guardera y correa	6	lbs/ft			
Coeficiente de fricción entre guardera y material	0.231				
Longuitud de la guardera	6	m	19.69	ft	
Profundidad de contacto en la guardera	182.9	mm	7.20	in	
	Total guarderas =		354.3	lbs	

(Tam) Tensión para acelerar el material		875.7	
(Tac) Resistencia de otros accesorios (raspadores, partidores, tripper, etc.)			
3 lb*Wb*N° de raspadores + otros	Tac =	150	lbs
(Tc) Tensión de cizalle del material en la partida			
2*Densidad*(2*B/3)^2*Lboca	Lboca = 0 m	0.0	ft
	Tc =	0.0	lbs
TENSION EFECTIVA TOTAL		**18421.9**	lbs

Potencia requerida por la correa			329.7	HP
Potencia accionamiento polea motriz			3.6	HP
Perdidas por transmisión %	6		20.0	HP
Potencia total en el eje motor	263.5	KW	353.2	HP
Motor eléctrico a instalar	298.4	KW	400.0	HP

KVAERNER METALS

Programa desarrollado por Ricardo Gonzalez M. - Octubre 1998

Job No. R0521300

DRY TAILINGS DISPOSAL
CONVEYORS PLUS TRUCKS

12/15/06
F.E.M.

DATA:

Tailings= 4200 mt/hr

Density= 1.6 t/m^3

Volume= 2625 m^3/hr

Equipment

1. **Filters:**

   Assume horizontal belt vacuum filters at 140 mt/hr/filter

   4200/ 140= 30 Units

   Assume filter size 150 m^2 55 long x 3.2 mW

   Auxiliary Equipment:
   - Vacuum receiver
   - Vacuum pumps
   - Filtrate pumps

2. **Material Handling Equipment**

   - Filter Cake Collecting Conveyors

     Assume two lines each collecting Filter Cake from 15 filters

     Vol = 15x 140=2100 mt/hr
     Assume angle of surcharge= 10 degree

     Velocity =295 fpm

     Idlers= 35 degrees troughing
     Size= 72" Capacity= 12506 m^3/hr

     Use two 72" wx 170 m long Belt Conveyors
     Power required = 100HP/ each

- Transfer Belt Conveyor

  Velocity 650 fpm

  35 degree idlers

  Size 60" Capacity= 4200 mt/hr

  Use one 60" w x 200 m long Belt conveyor
  Velocity = 850 fpm
  Power required = 300 HP

- Kidney Stockpile

  Stockpile height 12 m Stockpile width= 12/tan 40x 2=28.6 m

  Material angle of repose= 40 degree

  Kidney stockpile angle 90 degree

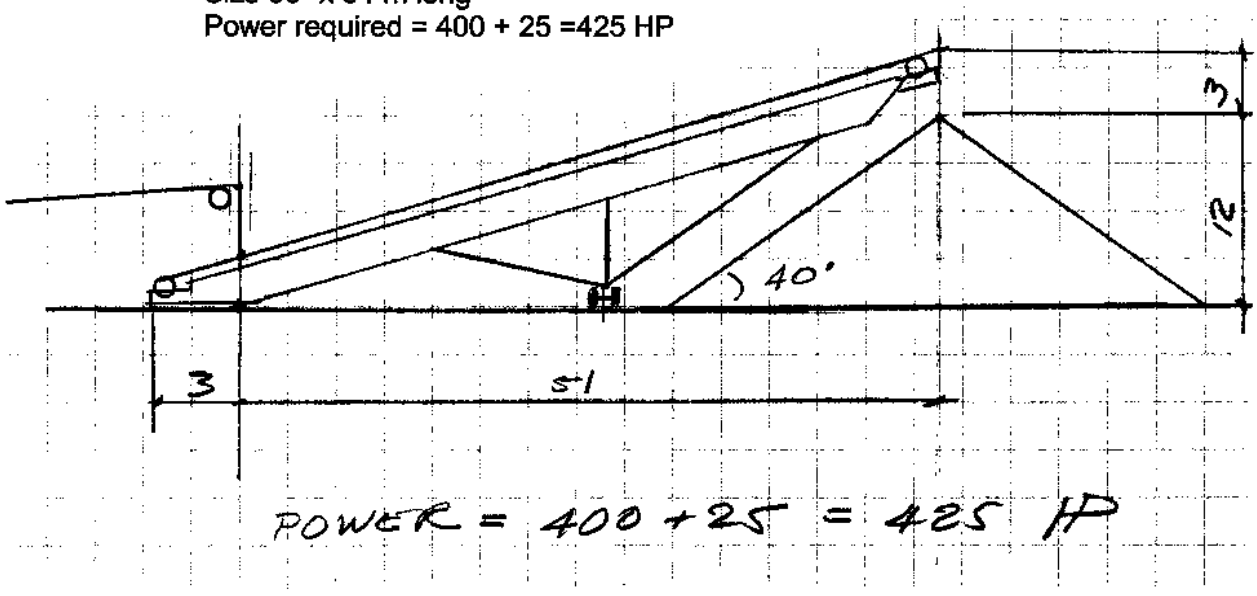
  Stockpile cross section= 28.6 x12/2= 171.61 m2

  Stacker radius= 50 m

  Stockpile Capacity= $(28.6)^2$ 3.1416/4x 12/3 + 50 x 3.1416/2 x 171.61= 16047 m^3

  Storage = 16047/2625 = 6 days

- Radial Stacker
  Capacity = 4200 mt/hr
  Size 60" x 54 m long
  Power required = 400 + 25 =425 HP



- Front Loaders plus Trucks

  CAT Front Loader 994 F

  CAT Truck Match 789 C

  Loader Bucket 36 m^3

  Truck Capacity 120 m^3

  Number of Bucket per Truck Load = 120/36 =3

  Number Truck Loads per hr = 2625/120 = 22

  Minimal Hauling Distance = (800+ 200)/2 = 500 m

  Maximum Hauling Distance = 2500 m

  Truck Velocity = 20 mph = 32 kph

- Truck Cycle Time

Time Loading per Truck	5.0 min
Travel Time = 2.5 x 60 x2 / 32 =	9.4 min
Truck Unloading	1.0 min
Cycle Time	15.4 min

  Truck trips per hr. 60/15.4= approx 4

- No. Trucks required

  No. Truck loads per hr/ truck loads per truck = 22/ 4 = 6 Trucks required

- Front Loaders

  Loading time 22 Trucks at 5 min/ truck =110 min

  110/60 = 2 Front Loaders required

- Additional Equipment

  One Landfill compactor, CAT 826 H for spreading and compacting the dumped filter cake

Appendix D – Quotations

002441

Terra Nova Technologies, Inc
Facsimile Transmittal

TO: **Fred Morris** **DATE:** **January 25, 2007**

Aker Kvaerner
Tucson Arizona

Use only as a reference + basis for costing out the conveyors.

FROM: **Mike Bernard**
PROJECT: **Stacking System Proposal for the Toromocho Project**

c.c: **Ron Kelly**

SUBJECT: **Stacking System Design and Budget Estimate**

Dear Fred,

As you requested, we have developed the attached proposed stacking system concepts based on the fundamental drawings you presented in our recent meetings in Tucson Arizona and subsequent telephone conversations and emails.

This brief study and budget estimate should provide the necessary information to assess the technical and economic feasibility of the proposed stacking process for going forward. This is a challenging location and concept, requiring further detailed study, to optimize both the system and the estimated costs, should you choose to go forward with our presented concept as your preferred solution.

If the project goes forward on the proposed basis, the equipment descriptions and stacking sequences should be further refined and detailed out, by performing a complete in-depth study.

System Design

The System Design illustrated in is concept, was developed based on the detailed information you provided TNT during our meetings in Tucson. The terrain is very challenging as you know, and requires that special features be incorporated into all of the equipment so that it can operate properly on the proposed area. The portables, for example, incorporate brakes on the motors and have special leveling features for the steep declines. Additionally, several other options have been incorporated into the overall system to make it functional. They are listed below. The system includes the electrical distribution and control to make it a totally functional system. It assumes a power feed near the head or tail of the system.

10770 Rockvill Street
Santee, CA 92071

Telephone: (619) 596-7400
Fax Number: (619) 596-7402

Terra Nova Technologies, Inc
Facsimile Transmittal

The capital cost budget estimate is ±10% based on Ex-Works San Diego.

Toromocho	**2900 tph**

Description	HP	Qty	Unit Price	Ext Price
CV-01 48" x 1729' OL Conveyor	700 HP	1	$ 1,253,800	$ 1,253,800
CV-02 48" x 1103' OL Conveyor	800 HP	1	$ 1,209,900	$ 1,209,900
CV-03 48" x 3821' Tripper OL Conveyor	700 HP	1	$ 2,168,200	$ 2,168,200
CV-04 48" x 35' Tripper Cross Belt	40 HP	1	$ 453,500	$ 453,500
CV-05 48" X 125' Ramp Portables	150 HP w/Brake	26	$ 219,500	$ 5,707,000
CV-06 48" x 90' Horiz Feed Conveyor	150 HP	1	$ 260,200	$ 260,200
CV-07 48" x 140' Horizontal Conveyor	100 HP	1	$ 679,100	$ 679,100
CV-08 48" x 120/140' Radial Stacker	200 HP	1	$ 664,300	$ 664,300

Ex-Works	**$ 12,396,000**

Options Included

CV-05 48" X 125' Ramp Portables
- Primary & Secondary Cleaners
- Plugged Chute detector

CV-06 48" x 90' Horiz Feed Conveyor
- Primary & Secondary Cleaners
- Hyd Luffing and Bang Plate Cylinder
- Side Leveling System
- Plugged Chute detector

CV-07 48" x 140' Horizontal Conveyor
- Primary & Secondary Cleaners
- Rear Tracks/Front Wheels
- Plugged Chute detector
- Generator

CV-08 48" x 120/140' Radial Stacker
- Primary & Secondary Cleaners
- Auto Belt Tracking
- Operators Cab
- Rear Wheels
- All Wheel Drive
- Plugged Chute detector

10770 Rockvill Street
Santee, CA 92071

Telephone: (619) 596-7400
Fax Number: (619) 596-7402

The capital cost estimates presented do not include any contingency factors and are based on historical data from recent similar systems we have installed. They are adjusted for Q1 2007 US dollars.

They are Ex Work's numbers and exclude all taxes and duties if applicable.

We normally estimate freight as 10% of Capital and Erection as 18% of Capital, if an all in number is required for the study.

We hope this information meets your expectations. If we can be of further help or you have any questions, please do not hesitate to all.

Sincerely,

George M. (Mike) Bernard
Vice President

Terra Nova Technologies, Inc. (TNT)
10770 Rockvill Street
Santee, CA 92071 (San Diego)

Telephone: (619) 596 7400
Fax: (619) 596 7402
mike.bernard@tntinc.com
www.tntinc.com

Nocos, Vianre

From: Morris, Fred
Sent: Monday, January 29, 2007 3:15 PM
To: Legaspi, Ferdie
Cc: Nocos, Vianre
Subject: FW: Budget Equipment Prices 2007

FYI. I am still waiting for a price from Chile.

FEM

From: smaracigan@empire-cat.com [mailto:smaracigan@empire-cat.com]
Sent: Monday, January 29, 2007 3:47 PM
To: Morris, Fred
Subject: Budget Equipment Prices 2007

Hi Fred the following is our best projection for 2010-2011 pricing. These number do not include installation,freight and/or any additional items requested. These prices are based standard specifications and delivery f.o.b Factory USA. U.S.D.

994F Highlift with Tires and Mawps bucket- $3,500,000.00 each

789C Trucks with Body and Tires- $2,000,000.00

834H Rubber Tire Machine, Tires- $870,000.00

Add 3% per year as an escalator

Thanks
Steve Maracigan

Legaspi, Ferdie

From: Lammers, Jim
Sent: Friday, December 15, 2006 10:32 AM
To: Glynn, Patrick; Legaspi, Ferdie; R0521300, Project
Subject: FW: Tailings Filtration

Gentlemen,

Here is pressure filtration estimate. Higher capital cost and probably somewhat lower operating costs due to reduced power consumption. Higher maintenance cost may offset that though. Big advantage that I see is that the cake will be about 50% of the moisture content, and perhaps less. Stacking this stuff would be a piece of cake, pun most definitely intended!

Jim

From: Jenoe T. Albert [mailto:jta@ipmachinery.com]
Sent: Friday, December 15, 2006 8:53 AM
To: Lammers, Jim
Subject: RE: Tailings Filtration

Hi Jim,

It was nice to hear from you.
This is the largest Filter Press project we get involved !!!
Are you sure about the mtph vs mtpd?

Your estimate is good. Per our sizing you would need 42 units.
We just manufactured (2) units of this size.
The unit price is USD 2,100,000.
This price includes Press,HPU and Control.
We need to run sizing for the auxiliaries.

A project like this would be a huge demand on our manufacturing.
It would take 3 to 4 years to manufacture it.

I hope this will help you.

Regards,

Jenoe

From: jim.lammers@akerkvaerner.com [mailto:jim.lammers@akerkvaerner.com]
Sent: Thursday, December 14, 2006 5:25 PM
To: Jenoe T. Albert
Cc: Patrick.Glynn@akerkvaerner.com; ferdie.legaspi@akerkvaerner.com; Project.R0521300@akerkvaerner.com
Subject: Tailings Filtration

Jenoe,
We are looking at a preliminary trade-off study for dry stacking solids from a copper concentrator. Grind size is P 80 of 125-135 microns, quite a bit coarser than Glamis. This is a basic filtration application, fill, air blow and dump. We are interested in the largest commercially available filters that you have. Moisture is important only

from downstream handling and stacking of the cake. A 50 mm deep chamber would probably work nicely. Have you had any similar applications previously? If so, what was the filtration rate per m2 of filter area? Using the above info, I calculate that a 100 chamber filter will filter about 110 mtph on a nine minute cycle. Do you believe that this is reasonable? What is the unit cost of such a filter? I used a cake density of 1800 kg/m3 of solids. I will be getting some test data in the next 3-4 weeks, and we will apply that to your quote to determine number of units required.

Just for your info we are handling about 4200 mt/h, so about 40-45 units will be required. Is your manufacturing arm capable of handling such an order? I believe that we can achieve a feed density of 60 to 62 % solids. I am hoping that you have a recent application which will provide a good budgetary price. Please feel free to correct my calculations as you see fit. We are currently doing a large feasibility study for the project so the detail design is a ways off. I have no idea at this point whether this option is practical from a cost point of view, but I hope you can help us resolve that question. Feed will be basic so no fancy materials will be required. Please identify your scope of supply and give us enough data so that we can price any ancillaries not provided by IPM such as air compressors, etc. If you have ancillary pricing, please include it.

Looking forward to hearing from you soon.

Jim

James H Lammers
Aker Kvaerner Metals
Principal Consulting Metallurgical Engineer
2550 N Dragoon St.
Tucson, Arizona 85711
Tel 520 917 5482
jim.lammers@akerkvaerner.com

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Legaspi, Ferdie

From: Lammers, Jim
Sent: Monday, December 18, 2006 10:05 AM
To: 'Glenn Welch'; 'Martin Kuhn'
Cc: Mike Empey; Glynn, Patrick; Legaspi, Ferdie; R0521300, Project
Subject: RE: Belt Filter Budgetary Pricing

Glenn,
We recognize that the moisture content will be high. Moisture and filtration rate are just one part of the equation. The cake will also have to be analysized for geotechnical stability to determine how we can "dry" stack this material. Delkor told us that La Coipa is running at 50 mm Hg absolute on their filters which are operating at 4000 m vs. our 4700 m. Grind size is comparable.

I hope this clarifies the situation somewhat. Seems that we are on the right track though.

Jim

From: Glenn Welch [mailto:gdwelch@pocockindustrial.com]
Sent: Monday, December 18, 2006 9:31 AM
To: 'Martin Kuhn'
Cc: Lammers, Jim; Mike Empey
Subject: RE: Belt Filter Budgetary Pricing

Martin/Jim,

Thanks for the information, we will make sure the filtration testing is done at a proper vacuum level to reflect site elevation. It is part of standard practice in our testing to look at flocculant addition as a filter aid if low to moderate rates are achieved to give you the trade-off data. As a side note, the addition of flocculant, or increasing pH usually also mean higher moisture content (which may or may not be of concern in this case). We will be working on some samples for this project this week, but may not have all required samples in house yet (will check on this and get back to you). Thanks

Best Regards,
Glenn Welch

Pocock Industrial, Inc.
6188 South 300 West
Salt Lake City, Utah 84107
Phone: (801) 265-9000
Fax: (801) 265-9852

From: Martin Kuhn [mailto:mckuhn@magintucson.com]
Sent: Friday, December 15, 2006 4:54 PM
To: James F. Minno; gdwelch@pocockindustrial.com
Subject: FW: Belt Filter Budgetary Pricing

Jim/Glenn,

Please review the following to make sure we are getting all of the information that Kvaerner needs. We will need

settling and filteration data for both the 1st cleaner tailings and the rougher tails.

If you have any questions please address them to Jim Lammers of Kvaerner and copy me.

Thanks

Martin

From: jim.lammers@akerkvaerner.com [mailto:jim.lammers@akerkvaerner.com]
Sent: Friday, December 15, 2006 10:24 AM
To: whitetg@gmail.com; mckuhn@magintucson.com
Cc: ferdie.legaspi@akerkvaerner.com; Patrick.Glynn@akerkvaerner.com; Project.R0521300@akerkvaerner.com
Subject: FW: Belt Filter Budgetary Pricing

Martin,
See the answers to my questions below. Once the typical tailings are produced, please insure that Pocock examines flocculant to improve filterability and runs tests at an appropriate vacuum. Also check to see how we match La Coipa with regard to grind size by assuming that the two size distributions are parallel to each other. Call if you have any questions.

Thanks,

Jim

From: David Minson [mailto:davidm@delkorglobal.com]
Sent: Friday, December 15, 2006 8:29 AM
To: Lammers, Jim
Cc: Clary, Rod; Glynn, Patrick; Legaspi, Ferdie; R0521300, Project
Subject: RE: Belt Filter Budgetary Pricing

Jim,
Good to talk to you, I have listed my answers below. On the testwork pointers, we suggest:-

1. Some investigation on flocculants to enhance the filtration rates. If the material flocculates well it reduces the number of filters required and hence the power consumption. It is then a trade off of power cost vs floc cost. The Hychem range of floccs seem to give good results, doses can be from 20 to 100 g/ton.
2. High pH should enhance filtration rates.
3. If you want to send me the test data when it becomes available we can provide some input on the filter size selection.

Kind Regards and best wishes for the festive season.

David

From: jim.lammers@akerkvaerner.com [mailto:jim.lammers@akerkvaerner.com]
Sent: Thursday, December 14, 2006 6:42 PM
To: davidm@delkorglobal.com
Cc: Rod.Clary@akerkvaerner.com; Patrick.Glynn@akerkvaerner.com; ferdie.legaspi@akerkvaerner.com; Project.R0521300@akerkvaerner.com
Subject: RE: Belt Filter Budgetary Pricing

David
Thank you for your prompt response. This is exactly what we had in mind. The tonnage is 4200 mt/h, so we are looking at about 25 to 30 units. This will be used in a preliminary trade-off study. We will be doing some testwork in the next few weeks and will then have a little better handle on the filtration rate. I have already warned the lab

to limit the vacuum to reflect site conditions, but thanks for pointing that out. It is not exactly the same, but close enough for our purposes at this time.

Two questions.
1. What was the La Coipa size consist in terms of P80?***[David Minson] 60% - 200 mesh, so it is similar*** We will have a P80 of 125-135 micron. Also what is the cake moisture?***[David Minson] averages 19 to 22%, depends on the ore body being treated.***
2. What is the lowest absolute pressure achievable for belt filters like these? ***[David Minson]At La Coipa, barometric pressure is 61kPa, and the filters are operating at 55 kPa vacuum, I have actually seen the value get to 60kPa.. This was because the water entering the vacuum pump was icy cold. I would say though that 50 kPa is the low average for La Coipa and can be used as a guide for other plants. Barometric pressure at 4700mAmsl is 56 kPa, so 45 kPa guage vacuum should be used.*** I told the lab to allow for 200 mm of Hg. Is this in the ballpark? Would be 560 mm of vacuum at sea level.

I will advise you of test results when they become available.

Jim

From: David Minson [mailto:davidm@delkorglobal.com]
Sent: Thursday, December 14, 2006 12:40 PM
To: Lammers, Jim
Cc: Clary, Rod; Glynn, Patrick; Legaspi, Ferdie; R0521300, Project
Subject: RE: Belt Filter Budgetary Pricing

Jim,

Jim I called and left a message asking re the production rate. For the moment I am considering that the plant is treating > 20 000 t/day ROM.

Probably the best is to use a cost per m2, for the filter. I am estimating that you would need 1 x 162m^2 Filter to treat every 4000 ton per day of tailings. To give you an idea La Coipa (at 4000m AMSL) production rate (form cake + dry only) is appox 1.4 mtph/m2. I have down-rated the capacity a bit to allow for the lower vacuum levels at 4700m.

Below I am copying a summary of a recent price send for this size of filter. At higher altitudes the vacuum draw decreases, the pump does less work, so the vac pump motor may drop to 450 Hp.

As long as the filter size selected is between 120 and 160m2 you can use the cost/m2 as an indicative number. By the way the relationship of price to m2 is not linear.

I hope this helps, kind regards

David Minson

1	**Delkor Horizontal Belt Filter: 162m2**	
1.1	**Filter** 1. 1. • Structure & frame - Mild Steel ASTM A36 with Epoxy Paint 2. 2. • Main Belt - SBR rubber 3. 3. • Pulleys & rollers - Mild Steel covered with Natural Rubber 4. 4. • Vacuum Box - AISI 304 + Pneumatic Lifting and	

	lowering system. 5. 5. • Belt Support System – Air Box Design plus 2 x Fans with 11kW motors 6. 6. • 75 kW (100 Hp) Filter Drive with AC variable speed Inverter		
	Value (Ex works – Delkor)	**US$**	**605 000.00**
	Value Components (Ex works Europe)	**US$**	**455 000.00**
1.2	**Assembly & Splicing of Main Belt in Workshop**		On site by others
1.3	**Ancillary Equipment per Filter** 7. 7. • One (1) Nash Vacuum Pump 904 – with 550 Hp motor 8. 8. • Two (2) Filtrate Receiver in Mild Steel 9. 9. • Two (2) REMO Cast Iron Filtrate Pump with 15kW (20 Hp) motor 10. 10. • One (1) Moisture Trap in Mild Steel 11. 11. • One (1) Manifold in Mild Steel with Natural Rubber Lining		
	Value (Ex works – Delkor)	**US$**	**385 000.00**
Total Supply Value for 1 x 162m^2 Delkor Belt Filter (ex works)		**US$**	**1 445 000.00**

From: jim.lammers@akerkvaerner.com [mailto:jim.lammers@akerkvaerner.com]
Sent: Tuesday, December 12, 2006 1:24 PM
To: davidm@delkorglobal.com
Cc: Rod.Clary@akerkvaerner.com; Patrick.Glynn@akerkvaerner.com; ferdie.legaspi@akerkvaerner.com; Project.R0521300@akerkvaerner.com
Subject: Belt Filter Budgetary Pricing

David,
I am working on a feasibility study where we are considering "dry tailings" stacking (filter cake) for a copper concentrator. We expect to get filtration data from Pocock by next week so we can size and determine the number of filters required.

Can you provide a budgetary price based on your most recent sales as to the cost per unit based on your largest commercially proven belt filter. The only thing that is unusual is that the application will be at 4700 m elevation, which will affect vacuum pump sizing. Right now this is in a very preliminary stage and we are simply looking as to whether further evaluation is worthwhile. Estimate should be based in today's US Dollars. Your prompt consideration of this request is most appreciated.

Jim

James H Lammers
Aker Kvaerner Metals
Principal Consulting Metallurgical Engineer
2550 N Dragoon St.
Tucson, Arizona 85711
Tel 520 917 5482

jim.lammers@akerkvaerner.com

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Nocos, Vianre

From: Legaspi, Ferdie
Sent: Friday, January 26, 2007 9:36 AM
To: 'John Marek'; Richard Rickard
Cc: Lammers, Jim; Morris, Fred; Nocos, Vianre
Subject: RE: Quick Guess At Equipment Costs

John,

Thanks for the quick response. Please fax the pages. Our fax # is 520 882 4231

Regards,
Ferdie

-----Original Message-----
From: John Marek [mailto:jmarek@imctucson.com]
Sent: Friday, January 26, 2007 9:07 AM
To: Legaspi, Ferdie; Richard Rickard
Subject: Quick Guess At Equipment Costs

Ferdie and Rick

It would take us some time to generate elegant equipment operating costs from first principals using local fuel and labor. However, from the Prefeas and other sources:

Cat 994 costs $1288/ shift without labor = $161 per clock hour Add labor at $17154/ year. 4 crews x $17154 / 1000 shifts / 8 hours = about $8.60/hr So the 994 is about $170/hour

The 826 is close to our 834 dozer = $532/8 + 8.6 = about $75/hour

The 789 from the Western Mining Cost service is [redacted] plus our labor = $169.00/hour

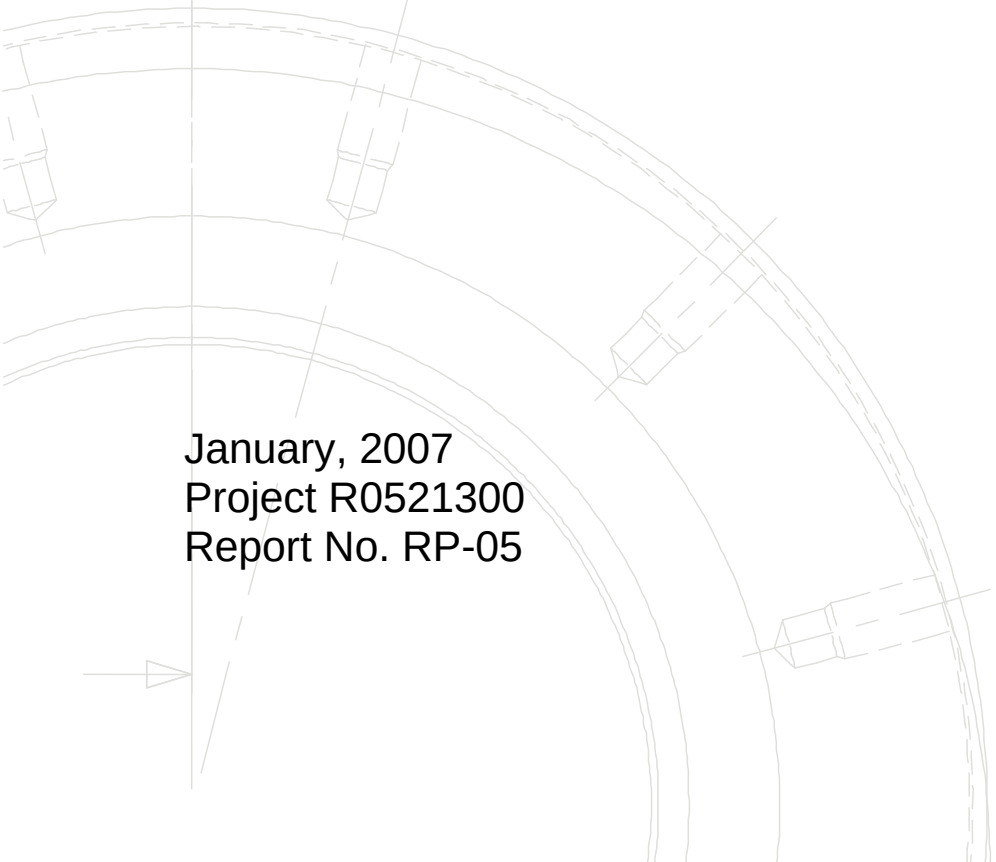
In the future, we work in terms of shifts scheduled and worked. All of the issues of effective hours our metered hours etc go away with that approach.

I can fax the pages from the Wester Mining Cost Service if you need them.
Regards,
John M

AKER KVÆRNER™

Toromocho Column Leaching Testwork Analysis

Prepared for
Peru Copper Inc.



January, 2007
Project R0521300
Report No. RP-05

Peru Copper Incorporated (PCI) has retained the services of Aker Kvaerner to conduct a Definitive Feasibility Study (DFS) for the Toromocho Project in Peru. The project involves an open pit mine, copper sulfide flotation concentrator, heap leach / solvent extraction / electrowinning facility, and related infrastructure.

The following analysis is based on the results of metallurgical column and laboratory test work and pre-feasibility reports provided by PCI to Aker Kvaerner. The preliminary test work was conducted at Plenge Laboratories and Metcon under the direction of Minerals Advisory Group.

Background Mineralogy and Metallurgical Test Work for the Toromocho Heap Leach

Copper mineralization at Toromocho occurs in a low hardness, highly weathered host rock that is categorized into the two broad classifications of intrusive ore and skarn ore. Intrusive ores comprise 80 percent of the heap leach feed and are categorized as diorite, granodiorite, feldspar porphyry, and quartz porphyry. The remaining 20 percent of the heap leach feed is comprised of the singularly designated classification of “skarn” ores.

The mineralogy of the intrusive and skarn ores has not been definitively determined but a number of primary minerals are strongly indicated to be present. The results of semi-quantitative mineral analysis by x-ray diffraction of selected samples of laboratory rougher flotation concentrates are presented in Table 1.0 and provide some insight into the mineralogy of the ores.

X-ray diffraction studies of flotation concentrates have indicated that copper present in the heap leach ore as the sulfides of digenite, chalcocite, covellite, chalcopyrite, bornite, tennantite, and enargite. No copper bearing, non-sulfide minerals were identified in the flotation concentrate: both intrusive and skarn ore types contain a significant background concentration of arsenic which is believed to be present as the copper - arsenic sulfide minerals, tennantite and enargite. Zinc is believed to occur, primarily, as the mineral sphalerite. The ore contains significant quantities of the iron sulfide mineral, pyrite.

In addition to the metallic sulfide minerals, the ores vary in composition and quantity of non-metallic minerals. An understanding of the non-metallic mineralization is economically important for two reasons. Certain non-metallic minerals, present in both intrusive and skarn ores, are leached by the sulfuric acid in the leach solution which consumes acid and increases the processing cost.

The skarn ore sample that was selected for column leach testing contains a large proportion of finely divided clay minerals that have potential to cause significant hydrologic flow problems in heap leach, heap slump, and high acid consumption. Clay minerals that have been identified by X-ray diffraction of flotation concentrates include the phyllosilicate minerals phlogopite, chlorite, and talc.

Calcite and dolomite are acid consuming carbonate minerals that are thought to be present in the ore. Fluoride is thought to be present as the mineral fluorite.

Table 1.0: PMET Quantitative Mineralogy using XRD Analysis with Rietveld Refinement, Results in Weight Percent

PMET I.D.	4708-1	4708-2	4708-3	4708-4	4708-5	4708-6	4708-7	4708-8	4708-9	4708-10	4708-11	4708-12	4708-13	4708-14
Metcon I.D.	67975	68017	68065	68053	68083	68115	68161	68297	68299	68301	68303	68293	68305	68307
quartz	1.0	1.7	5.2	1.9	1.2	0.2	0.5	17.1	16.8	20.5	9.7	12.6	8.3	5.9
k-feldspar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.7	8.2	3.7	1.6	2.5	2.0	1.5
Plagioclase	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	6.0	2.8	4.4	3.3	2.0	1.0
Phlogopite	2.9	0.0	6.7	2.5	0.0	0.0	0.0	24.8	30.0	22.5	18.0	11.8	16.1	17.9
Chlorite	0.0	0.0	0.0	2.5	0.0	1.0	0.5	2.1	2.8	3.5	10.7	5.6	2.1	10.7
Hornblende	1.6	0.0	4.1	0.0	0.0	2.1	0.6	0.7	2.3	9.2	12.3	4.3	18.4	16.4
Epidote	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.6	0.0	0.0	0.0	0.1	1.2
Diopside	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.3	4.2	2.1	4.7	14.5	2.9
Magnetite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.6	0.4	0.6	0.7
Pyrite	16.6	21.0	27.9	17.6	8.6	5.6	4.9	3.4	3.2	4.5	1.4	1.5	5.0	1.6
Chalcopyrite	56.8	41.1	27.8	33.1	76.9	82.8	78.5	19.3	14.7	6.8	1.9	23.8	25.2	1.7
Digenite	12.4	9.4	8.5	5.8	0.4	0.7	0.5	0.0	0.6	0.0	0.2	0.0	0.0	0.0
Covellite	4.7	0.0	7.1	4.0	2.0	2.9	2.9	2.0	1.0	2.1	0.2	1.8	2.0	0.8
Bornite	1.9	3.3	2.1	3.4	2.3	1.8	1.6	0.0	1.1	0.0	0.0	0.0	0.0	0.0
Tetrahedrite	0.8	7.1	2.9	4.1	1.8	0.7	2.3	0.0	1.5	0.0	0.0	0.0	0.0	0.0
Aktashite	0.0	0.0	0.0	3.1	1.1	0.9	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orickite*	0.0	15	0.0	0.0	0.0	0.0	0.0	0.0	4	0.0	0.0	0.0	0.0	0.0
Molybdenite	0.7	0.5	0.5	0.0	0.2	0.7	0.4	0.6	0.1	0.1	0.0	0.2	0.2	0.0
Lizardite	0.0	0.0	0.0	3.6	0.0	0.0	2.5	0.0	0.2	0.0	2.8	1.3	0.2	4.5
Talc	0.6	1.0	7.2	18.4	5.5	0.7	1.1	1.7	6.1	19.7	34.3	26.3	3.6	33.4
Jarosite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

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Leach Test Work

The commercial heap leach will utilize an aqueous solution of sulfuric acid and ferric ions to dissolve copper from copper bearing minerals in the ore. Aqueous raffinate solution from solvent extraction will be fortified with sulfuric acid prior to distribution of the solution across the surface of the heap and subsequent percolation of the solution through the heap by gravity flow. Copper minerals in the ore will react with solution as it percolates through the ore mass, increasing the dissolved copper concentration of the solution for subsequent recovery of the copper by solvent extraction / electrowinning.

The heap leach / solvent extraction / electrowinning plant design criteria are derived from the laboratory test work performed at Plenge Laboratories in Lima Peru. The test work included standard metallurgical bottle roll tests and column leach tests on three selected samples and blends of intrusive ore, arsenical bearing intrusive ore, and skarn ore.

Chemical Analysis of Leach Test Ore Samples

Four bulk ore samples were selected as representative samples for testing and analysis. A representative sample of intrusive ore, designated I+50-B, was selected as the most representative sample of heap leach ore. Two samples of arsenical bearing intrusive ores were tested to evaluate heap leaching as a method to treat ores that would produce high arsenic concentrate grades if processed by flotation. One bulk sample of skarn ore, designated S + 50-A, was selected for testing.

The four samples were analyzed by ICP to determine the weight percent of a suite of elements that are associated with the underlying economic and host rock mineralogy. The results of the ICP analysis are presented in Table 2. The chemical analysis shows a wide variation in composition among the four samples. The iron analysis varied from a high of 16.4 wt % in the skarn sample to a low of 2.8 wt % in the first of the two arsenical intrusive ores. Likewise the aluminum content varied from a high of 2.55 wt % in the skarn to a low of 0.39 wt % in the first arsenical intrusive. Magnesium varied from 4.63 wt % of the skarn to 0.127 % of the first arsenical intrusive. Potassium varied from a high of 2.40 wt % in the skarn sample to a low of 0.223 wt % in the first arsenical intrusive. The three intrusive samples are similar in composition but increase in Fe, Al, Mg, and K composition from the first arsenical to the I+50-B.

The variation in chemical analysis between the samples is indicative of the ore mineralogy and rock type in which the copper mineralization is hosted. ICP analysis is indispensable for estimating the quantity of impermeable, acid consuming clays, soluble iron minerals, and other minerals that determine the amenability of particular ore blocks to heap leach treatment.

Table 2: ICP Analysis of Leach Test Ores

Element		Sample Arsenical 23-42-6 6098	Sample Arsenical 29-42A-6 6099	Sample I + 50-B	Sample S + 50-A 6035
Fe	%	2.808	3.596	3.93	16.40
Al	%	0.390	0.705	1.2	2.55
Mg	%	0.127	0.406	0.966	4.63
K	%	0.223	0.472	0.646	2.40
Cu	%	0.349	0.446	0.346	0.55
Zn	%	0.079	0.762	0.077	0.13
Ca	%	0.035	0.100	0.06	0.22
Ti	%	0.012	0.035	0.038	0.12
Na	%	0.019	0.024	0.018	0.02
Pb	%	0.032	0.049	0.015	0.01
Mn	%	0.010	0.024	0.014	0.03
Sn	PPM	<5	<5	<5	43
Sb	PPM	<5	<5	<5	72
Bi	PPM	<5	<5	<5	50
Ni	PPM	<2	<2	<2	2
Sc	PPM	<1	1.638	<1	2
P	PPM	600.0	480.0	370	577
Mo	PPM	57.0	120.0	180	197
As	PPM	272.5	349.0	154	385
W	PPM	150.0	260.0	52	24
Cr	PPM	36.0	51.0	29	67
Be	PPM	15.0	20.0	26	1
V	PPM	4.6	20.0	22.5	44
Ba	PPM	41.0	31.0	15	46
Y	PPM	3.0	2.65	8.2	7
Ag	PPM	4.9	11.0	7.4	
Co	PPM	8.4	19.5	5.3	16
Sr	PPM	5.1	25.0	4.9	7
Zr	PPM	4.0	4.6	4.3	8
Cd	PPM	1.72	32.4	2.2	4

Acid and Cyanide Soluble Copper

Sequential diagnostic leaching tests are used to estimate the quantity of copper minerals that are soluble in sulfuric acid and sodium cyanide and minerals that are insoluble. The test results are useful in estimating the expected rate and recovery of copper from industrial heap leach operations.

Head samples of the I+50-B intrusive ore, two arsenical bearing intrusive ores, and the S + 50-A skarn ore were analyzed by standardized diagnostic test techniques to determine the acid soluble, cyanide soluble, and insoluble copper content. The results are presented in Table 3.

The common interpretation of the acid and cyanide solubility test results are summarized as follows:

Acid Soluble Minerals include malachite, azurite, tenorite, chrysocolla, and 50% of the cuprite.

Cyanide Soluble Minerals include chalcocite, bornite, covellite, enargite, tennantite and approximately 8% of the chalcopyrite.

Acid and Cyanide Insoluble Minerals include chalcopyrite and pyrite.

Table 3: Diagnostic Acid, Cyanide, and Insoluble Copper Leach Test Results on Intrusive and Skarn Ore Head Samples

% of Copper Soluble		72	68	49	32
Element		**Sample Arsenical** 23-42-6 6098	**Sample Arsenical** 29-42A-6 6099	**Sample I + 50-B** 6121	6035 **S + 50-A** 6035
Column		**27**	**28**	**19**	
Total Cu	%	0.349	0.446	0.346	0.57
Cu (H2SO4)	%	0.052	0.056	0.087	0.09
Cu (Cyanide)	%	0.199	0.246	0.081	0.09
Cu (Residual)	%	0.092	0.12	0.161	0.38
Sulfur Total	%	3.53*	3.28*	5.47	12.16
Sulfur Sulfide	%	4.65*	3.9*	5.18	11.42
F	PPM	800	1000	1900	6000
Cl	PPM	<100	<100	<100	<100
As	PPM	272	349	154	385

* As reported by Plenge Labs.

The acid soluble leaching results indicate that copper is present in each of the four ore samples as one of more of the minerals of copper oxide, carbonate, silicate, or sulfate. The cyanide soluble copper analysis support the x-ray diffraction analysis showing the presence of cyanide

soluble digenite, chalcocite, bornite, and enargite and/or tennantite. The non-acid soluble or cyanide soluble copper indicates the presence of chalcopyrite.

Bottle Roll Testing

Bottle roll tests are a diagnostic test procedure for quantifying the acid consuming potential of ore samples, the acid soluble copper in individual ore samples, and the amount of ferrous and ferric iron that is available from the ore from non-sulfide minerals.

Bottle Roll Tests on Skarn S+50-A Head Sample

Bottle roll tests were conducted on samples of skarn S+50-A ore by contacting 500 grams of the pulverized ore with 1000 ml of 100 and 50 g/L acid solutions for 24 hours . The results of the 100 and 50 g/L H2SO4 tests on sample S – 50A , are shown in Tables 4a and 4b.

The measured acid consumptions were 34.82 kg of acid per ton of ore (3.4 wt %) during the 100 g/L test and 20 kg acid per ton ore (2 wt %) during the 50 g/L acid test. The acid consumption values indicate that the skarn ore sample contains acid soluble gangue minerals that leach to a greater extent with increasing acid strength. In both tests, the indicated acid soluble copper grade was 0.11 wt pct, in good agreement with the 0.09 wt pct analytical acid soluble copper determination on the skarn head sample.

The 100 g/L acid solution leached 5 kg Fe / ton, resulting in a solution grade of 2.4 g/L total iron of which 1.48 g/L was ferric iron. The 50 g/L acid solution leached 3.4 kg Fe / ton from the skarn sample, resulting in a solution grade of 1.7 g/L total iron of which 1.01 g/L was ferric iron. The bottle roll test results indicate gangue mineral leaching from the skarn ore will solublize iron, and significant proportion of ferric iron, which is for leaching secondary sulfide copper.

Table 4a : Bottle Roll Tests of S-50 A Skarn Column Leach Head Sample – 100 gpl H2SO4 Solution

Product 24 Hour	g	Vol Cc	pH	emf mv	H2SO4 g/l	Cu mg/L	Fe mg/L	Fe ++ mg/L	Fe +++ mg/L	H2SO4 Cons kg/t	H2SO4 Cons kg/t gangue	H2SO4 Cons kg / lb Cu
Fresh Solution		1000			100.7							
Sol. Saliente	---	840	.88	424	83.13	560	2400	920	1480			
Sol. Lavado	---	620	1.00	449	20.33	130	500	270	230			
Residuo	500	---					---			36.53	34.82	31.46
Wt Pct Soluble						.1102 %	0.4317 %	0.188 %	0.2772 %			
Cab. Cal.	499.99											
Assay Head						0.57	16.4			Mole Fe / Mole H2SO4	.26	

Table 4b : Bottle Roll Tests of S-50 A Skarn Column Leach Head Sample – 50 gpl H2SO4 Solution

Product 24 Hour	g	Vol cc	pH	emf mv	H2SO4 g/l	Cu mg/L	Fe mg/L	Fe ++ mg/L	Fe +++ mg/L	H2SO4 Cons Kg/t	H2SO4 Cons Kg/t gangue	H2SO4 Cons Kg / lb Cu
Fresh Solution		1000			48.95							
Sol. Saliente	---	760	1.25	438	38.97	570	1700	660	1040			
Sol. Lavado	---	650	1.36	456	13.04	180	460	280	180			
Residuo	500	---					---			21.71	20.00	18.10
Wt Pct Soluble						0.11 %	0.3182 %	0.1367 %	0.1815 %			
Cab. Cal.	500.05											
Assay Head						0.57	16.4		Mole Fe / Mole H2SO4	.29		

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Bottle Roll Tests on Intrusive Ore: I+50-B

Two bottle roll tests were conducted on samples of I+50-B intrusive ore in which 240 gram samples of the pulverized ore were contacted with 500 ml of 50 and 10 gpl acid solutions for 24 hours. The results of the 50 and 10 g/L H2SO4 tests on I+50 -B, are shown in Tables 5a and 5b.

The measured acid consumptions were 39.5 kg of acid per ton of ore (4.0 wt %) during the 50 g/L test and 16.8 kg acid per ton ore (1.7 wt %) during the 10 gpl acid test. In both tests, the net acid soluble copper was .09 wt pct, in good agreement with the 0.087 wt pct acid soluble analytical result on the I+50-B head sample.

The 50 g/L H2SO4 solution leached 3.7 kg Fe / ton ore to a solution concentration of 1.85 g/L Fe. The 10 g/L acid solution leached 1.5 kg Fe / ton ore to a solution concentration of 0.73 g/L Fe. The solutions were not analyzed for ferric and ferrous iron.

The bottle roll test results indicate that gangue mineral leaching from the intrusive ore will generate iron for leaching secondary sulfide copper.

Table 5a: Bottle Roll Tests of I+50 B Intrusive Column Leach Head Sample – 50 gpl H2SO4 Solution PRUEBA: 6121-2

Producto		Vol	pH	emf	H2SO4	Cu		Ensaye Fe		Extracción : %		H2SO4
	g	cc		mv	g/l	%	mg/L	%	mg/L	Cu	Fe	kg/t
Fresh Solution		510			50							
Sol. Saliente	---	380	0.6	331	33.08	---	440	---	1850	19.5	7.2	
Sol. Lavado	---	395	0.9	358	8.77	---	118	---	485	5.4	2.0	
Residuo	239	---				0.269	---	3.7		25.0	9.2	39.5
Wt Pct Soluble							.0895 %		0.3743 %			
Cab. Cal.	240					0.357		4.1				
						0.347		3.9		Mole Fe / Mole H2SO4	.17	

Table 5b: Bottle Roll Tests of I+50 B Intrusive Column Leach Head Sample – 10 gpl H2SO4 Solution PRUEBA: 6121-1

Producto	Peso	Volumen	pH	Fem	H2SO4	Ensaye Cu		Ensaye Fe		Extracción : %		H2SO4
	G	cc		mv	g/l	%	mg/L	%	mg/L	Cu	Fe	kg/t
Fresh Solution		491			10							
Sol. Saliente	---	395	1.5	330	2.02	---	410	---	730	19.3	3.0	
Sol. Lavado	---	385	2.1	338	0.46	---	108	---	185	5.0	0.8	
Residuo	234	---				0.272	---	3.9		24.3	3.8	16.8
Wt Pct Soluble							0.087 %		0.1537 %			
Cab. Cal.	234					0.358		4.0				
Cab. Ensayada						0.347		3.9		Mole Fe / Mole H2SO4	.16	

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Laboratory Column Leach Study on Sample S+50-A Skarn Ore:

A four column laboratory leach investigation on a bulk sample of S+50-A Toromocho skarn ore was conducted at Plenge Laboratories in Lima Peru. The study was designed to investigate acidified, ferric sulfate leaching of oxidized and secondary sulfide copper minerals in four, 20 foot columns loaded with -1 inch skarn ore over a period of 180 days.

The leach test was stopped on column 1 after 17 days and columns 2 through 4 after nine days due to plugging of the columns by the high clay content of the skarn ore. The impermeability and plugging problem was compounded by ferric iron precipitates originating from the 3 g/L Fe+3, introduced in the “on” solution. In all four columns, a hydrostatic head of up to 13 cm of ponded irrigation solution was established above the surface of the column charge, even though the irrigation rate was limited to 5 L/hr-m2. Attempts to keep the columns going by shutting down irrigation flow on alternating days failed to alleviate the perched water table at the top of the columns and the columns were shut down.

The clays of the S+50-A skarn sample are also reactive with sulfuric acid. The column charges slumped over 13 percent during the short duration leach as a result of dissolution of reactive clays in the ore.

Clays, by definition, are impermeable to aqueous flow and unsuitable for treatment by heap leaching unless suitably blended with permeable rock. A program for blending of the S+50-A type skarn material is required to ensure that a limited percentage of skarn is thoroughly blended with a permeable, competent rock type. Slugging, or concentrating of unblended skarn, even in small quantities, has the potential to form myriad perched water tables within the heap, compromising the flow regime and possibly creating a heap liquefaction hazard.

Two blends of intrusive and skarn ore were tested for slump and permeability problems in 20 foot leach columns. A blend of 63 wt % I+50-B Intrusive ore was blended with 37 wt % S+50-A skarn in column 21 and 37 wt % intrusive to 63 wt % skarn in column 20. No plugging or slumping of the ore charge was observed in either test at the 5 L/hr-m2 irrigation rate employed. However, clay accumulation was visually observed at the bottom of both columns, especially in the 63 wt % skarn, column 20.

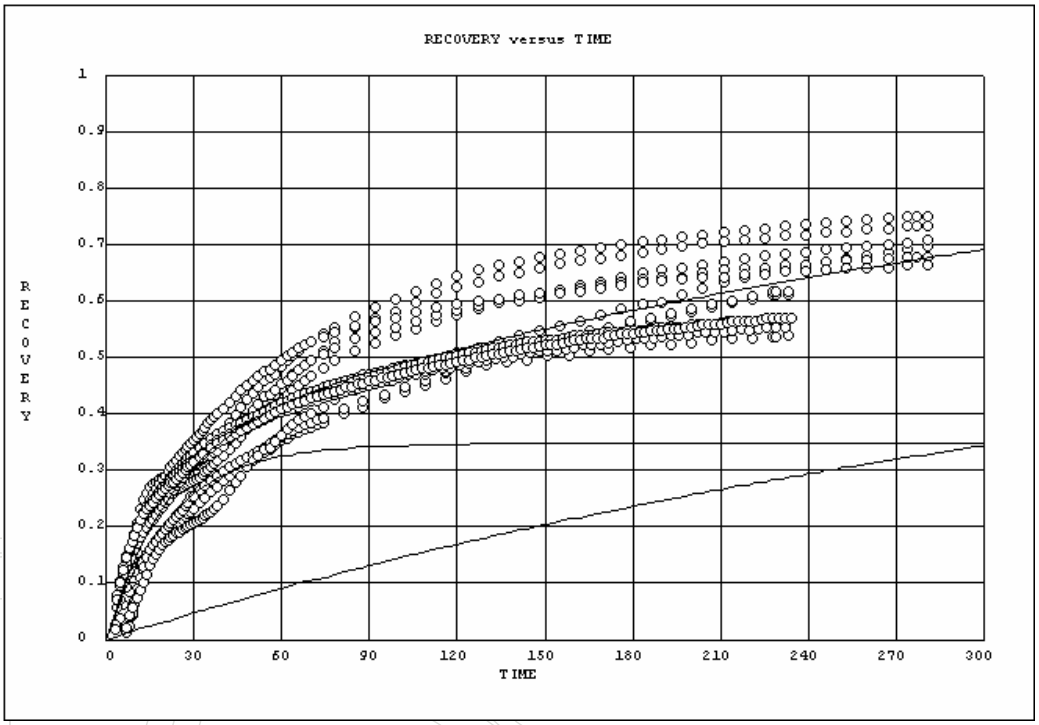
Simple blending of high clay content skarn ores may be insufficient to prevent migration of finely divided clays and subsequent aggregation into concentrated layers, creating a similar situation as with the unblended clays. The current heap leach design criteria has specified a maximum blend of ores with no more than 20 wt percent skarn material. Evaluation of process options to ensure proper blending and agglomeration of clays is not complete.

Laboratory Column Leach Study on Sample I+50-B intrusive ore:

A 12 column laboratory leach investigation on a bulk sample of the I+50-B Toromocho intrusive ore was conducted at the Plenge Laboratories in Lima Peru. The study investigated the effect of individual heap leach parameters on rate and extent of copper recovery from the intrusive ore. All leach columns were 20 feet long and diameters varied as shown. Variables investigated were irrigation rate, particle size, acid strength, and acid cure strength.

A summary of the column test results is presented in Table 6. During the test work, all ferrous iron in the “on” solutions was oxidized to ferric iron with hydrogen peroxide prior to introduction to the column. In general, the ferric iron concentration in the “on” solution was maintained at 3 g/L by dilution of the off solution, oxidation of the ferrous ion, and addition of ferric sulfate. In certain tests, the iron concentration was allowed increase near the end of the test as the iron concentration in the off solution increased above 3 g/L. All iron was oxidized to ferric before being returned to column.

Figure 1: Time versus Recovery for 12 Column, I + 50 - B Leaching Tests. Acid soluble and Cyanide soluble Copper curves over lay.



The copper recovery versus time relationship for all 12 columns is shown in Figure 1, above. Recoveries are based on total copper. Since the head analysis of the I+50-B sample indicated that the sum of acid and cyanide soluble copper was 51 pct of the total copper, recoveries greater than 100 % of the measured soluble copper were achieved in all 12 test columns. Individual curves can be correlated back to individual columns by comparing the recovery and time information from the graph with the summary of Table 6.

Table 6: Summary of Column Leach Test Results on Intrusive Ore Sample I+50-B

Column	Diam	Size	Cure H2SO4 Kg/t	Q lt/hr-m2	H2SO4 Raffinate g/l	Time Days	Flux m3/ton	Extraction Cu%	H2SO4 Gross Kg/t	H2SO4/Cu Gross Kg/Kg	H2SO4 Net Kg/t	H2SO4/Cu Net Kg/Kg	H2SO4 due to Iron Kg/t
14	6 "	-1"	0	5	5	330	3.6	73.16	27.48	10.86	23.54	9.30	8.47
15	6 "	-1"	5.97	5	5	330	3.8	72.79	28.68	11.39	24.77	9.83	3.54
16	6 "	-1"	11.82	5	5	295	3.6	75.59	30.06	11.49	25.99	9.94	2.29
17	6 "	-1"	13.84	5	5	295	3.2	73.37	27.08	10.67	21.73	8.51	-1.30
18	6 "	-1"	0	10	5	295	5.9	67.79	28.10	11.98	22.92	9.70	1.09
19	6 "	-1"	0	15	5	330	11.5	67.88	44.19	18.81	40.53	17.26	5.97
8	6 "	-1"	0	5	10	247	2.7	63.00	29.34	13.46	25.95	9.19	1.91
9	6 "	-1"	0	5	15	247	2.7	63.45	40.13	18.28	36.72	11.91	2.09
10	6 "	-1"	0	15	5	247	7.7	54.51	27.15	14.40	24.22	12.84	-0.34
24	12 "	-2"	0	15	5	247	8.2	57.38	21.19	10.67	18.10	9.12	-3.11
25	18 "	-4"	0	15	5	283	10.2	57.70	22.81	11.42	19.70	9.87	-0.56
26	24 "	-6"	0	15	5	283	9.6	59.11	23.74	11.61	20.56	10.05	-0.22
					Average	**286**	**6.06**	**65.48**	**29.16**	**12.92**	**25.39**	**10.63**	**1.65**
					STDV	33	3.23	7.29	6.69	2.85	6.69	2.41	3.21

002465

Analysis and of the I+50-B Intrusive Column Leach Tests

The total soluble copper in the I+50-B intrusive ore was 0.168 wt % which is the sum of the 0.087 wt % acid soluble and 0.081 wt % cyanide soluble Cu. The ore contained 0.161 wt % insoluble Cu for a total Cu head grade of 0.329 wt %. The heap leach process is expected to recover the acid and cyanide soluble copper, or 51 %.

Acid soluble copper minerals are expected to leach significantly faster than cyanide and insoluble copper minerals, at a rate that is proportional to the acid available in solution and the time of diffusion of acid into the mineral and product copper from the mineral. The one-hour bottle roll tests indicate that the acid soluble dissolution reaction occurs rapidly and that chemical reaction rate is not the rate limiting step. The rate of acid soluble copper dissolution appears to be limited by acid availability, whether in a low acid-high flow irrigation stream or high acid-low flow stream, and does not appear to be strongly dependent on concentration.

Cyanide soluble minerals are expected to leach more slowly, at a rate that is dependent on the concentration and availability of ferric iron in the irrigation solution, the rate of diffusion of ferric ions to the mineral surface and diffusion of the product copper to the bulk solution, and the chemical reaction rate. Unlike the acid soluble minerals, the reaction rate is expected to depend on both the gross concentration of ferric ions in solution as well as the electro-chemical potential related to the relative concentration of the ferric / ferrous ions in solution.

“Insoluble” copper minerals, primarily chalocopyrite, are not insoluble but the overall rate of leaching is significantly slower than the acid or cyanide soluble copper rates, with recovery occurring over a period of years rather than days or weeks.

The commercial metallurgical simulation package, METSIM, is geared toward resolving the difference in reaction rates between the fast leaching, acid soluble minerals and the slower leaching, cyanide soluble minerals. The program uses a variation of least squares regression to estimate a linear rate of leaching for each of the fast and slow leaching species and provides an estimate of the weight fraction of acid soluble, cyanide soluble, and insoluble minerals contained in the ore sample tested. The estimated weight fraction of each mineral class is represented by the regression coefficient. The net recovery for each column is calculated from the time vs recovery curve and is a weighted sum of the reaction rate for each mineral class, multiplied by the weight fraction of each class in the ore.

The linear rate equation for each mineral class, acid and cyanide soluble copper, is of the form:

$$\text{Fractional Cu Recovery at time, } T = 1 - (1-R)^T$$

Where R = the fraction of copper extracted per unit time and T= time of leaching. Since the column data is analyzed as recovery versus time in days, the indicated rate is weight fraction of copper leached per day.

Individual column leach results can be compared by using METSIM to resolve the overall reaction rates of acid soluble, cyanide soluble, and insoluble species for each column. The reaction rates determined from column tests can be applied to extrapolate the column results to simulate a continuous, industrial heap leach. As with any heap leach scale up from column data,

experience and judgment need to be used to develop suitable design factors. Since the estimated recovery is a percentage of the copper in a given column size, extrapolation of the METSIM rate to columns or industrial heaps of different lift height should be used with caution.

The difference in leaching rate between the acid and cyanide soluble copper minerals is illustrated on Figure 1. The three smooth curves overlaying the 12 columns of experimental data represent the rates of recovery of slower cyanide soluble sulfide minerals, the fast leaching acid soluble minerals and the sum of the two mineral classes. The curves are the average recovery versus time data for all 12 columns. The METSIM parameters are presented in the table 7, below.

Table 7: METSIM Examples of Leaching Parameters Derived from the Plenge Column Tests

	Wt Fraction	Fast Rate Constant	Wt Fraction	Moderate Rate Constant	Wt Fraction Insolubles	% Extraction of Reported Acid + Cyanide Soluble Cu *	Extraction % Cu Tot
	Fast	Fraction / day	Moderate	Fraction / day	Slow Rate	180 Days	180 Days
Average of All 12 Columns	0.3475	0.0446	0.652	0.00249	0	119	58
Column 26	0.243	0.0869	0.362	0.00986	0.395	110	54

* Copper extraction exceeded total soluble copper

Toromocho Copper Mineral Leaching in Plenge Column Tests

Acid Soluble Copper

The column data, shown on Figure 1, indicates that acid soluble copper leaching is essentially complete within 60 to 90 days. Although the acid soluble copper mineralization has not been identified, for modeling purposes the acid soluble mineral leaching reaction is represented by the chemical equation (1):

(Eq. 1) $CuO + H_2SO_4 = CuSO_4$ (solution) $+ H_2O$ Fast Leaching Mineral

The irrigation rate and raffinate acid strength will determine the copper concentration in solution during the first 30 – 60 days of leaching. The dependence of copper concentration on irrigation rate and acid strength is illustrated on the breakthrough curves of the Plenge column tests, plotted on Figure 2, and the corresponding data on Table 8. The rate of leaching of acid soluble copper and the grade of copper at breakthrough increases with higher acid strength and decreases with increasing irrigation rate.

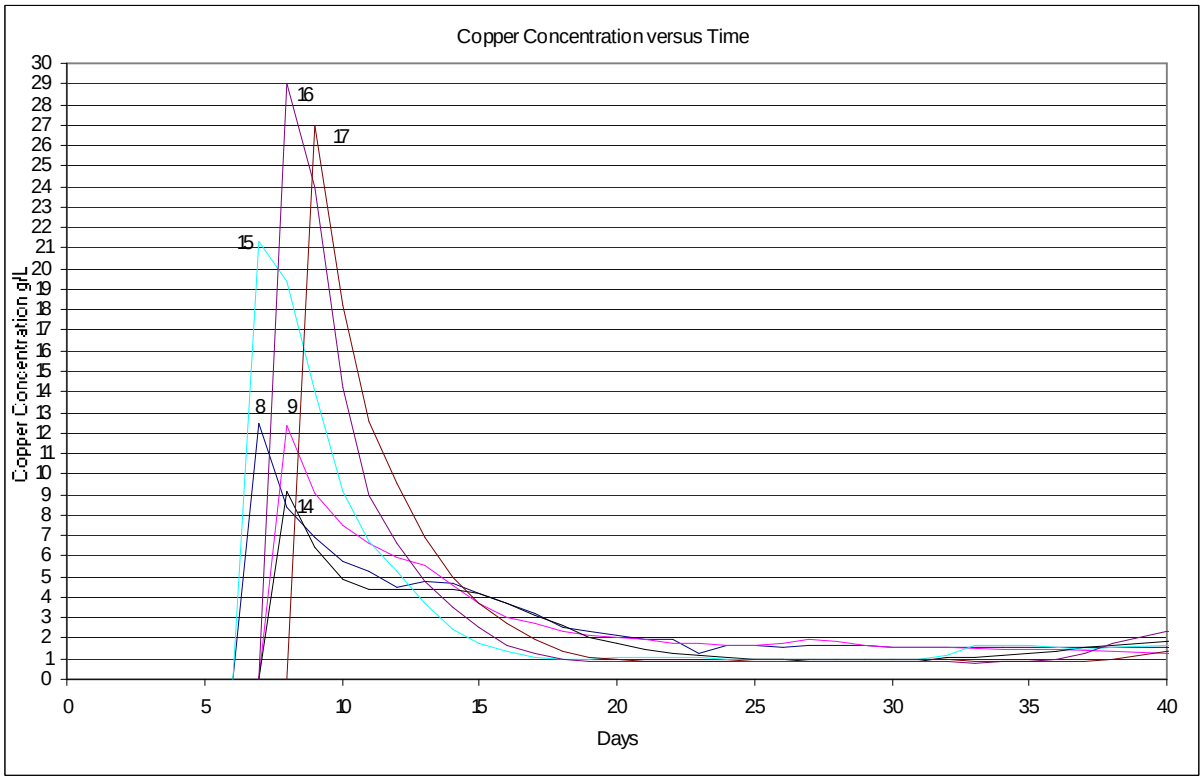
The measured acid strengths of the “on” solutions for columns 8, 9, and 14 are misleading. Most of the initial acid to the columns was supplied by precipitation of the ferric iron from the “on” solution. Precipitation of 3 g/L ferric iron is equivalent to 7.87 g/L acid by hydrolysis.

The plateau in the copper vs time data of Figure 2 for columns 8,9, and 14 suggests that the rate of oxide copper leaching was limited by the availability of acid at less than 25 g/L acid equivalent strength. Except for the columns in which an initial, strong acid cure was applied, little ferric iron appeared in the off solutions for the first 40 days of leaching. The implication is that the industrial heap leach may require a medium to strong acid cure step to provide ferric iron in solution for leaching of secondary sulfide copper. On-site column leach test work is planned for early 2007 in which a medium cure will be applied and the raffinate will be acidified to a nominal 20 – 25 g/L to support iron solubility and copper sulfide oxidation.

Table 8: Acid Strength vs Copper Concentration at Breakthrough

			g/L	g/L	g/L	g/L	g/L	g/L
	Acid Strength	**Copper at Breakthrough**	**Acid Off Days 1-8**	**Cu Off Days 1-8**	**Tot Fe Off Days 1-8**	**Fe+2 Off Days 1-8**	**Fe+3 Off Days 1-8**	**Fe+3 On Days 1-8**
Column 17	212 g/L Cure	27 g/L	1.69	10.70	15.14	9.29	5.86	0
Column 16	158 g/L Cure	29 g/L	0	11.70	10.37	6.36	4.01	0
Column 15	79 g/L Cure	21.3 g/L	0	10.26	3.09	2.92	0.17	0
Column 8	10 g/L Irrigation	12.5 g/L	0	6.60	0.03	0.00	.03	3
Column 9	15 g/L Irrigation	12.4 g/L	0	6.93	0.22	0.18	.04	3
Column 14	5 g/L Irrigation	9.2 g/L	0	6.60	0.03	0.00	.03	3

Figure 2: Breakthrough Copper Concentration versus Time, with Increasing Acid Strength: (see Table 8)



Cyanide Soluble Leaching $Fe_2(SO_4)_3$

A second percentage of the copper mineralization is present as a group of "secondary" sulfides that leach at a moderate, constant rate over time in the presence of ferric ion. For the purposes of analysis, modeling, and simulation, the following minerals and reactions have been incorporated, all showing moderate leaching rates.

$Cu_2S + Fe_2(SO_4)_3 = CuSO_4 + CuS + 2\ FeSO_4$ Moderate Leaching Rate

$2\ Cu_3AsS_4 + 35\ Fe_2(SO_4)_3 + 40H_2O = 2\ H_3AsO_4 + 70\ FeSO_4 + 6\ CuSO_4 + 37\ H_2SO_4$ Moderate

$CuS + Fe_2(SO_4)_3 = CuSO_4 + 2FeSO_4 + S^O$ Moderate Leaching Rate

Although the moderate leaching rate of the sulfide minerals is slower than the acid soluble minerals, the Plenge column test work indicates that the leaching rate of the secondary sulfide minerals lies within the range considered acceptable for an economically viable heap leaching operation.

A third mineral group, primarily chalcopyrite, leaches at a slow rate over a period of years.

$$CuFeS_2 + 2\ Fe_2(SO_4)_3 = CuSO_4 + 5\ FeSO_4 + 2\ S^o$$

Non-metallic Mineral Leaching and Acid Consumption

The extent of acid leaching of gangue minerals can be estimated from ICP analysis of the column "off" solutions for rock forming elements. Approximately 85 percent of the 25.8 net kg of acid consumed per ton of the I+50-B intrusive ore during the column leach series test was consumed by gangue mineral leaching.

The molar concentrations of Al, Fe, K, Mg, and Zn in the column "off" solutions are plotted as a function of the molar concentration of sulfur on Figures 3 - 7. The concentration of sulfur in solution is assumed to represent the cumulative sulfuric acid consumed by the ore. The plots include the combined analysis from all 12 column tests.

The leaching of Al, Fe, and Mg are well represented as a linear relationship, indicating that certain gangue minerals are easily soluble in acid, nearly independent of acid concentration.

$$H_2SO_4 + CaCO_3 = CaSO_4 \downarrow + CO_2 \uparrow + H_2O$$
$$3\ H_2SO_4 + 2\ Fe_2O_3 = Fe_2\ (SO_4)_3 + 3\ H_2O$$
$$H_2SO_4 + MgO = MgSO_4 + H_2O$$
$$H_2SO_4 + K_2O = K_2SO_4 + H_2O$$

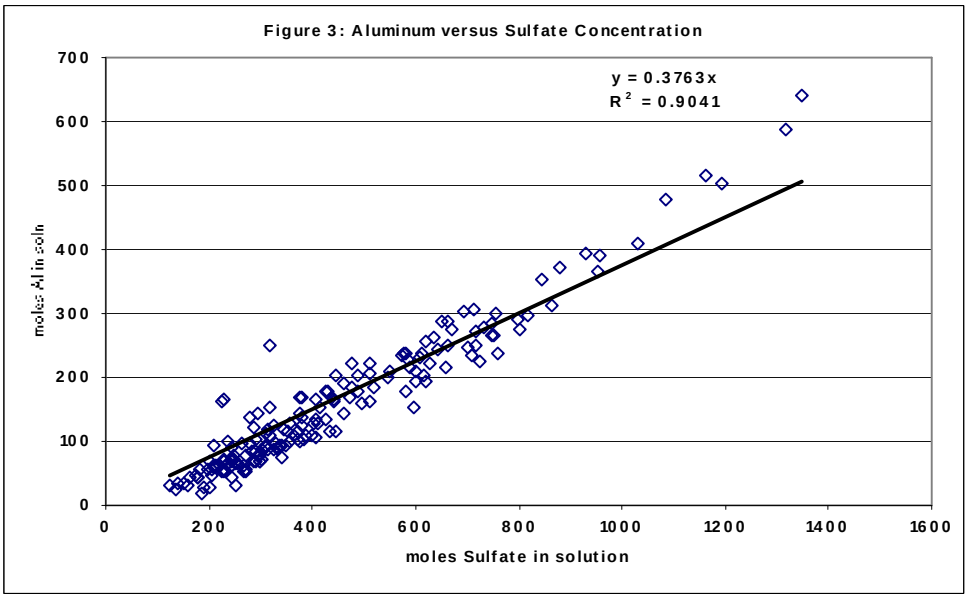


Figure 3: Aluminum versus Sulfate Concentration
y = 0.3763x
R² = 0.9041
moles Al in soln
moles Sulfate in solution
0
100
200
300
400
500
600
700
0
200
400
600
800
1000
1200
1400
1600

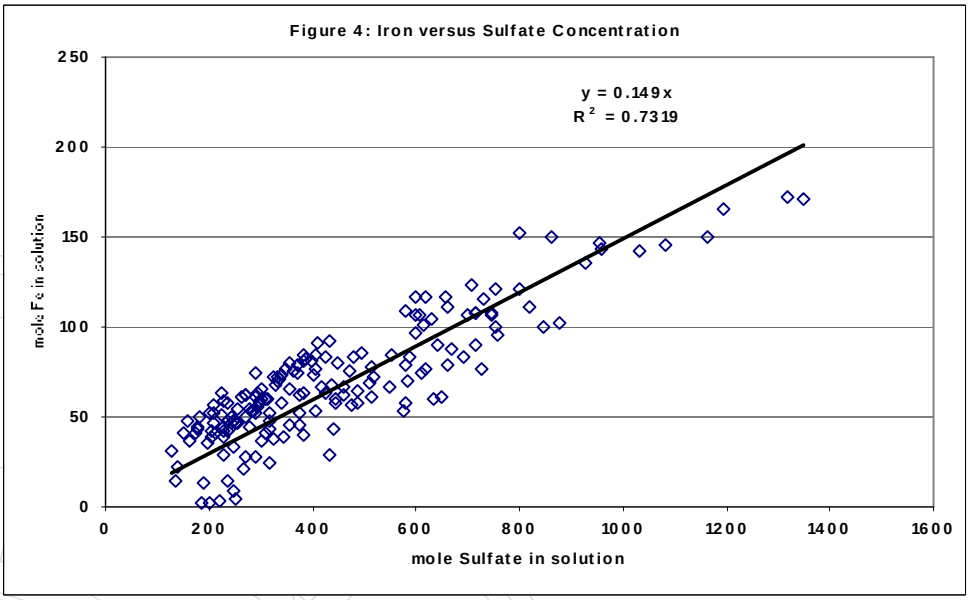


Figure 4: Iron versus Sulfate Concentration
y = 0.149x
R² = 0.7319
mole Fe in solution
mole Sulfate in solution
0
50
100
150
200
250
0
200
400
600
800
1000
1200
1400
1600

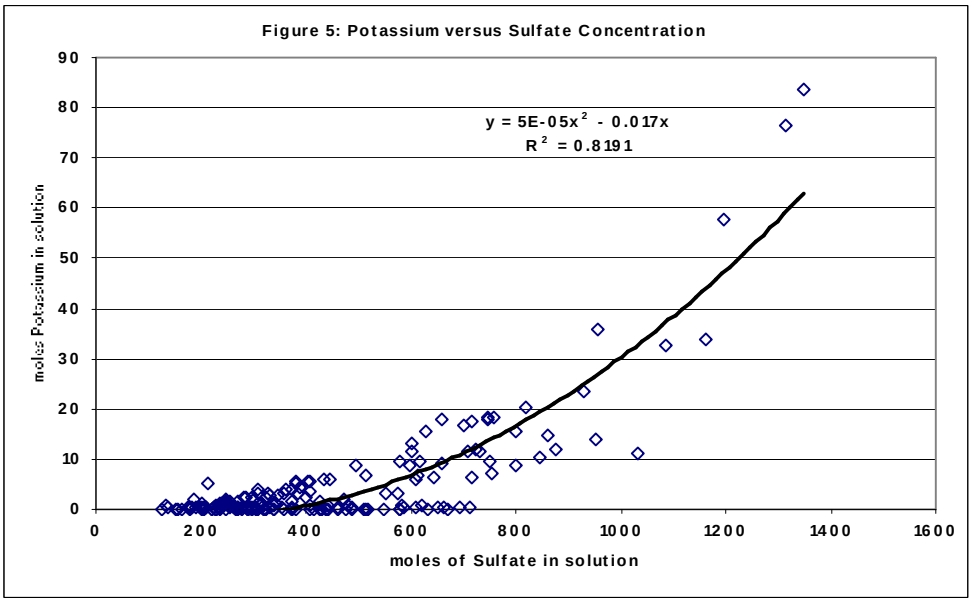


Figure 5: Potassium versus Sulfate Concentration
y = 5E-05x² - 0.017x
R² = 0.8191
moles Potassium in solution
moles of Sulfate in solution
0
10
20
30
40
50
60
70
80
90
0
200
400
600
800
1000
1200
1400
1600

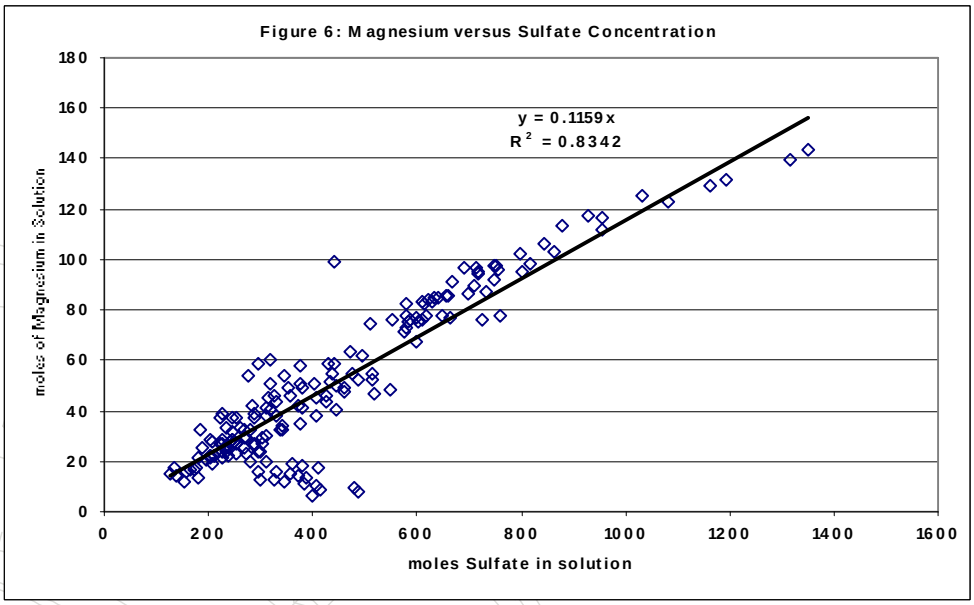
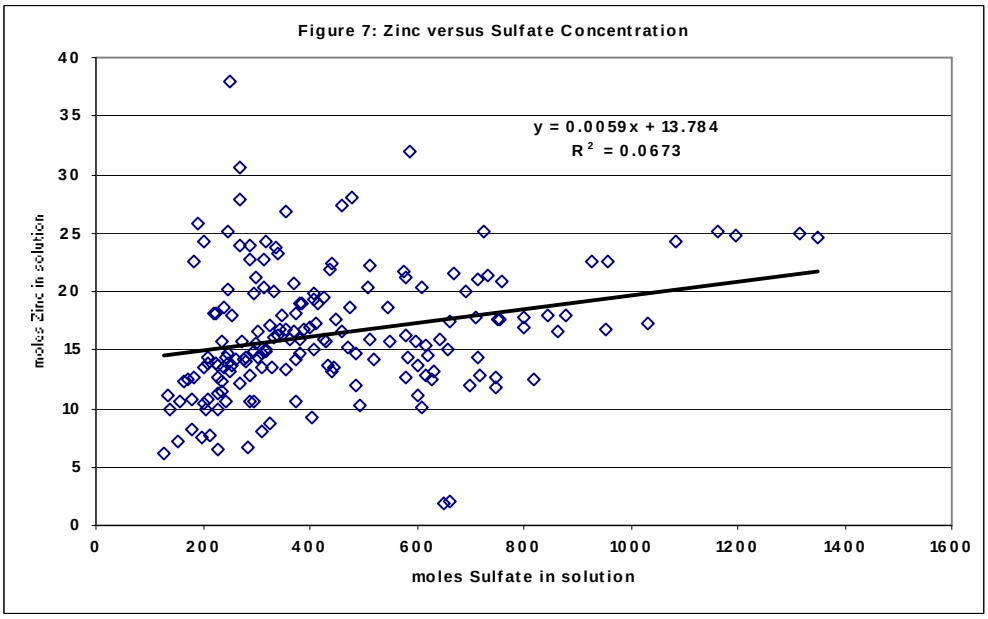


Figure 6: Magnesium versus Sulfate Concentration
y = 0.1159x
R² = 0.8342
moles of Magnesium in Solution
moles Sulfate in solution
0
20
40
60
80
100
120
140
160
180
0
200
400
600
800
1000
1200
1400
1600



Precipitation of Ferric Iron in Low Acidity Solutions

Acid consuming ores neutralize the acid in the leach solution, causing ferric iron to precipitate in a series of hydrolysis reactions beginning at approximately pH 1.6. The form of the ferric iron precipitate depends on the concentration of other ions in solution. Potassium containing minerals in the Toromocho ore are leached by sulfuric acid and release potassium into solution. As the solution pH increases, potassium and ferric iron precipitate as potassium jarosite, which generates acid through hydrolysis. The graph of potassium solubility as a function of acid addition, on Figure 5 of the previous section, indicates that potassium jarosite precipitated during the initial leaching phase in the Plenge columns, when acid consumption by the ore was at a maximum. The concentration of potassium in solution increased thereafter, as free acid in the "off" solution increased, indicating a reduction in jarosite precipitation as the pH declined.

Ferric iron is precipitated in a series of precipitates as solution pH increases. A series of precipitation reactions have been adopted for the purpose of simulation and modeling and are assumed to occur in sequence, as solution pH rises.

$3\ Fe_2(SO_4)_3 + K_2SO_4 + 12\ H_2O = 2\ KFe_3(SO_4)_2(OH)_6 + 6\ H_2SO_4$	Potassium Jarosite
$4\ Fe_2(SO_4)_3 + 14\ H_2O = Fe_8O_8(SO_4)(OH)_6 + 11\ H_2SO_4$	Schwertmannite
$Fe_2(SO_4)_3 + 4\ H_2O = 2\ FeOOH + 3\ H_2SO_4$	Geothite
$Fe_2(SO_4)_3 + 6\ H_2O = 2\ Fe(OH)_3 + 3\ H_2SO_4$	Ferrihydrite

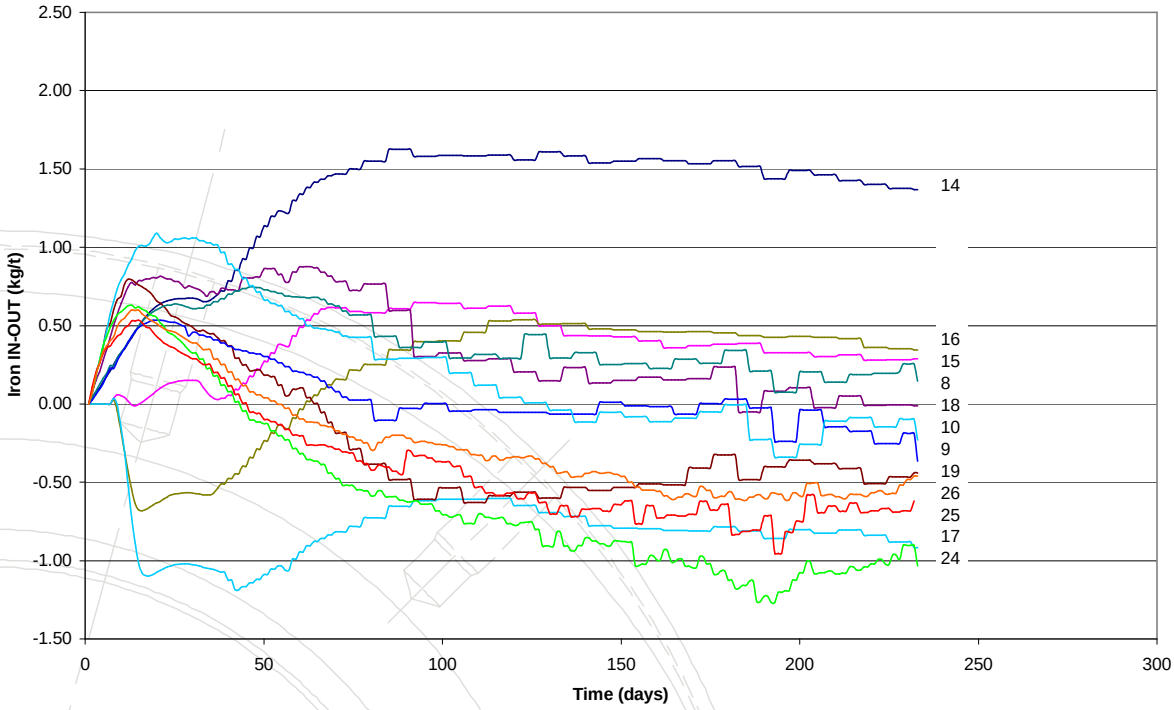
In the absence of monovalent cations, capable of forming jarosite precipitates, a series of hydroxyl-ferric sulfate precipitates form, most commonly represented by schwertmannite. Like jarosite, the precipitation of schwertmannite generates acid through aqueous hydrolysis.

At slightly higher pH's, or lower sulfate concentration, goethite precipitates. Finally, ferrihydrite precipitates until ferric iron is essentially depleted from the system.

During the Plenge column leach study, the ferric iron in the "on" solution was maintained at > 3 gpl Fe+3 and most of the ferric iron was precipitated in the column during the initial stage of contact. Iron precipitation in the columns can be seen on Figure 8 which shows the kg iron "in" minus kg iron "out" for each of the columns. A positive "in – out" value means that the iron added was precipitated while a negative value indicates that iron was re-mobilized or generated from the ore during the leach. In all cases, except the three columns in which an initial high acid cure was applied, the ferric iron was initially precipitated.

In most of the columns, the net iron precipitation eventually reversed and an equivalent amount of iron emerged from the column, which occurs at that point on the plot where the curve crosses the zero point on the y-axis. The amount of time for the iron "in" to equal the iron "out" is correlated with the amount of acid added, whether by higher flow rate or stronger acid strength of the solution.

Figure 8: Iron IN - OUT
I+50-B



Precipitation of Ferric Iron to Control Arsenic

One objective of the Toromocho heap leach is to process high arsenic ores by heap leaching to avoid smelter penalties.

The strategy depends on oxidation of arsenic to the plus five state and subsequent precipitation of arsenic by ferric iron as an amorphous iron arsenate with chemical composition similar to crystalline scorodite. The sequestration of arsenic by ferric iron is a three stage process. In the first stage, the minerals enargite or tennantite are believed to be leached by ferric ion, releasing copper and arsenic, and sulfuric acid into solution. Depending on the pH and the EMF of the solution, arsenic ion is soluble in solution as aqueous arsenate.

$$2\ Cu_3AsS_4 + 35\ Fe_2\ (SO_4)_3 + 40\ H_2O = 2\ H_3AsO_4 + 70\ FeSO_4 + 6CuSO_4 + 37\ H_2SO_4$$

Oxidation of sulfide sulfur to sulfate is beneficial in generating sulfuric acid, although only a portion of the sulfur may form sulfate with the remainder forming elemental sulfur. An excess of ferric iron in solution is necessary for sequestration of arsenic as iron arsenate according to the reaction:

$$H_3AsO_4 + Fe_2(SO_4)_3 + 4\ H_2O = 2\ FeAsO\ (OH)_4 + 3\ H_2SO_4$$

Ferric ion is reduced to ferrous ion during sulfide mineral leaching and precipitated during ferric arsenate precipitation. The rate of bacterial oxidation of ferrous to ferric ion is critical. Bacterial oxidation of ferrous ion occurs according to the accepted reaction:

$$4\ FeSO_4 + 2\ H_2SO_4 + O_2 = 2\ Fe_2\ (SO_4)_3 + 2H_2O$$

Estimating Acid Consumption from Analytical Data

The expected acid consumption of the heap leach is a function of the concentration of non-economic minerals in the ore. The table below compares measured acid consumption for the two arsenical intrusive ores and I+50-B intrusive. The primary difference in acid consumption between the three columns appears to be the amount of acid soluble rock minerals in the ore.

The wt % of acid soluble minerals in the ore is correlated with the analytical concentrations of Al, Mg, K, and iron as determined by an ICP analysis of the head sample. An algorithm has been developed to estimate the mineral composition of Toromocho ores from analytical data provided from ICP, acid and cyanide soluble copper, sulfide and total sulfur, copper, iron, and carbon determinations. Similar analysis of the post leach column tails, combined with ICP analysis of the leach solutions, can be used to infer the extent of reaction of each mineral species.

Table 9: I+50-B column 19 summary compared to Arsenical columns 27 and 28

Column	Size	Cure H2SO4 Kg/t	Q Lt / hr-m2	H2SO4 g/l	Time Days	Extraction Cu%	H2SO4 Gross Kg/t	H2SO4/ Cu Gross Kg/Kg	*H2SO4 Net Kg/t	*H2SO4/ Cu Net Kg/Kg	pH	EMF Ag/AgCl
19	-1"	0	15	5	274	66.39	**33.59**	14.62	30.01	**13.07**	1.67	521
27	-3/4"	0	15	5	229	75.81	**12.55**	4.80	8.48	**3.24**	1.37	534
28	-3/4"	0	15	5	229	69.99	**17.90**	5.73	13.04	**4.18**	1.41	704

Table 10: Analytical Head Assay

Column	27		28		19	
Cu %	0.349		0.446		0.346	
Cu (H2SO4) %	0.052		0.056		0.087	
Cu (Cianuro) %	0.199		0.246		0.081	
Cu Residual) %	0.092		0.120		0.161	
St %	3.53		3.28		5.47	
Ss %	4.65		3.90		5.18	
F ppm	800		1000		1900	
Cl ppm	<100		<100		<100	
As ppm	272.5		349.0		154.0	
	Estimated Minerals in the Ore and Residual – Weight Percent					
	Column 27	Column 27	Column 28	Column 28	Column 19	Column 19
	HEAD	Residual	HEAD	Residual	HEAD	Residual
CuO	0.065		0.070		0.109	
Cu2S	0.162	.0012	0.227	.0027	0.074	.0013
CuS		.0048		.0070		
CuFeS2	0.284	**.2570 / 9.5 %**	0.3460	**.314 / 9.2 %**	0.465	**.4500 / 3.2 %**
Cu3AsS4	0.143	.0840	0.183	.011	0.081	.0044
FeS2	6.090	**5.7900 / 4.9 %**	6.610	**6.26 / 5.2 %**	6.270	**6.0700 / 3.1 %**
ZnS	0.118	.0930	0.114	.0905	0.115	.03400
Fe2O3	-		0.586	0.1480	1.230	.9810
Al2O3	0.701	.6360	1.330	1.1300	2.370	.8830
K2O	0.257	.2520	0.548	0.4580	0.760	.6710
MgO	0.200	.1720	0.680	0.6410	1.610	1.4000
CaCO3	0.084		0.246		.152	

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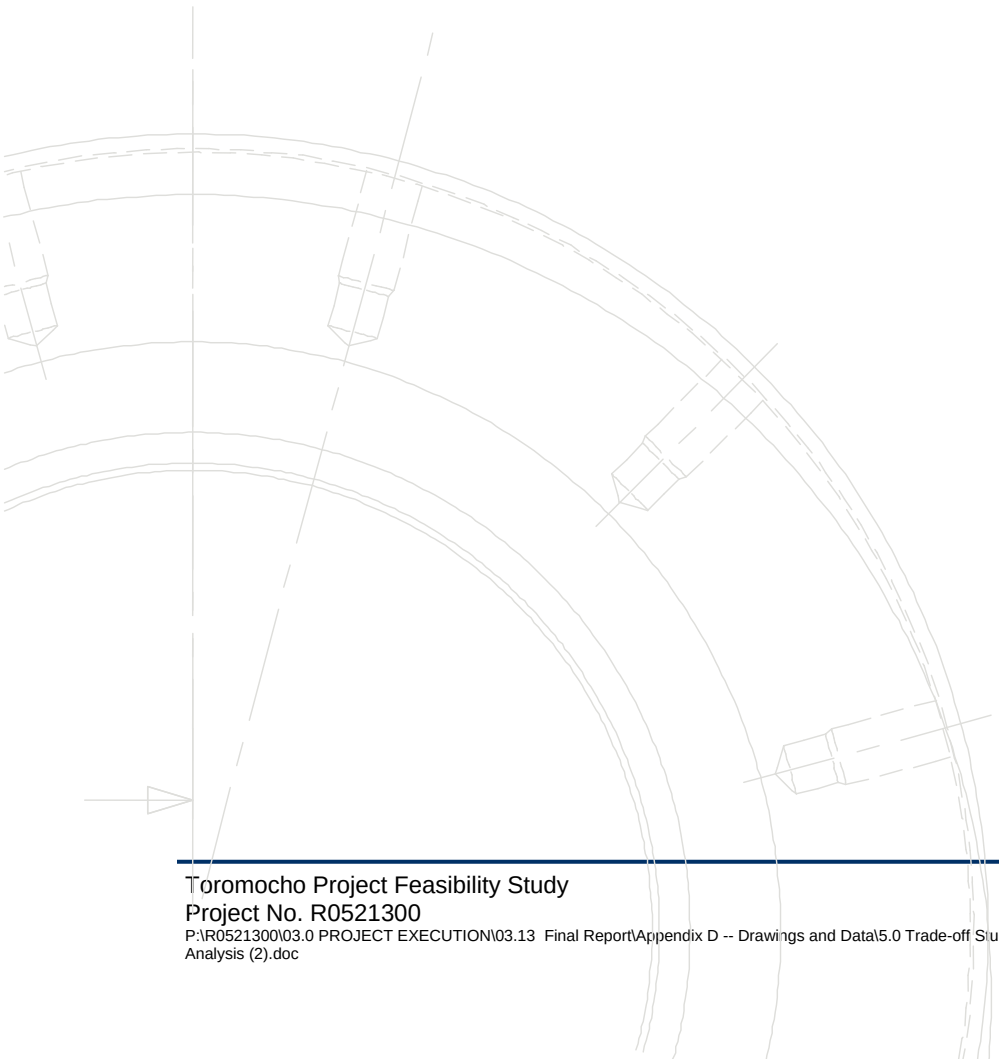
Recommendation for

Toromocho On-site

Leaching Test Work



Please find below, the finalized recommendations for the upcoming on-site heap leach test program. Since adjustments to the acid strength of the "on" solutions will be adjusted to maintain the acid strength of the off solution, timely communication of analytical results is an important component of the test program. Ideally, a spreadsheet of information will be recorded, updated, and made available on a daily basis so that the testing progress can be monitored. Gustavo Plenge has indicated that he will set up a web page so that column results and measurements can be posted and accessed on a daily basis.

The final recommendation for the intrusive and skarn composite samples for the on-site leach testwork are presented in the two tables below At the top of each table are the sample identifiers and recommended tons to be composited from each sample collected from the Toromocho pit.

Intrusive Composite:

Type			Intrusive	Intrusive	Intrusive	Intrusive	Intrusive	**Intrusive**
Tons			8	10	6	6	9	**39**
Sample			64938	64944	64947	8 - I (D)	64951	**Column Test**
								Composite
Cu		%	0.161	1.027	0.332	0.183	0.858	**0.573**
Cu Sol	H2SO4	%	0.036	0.260	0.060	0.035	0.267	**0.150**
Cu sol	CN	%	0.078	0.450	0.053	0.080	0.244	**0.208**
Cu	Residual	%	0.045	0.288	0.201	0.060	0.334	**0.200**
Hg		ppm	0.200	0.450	0.005	0.090	0.405	**0.265**
St		%	1.850	3.167	6.410	2.214	5.810	**3.859**
Ss		%	1.711	2.804	6.126	2.007	5.103	**3.499**
Ct		%	0.250	0.187	0.244	0.118	0.116	**0.182**
F		%	0.080	0.230	0.200	0.160	0.260	**0.191**
Cl		ppm	34	10	23	19	20	**21**
Mo		ppm	92	88	181	170	129	**125**
As		ppm	528	1730	70	270	327	**680**
Fe		%	2.490	3.100	8.050	2.665	7.300	**4.639**
Al		%	0.686	0.741	2.125	0.858	2.510	**1.369**
Mg		%	0.138	0.278	1.830	0.664	2.230	**0.998**
K		%	0.233	0.459	1.070	0.541	1.120	**0.672**
Ca		%	0.088	0.037	0.181	0.041	0.062	**0.076**
Zn		%	0.062	0.142	0.070	0.038	0.060	**0.079**

Skarn Composite:

Type			Skarn	Skarn	Skarn	**Skarn**
Tons			2	2	1	**5**
Sample			64941	64939	64946	**Column Test**
						Composite
Cu		%	0.416	0.515	0.627	**0.498**
Cu Sol	H2SO4	%	0.067	0.114	0.155	**0.103**
Cu sol	CN	%	0.098	0.118	0.086	**0.104**
Cu	Residual	%	0.231	0.239	0.378	**0.263**
Hg		ppm	0.087	0.101	0.108	**0.097**
St		%	5.812	4.448	7.610	**5.626**
Ss		%	5.345	4.004	6.587	**5.057**
Ct		%	0.208	0.180	0.410	**0.237**
F		%	0.180	0.430	0.310	**0.306**
Cl		ppm	109	52	54	**75**
Mo		ppm	104	257	117	**168**
As		ppm	55	536	326	**302**
Fe		%	6.740	6.540	12.100	**7.732**
Al		%	2.205	2.960	2.375	**2.541**
Mg		%	1.570	2.655	2.340	**2.158**
K		%	0.356	1.400	0.876	**0.878**
Ca		%	0.889	0.309	1.090	**0.697**
Zn		%	0.190	0.180	0.161	**0.180**

The arsenic content of the intrusive composite is high enough that selection of a specific arsenical intrusive is unnecessary.

Therefore, series 6 (column 12 - hi arsenic) of the proposed test program should be changed to test the recommendations of Ron Roman. A finalized table of the recommended columns and conditions is included.

Recommendations for On-site, Toromocho Feasibility Column Leach Study

A series of column leach tests are planned at the Toromocho site in the next few months to demonstrate the feasibility of the heap leach process at the high elevation site. Tests have been selected to compare the results of the ferric sulfate column leach study conducted in Lima, demonstrate the on-site feasibility of the leach process, and determine the effect of lift height on the heap leach process.

The proposed test plan is as follows:

Ore Feed Sample Analysis and Bottle Roll Tests:

A minimum of three (3), standardized bottle roll tests, (500 grams of pulverized sample contacted with 1 Liter of 200, 125, and 50 g/L sulfuric acid) should be conducted while the columns are being set up. The solutions for each bottle roll test should include determinations for total acid consumption, copper and iron in solution (total, ferrous, and ferric). An ICP scan of each bottle roll solutions should be conducted and reported. The purpose is to determine all soluble elements and the ability to close a mass balance acid consumption.

The ore head sample for each column series should be analyzed by two methods for acid soluble copper, cyanide soluble, and insoluble copper. In the first method, a standardized sulfuric acid soluble copper is determined followed by standard cyanide soluble copper analysis. A second acid soluble copper series should be conducted with a mixture of sulfuric acid and 5 % sulfurous acid (H2SO3), followed by standard cyanide soluble copper analysis.

A minimum quantity of the ore head sample should be preserved for five duplicates of the prescribed analysis.

Supporting Biological and Mineralogical Analysis:

The success of copper sulfide heap leaching is dependent on bacterial activity within columns for in-situ oxidation of ferrous to ferric ion. Other species of bacteria oxidize elemental sulfur directly and produce sulfuric acid. Column discharge solutions, at timed intervals (15, 30, 90 days), should be submitted for identification and concentration of the bacterial species present in solution to confirm that the conditions within the on-site columns will support a healthy biological consortium of bacteria.

Cure and irrigation make-up water should be selected from an acidic mine drainage source within the Kings Mill Tunnel Drainage that originates near the heap leach site. Sufficient volume should be available for the duration of the tests. Bacterial species and counts should be determined prior to initiation of the leach. Acidic Kings Mill Drainage solution is expected to contain a unique consortium of bacteria that is specifically adapted to the elevation, atmosphere, and temperature of the Toromocho area and should remain at site to preserve the bacterial life.

Identification of metal bearing and gangue minerals by XRD should be considered to establish the primary mineralogy of the sample.

Series 1 – Intrusive Ore; Trickle Cure; Nominal - 6 inch; 17°C:

A three column sequential leach of intrusive ore is recommended. The sequential leach will involve contacting the lead column (column 1) with a strong cure solution (30 - 50 g/L) until breakthrough of solution is accomplished for all three columns to simulate the expected lift height for the commercial heap leach. The solution discharging from column 1 will be sampled and fed to column 2. Likewise, the solution discharging from column 2 will be sampled and fed to column 3. When breakthrough is attained on the column 3 discharge, the cure will be stopped, the copper will be extracted from the column 3

discharge solution, and the column 3 discharge will be acidified (15 – 25 g/L acid) and recycled to column number 1, in a true closed loop. No iron or acid will be added to the feed solutions to column 2 (column 1 discharge) or column 3 feed (column 2 discharge). Solution make-up, if required, will be made up from the Kings Mill Drainage water.

The “on” solution to column 1 will be heated, as necessary, to maintain the temperature at 17°C ± 1°C. Overheating must be avoided to preserve the bacterial culture!

The solutions will be sampled and analyzed for copper, ferrous/ferric iron, Eh, pH, free acid. Off solutions should be analyzed by ICP scan and fluoride ion directly (actual Solutions Not Composites); every day for the first 10 days following breakthrough and every five days, thereafter.

The concept should be to maintain 0.5 – 1.0 g/L free acid (~ pH 1.6) in the column 3 discharge. If the free acid in the column 3 discharge exceeds 0.5 g/L, the recycle solution (“on solution”) acid strength would be reduced by the difference between the excess acid in the column 3 discharge and 0.5 g/L. Likewise, if the column 3 discharge solution acid grade is less than 0.5 g/L free acid, the acid strength of acidified raffinate recycle “on” solution to column 1 would be increased by 0.5 g/L. (ie; 20 g/L + 0.5 g/L = 20.5 g/L).

“Off” solutions should not be mixed, diluted, or heated.

Air Injection:

The third column of the three column sequence will be fitted with an air sparger through which air can be introduced at the base of the column and allowed to permeate upward through the column exiting the top of the ore column to the atmosphere. After stable leach conditions have been established in column 3 (50 – 60) days, a decision will be made to initiate air to the third columns. The column will be monitored for an increase or change, in the leaching rate, ferrous oxidation rate, acidity of the off solution, and biological cell count.

Series 2 – 80 pct Intrusive / 20 pct Skarn Ore; Trickle Cure: Nominal - 6 inch; 17°C:

The same 3 column, sequential arrangement using the “trickle” cure procedure as in series 1, above. The ore will be a blend of 80 % Intrusive / 20 % Skarn ores.

The “on” solution to column 1 will be heated, as necessary, to maintain the temperature at 17°C ± 1°C. Overheating must be avoided to preserve the bacterial culture!

“Off” solutions should not be mixed, diluted, or heated.

Air Injection:

The third column in the sequence will be fitted with an air sparger through which air can be introduced at the base of the column and allowed to permeate upward through the column exiting the top of the ore column to the atmosphere. After stable leach conditions

have been established in column 3 (50 – 60) days, a decision will be made to initiate air to the third columns. The column will be monitored for an increase or change in the leaching rate, ferrous oxidation rate, acidity of the off solution, and biological cell count.

Series 3 – 80 pct Intrusive / 20 pct Skarn Ore; Agglomerative Cure: Nominal - 6 inch; 17°C:

The same 3 column sequential leach as series 1 and 2 except an agglomerative style cure will be applied to the 80 % Intrusive / 20 % skarn blend ore prior to loading of the ore into the three columns. The agglomerative style cure will consist of wetting the as received ROM ore from moisture of approximately 2 pct to the 6 pct moisture. The wetting solution will be Kings Mill Drainage water acidified to 50 g/L H_2SO_4 typical strength. The ore will be spread on the floor, sprayed with acidic solution, and manually blended using a coning and quartering prior to loading in the columns. Acid solution application shall be 4 kg of H_2SO_4 per ton of ore.

The “on” solution to column 1 will be heated, as necessary, to maintain the temperature at 17°C ± 1°C. Overheating must be avoided to preserve the bacterial culture!

“Off” solutions should not be mixed, diluted, or heated.
The initial leaching solution will be acidified Kings Mill Tunnel Drainage water acidified with sulfuric acid to the same acid strength as the raffinate solution (15-25 g/L) until breakthrough of column 3 of the series. Following breakthrough from column 3, the copper will be extracted from the solution, the raffinate will be acidified to 15-20 g/L free acid, recycled as the feed to column 1. Acidified raffinate recycle will be maintained for the test duration.

Air Injection:

The third column in the sequence will be fitted with an air sparger through which air can be introduced at the base of the column and allowed to permeate upward through the column exiting the top of the ore column to the atmosphere. After stable leach conditions have been established in column 3 (50 – 60) days, a decision will be made to initiate air to the third columns. The column will be monitored for an increase or change in the leaching rate, ferrous oxidation rate, increased acidity of the off solution, and biological cell count.

Series 4 – Intrusive Ore; Column 26 Protocol; Nominal - 6 inch; Ambient:

A single column will be loaded with a sample of – 6 inch of the intrusive ore and treated using the same protocol as used on column 26 of the test columns in Lima. The conditions of the leach include irrigation of the column at 15 L/hr-m2 with raffinate acidified to 5 g/L H2SO4 free acid. The ferric iron of the on solution will be maintained at a minimum of 3 g/L ferric iron as practiced on column 26 of the Lima test work.

For the purpose of direct comparison with the Lima test work, a 20 foot column will be loaded with – 6 inch intrusive ore and started under the conditions of the column 26 test in Lima on I+50-B; Start with a 3g/L Fe+3 solution acidified to 5 g/L sulfuric acid applied

at an irrigation rate of 15 L/hr-m2. The column will be operated in closed circuit with solvent extraction. The SX raffinate will be acidified to 5 g/L H2SO4 prior to reapplication. Iron in the raffinate solution will be maintained at 3 g/L Fe+3 by oxidation of the iron in solution. Hydrogen peroxide will be used to oxidize any ferrous ions, and ferric sulfate will be added to maintain the iron concentrations, if required.

Kings Mill Tunnel Drainage water will be used as the water source for both the initial, dilution, and make-up water.

The solutions will be sampled and analyzed for copper, ferrous/ferric iron, Eh, pH, free acid. Off solutions should be analyzed by ICP scan and fluoride ion directly (actual Solutions Not Composites); every day for the first 10 days following breakthrough and every five days, thereafter.

Series 5 – Intrusive Ore; Column 26 Protocol; Nominal - 6 inch; 20°C:

A single column will be loaded with a sample of – 6 inch of the intrusive and treated using the same protocol as used on column 26 of the test columns in Lima. The conditions of the leach include irrigation of the column at 15 L/hr-m2 with raffinate acidified to 5 g/L H2SO4 free acid. The ferric iron of the on solution will be maintained at a minimum of 3 g/L ferric iron as practiced on column 26 of the Lima test work. The on solution will be heated as necessary to maintain the on solution temperature at 20 C.

For the purpose of direct comparison with the Lima test work, 20 foot column will be loaded with – 6 inch intrusive ore and started under the conditions of the column 26 test in Lima on I+50-B; Start with a 3g/L Fe^{+3} solution acidified to 5 g/L sulfuric acid applied at an irrigation rate of 15 L/hr-m2. The column will be operated in closed circuit with solvent extraction. The SX raffinate will be acidified to 5 g/L H_2SO_4 prior to reapplication. Iron in the raffinate solution will be maintained at 3 g/L Fe^{+3} by oxidation of the iron in solution using hydrogen peroxide and, if necessary, addition of ferric sulfate.

Kings Mill Tunnel Drainage water will be used as the water source for both the initial, dilution, and make-up water.

The solutions will be sampled and analyzed for copper, ferrous/ferric iron, eH, pH, and free acid. Off solutions should be analyzed by ICP scan and fluoride ion directly (actual Solutions Not Composites); every day for the first 10 days following breakthrough and every five days, thereafter.

Series 6 – 80 pct Intrusive / 20 pct Skarn Ore; 5 GPL Acidified Raffinate Leach; Nominal - 6 inch; 17°C:

A single column will be loaded with a sample of – 6 inch of an **80 pct Intrusive / 20 pct Skarn Ore** blend and treated at an irrigation rate of 5 L/hr-m2 with raffinate acidified to 5 g/L H2SO4 free acid. No ferric iron will be added in the off solution nor will the solution be adjusted other than to adjust the acid strength of 5 gpl.

The on solution will be heated as necessary to maintain the on solution temperature at 17 C.

A 20 foot column will be loaded with – 6 inch of the test blend of 80%Intrusive/20% Skarn ore and started with an aqueous solution acidified to 5 g/L sulfuric acid applied at an irrigation rate of 5 L/hr-m2. The column will be operated in closed circuit with solvent extraction. The SX raffinate will be acidified to 5 g/L H_2SO_4 prior to reapplication. Iron in the raffinate solution will not be maintained or oxidized.

Kings Mill Tunnel Drainage water will be used as the water source for both the initial and make-up waters.

The solutions will be sampled and analyzed for copper, ferrous/ferric iron, eH, pH, free acid. Off solutions should be analyzed by ICP scan and fluoride ion directly (actual Solutions Not Composites); every day for the first 10 days following breakthrough and every five days, thereafter.

Sample	Intrusive			80 % Intrusive / 20 % Skarn			80 % Intrusive / 20 % Skarn			Intrusive		80 % Intrusive / 20 % Skarn
	Column 1	Column 2	Column 3	Column 1	Column 2	Column 3	Column 1	Column 2	Column 3	Column 1	Column 2	Column 3
	Series 1	Series 1	Series 1	Series 2	Series 2	Series 2	Series 3	Series 3	Series 3	Series 4	Series 5	Series 6
Cure Type	**Trickle**	**Trickle**	**Trickle**	**Trickle**	**Trickle**	**Trickle**	**Agglom**	**Agglom**	**Agglom**	Column 26	Column 26	LOW Acid
Cure Rate, **L/hr-m2**	**6.3**	**6.3**	**6.3**	**6.3**	**6.3**	**6.3**	**4 kg/ton**	**4 kg/ton**	**4 kg/ton**			
Cure Acid Strength,g/L	**30**	**30**	**30**	**30**	**30**	**30**	**50**	**50**	**50**			
Irrigation Rate, L/hr-m2	**6.3**	**6.3**	**6.3**	**6.3**	**6.3**	**6.3**	**6.3**	**6.3**	**6.3**	**15**	**15**	**5**
Irrigation Acid Strength	**20**	**Col 1 Discharge**	**Col 2 Discharge**	**20**	**Col 1 Discharge**	**Col 2 Discharge**	**20**	**Col 1 Discharge**	**Col 2 Discharge**	**5**	**5**	**5**
On-Solution Temp	17	**Col 1 Discharge**	**Col 2 Discharge**	17	**Col 1 Discharge**	**Col 2 Discharge**	17	**Col 1 Discharge**	**Col 2 Discharge**	Ambient	**20 C**	**17 C**
Column Insulation	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**
Air Injection			**Yes**			**Yes**			**Yes**			
Particle Size	**- 6 in**	**- 6 in**	**- 6 in**	**- 6 in**	**- 6 in**	**- 6 in**	**- 6 in**	**- 6 in**	**- 6 in**	**- 6 in**	**- 6 in**	**- 6 in**
Fe+3, g/L	**Uncont**	**Uncont**	**Uncont**	**Uncont**	**Uncont**	**Uncont**	**Uncont**	**Uncont**	**Uncont**	**3**	**3**	**Uncont**
Innoculation/ Make Up	**Site H2O**	**Site H2O**	**Site H2O**	**Site H2O**	**Site H2O**	**Site H2O**	**Site H2O**	**Site H2O**	**Site H2O**	**Site H2O**	**Site H2O**	**Site H2O**
Aqueous Feed	**Acidified Raff**	**Col 1 Dish**	**Col 2 Dish**	**Acidified Raff**	**Col 1 Dish**	**Col 2 Dish**	**Acidified Raff**	**Col 1 Dish**	**Col 2 Dish**	**Cond Raff**	**Cond Raff**	**Acidified Raff**
24 inch Column	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Locked Cycle	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Bottle Roll Test	**X**			**X**								**X**

Recommended On-Site Test Program

Notes to On-Site Test Plan

1) Make-up and initial water for test series should be taken from an on-site source from the Kings Mill Tunnel drainage containing locally grown population of bacteria. Bacterial ID and counts should be conducted on the water.
2) The trickle cure will be applied on column 1 until breakthrough of solution from column 3. Following breakthrough from column 3, copper will be extracted, the acidity of the raffinate solution will be adjusted and recycled to column 1 of the series. The cure acid strength will be reviewed prior to the test start after the ore sample has been analyzed.
3) If possible, Columns 1 and 2 in the sequential series should have cone bottoms so that both ultra-fine solids and liquids discharging from the columns can be advanced to the next column.
4) Column 1, acidified raffinate recycle acid strengths may be adjusted during the test to maintain 0.5 to 1.0 g/L free acid in the column 3 discharge.
5) All columns should be insulated and, if necessary, heat traced so as to maintain bulk column temperature constant throughout the test. If the columns are to be enclosed and the room temperature of the enclosure is maintained at a constant temperature, heat tracing will not be necessary but the columns should still be covered with insulation. The selection of room temperature will be decided prior to test initiation but is expected to be 5 to 10 degrees Celsius. If heat tracing is required, each column should be wrapped with three, independently controllable strands, wrapped from top to bottom, so as to maintain the column temperature as nearly constant from start to finish.
6) Shakeout and phase break tests will be conducted on column off solutions over the course of the leach work to develop SX design criteria. Organic continuous shakeout data will be derived by contacting stripped organic with column PLS solution at an O/A ratio of 1.2 / 1 at temperatures of 5, 10, 15, and 20 Celsius. Primary break times (~60 seconds) and complete phase separation times (~ 90 seconds) will be recorded. Aqueous continuous phase break tests will be conducted at an O/A ratio of 0.8 / 1 under similar conditions and the primary and complete phase separation times recorded.
7) The high arsenic intrusive ore will be selected as ore sample analysis become available.
8) Two columns of intrusive ore will be tested using the criteria of column 26. One test will be conducted using the room temperature “on” solution while the second test will be conducted with solution temperature at 20 C.
9) Provision will be made for sparging of air into the bottom of column 3 in first three series, as indicated in the schedule above. After stable leach conditions have been established (50 – 60) days, a decision will be made to add air to the third columns, which will be monitored for an increase, or change in trend, in leaching rate, ferrous oxidation rate, increased acidity in the off solution, and possibly biological cell count.
10) An as yet to be defined series of biological analysis will be conducted on a timely basis for identification and quantification of active bacterial speciation. The Kings Mill drainage water will serve as a source of indigenous, cultured bacteria.

Diagnostic Leach Analytical			
Acid Strength	**150**	**100**	**50**
Solids Head:			
% Moisture (Low Temp)			
Acid Soluble Cu	**X**		
Cyanide Soluble Cu	**X**		
Total Cu	**X**		
Sulfide Sulfur	**X**		
Sulfur Total	**X**		
Carbon	**X**		
Whole Rock ICP Scan	**X**		
Incl: Fe,Zn, As,Cu,			
Al,Mg,K,Ca,Mn,P,Na			
Flouride	**X**		
Time	**2 Hours**	**2 Hours**	**2 Hours**
Sample	**Pulverized**	**Pulverized**	**Pulverized**
Undiluted Solutions:			
Whole Rock ICP	**X**	**X**	**X**
Incl: Fe,Zn, As,Cu,	**X**	**X**	**X**
Al,Mg,K,Ca,Mn,P,Na	**X**	**X**	**X**
Fe+++	**X**	**X**	**X**
Fe++	**X**	**X**	**X**
Fe Total	**X**	**X**	**X**
Cu	**X**	**X**	**X**
Fluoride	**X**	**X**	**X**
Wash Solution:			
Fe Total, Fe+++, Fe++	**X**	**X**	**X**
Cu	**X**	**X**	**X**
Solids Tail:			
Low Temp Dry	**X**	**X**	**X**
Acid Soluble Cu	**X**	**X**	**X**
Cyanide Soluble Cu	**X**	**X**	**X**
Total Cu	**X**	**X**	**X**
Sulfide Sulfur	**X**	**X**	**X**
Sulfur Total	**X**	**X**	**X**
Carbon	**X**	**X**	**X**
Whole Rock ICP Scan	**X**	**X**	**X**
Incl: Fe,Zn, As,Cu,			
Al,Mg,K,Ca,Mn,P,Na			

Recommended Analytical Determinations

Toromocho CLP Concentrator Capacity Trade off Study

Prepared for

Peru Copper Inc.

January, 2007
Project No. R0521300
Report No. RP-06

AKER KVÆRNER™

Exhibit B
USE OF REPORT

This report was prepared for Peru Copper Inc. (Client) by Aker Kvaerner E&C, a division of Aker Kvaerner Canada Inc. (Aker Kvaerner) pursuant to the contract agreement (Agreement) between the Client and Aker Kvaerner.

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1.0 INTRODUCTION

Peru Copper Inc. has retained the services of Aker Kvaerner to carry out a Definitive Feasibility Study (DFS) for the Toromocho Project in Peru. The project involves an open-pit mine, sulphide concentrator, heap leach/SX/EW facility and related infrastructure.

One of the first activities for the sulphide concentrator was to carry out a capacity trade-off study. A Pre-feasibility Study (PFS) on Toromocho was carried out in early 2005 based on a concentrator capacity of 150,000 t/a with two lines of SAG and ball mills. At the start of the capacity trade-off study, it was decided to determine the maximum capacity that could be achieved with one line of SAG and two ball mills based on SAG mill sizes of 36', 38' and 40' diameter with nominal capacities of 70,000, 83,000 and 100,000 t/d respectively. Subsequently, it was decided to also investigate an option with two lines of 36' diameter SAG mills plus ball mills.

Preliminary process designs were developed for the 3 initial options primarily based on design criteria that were taken from the PFS and then these were used to generate capital and operating cost estimates. For the capital cost estimates, budget prices were obtained for the crushers and mills and then the unit costs for the other items were taken from the PFS and applied to the numbers of units from the equipment lists. The operating cost estimates were developed by using a combination of information from the PFS and in-house data.

In order to provide the basis for sizing the SAG and ball mills, samples were sent to SGS Lakefield to carry out SPI and Bond Work Index tests. At the time of the study, 61 samples had been tested although approximately 44 more samples will be tested eventually to provide the data required for the DFS. These results were used to estimate the capacities that can be achieved for the 3 different SAG mill sizes. As a result, the daily capacities for the 3 mill sizes were revised to 65,000, 77,000 and 92,000 t/d. The fourth option with two 36' diameter SAG mills has a capacity of 130,000 t/d.

The daily capacities and capital and operating cost estimates were provided to PCI for introduction into their financial model and IRRs and NPVs were determined for each case in order to establish the optimum case.

This report presents the findings of the study including the preliminary process design information, capital and operating cost estimate details, financial model outputs, and a comparison of the alternatives.

2.0 SCOPE OF WORK

The objective of the Concentrator Capacity Trade-off Study is to compare the following cases:

- Single grinding line with 36' diameter SAG mill
- Single grinding line with 38' diameter SAG mill
- Single grinding line with 40' diameter SAG mill
- Two grinding lines with 36' diameter SAG mills

The scope of work is as follows:

(a) Monitor the SPI and BWI testwork being carried out by SGS Lakefield.

(b) Review the process design criteria and process flow sheet used in the PFS and revise where appropriate.

(c) Prepare preliminary process designs for the concentrator for the four cases including preliminary mass balances and equipment lists.

(d) Obtain vendor budget pricing for the crushers and grinding mills.

(e) Develop direct capital cost estimates for the concentrator for the four cases based on the equipment lists, vendor pricing and the equipment pricing from the PFS estimate.

(f) Develop overall project costs for each case from the concentrator direct costs by estimating the costs for the heap leach/SX/EW, infrastructure and indirect costs by factoring the costs from the PFS.

(g) Develop concentrator operating costs for each case using a combination of in-house information plus data from the PFS.

(h) Provide the capital and operating cost estimates to PCI for running the project financial model for each case.

(i) Take the results of the financial analysis and make a recommendation on the optimum plant capacity.

(j) Prepare a report on the study findings.

3.0 PROCESS DESIGN

The preliminary plant design is based on the design criteria from the previous testwork carried out by METCON.

3.1 Metallurgical Testwork

The following is based on the metallurgical testwork and feasibility study reports that have been provided by PCI to Aker Kvaerner and the preliminary testwork that has recently been carried out by Metcon Research, Pocock Industrial Inc., Hazen Research and SGS Lakefield. The test work was conducted from December 2004 through the end of 2006 and is still ongoing.

Over the course of the past several years, a variety of bench flotation testwork and locked-cycle testwork has been performed on ore from the Toromocho project. Some of the highlights of the findings are listed below.

Testwork has been carried out on seven rock/alteration type composites which were believed to be representative of the Toromocho deposit. Three of the composites contained essentially no talc and four contained significant amounts of talc. Copper recovery into the final copper concentrate was in the range of 76 to 93% with copper concentrate grades after the three cleaning stages of 24 to 30 % copper, regardless of talc content in the ore.

A series of tests were performed on these composites to optimize flotation parameters. Concentrate upgrading and flotation reagents dosage optimization studies were performed as well.

The main portion of this metallurgical study was conducted on seven rock type composites. The make-up of these composites was specified by Independent Mining Consultants (IMC). A description of these composites and corresponding abbreviations used throughout this report follow in Table 3-1.

Table 3-1
Rock Composites and Abbreviations

Composite Description	Abbreviation
Intrusive Breccia (Soluble <20%)	IB+20
Intrusive No Breccia (Soluble >20%)	I+20
Skarn Breccia (Soluble >20%)	SB+20
Skarn No Breccia (Soluble >20%)	S+20
Skarn Breccia (Soluble <20%)	SB-20
Skarn No Breccia (Soluble <20%)	S-20
Intrusive No Breccia (Soluble <20%)	I-20

Test charge samples representative of the above composites were prepared for testing. These composite samples were tested for amenability to conventional

flotation. A flotation-leach-flotation processing option was also evaluated for each composite.

The following tabulation in Table 3-2 presents the main elements of interest for each sample evaluated in the previous study. This tabulation includes the soluble copper content of each sample, which provides an indication of the secondary sulfide copper mineralization.

Table 3-2
Rock Type Composites Head Analysis

Composite ID	Assays (%)						Soluble Cu (%)
	Cu	Fe	Ag (g/t)	As	Zn	Mo	
IB+20	0.64	6.35	5.5	0.014	0.02	0.013	58.73
I+20	0.63	6.55	11.0	0.043	0.02	0.012	63.93
SB+20	0.58	9.10	6.0	0.030	0.02	0.008	70.69
S+20	0.71	8.55	8.0	0.028	0.10	0.008	60.29
SB-20	0.61	8.75	9.0	0.005	0.06	0.023	8.33
S-20	0.57	8.90	9.5	0.007	0.21	0.011	10.53
I-20	0.63	8.45	8.5	0.010	0.12	0.034	8.33

The main impurities that are found in the skarn and intrusive (breccia and non breccia) concentrates are pyrite and insoluble silicates. Pyrite was found mainly in the composites containing primary sulfide copper mineralization.

The antimony values are in the range of less than 5 ppm to 1584 ppm; the bismuth content is less than 2 ppm; cadmium is in the range of less than 0.2 ppm to 136 ppm; mercury is less than 3 ppm. Arsenic concentrations ranged from 0.006 to 3.425% and the average for all concentrates was 0.738%.

Silver recovery was higher for the brecciated intrusive rock type. The skarn rock types showed the lowest silver recoveries.

Molybdenum recoveries were impacted by the addition of carboxymethylcellulose (CMC) into the cleaners. Insoluble depression with a high dosage of CMC has a detrimental effect on molybdenite recovery.

3.2 Process Description

Preliminary plant flotation circuits have been developed for each of the options based on the following: (See Table 3-3)

Table 3-3
Process Parameters

Ore Composition	
Cu	0.60%
Mo	0.027%
Metal Recovery	
Cu	89%
Mo	60%
Reagent dosages	
Lime	4.84 kg/t
PAX	40 g/t
AF-238	12 g/t
CMC-7M	95 g/t
MIBC	163 g/t
Diesel	750 g/t
Flocculant (Hychem AF-302)	105 g/t

The circuit is presented in Appendix A and consists of:

- Primary crushing
- SAG milling
- Ball milling
- Pebble crushing
- Copper rougher flotation
- Copper rougher concentrate regrind
- Three copper cleaning flotation stages
- Cleaner-scavenger flotation
- Copper concentrate thickening
- Copper flotation tails thickening and filtration
- Copper flotation tails heat conditioning
- Talc-moly rougher flotation
- Talc-moly scavenger flotation
- Talc-moly rougher concentrate thickening, filtration and roasting

- Talc selective rougher flotation
- Moly rougher flotation
- Six moly cleaning flotation stages
- Final moly concentrate thickening and filtration.

The process flow sheets and general arrangement drawings are included as Appendix A. The mass balances for each case are included as Appendix B, the equipment lists are included as Appendix C and the design criteria for base case 92 kt/d is included as Appendix D.

3.2.2 Crushing and Grinding

Crushing and grinding parameters have been developed for Toromocho ore using previous BWI and JKSimMet Test results. Laboratory tests showed that the optimal flotation feed grind size P_{80} is about 106 mesh, – 125 µm, for roughing depending on the composite material to be ground and P_{80} – 40 µm for the cleaner stage.

Based on the above mentioned criteria for the 92,000 t/d case, a gyratory primary crusher model Traylor 63 x 113 has been selected. For each of other two cases, a gyratory crusher model Superior MK II 80 x 110 was chosen.

The ROM ore is transported by trucks to the primary gyratory crusher where it is crushed to minus 160 mm. The ore is then conveyed by two consecutive overland conveyors to the crushed ore stockpile. Crushed ore from stockpile is reclaimed by belt feeders and conveyed to the grinding circuit that consists of a closed circuit SAG mill with a trommel and two vibrating screens followed by a pebble crusher for the screen oversize material. The trommel and vibrating screens undersize products feed the cyclone clusters, which are in closed circuit with two ball mills. The ore is ground to 80% passing 125 microns and the cyclone overflow passes directly to the copper rougher flotation circuit.

3.2.3 Copper Flotation Circuit

The flow sheet developed at METCON included copper rougher flotation and three copper cleaning stages with a cleaner scavenger stage. Carboxymethylcellulose (CMC) will be used to depress naturally floating talc and silicate minerals as well as to achieve an acceptable final copper concentrate grade.

The following flotation circuit description is for the 92,000 t/d case. The entire copper rougher scavenger flotation circuit consists of twenty-eight 200 m^3 conventional flotation tank cells. A rougher flotation pH of 10.5 provides acceptable overall copper and molybdenum recoveries. The best copper recoveries and concentrate grades were obtained at an approximate ratio of 1:3 of the two copper sulphide collectors; Aerofloat 238 (AF-238) and Potassium Amyl Xanthate (PAX). The copper rougher flotation concentrate and the moly-talc scavenger concentrate are

collected and combined with the moly-rougher flotation tails sent to regrinding in six VTM-1500 tower mills, which are in closed circuit with three regrind cyclone clusters. Each regrind cyclone cluster consists of nine 10" cyclones (seven operating and two standby) and is in closed circuit with two tower mills. The regrind cyclone clusters overflow ground to 80% minus 40 microns passes directly to the five 100 m^3 first copper cleaner tank cells.

The copper rougher tails are combined with the first copper cleaner tails and disposed to the tailing dam through the final tailings thickeners.

The first copper cleaner concentrate is sent to seven 5 m x 14 m 2nd cleaner column cells for further upgrading. The concentrate from the second cleaners is sent for final cleaning to the five 5 m x 14 m third cleaner column cells. The third cleaner concentrate now represents the final bulk copper concentrate.

The tails from the third cleaner flows to four 16 m^3 cleaner-scavenger tank cells, from which concentrate is recycled back to the second copper cleaners for additional recovery.

The bulk concentrate is thickened in an 18 m diameter high rate thickener and sent to a set of filters where it is discharged to the stockpile for shipping to a smelter for final processing.

3.2.4 Talc-Moly Flotation Circuit

The second copper cleaner tails along with cleaner-scavenger tails are combined, thickened and fed to conditioning tanks, where the pulp will be heated for 30 minutes at 85°C using steam. During this process, most of flotation reagents will be stripped from the mineral surfaces.

With MIBC frother addition to the moly-talc rougher flotation, moly and talc will be separated into the concentrate, while copper sulphides report to the tail and will be floated in the next moly-talc scavenger stage with an addition of PAX. The sulphide concentrate is recycled back to the regrind circuit, while tails flow to the final tailings thickener.

Moly-talc rougher concentrate after thickening and filtration goes to roasting, where molybdenum will be oxidized at 232 – 260°C. Talc will be selected into the talc concentrate in the next talc rougher flotation stage and pumped directly into the final tailings thickener, while tails go to molybdenite rougher flotation. With the addition of molybdenite collectors (either diesel or kerosene), the molybdenite concentrate will be floated and passed through six cleaning stages to produce final molybdenite concentrate.

4.0 CAPITAL COST ESTIMATES

Order-of-magnitude project capital cost estimates were developed for the following cases:

- Single grinding line with 36' diameter SAG mill – capacity 65,000 t/d
- Single grinding line with 38' diameter SAG mill – capacity 77,000 t/d
- Single grinding line with 40' diameter SAG mill – capacity 92,000 t/d
- Two grinding lines with 36' diameter SAG mills – capacity 130,000 t/d

The costs were developed in fourth quarter 2006 US dollars and are subject to the qualifications and exclusions listed below

The capital costs for the mine, concentrator and infrastructure for these options are summarized in Table 4-1 and are inclusive of the costs up to and including plant commissioning and startup. The detailed capital cost estimate is included as Appendix E.

Table 4-1
Project Capital Costs for Different Cases

Area	**65,000 t/d**	**77,000 t/d**	**92,000 t/d**	**130,000 t/d**
Concentrator	321,133,538	385,574,957	417,862,401	560,741,238
Infrastructure	41,286,407	41,286,407	41,286,407	41,286,407
Total Direct Costs	362,419,946	426,861,364	459,148,808	602,027,645
Indirect Costs	114,039,404	133,436,271	143,154,791	186,161,321
Sub-total Direct + Indirect Costs	476,459,349	560,297,635	602,303,599	788,188,966
Contingency	119,114,837	140,074,409	150,575,900	197,047,242
Owner's Costs	58,559,000	62,232,000	66,511,000	76,254,000
Mine	194,204,000	215,979,000	229,903,000	250,790,000
Owner's Costs and Mine Contingency	21,494,855	23,647,935	25,195,190	27,798,700
Tailings Dam	60,746,120	68,048,002	76,666,289	96,651,509
Heap Leaching/SX/EW	315,225,000	315,225,000	315,225,000	315,225,000
Project Total	**1,245,793,162**	**1,385,503,981**	**1,466,379,978**	**1,751,955,457**

4.1 Concentrator Direct Capital Costs

The first activity in the development of the concentrator direct capital costs for each case was to estimate the mechanical equipment costs. For this, the costs from the PFS for each item of equipment in the concentrator were inserted into a column in the spreadsheet for use as a basis for generating the estimates for the four cases. Parallel columns were then set up for the other four cases. The vendor budget prices obtained for the crushers and mills were inserted into the relevant estimate column. Copies of the quotations are presented in Appendix F Then the equipment lists for the four cases were used to establish the number of pieces for each item of equipment and the unit price for each item from the PFS was reviewed as used as a basis for the estimate either unchanged or factored where necessary. The costs for each item were then summed to provide the total installed equipment cost.

Then factors were developed using the costs from the PFS for the different commodities and these were applied to the installed equipment costs for each item. The total of the costs for the commodities were then added to the installed equipment cost to establish the total direct costs for the concentrator for each case. These are shown in the Table 4-2.

Table 4-2
Concentrator Direct Capital Costs for Different Cases

Area	65,000 t/d	77,000 t/d	92,000 t/d	130,000 t/d
General	126,533	126,533	126,533	126,533
Primary Crushing and Ore Handling	15,832,391	17,268,233	17,533,944	23,042,465
Grinding	77,735,607	98,701,903	107,927,465	149,257,157
Flotation	21,610,406	26,430,167	30,601,846	42,951,006
Moly Plant	4,149,661	4,149,661	4,149,661	4,149,661
Concentrate Handling	6,060,665	6,734,892	6,931,048	9,502,715
Tailings Thickening	4,891,797	5,074,091	5,282,427	5,777,224
Services	9,512,477	9,512,477	9,512,477	9,512,477
Subtotal Installed Mechanical Equipment	139,919,538	167,997,957	182,065,401	244,319,238
Earthworks and Civil	29,049,000	34,878,000	37,799,000	50,723,000
Concrete	49,992,000	60,024,000	65,050,000	87,293,000
Structural Steel	34,538,000	41,468,000	44,941,000	60,307,000
Building, Architectural	1,846,000	2,216,000	2,402,000	3,223,000
Electrical	31,431,000	37,738,000	40,898,000	54,882,000
Instrumentation	10,059,000	12,077,000	13,088,000	17,564,000
Piping	24,299,000	29,176,000	31,619,000	42,430,000
Subtotal Installed Commodities	181,214,000	217,577,000	235,797,000	316,422,000
Direct Costs Total	321,133,538	385,574,957	417,862,401	560,741,238

4.2 Indirect Costs

The indirect costs were calculated by developing factors for the different elements from the PFS and applying these to the total direct costs. A fixed cost for environmental was applied to each case.

4.3 Other Costs

The other costs were developed as follows:

- A 25% contingency was applied to the direct and indirect costs.
- The Owner's and mine costs for each option were provided by PCI.
- An 8.5% contingency was applied to the Owner's and mine costs.
- Tailings dam costs were factored from the PFS cost based on plant capacity.
- A fixed cost was applied for the heap leach/SX/EW based on the cost from the PFS.

5.0 OPERATING COST ESTIMATES

Preliminary operating cost estimates have been developed for the following process options.

- Single grinding line with 36' diameter SAG mill – capacity 65,000 t/d
- Single grinding line with 38' diameter SAG mill – capacity 77,000 t/d
- Single grinding line with 40' diameter SAG mill – capacity 92,000 t/d
- Two grinding lines with 36' diameter SAG mills – capacity 130,000 t/d

A summary of the cost for the four options is shown in Table 5-1. The costs were developed in fourth quarter 2006 US dollars and are subject to the qualifications and exclusions listed below.

The operating costs were estimated by developing costs for labour, reagents and consumables, electrical power and maintenance supplies. The basis for developing the costs for each area is as follows.

- Labour costs were developed by estimating the number of operators and maintenance personnel required for the 92,000 t/d option and then applying payroll costs for each position. The payroll costs were taken from a similar operating mine in Bolivia. The total labour cost includes 10% for Vacation/Sick Leave/Absenteeism (VSA). The number of operators and maintenance personnel required is the same for each option.
- Reagents costs were developed based on the consumptions from the latest Metcon testwork for the copper flotation circuit and assumed data for the molybdenum flotation circuit. For the consumables, the consumptions are based on using in-house data for liners and grinding media. The unit costs for the concentrator reagents and consumables were taken from vendors and in-house data. The total cost include a 15% cost of consumables transportation from the vendors to the site.
- Electrical power costs were developed based on the power consumption for each item of equipment from the equipment list and then applying a derating factor for high altitude, utilization rate and power draw rate. The unit cost for electrical power is 0.041 USD/KWh and has been provided by PCI.
- Maintenance supplies were developed by applying a factor to the total process plant direct costs including plant commodities.
- A contingency of 15% has been applied to all the costs.

The costs are summarized below.

5.1 Option 65,000 t/d

The operating costs for the 65,000 t/d concentrator capacity case are shown in Table 5-2 through Table 5-7.

5.2 Option 77,000 t/d

The operating costs for the case 77,000 t/d concentrator capacity are shown in Table 5-8 and Table 5-10.

Table 5-1
Process Plant Operating Cost

	130,000 tpd (USD)	92,000 tpd (USD)	77,000 tpd (USD)	65,000 tpd (USD)
Labour	4,026,600	4,026,600	4,026,600	4,026,600
Consumables	116,692,548	82,048,768	69,011,400	58,349,764
Power	40,806,119	28,989,619	23,958,492	20,657,424
Maintenance Supplies	16,822,237	12,535,872	11,567,249	9,634,006
Plant other	896,200	641,200	545,500	465,700
Contingency	26,886,556	19,236,309	16,366,386	13,970,024
Total	**206,130,260**	**147,478,368**	**125,475,627**	**107,103,518**
USD / t of ore milled	**4.83**	**4.88**	**4.96**	**5.02**

Table 5-2
Plant Labour Costs
(130 kt/d/ 92 kt/d/ 77 kt/d/ 65 kt/d)

Plant Area	Total	Cost/Man/mth USD	Annual Salary USD
Supervision and Experts			
Process Manager (expat)	1	$20,000	$ 240,000
Mill Superintendent (expat)	1	$12,500	$ 150,000
Assistant Superintendent	1	$3,750	$ 45,000
Chief Metallurgist (expat)	1	$8,000	$ 96,000
Mill Maintenance Superintendent	1	$3,300	$ 39,600
Maintenance Superintendent Assistant	1	$3,750	$ 45,000
Chief Power Engineer	1	$3,750	$ 45,000
Assay Lab Manager	1	$3,750	$ 45,000
Mill General Foreman	1	$3,750	$ 45,000
Mill Foreman	4	$3,300	$ 158,400
Mill Maintenance Foreman	4	$3,300	$ 158,400
Secretary	1	$1,590	$ 19,080
Metallurgist	2	$3,300	$ 79,200
Maintenance Planner	4	$3,300	$ 158,400
Maintenance Engineers	4	$3,300	$ 158,400
Subtotal	28		$ 1,482,480
Plant Workers			
Control Room Operator	4	$1,860	$ 89,280
Primary Crushing Area	6	$1,590	$ 114,480
Coarse Ore Storage Area	2	$1,590	$ 38,160
Grinding Circuit Area	8	$1,590	$ 152,640
Flotation Area	12	$1,860	$ 267,840
Flot. Conc. Handling Area	4	$1,860	$ 89,280
Tailings Handling	4	$1,590	$ 76,320
Tailings Disposal	8	$1,590	$ 152,640
Reagents Area	13	$1,590	$ 248,040
Plant Services Operators	3	$1,590	$ 57,240
Laboratory Chemist / Assayers / Sampler	16	$1,860	$ 357,120
Mechanics	19	$1,590	$ 362,520
Electrical	11	$1,860	$ 245,520
Instrumentation	5	$1,860	$ 111,600
Labourers	12	$1,260	$ 181,440
Subtotal	**127**		**$ 2,544,120**
TOTAL	**155**		**$ 4,026,600**
Vacation/Sick Leave/Absenteeism	10%		$ 402,660
GRAND TOTAL			**$ 4,429,260**

Table 5-3
Process Plant Consumables (65,000 t/d Option)

Plant Area	Lime (t/a)	PAX (t/a)	AF-238 (t/a)	CMC-7M (t/a)	Diesel (t/a)	MIBC (t/a)	Flocculant (t/a)	Balls (t/a)	Liners (t/a)	Misc. (USD/a)	Cost (USD/a)
											-
Primary Crushing Area									80		154,400
Coarse Ore Storage											-
Grinding Circuit	103,346	0	0					27,758	1,299		31,159,286
Copper Flotation Area	0	854	256	2,028		3,480	12	851		206,500	14,549,526
Moly-Talc Flotation Area					16,014		6			290,467	3,515,205
Tailings Handling						0	316				1,160,508
Tailings Disposal											-
Laboratory reagents										200,000	200,000
Total Consumption	**103,346**	**854**	**256**	**2,028**	**16,014**	**3,480**	**334**	**28,609**	**1,379**		
Subtotal Cost	**$ 11,368,071**	**$ 1,879,020**	**$ 389,470**	**$ 1,785,069**	**$ 3,202,875**	**$ 9,884,499**	**$ 1,227,525**	**$ 17,644,663**	**$ 2,660,766**	**$ 696,967**	**$ 50,738,925**
Transport Cost 15%	$ 1,705,211	$ 281,853	$ 58,420	$ 267,760	$ 480,431	$ 1,482,675	$ 184,129	$ 2,646,699	$ 399,115	$ 104,545	$ 7,610,839
TOTAL	**$ 13,073,282**	**$ 2,160,873**	**$ 447,890**	**$ 2,052,829**	**$ 3,683,306**	**$ 11,367,174**	**$ 1,411,654**	**$ 20,291,363**	**$ 3,059,881**	**$ 801,512**	**$ 58,349,764**

002504

Table 5-4
Consumables Unit Cost

Unit Costs	USD/t
Lime	110.0
PAX	2200.0
AF-238	1520.0
CMC	880.0
MIBC	2840.0
Diesel	200.0
Flocculant	3670.0
Grinding balls 5'	659.0
Grinding balls 4'	600.0
Grinding media 1.5'	423.0
Mill & Crusher Lining	1930.0
Polybags, USD/bag	12.0
Filter Cloth, USD/m²	100.0

Table 5-5
Process Plant Power (65,000 t/d Option)

Plant Area	Connected Load kW	Drawn Load kW	Annual Utilization %	Annual Power Consumption MWh	Annual Cost USD/a
Primary Crushing Area	6090.3	4373.5	80	30649	$ 1,256,620
Coarse Ore Storage	169.0	107.9	90	851	$ 34,878
Grinding Circuit	100182.6	46305.9	90	365076	$ 14,968,100
Copper Flotation Area	17284.4	7208.6	90	56833	$ 2,330,149
Talc-Moly Flotation Area	6266.4	2352.1	90	18544	$ 760,314
Tailings Handling	3470.0	1424.4	90	11230	$ 460,413
Tailings Disposal	1193.6	377.6	90	2977	$ 122,057
Plant Reagents / Fuels	846.9	333.4	90	2628	$ 107,755
Utilities / Plant Services	4036.8	1909.2	90	15052	$ 617,137
TOTAL	**139540.0**	**64392.5**		**503840**	**$ 20,657,424**

002506

Table 5-6
Process Plant Maintenance Cost
(130 ktpd/ 92 kt/d/ 77 kt/d/ 65 kt/d)

	130,000 tpd (USD)	92,000 tpd (USD)	77,000 tpd (USD)	65,000 tpd (USD)
General	126,533	126,533	126,533	126,533
Primary Crushing, Coarse ore handling & Stockpile	23,042,465	17,533,944	17,268,233	15,832,391
Grinding Plant	149,257,157	107,927,465	98,701,903	77,735,607
Copper Flotation and Regrinding	42,951,006	30,601,846	26,430,167	21,610,406
Molybdenum Flotation	4,149,661	4,149,661	4,149,661	4,149,661
Concentrate thickening, Filtration and Storage	9,502,715	6,931,048	6,734,892	6,060,665
Tailings Thickening and Water recovery	5,777,224	5,282,427	5,074,091	4,891,797
Services	9,512,477	9,512,477	9,512,477	9,512,477
Subtotal Process Plant Mechanical Equipment	**244,319,238**	**182,065,401**	**167,997,957**	**139,919,538**
Factored Commodities				
Earthworks and Civil	50,723,000	37,799,000	34,878,000	29,049,000
Concrete	87,293,000	65,050,000	60,024,000	49,992,000
Structural Steel	60,307,000	44,941,000	41,468,000	34,538,000
Buildings, Architectural	3,223,000	2,402,000	2,216,000	1,846,000
Building Services		0	0	0
Electrical	54,882,000	40,898,000	37,738,000	31,431,000
Instrumentation	17,564,000	13,088,000	12,077,000	10,059,000
Piping	42,430,000	31,619,000	29,176,000	24,299,000
Insulation and Protection				
Subtotal Process Plant Factored Commodities	**316,422,000**	**235,797,000**	**217,577,000**	**181,214,000**
Subtotal Process Plant	**560,741,238**	**417,862,401**	**385,574,957**	**321,133,538**
Mill Maintenance (USD)	**16,822,237**	**12,535,872**	**11,567,249**	**9,634,006**

002507

Table 5-7
Operating Cost Summary (65,000 t/d Option)

Processing Plant Area	Labour	Consumables	Power	Maintenance Supplies	Mill Other	Total
Supervision	$ 1,482,480				$ 465,700	$ 1,948,180
Crushing	$ 114,480	$ 177,560	$ 1,256,620			$ 1,548,660
Reclaim & Stockpile	$ 38,160		$ 34,878			$ 73,038
Grinding	$ 152,640	$ 35,833,179	$ 14,968,100			$ 50,953,919
Copper Flotation Area	$ 357,120	$ 16,731,955	$ 2,330,149			$ 19,419,224
Talc-Moly Flotation Area	$ 89,280	$ 4,042,486	$ 760,314			$ 4,892,080
Tailings Handling	$ 76,320	$ 1,334,584	$ 460,413			$ 1,871,317
Tailings Disposal	$ 152,640		$ 122,057			$ 274,697
Reagent Area	$ 248,040		$ 107,755			$ 355,795
Utilities / Plant Service	$ 57,240		$ 617,137			$ 674,377
General Labourers / Admin	$ 181,440					$ 181,440
Assay Lab	$ 357,120	$ 230,000				$ 587,120
Maintenance	$ 719,640			$ 9,634,006		$ 10,353,646
Subtotal	**$ 4,026,600**	**$ 58,349,764**	**$ 20,657,424**	**$ 9,634,006**	**$ 465,700**	**$ 93,133,494**
Contingency	$ 402,660	$ 8,752,465	$ 3,098,614	$ 1,445,101	$ 69,855	$ 13,970,024
TOTAL	**$ 4,429,260**	**$ 67,102,228**	**$ 23,756,038**	**$ 11,079,107**	**$ 535,555**	**$ 107,103,518**
USD / t of ore milled	**$ 0.21**	**$ 3.14**	**$ 1.11**	**$ 0.52**	**$ 0.03**	**$ 5.02**
Distribution, %	4.14	62.65	22.18	10.34	0.50	99.81

002508

Table 5-8
Process Plant Consumables (77,000 t/d Option)

Plant Area	Lime (t/a)	PAX (t/a)	AF-238 (t/a)	CMC-7M (t/a)	Diesel (t/a)	MIBC (t/a)	Flocculant (t/a)	Balls (t/a)	Liners (t/a)	Misc. (USD/a)	Cost (USD/a)
											-
Primary Crushing Area									90		173,700
Coarse Ore Storage											-
Grinding Circuit	122,425	0	0					32,883	1,488		36,813,604
Copper Flotation Area		1,012	304	2,403		4,123	15	1,006		263,600	17,253,978
Moly-Talc Flotation Area					18,971		7			344,057	4,164,132
Tailings Handling							375				1,374,499
Tailings Disposal											-
Laboratory reagents										230,000	230,000
Total Consumption	**122,425**	**1,012**	**304**	**2,403**	**18,971**	**4,123**	**396**	**33,889**	**1,578**		
Subtotal Cost	**$ 13,466,792**	**$ 2,225,916**	**$ 461,372**	**$ 2,114,620**	**$ 3,794,175**	**$ 11,709,330**	**$ 1,453,888**	**$ 20,901,548**	**$ 3,044,614**	**$ 837,657**	**$ 60,009,913**
Transport Cost 15%	$ 2,020,019	$ 333,887	$ 69,206	$ 317,193	$ 569,126	$ 1,756,399	$ 218,083	$ 3,135,232	$ 456,692	$ 125,649	$ 9,001,487
TOTAL	**$ 15,486,811**	**$ 2,559,803**	**$ 530,577**	**$ 2,431,813**	**$ 4,363,301**	**$ 13,465,729**	**$ 1,671,972**	**$ 24,036,781**	**$ 3,501,307**	**$ 963,306**	**$ 69,011,400**

002509

Table 5-9
Process Plant Power (77,000 t/d Option)

Plant Area	Connected Load kW	Drawn Load kW	Annual Utilization %	Annual Power Consumption MWh	Annual Cost USD/a
Primary Crushing Area	7209.3	4653.5	80	32612	$ 1,337,072
Coarse Ore Storage	169.0	107.9	90	851	$ 34,878
Grinding Circuit	119264.1	54545.2	90	430035	$ 17,631,424
Copper Flotation Area	21167	8247.3	90	65022	$ 2,665,904
Talc-Moly Flotation Area	6090.7	2668.9	90	21041	$ 862,692
Tailings Handling	4146.1	1577.8	90	12439	$ 509,999
Tailings Disposal	1342.8	444.7	90	3506	$ 143,753
Plant Reagents / Fuels	899.8	354.2	90	2792	$ 114,490
Utilities / Plant Services	4305.9	2036.5	90	16056	$ 658,280
TOTAL	**164595.1**	**74636.0**		**584353**	**$ 23,958,492**

002510

Table 5-10
Operating Cost Summary (77,000 t/d Option)

Processing Plant Area	Labour	Consumables	Power	Maintenance Supplies	Mill Other	Total
Supervision	$ 1,482,480				$ 545,500	$ 2,027,980
Crushing	$ 114,480	$ 199,755	$ 1,337,072			$ 1,651,307
Reclaim & Stockpile	$ 38,160		$ 34,878			$ 73,038
Grinding	$ 152,640	$ 42,335,645	$ 17,631,424			$ 60,119,709
Copper Flotation Area	$ 357,120	$ 19,842,075	$ 2,665,904			$ 22,865,099
Talc-Moly Flotation Area	$ 89,280	$ 4,788,752	$ 862,692			$ 5,740,724
Tailings Handling	$ 76,320	$ 1,580,674	$ 509,999			$ 2,166,993
Tailings Disposal	$ 152,640		$ 143,753			$ 296,393
Reagent Area	$ 248,040		$ 114,490			$ 362,530
Utilities / Plant Service	$ 57,240		$ 658,280			$ 715,520
General Labourers / Admin	$ 181,440					$ 181,440
Assay Lab	$ 357,120	$ 264,500				$ 621,620
Maintenance	$ 719,640			$ 11,567,249		$ 12,286,889
Subtotal	**$ 4,026,600**	**$ 69,011,400**	**$ 23,958,492**	**$ 11,567,249**	**$ 545,500**	**$ 109,109,241**
Contingency	$ 402,660	$ 10,351,710	$ 3,593,774	$ 1,735,087	$ 81,825	$ 16,366,386
TOTAL	**$ 4,429,260**	**$ 79,363,110**	**$ 27,552,266**	**$ 13,302,336**	**$ 627,325**	**$ 125,475,627**
USD/t of ore milled	**$ 0.18**	**$ 3.14**	**$ 1.09**	**$ 0.53**	**$ 0.02**	**$ 4.96**
Distribution, %	3.53	63.25	21.96	10.60	0.50	99.84

5.3 Option 92,000 t/d

The operating costs for the case 92,000 t/d concentrator capacity are shown in Table 5-11 through Table 5-13.

5.4 Option 130,000 t/d

The operating costs for the 130,000 t/d concentrator capacity case are shown in Table 5-14 through Table 5-16.

Table 5-11
Process Plant Consumables (92,000 t/d Option)

Plant Area	Lime (t/a)	PAX (t/a)	AF-238 (t/a)	CMC-7M (t/a)	Diesel (t/a)	MIBC (t/a)	Flocculant (t/a)	Balls (t/a)	Liners (t/a)	Misc. (USD/a)	Cost (USD/a)
											-
Primary Crushing Area									100		193,000
Coarse Ore Storage											-
Grinding Circuit	146,274	0	0					39,289	1,627		43,694,747
Copper Flotation Area	0	1,209	363	2,871		4,926	17	1,201		292,200	20,591,768
Moly-Talc Flotation Area					22,667		8			411,079	4,975,251
Tailings Handling						0	447				1,641,988
Tailings Disposal											
Laboratory reagents										250,000	250,000
Subtotal Consumption	**146,274**	**1,209**	**363**	**2,871**	**22,667**	**4,926**	**473**	**40,489**	**1,727**		
Subtotal Cost	**$ 16,090,193**	**$ 2,659,536**	**$ 551,249**	**$ 2,526,559**	**$ 4,533,300**	**$ 13,990,368**	**$ 1,736,770**	**$ 24,972,655**	**$ 3,332,845**	**$ 953,279**	**$ 71,346,755**
Transport Cost 15%	$ 2,413,529	$ 398,930	$ 82,687	$ 378,984	$ 679,995	$ 2,098,555	$ 260,515	$ 3,745,898	$ 499,927	$ 142,992	$ 10,702,013
TOTAL	**$ 18,503,722**	**$ 3,058,466**	**$ 633,937**	**$ 2,905,543**	**$ 5,213,295**	**$ 16,088,923**	**$ 1,997,285**	**$ 28,718,553**	**$ 3,832,772**	**$ 1,096,271**	**$ 82,048,768**

002513

Table 5-12
Process Plant Power (92,000 t/d Option)

Plant Area	Connected Load kW	Drawn Load kW	Annual Utilization %	Annual Power Consumption MWh	Annual Cost USD/a
Primary Crushing Area	7671.9	5169.0	80	36224	$ 1,485,196
Coarse Ore Storage	169.0	107.9	90	851	$ 34,878
Grinding Circuit	140165.6	64451.9	90	508139	$ 20,833,701
Copper Flotation Area	27646	11370.0	90	89641	$ 3,675,275
Talc-Moly Flotation Area	7509.6	3803.6	90	29988	$ 1,229,504
Tailings Handling	4589.0	1793.8	90	14142	$ 579,833
Tailings Disposal	1865.0	599.2	90	4724	$ 193,688
Plant Reagents / Fuels	1058.6	416.7	90	3285	$ 134,694
Utilities / Plant Services	5382.4	2545.6	90	20070	$ 822,850
TOTAL	**196057.4**	**90257.7**		**707064**	**$ 28,989,619**

002514

Table 5-13
Operating Cost Summary (92,000 t/d Option)

Processing Plant Area	Labour	Consumables	Power	Maintenance Supplies	Mill Other	Total
Supervision	$ 1,482,480				$ 641,200	$ 2,123,680
Crushing	$ 114,480	$ 221,950	$ 1,485,196			$ 1,821,626
Reclaim & Stockpile	$ 38,160		$ 34,878			$ 73,038
Grinding	$ 152,640	$ 50,248,959	$ 20,833,701			$ 71,235,300
Copper Flotation Area	$ 357,120	$ 23,680,534	$ 3,675,275			$ 27,712,929
Talc-Moly Flotation Area	$ 89,280	$ 5,721,539	$ 1,229,504			$ 7,040,323
Tailings Handling	$ 76,320	$ 1,888,286	$ 579,833			$ 2,544,439
Tailings Disposal	$ 152,640		$ 193,688			$ 346,328
Reagent Area	$ 248,040		$ 134,694			$ 382,734
Utilities / Plant Service	$ 57,240		$ 822,850			$ 880,090
General Labourers / Admin	$ 181,440					$ 181,440
Assay Lab	$ 357,120	$ 287,500				$ 644,620
Maintenance	$ 719,640			$ 12,535,872		$ 13,255,512
Subtotal	**$ 4,026,600**	**$ 82,048,768**	**$ 28,989,619**	**$ 12,535,872**	**$ 641,200**	**$ 128,242,059**
Contingency	$ 402,660	$ 12,307,315	$ 4,348,443	$ 1,880,381	$ 96,180	$ 19,236,309
TOTAL	**$ 4,429,260**	**$ 94,356,083**	**$ 33,338,062**	**$ 14,416,253**	**$ 737,380**	**$ 147,478,368**
USD/t of ore milled	**$ 0.15**	**$ 3.12**	**$ 1.10**	**$ 0.48**	**$ 0.02**	**$ 4.88**
Distribution, %	3.00	63.98	22.61	9.78	0.50	99.86

002515

Table 5-14
Process Plant Consumables (130,000 t/d Option)

Plant Area	Lime (t/a)	PAX (t/a)	AF-238 (t/a)	CMC-7M (t/a)	Diesel (t/a)	MIBC (t/a)	Flocculant (t/a)	Balls (t/a)	Liners (t/a)	Misc. (USD/a)	Cost (USD/a)
											-
Primary Crushing Area									160		308,800
Coarse Ore Storage											-
Grinding Circuit	206,692	0	0					55,517	2,597		62,317,393
Copper Flotation Area	0	1,708	512	4,057		6,961	25	1,694		412,900	29,095,751
Moly-Talc Flotation Area					32,029		12			580,734	7,030,211
Tailings Handling						0	632				2,319,627
Tailings Disposal											-
Laboratory reagents										400,000	400,000
Total Consumption	**206,692**	**1,708**	**512**	**4,057**	**32,029**	**6,961**	**669**	**57,210**	**2,757**		
Total Cost	**$ 22,736,142**	**$ 3,758,040**	**$ 778,939**	**$ 3,570,138**	**$ 6,405,750**	**$ 19,768,999**	**$ 2,453,661**	**$ 35,286,125**	**$ 5,320,354**	**$ 1,393,634**	**$ 101,471,781**
Transport Cost 15%	$ 3,410,421	$ 563,706	$ 116,841	$ 535,521	$ 960,863	$ 2,965,350	$ 368,049	$ 5,292,919	$ 798,053	$ 209,045	$ 15,220,767
TOTAL	**$ 26,146,563**	**$ 4,321,746**	**$ 895,780**	**$ 4,105,659**	**$ 7,366,613**	**$ 22,734,348**	**$ 2,821,710**	**$ 40,579,044**	**$ 6,118,407**	**$ 1,602,679**	**$ 116,692,548**

002516

Table 5-15
Process Plant Power (130,000 t/d Option)

Plant Area	Connected Load kW	Drawn Load kW	Annual Utilization %	Annual Power Consumption MWh	Annual Cost USD/a
Primary Crushing Area	12180.7	8746.9	80	61299	$ 2,513,239
Coarse Ore Storage	337.9	215.8	90	1701	$ 69,757
Grinding Circuit	200365.2	92611.8	90	730151	$ 29,936,201
Copper Flotation Area	34569	14417.3	90	113666	$ 4,660,298
Talc-Moly Flotation Area	9399.6	3528.2	90	27816	$ 1,140,471
Tailings Handling	6072.5	2492.6	90	19652	$ 805,723
Tailings Disposal	2387.2	755.2	90	5954	$ 244,114
Plant Reagents / Fuels	1587.9	625.0	90	4928	$ 202,041
Utilities / Plant Services	8073.6	3818.4	90	30104	$ 1,234,275
TOTAL	**274973.5**	**127211.3**		**995271**	**$ 40,806,119**

002517

Table 5-16
Operating Cost Summary (130,000 t/d Option)

Processing Plant Area	Labour	Consumables	Power	Maintenance Supplies	Mill Other	Total
Supervision	$ 1,482,480				$ 896,200	$ 2,378,680
Crushing	$ 114,480	$ 355,120	$ 2,513,239			$ 2,982,839
Reclaim & Stockpile	$ 38,160		$ 69,757			$ 107,917
Grinding	$ 152,640	$ 71,665,002	$ 29,936,201			$ 101,753,843
Copper Flotation Area	$ 357,120	$ 33,460,113	$ 4,660,298			$ 38,477,531
Talc-Moly Flotation Area	$ 89,280	$ 8,084,742	$ 1,140,471			$ 9,314,493
Tailings Handling	$ 76,320	$ 2,667,571	$ 805,723			$ 3,549,614
Tailings Disposal	$ 152,640		$ 244,114			$ 396,754
Reagent Area	$ 248,040		$ 202,041			$ 450,081
Utilities / Plant Service	$ 57,240		$ 1,234,275			$ 1,291,515
General Labourers / Admin	$ 181,440					$ 181,440
Assay Lab	$ 357,120	$ 460,000				$ 817,120
Maintenance	$ 719,640			$ 16,822,237		$ 17,541,877
Subtotal	**$ 4,026,600**	**116,692,548**	**$ 40,806,119**	**$ 16,822,237**	**$ 896,200**	**$ 179,243,704**
Contingency	$ 402,660	$ 17,503,882	$ 6,120,918	$ 2,523,336	$ 134,430	$ 26,886,556
TOTAL	**$ 4,429,260**	**$ 134,196,430**	**$ 46,927,037**	**$ 19,345,573**	**$ 1,030,630**	**$ 206,130,260**
USD/t of ore milled	**$ 0.10**	**$ 3.14**	**$ 1.10**	**$ 0.45**	**$ 0.02**	**$ 4.83**
Distribution, %	2.15	65.10	22.77	9.39	0.50	100.00

002518

6.0 COMPARISON OF ALTERNATIVES

A matrix is presented in Table 6-1 which provides a basis for comparing the different alternatives that have been considered in this study. PCI also ran a fifth case based on a 100,000 t/d throughput with a 40-ft dia SAG mill. The main data presented includes the daily capacity, annual productions of copper and molybdenum, capital and operating costs, IRR and NPV generated by PCI, water consumption and other miscellaneous factors that have an impact on the selection of the process plant options. The factors in the table are discussed in the following sections.

6.1 IRR and NPV

The option that has the best IRR and NPV is the single line with a 40'-ft dia SAG mill. If a throughput of 100,000 t/d can be achieved rather than 92,000 t/d then the IRR will increase from 13.6% to 14.5%.

6.2 Financing Capability

The capability of PCI to finance the project will be directly related to the capital cost of the project and the financial return. However, the capital costs for all the options are well over USD 1 billion so the difference in the financing capability of the options will be modest.

6.3 Constructability

The constructability of the project among other matters relates to the size of the largest pieces of equipment and the size of the footprint of the plant. However, the equipment for all the options is large and the difference in constructability of the different options is not expected to have a major impact on the selection of the plant capacity.

6.4 Transportation Limitations

This option factor primarily relates to the transportation limitations as they relate to transportation of concentrate from the concentrator to the port. The difference between the options will be in the number of trains that will be required per year.

6.5 Tailings Capacity

The ultimate capacity, and consequently the cost, of the tailings disposal facility will be the same for all the options. The project would typically construct a starter dam initially and, obviously, if it is decided to size the starter dam for a particular duration, say 2 years, then the cost will increase with increasing plant throughput. However, the cost of the starter dam would be modest in relation to the overall project cost and, consequently, is not expected to have a major impact on the selection of the plant capacity.

6.6 Water Consumption

The only limitation on the quantity of water for the Project is based on the amount of water that the Kingsmill Tunnel produces. Based on the water supply requirement calculations, the project will have sufficient water from the Kingsmill Tunnel to fulfill the Project requirements.

6.7 Environmental/Permitting Limitations

The environmental and permitting issues increase with the growth in the plant throughput due to the additional discharge of gases, solids and liquids, among others.

Table 6-1
Toromocho Concentrator Capacity Comparison Matrix

(values in $000's or 000's unless noted)

	Capacity Options, t/d				
Factor	65,000	77,000	92,000	130,000	100,000
SAG Mill Diameter, ft	36	38	40	36	40
Copper Production, t/a	107.6	127.1	152.2	215.4	165.6
Molybdenum Production, t/a	2.5	2.9	3.5	5.0	3.8
Mine Life, years	33	30	24	19	23
Mill Life, years	40	34	29	21	27
Capital Cost MUSD*	1,265.9	1,407.7	1,491.1	1,782.4	1,495.2
Operating Cost MUSD/a	107.1	125.5	147.5	206.1	159.2
Financial Rate of Return, %	12.9	12.7	13.6	13.6	14.5
NPV @ 10% MUSD	264.1	266.0	364.4	401.9	467.5
Financing Capability	Easiest	Medium	Medium	Most difficult	Medium
Constructability	Easiest	Medium	Medium	Most difficult	Medium
Transportation Limitations	Easiest	Medium	Medium	Most difficult	Medium
Tailings Capacity	Smallest	Medium	Medium	Largest	Medium
Water Supply Requirement, m^3/d	21,500	25,400	29,500	42,700	32,000
Environmental/Permitting Limitations	Medium	Medium	Medium	Most difficult	Medium

* The capital cost includes Working Capital
The IRRs and NPVs are based on the following metal prices:

Copper Price, US¢/lb	1.30
Moly Price, US¢/lb	13.00
Silver Price, USD/oz	6.50

002521

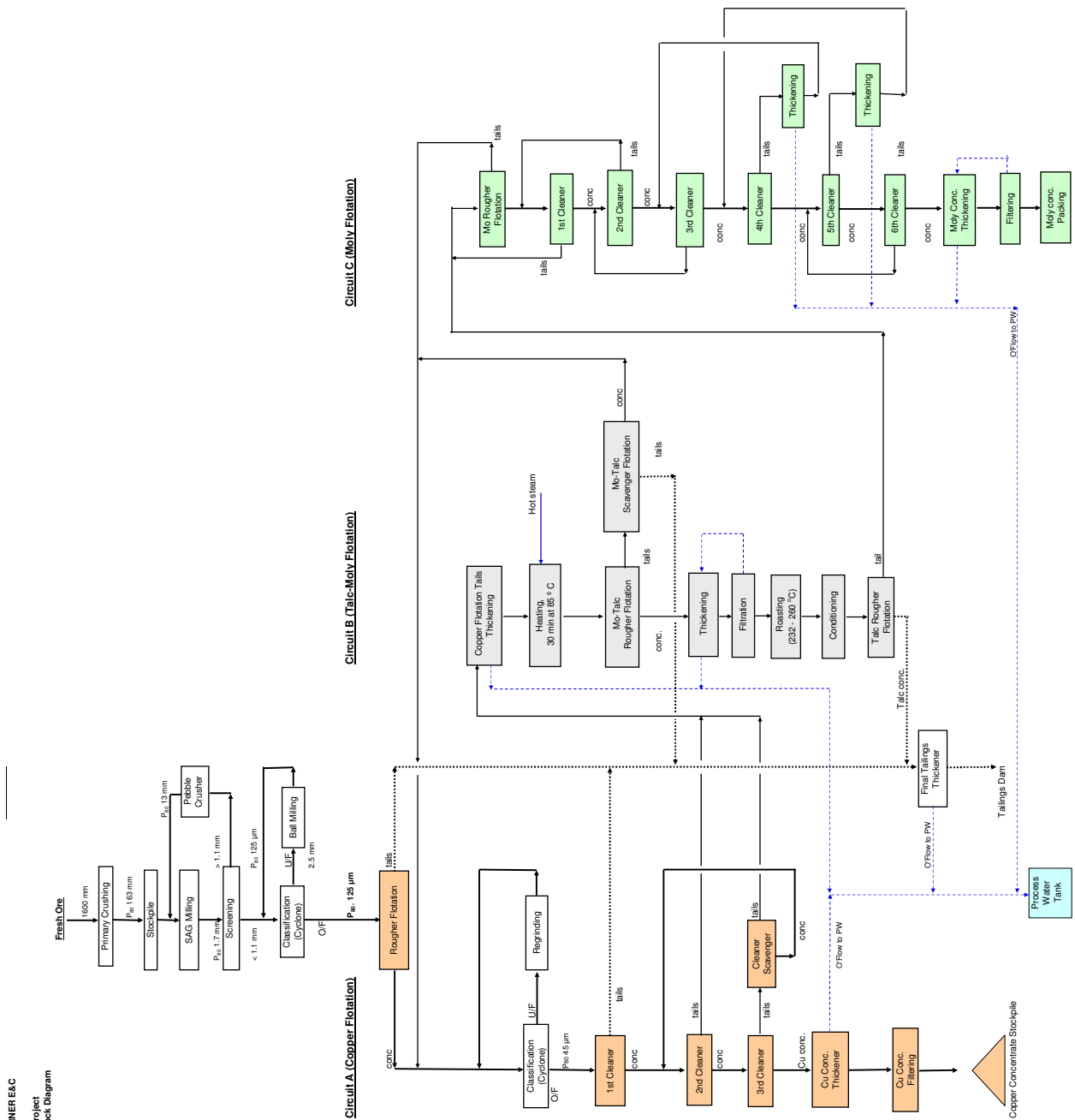
7.0 CONCLUSIONS

From a review of the information in Table 6-1, it can be seen that the 40-ft dia option offers the best financial return on the project and is intermediate with regard to all the other factors that have been considered. Also, if the throughput can be increased to approximately 100,000 t/d, then the IRR and NPV improve noticeably as well. Consequently, this option has been selected as the optimum for using as the basis for the execution of the DFS.

8.0 RECOMMENDATIONS

It is recommended that the design of the concentrator for the DFS be based on the use of a single grinding line with a 40-ft dia SAG mill. The latest grinding testwork results show that a capacity of 100,000 t/d should be achievable with this circuit.

Appendix A
Drawings


AKER KVAERNER E&C
Toromocho Project
Flowsheet Block Diagram
Fresh Ore
1600 mm
Primary Crushing
P80 163 mm
Stockpile
SAG Milling
P80 13 mm
Pebble Crusher
P80 1.7 mm
Screening
> 1.1 mm
< 1.1 mm
P80 125 µm
Classification (Cyclone)
U/F
Ball Milling
2.5 mm
O/F
P80 125 µm
Circuit A (Copper Flotation)
Rougher Flotation
tails
conc
Regrinding
Classification (Cyclone)
U/F
O/F
P80 45 µm
1st Cleaner
tails
conc
2nd Cleaner
tails
conc
3rd Cleaner
tails
conc
Cleaner Scavenger
tails
conc
Cu conc.
Cu Conc. Thickener
Cu Conc. Filtering
Copper Concentrate Stockpile
O'Flow to PW
Circuit B (Talc-Moly Flotation)
Copper Flotation Tails Thickening
Heating, 30 min at 85 ° C
Hot steam
Mo-Talc Rougher Flotation
conc.
tails
Mo-Talc Scavenger Flotation
conc
tails
Thickening
Filtration
Roasting (232 - 260 °C)
Conditioning
Talc Rougher Flotation
tail
Talc conc.
Final Tailings Thickener
O'Flow to PW
Tailings Dam
Process Water Tank
Circuit C (Moly Flotation)
Mo Rougher Flotation
tails
tails
1st Cleaner
conc
tails
2nd Cleaner
conc
tails
3rd Cleaner
conc
tails
4th Cleaner
conc
Thickening
tails
5th Cleaner
conc
Thickening
tails
6th Cleaner
conc
tails
Moly Conc. Thickening
Filtering
Moly conc. Packing
O'Flow to PW

DRAWING NO. 220-F-001

REFERENCE FILES:

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LEGEND:
- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

RECIRCULATING PEBBLE
220-F-002

CRUSHED COARSE ORE
200-F-001

BELT SCALE
220-SL-001

PEBBLE RECIRCULATING CONVEYOR DISCHARGE CHUTE
220-CH-032

SAG MILL FEED CONVEYOR
220-CV-001

SAG MILL FEED CONVEYOR DISCHARGE CHUTE
220-CH-001

TRANSFER CONVEYOR DISCHARGE CHUTE
220-CH-006

TRANSFER CONVEYOR
220-CV-003

SAG MILL BIN CONVEYOR DISCHARGE CHUTE
220-CH-004

SAG MILL BALL BIN CONVEYOR
220-CV-002

BELT SCALE
220-SL-002

SAG MILL BALL BIN DISCHARGE CHUTE
220-CH-002

SAG MILL BALL BIN
220-BN-001

MILK OF LIME
270-F-001

GRINDING AREA OVERHEAD CRANE
220-CN-001

SAG MILL FEED CHUTE
220-CH-002

SAG MILL
220-ML-001

SAG TROMMEL SCREEN
220-SN-001

SAG TROMMEL U/S DISCHARGE CHUTE
220-CH-011

SAG TROMMEL O/S DISCHARGE CHUTE
220-CH-010

SAG MILL SCREEN OVERSIZE CHUTES
220-CH-005/006

SAG MILL SCREENS
220-SN-002/003

SAG MILL SCREEN UNDERSIZE CHUTES
220-CH-012/013

TO BALL MILL CYCLONE FEED PUMPBOX
220-F-003

PEBBLE COLLECTOR CONVEYOR
220-CV-004

PEBBLE COLLECTOR CONVEYOR DISCHARGE CHUTE
220-CH-015/015

TO PEBBLE CRUSHER
220-F-002

PEBBLE TRANSFER CONVEYOR
220-CV-005

SELF CLEANING ELECTROMAGNET
220-MA-001

METAL DETECTOR
220-MD-001

PRELIMINARY

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THIS DRAWING IS NOT VALID UNLESS THE LATEST REVISION INITIALS ARE HANDWRITTEN

REVISIONS NO	DESCRIPTION	BY	CHK'D	APPROVED	DATE
1	ISSUED FOR PRELIMINARY FEASIBILITY REPORT	RLA			NOV06

PREPARATION	BY	DATE	APPROVALS	BY	DATE
DESIGN			PROCESS		
DRAWN	RLA	NOV06	ENGINEERING		
CHECKED			PROJECTS		
ACCEPTED			CLIENT		

ISSUE RECORD

CURRENT ISSUE FOR:		
ISSUE	REV.	DATE
CLIENT APP'L		
QUOTATION		
CONSTRUCTION		

CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: SAG MILL AREA FLOW SHEET

SCALE NONE | PROJ. NO. 180600 | REVISION A

DRAWING NO. DWG- 220-F-001

COPPER CLEANER SCAVENGER TAILS

2ND COPPER CLEANER TAILS

COPPER FLOTATION TAILS THICKENER

O/F TO PW

FILTRATE RETURN PUMP

PRESSURE FILTER

HOT STEAM

STORAGE TANK

MOLY-TALC ROUGHER CELLS

MOLY-TALC SCAVENGER CLEANER CELLS

TO FINAL TAILINGS THICKENER

TO REGRIND MILL CYCLONE PUMPBOX

CONCENTRATE

THICKENER

O/F TO PW

FILTRATE RETURN PUMP

PRESSURE FILTER

ROTARY KILN

CONDITIONING TANK

TALC ROUGHER CELLS

TALC CONCENTRATE

MOLY ROUGHER CELLS

TO REGRIND MILL CYCLONE PUMPBOX

MOLY 1ST CLEANER COLUMN

TO FINAL TAILING THICKENER

DRAWING NO. 000-F-001

MOLY 2ND CLEANER COLUMN

MOLY 3RD CLEANER COLUMN

MOLY 4TH CLEANER COLUMN

MOLY 5TH CLEANER COLUMN

MOLY 6TH CLEANER COLUMN

THICKENER

O/F TO PW

INTERMEDIATE THICKENER

O/F TO PW

INTERMEDIATE THICKENER

O/F TO PW

KEY PLAN

TO MOLY CONC. PACKING

PRELIMINARY

LEGEND:

- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

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ISSUE RECORD

CURRENT ISSUE FOR:		
ISSUE	REV.	DATE
CLIENT APP'L		
QUOTATION		
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CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: OVERALL FLOW DIAGRAM

SCALE | PROJ. NO. 180600 | REVISION

DRAWING NO. DWG-000-F-002

REFERENCE FILES:

J:\CadPro\180600\FLOW\Flow.dwg\0000002.806 15/12/2006 3:53:41 PM ctc0736 Rev. 11Aug05 AKA180R.DGN

DUMP HOOPER
TRANSFER CONVEYOR
OVERLAND CONVEYOR #1
OVERLAND CONVEYOR #2
COURSE ORE STOCKPILE
CONVEYOR
SAG MILL
TROMMEL SCREEN
SAG SCREENS
O/S
U/S
CONVEYOR
RECIRCULATING CONVEYOR
BIN
BELT FEEDER
PEBBLE CRUSHER (2)
COPPER CONCENTRATE THICKENER
TO PROCESS WATER TANK
PRESSURE FILTER
FILTRATE RETURN PUMP
COPPER CONC. STOCKPILE
CYCLONE CLUSTERS
CYCLONE CLUSTERS
BALL MILL
BALL MILL
COPPER ROUGHER FLOTATION CELLS (28)
TALC ROUGHER CONC
MOLY-TALC SCAV ROUGHER TAI
FINAL TAILINGS THICKENER
TO PROCESS WATER TAN
TO TAILINGS DA
3rd COPPER CLEANER FLOTATION COLUMNS (5)
MOLY TALC SCAV. CONC.
MOLY ROUGHER TAILS
PUMP
PUMPBOX
PUMP
2nd COPPER CLEANER FLOTATION COLUMNS (7)
COPPER CLEANER SCAVENGER CELLS
1st COPPER CLEANER FLOTATION CELLS
CYCLONE CLUSTERS
REGRIND MILL PACKAGES
TO COPPER FLOTATION TAILS THICKENER
2nd COPPER CLEANER TAILS

LEGEND:
- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

PRELIMINARY

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CONSTRUCTION		

AKER KVÆRNER™
E&C Division
Toronto Canada

CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: OVERALL FLOW DIAGRAM

SCALE NONE | PROJ. NO. 180600 | REV A

DRAWING NO. DWG- 000-F-001

DRAWING NO. 200-F-001

REFERENCE FILES:

J:\CadProj\180600\FLOWFlow.dwg\200100.806 15/12/2006 4:00:13 PM ct00736 Rev. 11Aug05 AK41BDR.DGN

PRIMARY CRUSHING AREA BAGHOUSE 200-DC-002

FROM PICK UP POINTS

DUST ROTARY VALVE 200-ZM-001

FROM PIT

PRIMARY CRUSHER OVERHEAD CRANE 200-CN-001

MONORAIL CRANE 200-CN-002

ROCK BREAKER 200-RB-001

DUMP HOPPER 200-BN-001

PRIMARY CRUSHER 200-CR-001

PRIMARY CRUSHER DUST SUPPRESSION SYSTEM 200-DC-001

PRIMARY CRUSHING AREA AIR COMPRESSOR 200-GC-001

PRIMARY CRUSHER DISCHARGE CHUTE 200-CH-001

PRIMARY CRUSHER DISCHARGE FEEDER 200-FE-001

IRON REMOVAL MAGNET 200-MA-001

PRIMARY CRUSHER DISCHARGE FEEDER CHUTE 200-CH-002

TRASH BIN 200-BN-002

CRUSHED ORE TRANSFER CONVEYOR 200-CV-001

CRUSHED ORE TRANSFER CONVEYOR DISCHARGE CHUTE 200-CH-003

CRUSHED ORE TRANSFER CONVEYOR#1 DISCHARGE CHUTE 200-CH-004

CRUSHED ORE OVERLAND CONVEYOR #1 200-CV-002

CRUSHED ORE OVERLAND CONVEYOR #2 200-CV-003

FRESH WATER 280-F-001

BELT SCALE 200-SL-001

OVERLAND CONVEYOR #2 DISCHARGE CHUTE 200-CH-005

COARSE ORE STOCKPILE 210-ST-001

COARSE ORE STOCKPILE DUST SUPPRESSION SYSTEM 210-DC-001

HP PLANT AIR 290-F-001

COARSE ORE STOCKPILE DISCHARGE CHUTES 210-CH-001/002/003

COARSE ORE STOCKPILE DISCHARGE BELT FEEDERS 210-FE-001/002/003

BELT FEEDERS DISCHARGE CHUTES 210-CH-005/006/007

TO SAG MILL 220-F-001

SAG MILL FEED CONVEYOR 220-CV-001

LEGEND:

- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

PRELIMINARY

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QUOTATION		
CONSTRUCTION		

CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: PRIMARY CRUSHING AREA FLOW SHEET

AKER KVÆRNER™ E&C Division Toronto Canada

SCALE NONE | PROJ. NO. 180600 | REVISION A

DRAWING NO. DWG- 200-F-001

DRAWING NO. 270-F-003

FRESH WATER
280-F-001

FLOCCULANT IN BAGS
HYCHEMAF.302

FLOCCULANT HYCHEM AF.302
MIXING SYSTEM
270-FT-001
(VENDORS's PACKAGE)

DRY FLOCCULANT
DOSING UNIT

WETTING
UNIT

MIXING
TANK

FLOCCULANT
TRANSFER PUMP

FLOCCULANT
STORAGE TANK

FLOCCULANT
METERING PUMPS

TO COPPER CONCENTRATE THICKENER
230-F-002

TO COPPER FLOTATION TAILS THICKENER
250-F-001

TO MOLY-TALC CONCENTRATE THICKENER
250-F-001

TO 4th MOLY CLEANER TAILINGS THICKENER
250-F-002

TO 5th MOLY CLEANER TAILINGS THICKENER
250-F-002

TO MOLY CONCENTRATE THICKENER
250-F-003

TO FINAL TAILINGS THICKENER
260-F-001

LEGEND:
- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

PRELIMINARY

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Toronto Canada

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CLIENT/PROJECT
TOROMOCHO COPPER
PROJECT-DFS

TITLE
PLANT REAGENT AREA
FLOW SHEET SHT 2 OF 2

SCALE NONE | PROJ. NO. 180600 | REVISION

DRAWING NO.
DWG- 270-F-003

REVISION A

AKA1BDR.DGN Rev. 11Aug05 ctc0736

DRAWING NO. 270-F-002

PROCESS WATER
280-F-001

REAGENT AREA
MONO RAIL HOIST
270-HS-001

XANTHATE EXHAUST FAN
270-FN-001

XANTHATE
(PAX)

XANTHATE MIXING TANK & AGITATOR
270-TK-004
270-AG-004

XANTHATE TRANSFER PUMP
270-PP-004

XANTHATE HOLDING TANK
270-TK-005

XANTHATE HOLDING TANK PUMPS
270-PP-005
270-PP-105

XANTHATE DAY TANK
270-TK-006

XANTHATE METERING PUMPS
270-PP-201 TO
270-PP-206

TO BALL MILL
220-F-003

TO ROUGHER FLOTATION AREA
230-F-001

TO 1st CLEANER FLOTATION AREA
230-F-002

ATM.

MIBC EXHAUST FAN
270-FN-002

MIBC TRANSFER PUMP
270-PP-010

FROTHER MIBC DELIVERY ISOTAINER

MIBC HOLDING TANK
270-TK-011

MIBC HOLDING TANK PUMPS
270-PP-011
270-PP-111

MIBC DAY TANK
270-TK-012

MIBC METERING PUMPS
270-PP-210
270-PP-213

TO ROUGHER FLOTATION AREA
230-F-001

TO 1st CLEANER FLOTATION AREA
230-F-002

TO COPPER 2nd CLEANER AREA
230-F-003

REFERENCE FILES:

POTABLE WATER
280-F-001

REAGENT AREA
SAFETY SHOWERS &
EYEWASH STATIONS
270-ES-001/101
270-ES-002/102

AM-238
COLLECTOR
DELIVERY ISOTAINER

AF 238
TRANSFER PUMP
270-PP-018

AMINO DTP
HOLDING TANK
270-TK-019

AF 238
HOLDING TANK PUMP
270-PP-019
270-PP-119

AF 238
DAY TANK
270-TK-020

AMINO DTP
METERING PUMPS
270-PP-220 TO
270-PP-224

TO SAG MILL
220-F-001

TO ROUGHER FLOTATION AREA
230-F-001

TO 1st CLEANER FLOTATION AREA
230-F-001

REAGENT AREA
FORKLIFT
270-ZM-001

REAGENT AREA
WEIGH SCALE
270-WE-001

ATM.

SPARE
EXHAUST FAN
6300-FN-004

CMC
BULK BAG

CMC MIXING TANK & AGITATOR
270-TK-025
270-AG-025

CMC
TRANSFER PUMP
270-PP-025

CMC
HOLDING TANK
270-TK-026

CMC TANK
HOLDING PUMPS
270-PP-026
270-PP-126

CMC
DAY TANK
270-TK-027

CMC
METERING PUMP
270-PP-227 TO
270-PP-229

TO COPPER 2nd CLEANER FLOTATION AREA
230-F-003

REAGENT AREA
SUMP PUMP
270-PP-043/044

LEGEND:
- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

PRELIMINARY

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CLIENT/PROJECT
TOROMOCHO COPPER PROJECT-DFS

TITLE
PLANT REAGENT AREA FLOW SHEET SHT 1 OF 2

SCALE NONE | PROJ. NO. 180600 | REVISION
DRAWING NO.
DWG- 270-F-002
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Rev.. 11Aug05

AKA1BDR.DGN

FROM PEBBLE TRANSFER CONVEYOR
220-F-001

PEBBLE TRANSFER CONVEYOR DISCHARGE CHUTE
220-CH-017

PEBBLE CRUSHER FEED BIN
220-BN-002

PEBBLE FEED BIN DISCHARGE CHUTE
220-CH-020

PEBBLE FEED BIN DISCHARGE CHUTE
220-CH-021

PEBBLE CRUSHER FEEDER
220-FE-001

PEBBLE CRUSHER FEEDER
220-FE-002

PEBBLE CRUSHER FEEDER DISCHARGE CHUTE
220-CH-024

PEBBLE CRUSHER FEEDER DISCHARGE CHUTE
220-CH-025

PEBBLE CRUSHER
220-CR-001

PEBBLE CRUSHER
220-CR-002

PEBBLE CRUSHER DISCHARGE CHUTE
220-CH-028

PEBBLE CRUSHER DISCHARGE CHUTE
220-CH-029

PEBBLE RECIRCULATING CONVEYOR
220-CV-006

TO SAG MILL
220-F-001

LEGEND:
- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

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Toronto Canada

CLIENT/PROJECT
TOROMOCHO COPPER PROJECT-DFS

TITLE
PEBBLE CRUSHING AREA FLOW SHEET

SCALE NONE | PROJ. NO. 180600 | REVISION

DRAWING NO.
DWG- 220-F-002

A

DRAWING NO. 250-F-001

COPPER CONCENTRATE THICKENER FLOCCULANT IN-LINE MIXER 250-MX-001
FLOCCULANT 270-F-003
COPPER CLEANER SCAVENGER TAILS 230-F-004
2nd COPPER CLEANER TAILS 230-F-003
COPPER TAILINGS THICKENER PUMPBOX 230-F-TK-028
COPPER TAILINGS THICKENER FEED PUMP 230-PP-026/126
COPPER TAILS THICKENER FEED SAMPLER 230-SA-003
COPPER FLOTATION TAILS THICKENER 250-TK-001
COPPER FLOTATION TAILS THICKENER O/F PUMPBOX 250-TK-002
O/F TO PW
THICKENER O/F PUMP 250-PP-002/102
COPPER TAILS THICKENER U/F PUMP 250-PP-004/104
HOT STEAM FROM BOILER(L.P)
COPPER TAILS STORAGE TANK AGITATORS 250-AG-004 TO AG-006
HOT STEAM
COPPER TAILS STORAGE TANK 250-TK-004 TO 006
250-TK-008
250-PP-008/108
MOLY-TALC ROUGHER CELLS 250-FO-001 to FO-004
MOLY-TALC SCAV FEED PUMPBOX 250-TK-010
MOLY-TALC SCAV FEED PUMP 250-PP-010/110
MOLY-TALC SCAVENGER CELLS 250-FO-008 to 009
MOLY-TALC SCAV.TAIL PUMPBOX 250-TK-012
MOLY-TALC SCAV.TAIL PUMP 250-PP-012/112
TO FINAL TAILINGS THICKENER 260-F-001
CONCENTRATE
TO MOLY ROUGHER TAILINGS PUMPBOX 250-F-002
MOLY TALC CONC. THICKENER FEED PUMPBOX 250-TK-014
MOLY TALC CONC. THICKENER FEED PUMP 250-PP-014/114

COPPER CONCENTRATE THICKENER FLOCCULANT IN-LINE MIXER 250-MX-002
FLOCCULANT 270-F-003
MOLY TALC CONC. THICKENER 250-TM-016
THICKENER O/F TANK 250-TK-018
O/F TO PW
THICKENER O/F PUMP 250-PP-018/118
U/F PUMP 250-PP-016/116
MOLY TALC CONC FILTER 250-FL-001/002/102
FILTRATE RETURN PUMP 250-PP-022/122
MOLY TALC CONC FILTER DISCHARGE CHUTE 250-CH-004
MOLY TALC CONC STORAGE TANK 250-TK-020
FILTER FEED PUMP 250-PP-020/120
MOLY TALC CONC. ROTARY KILN 250-KN-001/002
TALC RO. FEED PUMP 250-PP-026/126
MOLY TALC CONC STORAGE TANK 250-TK-026
TALC ROUGHER FLOTATION CELLS 250-FO-012 TO 250-FO-015
TALC CONCENTRATE
TALC RO. TAILS PUMPBOX 250-TK-030
TALC RO. TAILS PUMP 250-PP-030/130
TO MOLY ROUGHER FEED PUMPBOX 250-F-002
TALC ROUGHER CONC. PUMPBOX 250-TK-028
TALC ROUGHER CONC. PUMP 250-PP-028
TO FINAL TAILING THICKENER 260-F-001
COPPER TAILINGS SUMP PUMP 250-PP-012

LEGEND:
- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

PRELIMINARY

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CONSTRUCTION		

CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: MOLY- TALC FLOTATION AREA FLOW SHEET

SCALE NONE | PROJ. NO. 180600 | REVISION A

DRAWING NO. DWG- 250-F-001

REFERENCE FILES:

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DRAWING NO. 250-F-002

MOLY-TALC SCAV CONC.
250-F-001

TALC ROUGHER TAILS
250-F-001

MOLY RO. FEED PUMPBOX 250-TK-032

250-PP-032/132

MOLY ROUGHER FEED SAMPLER 250-SA-001

MOLY ROUGHER CELLS 250-FO-018 TO FO-023

MOLY RO. TAILS PUMP 250-PP-034/134

MOLY RO. TAILS PUMPBOX 250-TK-034

TO REGRIND MILL CYCLONE PUMPBOX 230-F-001

1st MOLY CL. FEED PUMP 250-PP-036/136 250-FO-026

1st MOLY CL. FEED PUMPBOX 250-TK-036

MOLY 1st CLEANER COLUMN 250-FO-026

MOLY 2nd CLEANER COLUMN 250-FO-028

MOLY 3rd CLEANER COLUMN 250-FO-030

MOLY 4th CLEANER COLUMN 250-FO-032

MOLY 5th CLEANER COLUMN 250-FO-034

MOLY 6th CLEANER COLUMN 250-FO-036

TO MOLY CONC. HANDLING 250-F-003

POTABLE WATER 280-F-001

SHOWER &SAFETY EYE WASH STATION 250-ES-001/101 TO ES 003/103

MOLY 2nd CL. PUMP 250-PP-038/138

MOLY 2nd CLEANER FEED PUMPBOX 250-TK-038

3rd CL. FEED PUMPBOX 250-TK-040

3rd CL.FEED PUMP 250-PP-040/140

4th CL. FEED PUMPBOX 250-TK-042

4th CL.FEED PUMP 250-PP-042/142

5th CL. FEED PUMPBOX 250-TK-052

5th CL.FEED PUMP 250-PP-052/152

6th CL. FEED PUMPBOX 250-TK-062

6th CL.FEED PUMP 250-PP-062-162

FROM COLUMN AIR COMPRESSOR 290-F-001

4th MOLY CLEANER TAIL THICKENER FLOCCULANT IN-LINE MIXER 250-MX-003

FLOCCULANT 270-F-003

4th CL. TAILS THICKENER FEED PUMP 250-PP-044/144

4th CL.TAILS THK.FEED PUMPBOX 250-TK-044

5th CL.TAILS THK.FEED PUMP 250-PP-054/154

5th CL.TAILS PUMPBOX 250-TK-054

5th MOLY CLEANER TAIL THICKENER FLOCCULANT IN-LINE MIXER 250-MX-004

FLOCCULANT 270-F-003

MOLY FLOTATION AREA SUMP PUMP 250-PP-067/068

MOLY 5th CL. THK O/F PUMPBOX 250-TK-060

MOLY 5th CL.TAILS THICKENER 250-TK-056

MOLY 5th CL. THK O/F PUMP 250-PP-060/160

TO PROCESS WATER TANK 280-F-001

MOLY 4th CL.THICKENER O/F PUMPBOX 250-TK-048

5th CL.TAILS THICKENER U/F PUMP 250-PP-056/156

4th MOLY CL. THICKENER 250-TK-046

4th MOLY CL. THICKENER U/F PUMP 250-PP-046/146

4TH MOLY CL. THICKENER O/F PUMP 250-PP-048/148

TO PROCESS WATER TANK 280-F-001

LEGEND:

PRIMARY FLOW

SECONDARY FLOW

INTERMITTENT FLOW OR ALTERNATE FLOW

PRELIMINARY

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Toronto Canada

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CLIENT/PROJECT
TOROMOCHO COPPER PROJECT-DFS

TITLE
MOLY FLOTATION AREA FLOWSHEET

SCALE NONE | PROJ. NO. 180600 | REVISION A

DRAWING NO.
DWG- 250-F-002

AKA1BDR.DGN Rev. 11Aug05 cto0736

DRAWING NO. 250-F-003

MOLY CONC. THICKENER FLOCCULANT IN-LINE MIXER 250-MX-006

FLOCCULANT 270-F-003

6th MOLY CONC. 250-F-002

MOLY CONC THICKENER FEED PUMPBOX 250-TK-070

MOLY CONC. THICKENER FEED PUMP 250-PP-070/170

MOLY CONC. SAMPLER 250-SA-002

MOLY CONC. THICKENER 250-TK-072

MOLY CONC. THICKENER O/F PUMPBOX 250-TK-074

MOLY CONC. THICKENER O/F PUMPBOX 250-PP-074/174

TO PROCESS WATER TANK 280-F-001

POTABLE WATER 250-F-001

SHOWER &SAFETY EYE WASH STATION 250-ES-004/104

MOLY CONC. THICKENER SUMP PUMP 250-PP-080

U/F PUMP 250-PP-072/172

MOLY CONC. STORAGE TANK 250-TH-076

FILTER FEED PUMP 250-PP-076/176

MO CONC FILTER 250-FL-004/104

FILTRATE RETURN PUMP 250-PP-078/178

FILTRATE RETURN PUMPBOX 250-TK-078

MO CONC FILTER DISCHARGE CHUTE 250-CH-001

MOLY CONCENTRATE STOCKPILE

FRONT END LOADER 250-ZM-001

LEGEND:

- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

PRELIMINARY

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Toronto Canada

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CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: MOLY CONCENTRATE HANDLING AREA FLOWSHEET

SCALE NONE | PROJ. NO. 180600 | REVISION A

DRAWING NO. DWG- 250-F-003

AKA1BDR.DGN Rev. 11Aug05 ctc0736

270-F-001

PROCESS WATER
280-F-001

TO ATMOS.

AIR

EXHAUST FAN

BIN VENT

LIME SLAKING PACKAGE
270-LM-001

LIME SILO

3400t

LIME PNEUMATIC
CONVEYOR SYSTEM
270-CV-001

CALCINED LIME
FROM TRUCKS

AIR

BLOWER

DISCHARGER

LIME
WEIGH FEEDER

LIME FEEDER
DISCHARGE CHUTE

LIME SLAKING
TOWER MILL
FEED CONVEYOR

LIME SLAKING
BALL CHARGE
270-ZM-002

LIME SLAKING
TOWER MILL

RECYCLE
PUMPS (2)

RECYCLE
PUMPBOX

CYCLOPAC

CYCLONE FEED
PUMPBOX

CYCLONE VERTICAL
FEED PUMPS (2)

VENT

MILK OF LIME
HOLDING
TANK & AGITATOR
270-TK-001
270-AG-001

MILK OF LIME
LOOP PUMPS
270-PP-001
270-PP-101

TO SAG MILL
220-F-001

TO ROUGHER
FLOTATION AREA
230-F-001

TO 1st CLEANER
FLOTATION AREA
230-F-002

TO 2nd CLEANER
FLOTATION AREA
230-F-003

M

LIME AREA
SUMP PUMP
270-PP-042

PROCESS WATER TANK
280-F-001

LIME AREA
SAFETY SHOWER
270-ES-001/101

LEGEND:
- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

PRELIMINARY

AKA1BDR.DGN Rev. 11Aug05

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REVISIONS NO	DESCRIPTION	BY	CHK'D	APPROVED	DATE
A	ISSUED FOR INFORMATION	RLA			29/11/06

REVISIONS NO	DESCRIPTION	BY	CHK'D	APPROVED	DATE

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DESIGN		
DRAWN	RLA	29/11/06
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ACCEPTED		

APPROVALS	BY	DATE
PROCESS		
ENGINEERING		
PROJECTS		
CLIENT		

ISSUE RECORD

CURRENT ISSUE FOR:	REV.	DATE
ISSUE		
CLIENT APP'L		
QUOTATION		
CONSTRUCTION		

CLIENT/PROJECT
TOROMOCHO COPPER
PROJECT-DFS

TITLE
LIME SYSTEM
AREA FLOW SHEET

AKER KVÆRNER™
E&C Division
Toronto Canada

SCALE NONE | PROJ. NO. 180600

DRAWING NO.
DWG- 270-F-001

REVISION
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DRAWING NO: 220-F-003

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Rev. 11Aug05

AKA1BDR.DGN

TO ROUGHER FLOTATION
230-F-001

FLOTATION FEED SAMPLER
230-SA-001

BALL MILL CYCLONE CLUSTER
220-CY-001/003

BALL MILL CYCLONE CLUSTER
220-CY-002/004

BALL BIN
220-BN-003/004

BALL MILL BALLS CONVEYOR FEED CHUTES
220-CH-038-039

BALL MILL BALLS BIN CONVEYOR
220-CV-008

BALL MILL BALLS TRANSFER CONVEYOR #1
220-CV-009

BELT SCALE
220-SL-003

BALL MILL BALLS TRANSFER CONVEYOR #2
220-CV-010

MILK OF LIME
270-F-001

PROCESS WATER
280-F-001

BALL MILL FEED CHUTE
220-CH-034

BALL MILL FEED CHUTE
220-CH-035

BALL MILL DISCHARGE CHUTES
220-CH-046/047

BALL MILL
220-ML-002

BALL MILL
220-ML-003

SAG MILL SCREENS U/S
220-F-001

POTABLE WATER
280-F-001

GRINDING AREA SAFETY SHOWER & EYEWASH STATION
220-ES-001/101

BALL MILL CYCLONE FEED PUMPBOX
220-TK-001

BALL MILL CYCLONE FEED PUMPS
220-PP-001/101
220-PP-003-004

GRINDING AREA SUMP PUMP
220-PP-008/009

LEGEND:
- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

PRELIMINARY

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REVISIONS	NO	DESCRIPTION	BY	CHK'D	APPROVED		DATE
	1	ISSUED FOR PRELIMINARY FEASIBILITY REPORT	ELA				05/12/06

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ACCEPTED			CLIENT		

ISSUE RECORD	CURRENT ISSUE FOR:		
	ISSUE	REV.	DATE
	CLIENT APP'L		
	QUOTATION		
	CONSTRUCTION		

CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: GRINDING AREA FLOW SHEET

AKER KVÆRNER™ E&C Division
Toronto Canada

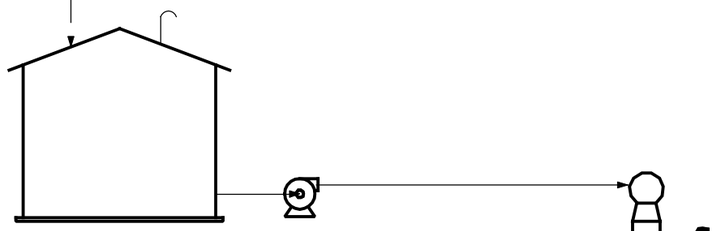
SCALE NONE | PROJ. NO. 180600 | REVISION

DRAWING NO. DWG- 220-F-003

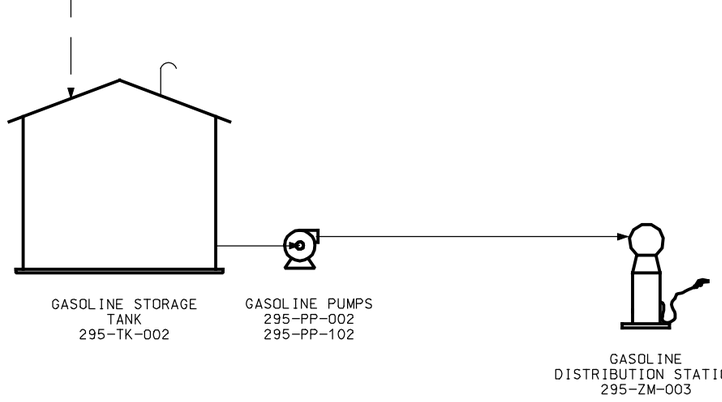
REVISION A

DRAWING NO. 295-F-001

DIESEL FROM TANK CAR



GASOLINE FROM TANK CARS



LEGEND:

- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

PRELIMINARY

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DRAWN	RLA	29/11/06	ENGINEERING		
CHECKED			PROJECTS		
ACCEPTED			CLIENT		

CURRENT ISSUE FOR:		
ISSUE	REV.	DATE
CLIENT APP'L		
QUOTATION		
CONSTRUCTION		

CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: FUELS AREA FLOW SHEET

AKER KVÆRNER™ E&C Division
Toronto Canada

SCALE NONE | PROJ. NO. 180600 | REVISION

DRAWING NO. DWG- 295-F-001

A

DRAWING NO. 260-F-001

COPPER ROUGHER TAIL
230-F-001

COPPER 1st CLEANER TAILS
230-F-002

MOLY TALC SCAV. TAIL
250-F-001

TALC ROUGHER CONC.
250-F-001

FINAL TAILINGS THICKENER FEED PUMPBOX
250-TK-001

FINAL TAILINGS SAMPLER
260-SA-001/101

FINAL TAILINGS THICKENER FEED PUMP
250-PP-001/101

FINAL TAILINGS THICKENER FLOCCULANT IN-LINE MIXER
250-MX-001

FLOCCULANT
270-F-003

FINAL TAILINGS THICKENER TANK
250-TK-004

FINAL TAILINGS THICKENER TANK
250-TK-005

FINAL TAILINGS THICKENER U/F PUMP
260-PP-005/105

CYCLONE FEED PUMPBOX
260-F-002

FINAL THICKENERS O/F PUMPBOX
260-TK-002

FINAL TAILING THICKENER O/F PUMP
260-PP-002/102

PROCESS WATER TANK
280-F-001

CYCLONE FEED PUMPBOX
260-F-002

PORTABLE WATER
250-F-001

FINAL TAILINGS AREA SAFETYSHOWER & EYE WASH STATION
260-ES-00/101

FINAL TAILINGS THICKENER U/F PUMP
260-PP-004/104

LEGEND:
- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

PRELIMINARY

AKER KVÆRNER™
E&C Division
Toronto Canada

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ACCEPTED			CLIENT		

ISSUE RECORD

CURRENT ISSUE FOR:		
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QUOTATION		
CONSTRUCTION		

CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: FINAL TAILINGS HANDLING AREA FLOWSHEET

SCALE NONE | PROJ. NO. 180600 | REVISION A

DRAWING NO. DWG- 260-F-001

AKA1BDR.DGN Rev. 11Aug05 ctc0736

DRAWING NO.
260-F-002

REFERENCE FILES:

ROUGHER TAILINGS
THICKENER U/F
260-F-001

TAILINGS CYCLONES
260-CY-001 TO 008
260-CY-101 TO 104

TAILINGS CYCLONE
FEED PUMPBOX
260-TK-001

TAILINGS CYCLONE
FEED PUMPS
260-PP-001/101

FINAL TAILINGS POND

ROUGHER TAILINGS POND
WATER RECLAIM PUMPS
260-PP-004/104

PROCESS WATER TANK
280-F-001

LEGEND:

- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

PRELIMINARY

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ISSUE RECORD	CURRENT ISSUE FOR:	REV.	DATE
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	CLIENT APP'L		
	QUOTATION		
	CONSTRUCTION		

CLIENT/PROJECT
TOROMOCHO COPPER PROJECT-DFS

TITLE
TAILINGS DISPOSAL AREA FLOW SHEET

SCALE NONE | PROJ. NO. 180600 | REVISION

DRAWING NO.
DWG-260-F-002

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DRAWING NO. 230-F-001

BALL MILL CYCLONES O/F
220-F-003

MIBC FROTHER
270-F-002

DIESEL
295-F-001

MILK OF LIME
270-F-001

FLOTATION AIR BLOWER
230-GB-001/101

COPPER ROUGHER FLOTATION FEED PUMPBOX
230-TK-001

COPPER ROUGHER FLOTATION FEED PUMPS
230-PP-001/101/002

SPLITTER BOX

COPPER ROUGHER FLOTATION CELLS
230-FO-001 TO FO-007

COPPER ROUGHER FLOTATION CELLS
230-FO-008 TO FO-014

SPLITTER BOX

COPPER ROUGHER FLOTATION CELLS
230-FO-015 TO FO-021

COPPER ROUGHER FLOTATION CELLS
230-FO-022 TO 230-FO-028

ROUGHER FLOTATION AREA OVERHEAD CRANE
230-F-001

PROCESS WATER
280-F-001

FLOCCULANT
270-F-003

COPPER ROUGHER TAILS SAMPLER
230-SA-001

COPPER ROUGHER TAILINGS THICKENER FLOCCULANT IN-LINE MIXER
230-MX-001

COPPER ROUGHER TAILINGS THICKENER FEED PUMPBOX
230-TK-004

TO TAILINGS THICKENER
260-F-001

COPPER ROUGHER TAILINGS
230-PP-004/104

TO COPPER 1st CLEANER FLOTATION
230-F-002

REGRIND MILL CYCLONE CLUSTERS
230-CY-001 TO CY-003

REGRIND MILL BALL BIN
230-BN-001

REGRIND MILL BALL BUCKET
230-BN-002

REGRIND MILL PACKAGES
230-ML-001 TO 230-ML-006

MOLY ROUGHER TAILS
250-F-002

REGRIND CYCLONE FEED PUMPBOX
230-TK-006

REGRIND CYCLONE FEED PUMPS
230-PP-006/106 230-PP-007/008

LEGEND:
- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

PRELIMINARY

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E&C Division
Toronto Canada

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CURRENT ISSUE FOR:

ISSUE	REV.	DATE
CLIENT APP'L		
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CONSTRUCTION		

CLIENT/PROJECT: TOROMOCHO COPPER FLOW SHEET

TITLE: COPPER ROUGHER FLOTATION AREA FLOW SHEET

SCALE NONE | PROJ. NO. 180600 | REVISION A

DRAWING NO. DWG-230-F-001

AK41BDR.DGN Rev. 11Aug05

DRAWING NO. 240-F-001

COPPER CONCENTRATE
230-F-004

FLOTATION COPPER CONCENTRATE SAMPLER
240-SA-001

PROCESS WATER
280-F-001

FLOCCULANT
270-F-003

COPPER CONCENTRATE THICKENER FLOCCULANT IN-LINE MIXER
240-MX-001

COPPER CONCENTRATE THICKENER O/F PUMPBOX
240-TK-002

TO PROCESS WATER TANK
280-F-001

COPPER CONCENTRATE THICKENER TANK & MECHANISM
240-TK-001
240-TM-001

CONCENTRATE THICKENER O/F PUMPS
240-PP-002/102

COPPER CONCENTRATE THICKENER U/F PUMPS
240-PP-004/104

COPPER CONCENTRATE STORAGE TANK & AGITATOR
240-TK-006
240-AG-006

COPPER CONCENTRATE FILTERS
240-FL-001/002

COPPER CONCENTRATE FILTER FEED PUMPS
240-PP-006/106

POTABLE WATER
280-F-001

COMPRESSED AIR
290-F-001

COPPER CONCENTRATE FILTRATE RETURN PUMPS
240-PP-008/108

COPPER CONCENTRATE FILTRATE RETURN PUMPBOX
240-TK-008

CONCENTRATE THICKENER SAFETY SHOWER & EYEWASH STATION
240-ES-001/101

COPPER CONCENTRATE FILTER DISCHARGE CHUTE
240-CH-004

TRUCK

TBA

CONCENTRATE THICKENER SUMP PUMP
240-PP-014

COPPER CONCENTRATE STOCKPILE

FRONT END LOADER
240-ZM-001

LEGEND:

PRIMARY FLOW

SECONDARY FLOW

INTERMITTENT FLOW OR ALTERNATE FLOW

REFERENCE FILES:

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ISSUE RECORD	CURRENT ISSUE FOR:	REV.	DATE
	CLIENT APP'L		
	QUOTATION		
	CONSTRUCTION		

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CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: COPPER CONCENTRATE HANDLING AREA FLOW SHEET

SCALE NONE | PROJ. NO. 180600 | REVISION A

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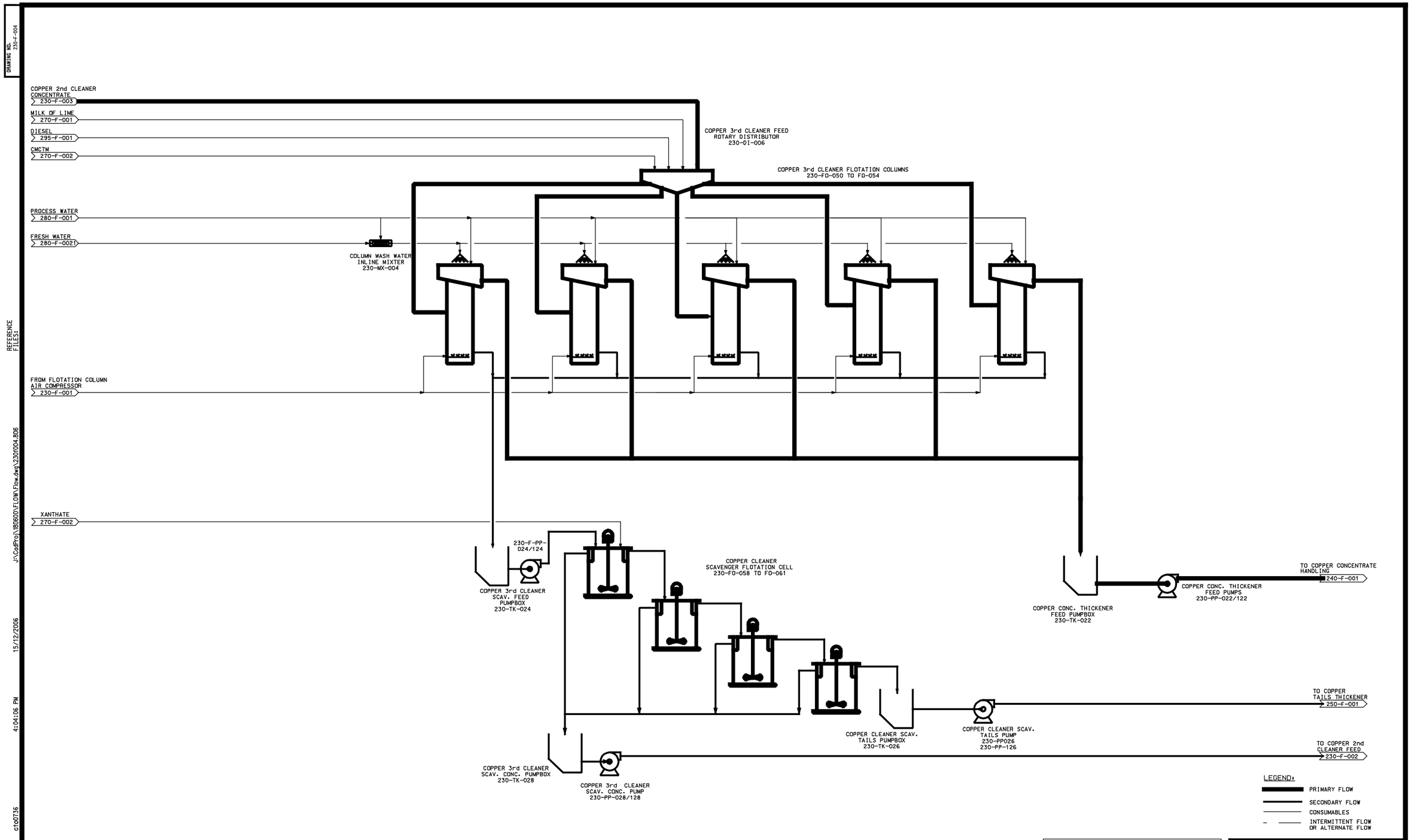

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CONSTRUCTION		

CLIENT/PROJECT
TOROMOCHO COPPER PROJECT-DFS

TITLE
COPPER 3rd CLEANER FLOTATION AREA FLOW SHEET

SCALE NONE | PROJ. NO. 180600 | REVISION A
DRAWING NO.
DWG- 230-F-004

DRAWING NO. 230-F-004
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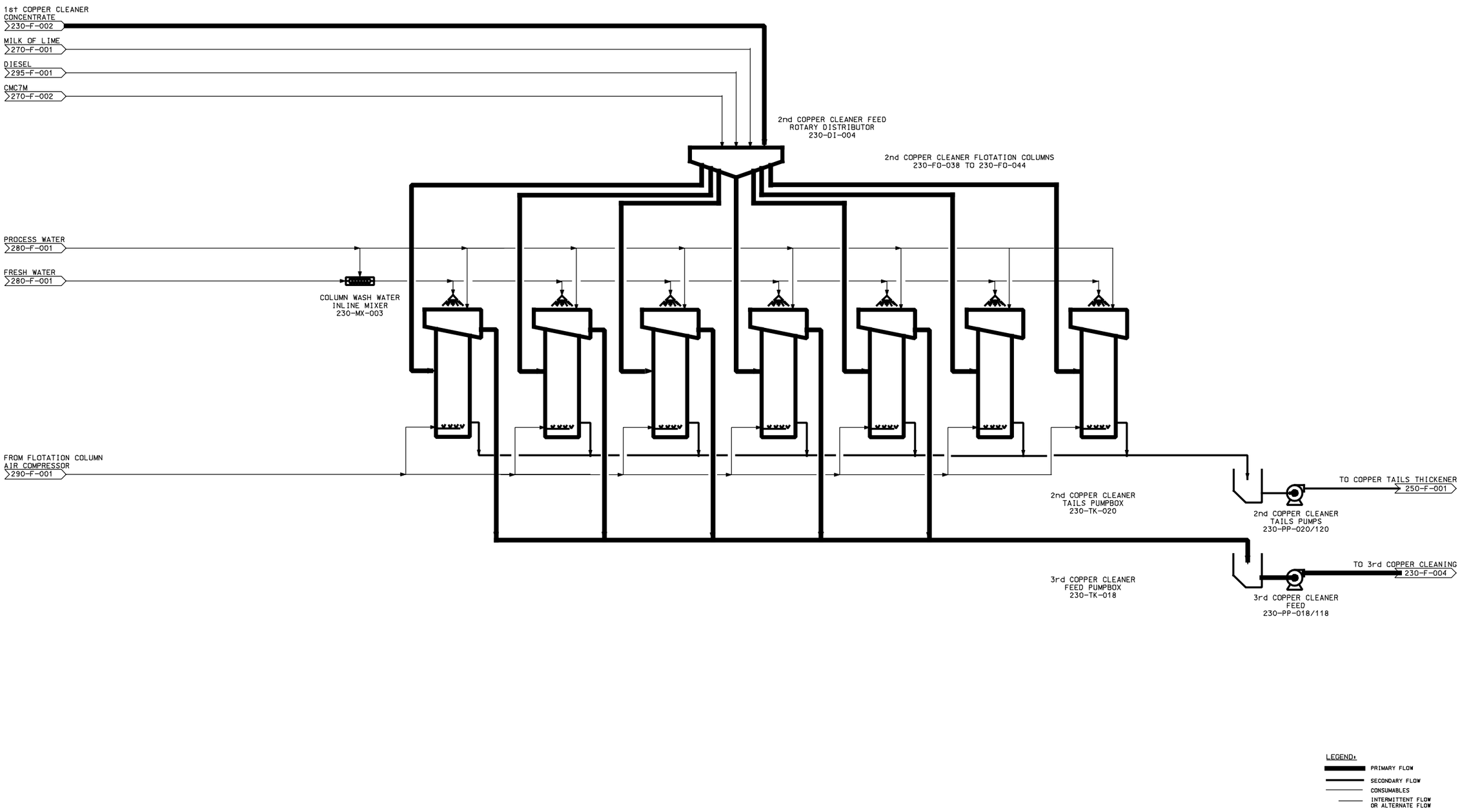

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ISSUE RECORD

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QUOTATION		
CONSTRUCTION		

CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: COPPER 2nd CLEANER FLOTATION AREA FLOW SHEET

SCALE

PROJ. NO. 180600

DRAWING NO. DWG- 230-F-003

REVISION A

DRAWING NO. 230-F-003

REFERENCE FILES:

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DRAWING NO.: 230-F-002

REGRIND CYCLONE O/F
220-F-001

2nd CLEANER TAILS
230-F-003

COPPER 1st CLEANER FEED PUMPBOX
230-TK-010

COPPER 1st CLEANER FEED PUMPS
230-PP-010/110

MILK OF LIME
270-F-001

MIBC FROTHER
270-F-002

COPPER 1st CLEANER FLOTATION CELLS
230-FO-020 TO FO-024

PROCESS WATER
280-F-001

POTABLE WATER
280-F-001

FLOTATION AREA SAFETY SHOWER & EYEWASH STATIONS
230-ES-001/101 TO 230-ES-003/103

FLOCCULANT
270-F-001

CLEANER TAILINGS THICKENER FLOCCULANT IN-LINE MIXER
230-MX-002

TO TAILINGS THICKENER
260-F-001

FROM FLOTATION AIR BLOWER
230-F-001

COPPER 1st CLEANER TAILS PUMP BOX
230-TK-014

COPPER 1st CLEANER TAILS PUMP
230-PP-014

COPPER 1st CLEANER TAILS SAMPLER
230-SA-002

COPPER 3rd CLEANER SCAVENGER CONC.
230-F-004

CMC7M
270-F-002

COPPER 2nd CLEANER FEED CONDITIONING TANKS
230-TK-012/013

TO COPPER 2nd CLEANER
230-F-003

COPPER 2nd CLEANER FEED. PUMP
230-PP-016/116

FLOTATION AREA SUMP PUMP
230-PP-024

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LEGEND:
- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

PRELIMINARY

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PROJECTS			
CLIENT			

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CURRENT ISSUE FOR:

ISSUE	REV.	DATE
CLIENT APP'L		
QUOTATION		
CONSTRUCTION		

CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: 1st COPPER CLEANER FLOTATION AREA FLOW SHEET

AKER KVÆRNER™ E&C Division
Toronto Canada

SCALE NONE | PROJ. NO. 180600 | REVISION A

DRAWING NO. DWG- 230-F-002

DRAWING NO: 290-F-001

REFERENCE FILES:

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Rev. 11Aug05

AK11BDR.DGN

HP PLANT
AIR COMPRESSOR PACKAGE
290-GC-001

COMPRESSOR

AIR INTAKE FILTER

AIR

AIR RECEIVER

TO COARSE ORE STOCKPILE DUST SUPPRESSION SYSTEM
200-F-001

TO HOSE STATIONS

COLUMN FLOTATION
AIR COMPRESSOR PACKAGES
290-GC-002 TO 290-GC-005

COMPRESSORS

INTAKE FILTERS

AIR

AIR RECEIVERS

TO 2nd & 3rd CLEANER FLOTATION CELLS
230-F-003

TO MOLY CLEANER FLOTATION CELLS
230-F-002

CONCENTRATE AIR
COMPRESSOR PACKAGES
290-GC-006 TO 290-GC-009

COMPRESSORS

INTAKE FILTERS

AIR

AIR RECEIVERS

TO PRESS FILTER
240-F-001

INSTRUMENT AIR
COMPRESSOR PACKAGE
290-GC-010

COMPRESSOR

INTAKE FILTER

AIR

AIR RECEIVER

INSTRUMENT
AIR DRYER
290-DR-001

TO INSTRUMENT AIR USERS

AIR

COPPER FLOTATION AIR BLOWERS
230-GB-002
230-GB-101

TO ROUGHER FLOTATION AREA
230-F-001

AIR

MOLY-TALC FLOTATION
AIR BLOWERS
250-GB-001-101

TO MOLY TALC FLOATATION AREA
250-F-001

LEGEND:

- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

PRELIMINARY

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DRAWN	RLA	29/11/06	ENGINEERING			
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ACCEPTED			CLIENT			

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ISSUE	REV.	DATE
CLIENT APP'L		
QUOTATION		
CONSTRUCTION		

CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: AIR SYSTEMS FLOW SHEET

SCALE NONE | PROJ. NO. 180600 | REVISION A

DRAWING NO. DWG-290-F-001

DRAWING NO. 280-F-001

COPPER CONCENTRATE THICKENER O/F
240-F-001

FINAL TAILINGS THICKENER O/F
260-F-001

COPPER FLOTATION TAILINGS THICKENER O/F
250-F-001

TAILINGS DAM RECLAIMED WATER
260-F-002

MOLY-TALC CONC. THICKENER O/F
250-F-001

4th MOLY CLEANER CONC. THICKENER O/F
250-F-002

5th MOLY CLEANER CONC. THICKENER O/F
250-F-002

MAKE UP WATER

PROCESS WATER RESERVOIR
280-TK-004

PROCESS WATERS PUMPS
280-PP-004
280-PP-104

HOSE STATION PUMPS
280-PP-006
280-PP-106

TO SAG MILL AREA
220-F-001

TO GRINDING AREA
220-F-003

TO COPPER FLOTATION AREA
230-F-001

TO COPPER CONCENT. HANDLING AREA
240-F-001

TO MOLY TALC. FLOTATION AREA
250-F-001

TO MOLY CONCENTRATE HANDLING AREA
250-F-003

TO LIME SLAKING
270-F-001

TO PLANT REAGENT AREA
270-F-002

TO HOSE STATIONS

TO CRUSHING AREA
CRUSHING AREA DUST SUPPRESSION SYSTEMS
200-F-001

TO FLOCCULANT MIXING
270-F-003

TO COPPER
2nd CLEANER FLOTATION AREA
230-F-003

TO GRINDING AREA SAFETY
SHOWER & EYEWASH STATION
220-F-003

TO COPPER FLOTATION AREA SAFETY
SHOWERS & EYEWASH STATIONS
230-F-002

TO TAILINGS HANDLING AREA SAFETY
SHOWER & EYEWASH STATIONS
260-F-001

TO CONCENTRATE HANDLING AREA SAFETY
SHOWER & EYEWASH STATION
240-F-001

TO REAGENT AREA SAFETY
SHOWERS & EYEWASH STATIONS
270-F-002

TO MOLY TALC.FLOTATION AREA SAFETY
SHOWERS & EYEWASH STATIONS
250-F-001

FRESH WATER
280-F-001

FRESH WATER
INTAKE PUMP

FRESH WATER
RESERVOIR
280-TK-001

FIRE RESERVE
WATER

FRESH WATER
PUMPS
280-PP-001
280-PP-101

GLAND WATER PUMPS
6200-PP-002/102
280-PP-003

POTABLE WATER
TREATMENT SYSTEM
280-WT-001

POTABLE
WATER TANK
280-TK-010

POTABLE WATER
SUPPLY PUMPS
280-PP-010
280-PP-110

TO GLAND WATER RING

TO FIRE WATER

DIESEL
DRIVEN PUMP

ELECTRIC
DRIVEN PUMP

FIRE WATER
JOCKEY PUMP

FIRE WATER PUMP
PACKAGE SYSTEM
280-FP-001

LEGEND:
- PRIMARY FLOW
- SECONDARY FLOW
- CONSUMABLES
- INTERMITTENT FLOW OR ALTERNATE FLOW

PRELIMINARY

REFERENCE FILES:

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REVISIONS	NO	DESCRIPTION	BY	CHK'D	APPROVED	DATE
	1	ISSUED FOR INFORMATION	RLA			05/12/06

PREPARATION	BY	DATE	APPROVALS	BY	DATE
DESIGN			PROCESS		
DRAWN	RLA	NOV29/06	ENGINEERING		
CHECKED			PROJECTS		
ACCEPTED			CLIENT		

ISSUE RECORD

CURRENT ISSUE FOR:		
ISSUE	REV.	DATE
CLIENT APP'L		
QUOTATION		
CONSTRUCTION		

CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: WATER MANAGEMENT PROCESS FLOW SHEET

AKER KVÆRNER™ E&C Division
Toronto Canada

SCALE NONE | PROJ. NO. 180600 | REVISION A

DRAWING NO. DWG- 280-F-001

Appendix B
Mass Balance

PROCESS FLOW MASS BALANCE

Aker Kvaerner

Nominal Feedrate - 92000 mtpd
Crushing/Conveying Availability = 80.0%
Concentrator Availability = 90.0%
Feed grade - 0.60% Total Cu
Feed grade - 0.027% Total Mo

TOROMOCHO COPPER-MOLY PROJECT
PRIMARY CRUSHING AND STOCKPILE CIRCUIT

Project No. 180600
Date 18/12/2006
Revision A

METALLURGICAL BALANCE

Str. No	Description	%Cu	% Mo	%Wt	Units	%Dist Overall		MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Slurry	Solids SG	% Sols by Wt	Slurry SG
	PRIMARY CRUSHER													
	Total - ROM Ore from Trucks	0.60	0.027	100.00	60.00	100.00		4600.0	142.3	4742.3	1846.0	2.70	97.0	2.57
	CRUSHER DISCHARGE CONVEYOR													
	Crushed Ore from Discharge Pocket	0.60		100.00	60.00	100.00		4600.0	142.3	4742.3	1846.0	2.70	97.0	2.57
	OVERLAND CONVEYORS													
	Crushed Ore from Crusher	0.60		100.00	60.00	100.00		4600.0	142.3	4742.3	1846.0	2.70	97.0	2.57
	Fresh Water to Coarse Ore Overland Conv Dust. Sup.								2.0	2.0	2.0			
	Fresh Water Shuttle Conv. Dust Suppression								1.0	1.0	1.0			
	COARSE ORE STACKER													
	Crushed Ore from Conveyors	0.60		100.00	60.00	100.00		4600.0	142.3	4742.3	1846.0	2.70	97.0	2.57
	COARSE ORE STOCKPILE													
	Coarse Ore from Stacker	0.60		100.00	60.00	100.00		4600.0	142.3	4742.3	1846.0	2.70	97.0	2.57
	Stockpile Reclaim Dust Suppression Water								37.5	37.5	37.5			
	COARSE ORE FEEDERS													
	New Feed to SAG mill	0.60		100.00	60.00	100.00		3833.3	118.6	3951.9	1538.3	2.70	97.0	2.57

Nominal Feedrate - 92000 mtpd
Crushing/Conveying Availability = 80.0%
Concentrator Availability = 90.0%
Feed grade - 0.60% Total Cu
Feed grade - 0.027% Total Mo

TOROMOCHO COPPER-MOLY PROJECT
GRINDING & PEBBLE CRUSHING CIRCUIT

PROJECT NO. 180600
DATE 18/12/2006
REVISION A

METALLURGICAL BALANCE

Str. No	Description	%Cu	% Mo	%Wt	Units	%Dist Overall		MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Slurry	Solids SG	% Sols by Wt	Slurry SG
	SAG MILL FEED													
	New Feed from Coarse Ore Stockpile	0.60	0.03	100.00	60.00	100.00		3833.3	118.6	3951.9	1538.3	2.70	97.0	2.57
	Recycled Pebbles	0.60		25.00	15.00	25.00		958.3	239.6	1197.9	594.5	2.70	80.0	2.01
	SAG Mill Feed	0.60		125.00	75.00	125.00		4791.7	358.1	5149.8	2132.8	2.70	93.0	2.41
	SAG MILL													
	SAG Mill Feed	0.60		125.00	75.00	125.00		4791.7	358.1	5149.8	2132.8	2.70	93.0	2.41
	SAG Mill Feed Water	-		-	-	-			1695.4	1695.4	1695.4	-	-	-
	SAG Mill Discharge	0.60		125.00	75.00	125.00		4791.7	2053.6	6845.2	3828.3	2.70	70.0	1.79
	SAG TROMMEL FEED													
	SAG Mill Discharge	0.60		125.00	75.00	125.00		4791.7	2053.6	6845.2	3828.3	2.70	70.0	1.79
	SAG Trommel and screen water	-		-	-	-			526.6	526.6	526.6	-	-	-
	SAG Trommel Feed	0.60		125.00	75.00	125.00		4791.7	2580.1	7371.8	4354.8	2.70	65.0	1.69
	SAG TROMMEL													
	SAG Trommel O'Size	0.60		115.0	69.00	115.00		4408.3	1243.4	5651.7	2876.1	2.70	78.0	1.97
	SAG Trommel U'Size	0.60		10.00	6.00	10.00		383.3	1336.8	1720.1	1478.7	2.70	22.3	1.16
	SAG Trommel Feed	0.60		125.00	75.00	125.00		4791.7	2580.1	7371.8	4354.8	2.70	65.0	1.69
	SAG SCREEN													
	SAG Discharge Screen O'Size	0.60		25.00	15.00	25.00		958.3	239.6	1197.9	594.5	2.70	80.0	2.01
	SAG Discharge Screen U'Size	0.60		90.00	54.00	90.00		3450.0	1003.8	4453.8	2281.6	2.70	77.5	1.95
	SAG Discharge Screen Feed	0.60		115.00	69.00	115.00		4408.3	1243.4	5651.7	2876.1	2.70	78.0	1.97
	PEBBLE CRUSHER FEED													
	SAG Discharge Screen O'Size	0.60		25.00	15.00	25.00		958.3	239.6	1197.9	594.5	2.70	80.0	2.01
	Pebble Crusher Feed/Discharge	0.60		25.00	15.00	25.00		958.3	239.6	1197.9	594.5	2.7	80.0	2.01
	BALL MILL CYCLONE FEED							3833.3						
	SAG Trommel U'Size	0.60		10.00	6.00	10.00		383.3	1336.8	1720.1	1478.7	2.70	22.3	1.16
	SAG Discharge Screen U'Size	0.60		90.00	54.00	90.00		3450.0	1003.8	4453.8	2281.6	2.70	77.5	1.95
	Ball Mill Cyclone Underflow	0.60		300.00	162.00	270.00	*	######	4928.6	16428.6	9187.8	2.70	70.0	1.79
	Ball Mill Milk of Lime Feed							18.6	167.0	185.5	175.4	2.20	10.0	1.06
	Ball Mill Cyclone Dilution Water	-		-	-	-			6273.2	6273.2	6271.6		-	-
	SAG + Ball Mills Cooling Water	-		-	-	-			172.5	172.5	172.5	-	-	-
	Ball Mill Cyclone Feed Pump Gland Water	-		-	-	-			34.5	34.5	34.5	-	-	-
	Ball Mill Cyclone Feed	0.60		400.00	216.00	360.00		######	13916.3	29268.2	19602.2	2.70	52.5	1.49
	BALL MILL CYCLONES													
	Flotation Circuit Feed	0.60		100.00	54.00	90.00		3851.9	8987.7	12839.6	10414.4	2.70	30.0	1.23
	Ball Mill Cyclone Underflow	0.60		300.00	162.00	270.00		######	4928.6	16428.6	9187.8	2.70	70.0	1.79
	Ball Mill Cyclone Feed	0.60		400.00	216.00	360.00		######	13916.3	29268.2	19602.2	2.70	52.5	1.49

CHECK ON GRINDING CIRCUIT TOTAL WATER & SLURRY:		MTPH	M3/HR
INCOMING:		Water	Slurry
Fresh Water to Coarse Ore Overland Conv Dust. Sup.		2	2
Fresh Water Shuttle Conv. Dust Suppression		1	1
Stockpile Reclaim Dust Suppression Water		38	38
New Feed from Coarse Ore Stockpile		119	1538
SAG Mill Feed Water		1695	1695
SAG Trommel and screen water		527	527
Ball Mill Cyclone Dilution Water		6273	6272
SAG + Ball Mills Cooling Water		173	173
Ball Mill Milk of Lime Feed		167	175
Ball Mill Cyclone Feed Pump Gland Water		35	35
	Total In	9028	10455
OUTGOING:			
Dust Suppression Losses		41	41
Flotation Circuit Feed		8988	10414
	Total Ou	9028	10455
		0.0	0.0

Nominal Feedrate - 92000 mtpd
Crushing/Conveying Availability = 80.0%
Concentrator Availability = 90.0%
Feed grade - 0.60% Total Cu
Feed grade - 0.027% Total Mo

TOROMOCHO COPPER-MOLY PROJECT
BULK FLOTATION AND REGRIND CIRCUIT

PROJECT NO. 180600
DATE 18/12/2006
REVISION A

METALLURGICAL BALANCE

Str. No	Description	%Cu	% Mo	%Wt	Cu Units	Cu,%Dist Overall	Mo,%Dist Overall	MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Slurry	Solids SG	% Sols by Wt	SG
		0.85	0.02	1.42	1.20	2.00	1.00							
	OVERALL FLOTATION CIRCUIT													
	Copper Flotation Concentrate	26.00	0.04	2.05	53.40	89.00	3.20	78.7				4.40		
	Moly Flotation Concentrate	0.70	50.0	0.03	0.02	0.04	60.00	1.2				2.70		
	Final Flotation Tails	0.07	0	97.91	6.58	10.96	36.80	3771.9				2.68		
	Flotation Circuit Feed	0.60	0.03	100.00	60.00	100.00	100.00	3851.9	8987.7	12839.6	10414.4	2.70	30.0	1.23
	COPPER ROUGHER FLOTATION													
	Undiluted Copper Rough. Flot. Conc.	4.50	0.18	12.61	56.76	94.60	83.62	483.5	1128.2	1611.7	1296.6	2.87	30.0	1.24
	Copper Rougher Flotation Tail	0.04	0.01	87.39	3.24	5.40	16.38	3368.4	7859.5	11227.9	9117.7	2.68	30.0	1.23
	Flotation Circuit Feed	0.60	0.03	100.00	60.00	100.00	100.00	3851.9	8987.7	12839.6	10414.4	2.70	30.0	1.23
	COPPER ROUGH. CONC. LAUNDER WATER													
	Undiluted Copper Rough. Flot. Conc.	4.50	0.18	12.61	56.76	94.60	83.62	483.5	1128.2	1611.7	1296.6	2.87	30.0	1.24
	Copper Rougher Flot. Launder Water	-		-	-	-			115.1	115.1	115.1	-	-	1.00
	Diluted Copper Rough. Flot. Conc.	4.50	0.18	12.61	56.76	94.60	83.62	483.5	1243.3	1726.8	1411.8	2.87	28.0	1.22
	REGRIND CIRCUIT NEW FEED													
	Diluted Copper Rough. Flot. Conc.	4.50	0.18	12.61	56.76	94.60	83.62	483.5	1243.3	1726.8	1411.8	2.87	28.0	1.22
	Diluted Mo-Talc Scavenger Conc.	12.00	1.35	0.02	0.24	0.40	1.00	0.8	2.7	3.5	3.0	3.27	22.0	1.18
	Moly Rougher Flotation Tail	3.54	0.37	0.53	1.87	3.11	7.20	20.2	84.7	105.0	91.9	2.83	19.3	1.14
	Regrind Mill Cooling Water	-		-	-	-			17.0	17.0	17.0	-	-	1.00
	Regrind Mill Dilution Water	-		-	-	-			97.0	97.0	97.0	-	-	1.00
	Regrind Mill Feed Pump Gland Water								0.0	0.0	0.0		-	1.00
	Milk of Lime to Regrinding Sump							3.2	28.8	32.0	30.3	2.20	10.0	1.06
	Regrind Mill Sump Water								433.0	433.0	433.0	-	-	1.00
	Cycl.Feed Pump Gland Water	-		-	-	-			3.3	3.3	3.3	-	-	1.00
	Regrind Circuit New Feed	4.47	0.19	13.16	58.87	98.11	91.82	507.7	1909.9	2417.6	2087.2	2.86	21.0	1.16
	REGRIND CYCLONE													
	Regrind Cyclone Overflow	4.47	0.19	13.16	58.87	98.11	91.82	507.7	1909.9	2417.6	2087.2	2.87	21.0	1.16
	Regrind Cyclone Underflow	4.47	0.19	19.74	88.30	147.17	137.73	756.8	407.5	1164.2	671.3	2.87	65.0	1.73
	Diluted Regrind Cyclone Feed	4.47	0.19	32.90	147.17	245.28	229.55	1264.5	2317.4	3581.9	2758.1	2.87	35.3	1.30
	REGRIND MILL FEED													
	Regrind Cyclone Underflow	4.47	0.19	19.74	88.30	147.17	137.73	756.8	407.5	1164.2	671.3	2.87	65.0	1.73
	Regrind Mill Dilution Water								97.0	97.0	97.0	-	-	1.00
	Diluted Regrind Mill Feed	4.47	0.19	19.74	88.30	147.17	137.73	756.8	504.5	1261.3	768.3	2.87	60.0	1.64
	1ST COPPER CLEANER FEED													
	Regrind Cyclone Overflow	4.47	0.19	13.16	58.87	98.11	91.82	507.7	1909.9	2417.6	2087.2	2.87	21.0	1.16
	1st Copper Clnr Feed Pump Seal Water								5.1	5.1	5.1	-	-	1.00
	1st Copper Clnr Feed Dilution Water								115.8	115.8	115.8	-	-	1.00
	Diluted 1st Copper Cleaner Feed	4.47	0.19	13.16	58.87	98.11	91.82	507.7	2030.8	2538.5	2207.8	2.87	20.00	1.15
	1ST COPPER CLEANER FLOTATION													
	1st Copper Cleaner Concentrate	13.82	0.49	4.05	56.04	93.40	73.60	155.4	466.2	621.6	512.2	3.38	25.00	1.21
	1st Copper Cleaner Tail	0.31	0.05	9.11	2.83	4.71	18.22	352.3	1564.6	1916.9	1695.6	2.69	18.4	1.13
	Diluted 1st Copper Cleaner Feed	4.47	0.19	13.16	58.87	98.11	91.82	507.7	2030.8	2538.5	2207.8	2.87	20.0	1.15
	1ST.COPPER CLEAN.CONC.LAUND.WATER													
	Undiluted 1st.Copper Cleaner Conc.	13.82	0.49	4.05	56.04	93.40	73.60	155.4	466.2	621.6	512.2	3.38	25.0	1.21
	1st Copper Clean. Conc.Launder Water	-		-	-	-			118.4	118.4	118.4	-	-	1.00
	Diluted 1st.Copper Cleaner Conc.	13.82	0.49	4.05	56.04	93.40	73.60	155.4	584.6	740.0	630.6	3.38	21.00	1.17
	2ND COPPER CLEANER FEED													
	1st Copper Cleaner Concentrate	13.82	0.49	4.05	56.04	93.40	73.60	155.4	584.6	740.0	630.57	3.38	21.0	1.17
	Diluted Copper Cleaner Scav. Conc.	22.0	0.08	0.94	20.64	34.40	2.95	36.0	143.9	179.8	152.84	4.00	20.0	1.18
	2nd Copper Clnr Feed Pump Seal Water	-		-	-	-			1.9	1.9	1.91	-	-	1.00
	2nd Copper Clnr Feed Dilution Water	-		-	-	-			35.1	35.1	35.09	-	-	1.00
	Diluted 2nd Copper Cleaner Feed	15.36	0.41	4.99	76.68	127.80	76.55	191.4	765.4	956.8	820.4	3.48	20.00	1.17

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2ND COPPER CLEANER FLOTATION													
Undiluted 2nd Copper Cleaner Concentrate	19.99	0.22	3.79	75.80	126.33	30.65	145.4	436.1	581.4	474.0	3.83	25.00	1.23
2nd Copper Cleaner Tail	0.74	1.03	1.20	0.88	1.47	45.90	46.0	329.4	375.4	346.4	2.71	12.3	1.08
Diluted 2nd Copper Cleaner Feed	15.36	0.41	4.99	76.68	127.80	76.55	191.4	765.4	956.8	820.4	3.48	20.0	1.17
2ND COPPER CLEAN.CONC. LAUNDER WATER													
Undiluted 2nd Copper Cleaner Concentrate	19.99	0.22	3.79	75.80	126.33	30.65	145.4	436.1	581.4	474.0	3.83	25.0	1.23
2nd Copper Cleaner Conc. Launder Water								79.3	79.3	79.3	-	-	1.00
Diluted 2nd Copper Cleaner Concentrate	19.99	0.22	3.79	75.80	126.33	30.65	145.4	515.4	660.7	553.3	3.83	22.00	1.19
3RD COPPER CLEANER FEED													
Diluted 2nd Copper Cleaner Concentrate	19.99	0.22	3.79	75.80	126.33	30.65	145.4	515.4	660.7	553.3	3.83	22.0	1.19
3rd Copper Clnr Feed Pump Seal Water	-		-	-	-			1.5	1.5	1.5	-	-	1.00
3rd Copper Clnr Feed Dilution Water	-		-	-	-			123.5	123.5	123.5	-	-	1.00
Diluted 3rd Copper Cleaner Feed	19.99	0.22	3.79	75.80	126.33	30.65	145.4	640.4	785.7	678.3	3.83	18.50	1.16
3RD COPPER CLEANER FLOTATION													
Undiluted 3rd Copper Cleaner Concentrate	26.00	0.04	2.05	53.40	89.00	3.20	78.7	249.3	328.0	267.2	4.40	24.00	1.23
3rd Copper Cleaner Tail	12.89	0.43	1.74	22.40	37.33	27.45	66.6	391.1	457.7	411.1	3.32	14.6	1.11
Diluted 3rd Copper Cleaner Feed	19.99	0.22	3.79	75.80	126.33	30.65	145.4	640.4	785.7	678.3	3.83	18.5	1.16
3RD COPPER CLEAN.CONC. LAUNDER WATER													
Undiluted 3rd Copper Cleaner Concentrate	26.00	0.04	2.05	53.40	89.00	3.20	78.7	249.3	328.0	267.2	4.40	24.0	1.23
3rd Copper Cleaner Conc. Launder Water								29.8	29.8	29.8	-	-	1.00
Final 3rd Copper Cleaner Concentrate	26.00	0.04	2.05	53.40	89.00	3.20	78.7	279.1	357.9	297.0	4.40	22.00	1.20
COPPER CLEANER-SCAV. FLOTATION													
Undiluted Copper Cleaner-Scav. Conc.	22.0	0.08	0.94	20.64	34.40	2.95	36.0	127.5	163.5	136.5	4.00	22.0	1.20
Copper Cleaner-Scav. Tail	2.20	0.83	0.80	1.76	2.93	24.50	30.7	263.6	294.2	274.6	2.77	10.4	1.07
Copper Cleaner-Scav. Feed	12.89	0.43	1.74	22.40	37.33	27.45	66.6	391.1	457.7	411.1	3.3	14.6	1.11
COPPER CLEAN.SCAV. CONC. LAUNDER WATER													
Undiluted Copper Cleaner-Scav. Conc.	22.0	0.08	0.94	20.64	34.40	2.95	36.0	127.5	163.5	136.5	4.00	22.0	1.20
Copper Cleaner-Scav. Conc. Launder Water	-		-	-				16.3	16.3	16.3	-	-	1.00
Diluted Copper Cleaner-Scav. Conc.	22.0	0.08	0.94	20.64	34.40	2.95	36.0	143.9	179.8	152.8	4.00	20.0	1.18
COPPER FLOTATION CIRCUIT TAILS													
Copper Rougher Flotation Tail	0.04	0.01	87.39	3.24	5.40	16.38	3368.4	7859.5	11227.9	9117.7	2.68	30.0	1.23
1st Copper Cleaner Tail	0.31	0.05	9.11	2.83	4.71	18.22	352.3	1564.6	1916.9	1695.6	2.69	18.4	1.13
2nd Copper Cleaner Tail	0.74	1.03	1.20	0.88	1.47	45.90	46.0	329.4	375.4	346.4	2.7	12.3	1.08
Copper Cleaner-Scavenger Tail	2.20	0.83	0.80	1.76	2.93	24.50	33.9	263.6	294.2	274.6	2.77	11.5	1.07
OSA Wash Water								33.1	33.1	33.1	-	-	1.00
Copper Flotation Circuit Tails	0.09	0.03	98.49	8.71	14.51	105.00	3800.5	10050.1	13847.5	11467.4	2.68	27.4	1.21
COPPER FLOTATION CONCENTRATE THICKENER FEED													
Final 3rd Copper Cleaner Concentrate	26.00	0.04	2.05	53.40	89.00	3.20	78.7	279.1	357.9	297.0	4.40	22.0	1.20
Copper Flot.Conc.Thickener Feed Pump Gld.	-		-	-				0.8	0.8	0.8	-	-	1.00
Copper Flotation Conc. Filter Filtrate	-		-	-			0.0	41.4	41.4	41.4	-	-	1.00
Copper Flotation Conc. Thickener Feed	26.00	0.04	2.05	53.40	89.00	3.20	78.7	321.4	400.1	339.3	4.40	19.7	1.18
COPPER FLOTATION CONCENTRATE THICKENER													
Copper Flotation Conc.Thickener Underflow	26.00	0.04	2.05	53.40	89.00	3.20	78.7	42.4	121.1	60.3	4.40	65.0	2.01
Copper Flotation Conc. Thickener Overflow								279.0	279.0	279.0			1.00
Copper Flotation Conc. Thickener Feed	26.00	0.04	2.05	53.40	89.00	3.20	78.7	321.4	400.1	339.3	4.4	19.7	1.18
COPPER FLOTATION CONCENTRATE SLURRY STORAGE													
Copper Flotation Conc. Thickener Underflow	26.00	0.04	2.05	53.40	89.00	3.20	78.7	42.4	121.1	60.3	4.40	65.0	2.01
Copper Flot.Conc. Thick.U'Flow Pump Gld. W	-		-	-				0.8	0.8	0.8	-	-	1.00
Copper Flot.Conc. Slurry Storage Feed/Disch	26.00	0.04	2.05	53.40	89.00	3.20	78.7	43.2	121.9	61.1	4.40	64.6	2.00
COPPER FLOTATION CONCENTRATE FILTER FEED													
Copper Flot.Conc. Slurry Storage Feed/Disch	26.00	0.04	2.05	53.40	89.00	3.20	78.7	43.2	121.9	61.1	4.40	64.6	2.00
Copper Flot.Conc. Filter Feed Pump Gld. Wa	-		-	-				0.8	0.8	0.8	-	-	1.00
Copper Flot.Conc. Filter Feed (actual)	26.00	0.04	2.05	53.40			78.7	44.0	122.7	61.9	4.40	64.2	1.98
Copper Flot.Conc. Filter Wash Water								5.3	5.3	5.3	-	-	1.00
Copper Flot.Conc. Filter Feed (effective)	26.00	0.04	2.05	53.40	89.00	3.20	78.7	49.2	128.0	67.1	4.40	61.5	1.91
			########										
COPPER FLOTATION CONCENTRATE FILTER													
Filtered Copper Flotation Concentrate	26.00	0.04	2.05	53.40	89.00	3.20	78.7	7.8	86.5	25.7	4.40	91.0	3.37
Copper Flotation Concentrate Filter Filtrate	-		-	-				41.4	41.4	41.4	-	-	1.00
Copper Flotation Concentrate Filter Feed	26.00		2.05	53.40	89.00	3.20	78.7	49.2	128.0	67.1	4.40	61.53	1.91

TOROMOCHO COPPER-MOLY PROJECT

CHECK ON COPPER FLOTATION TOTAL WATER & SLURRY:		MTPH	M3/HR
INCOMING		Water	Slurry
Flotation Circuit Feed		8987.7	10414
Diluted Mo-Talc Scavenger Conc.		2.7	3
Moly Rougher Flotation Tail		84.7	92
Copper Rougher Flot. Launder Water		115.1	115
Copper Cleaner-Scav. Conc. Launder Water		16.3	16
Regrind Mill Cooling Water		17.0	17
Regrind Mill Dilution Water		97.0	97
Regrind Mill Feed Pump Gland Water		0.0	0
Regrind Mill Sump Milk of Lime Feed		28.8	30
Regrind Mill Sump Water		433.0	433
Cycl.Feed Pump Gland Water		3.3	3
1st Copper Clnr Feed Pump Seal Water		5.1	5
1st Copper Clnr Feed Dilution Water		115.8	116
1st Copper Clean. Conc.Launder Water		118.4	118
2nd Copper Clnr Feed Pump Seal Water		1.9	2
2nd Copper Clnr Feed Dilution Water		35.1	35
2nd Copper Cleaner Conc. Launder Water		79.3	79
Bulk 3rd Clnr Feed Pump Seal Water		1.5	1.5
Bulk 3rd Clnr Feed Dilution Water		123.5	124
Bulk 3rd Cleaner Launder Water		29.8	30
OSA Wash Water		33.1	33
	Total In	10329	11765
OUTGOING			
Final Bulk 3rd Cleaner Concentrate		279	297
Copper Flotation Circuit Tails		10050	11467
	Total Out	10329	11764
		0.0	-0.3

Nominal Feedrate - 92000 mtpd
Crushing/Conveying Availability = 80.0%
Concentrator Availability = 90.0%
Feed grade - 0.60% Total Cu
Feed grade - 0.027% Total Mo

TOROMOCHO COPPER-MOLY PROJECT
MOLY-TALC FLOTATION CIRCUIT

PROJECT NO. 180600
DATE 18/12/2006
REVISION A

METALLURGICAL BALANCE

Str. No	Description	%Cu	% Mo	%Wt	Cu Units	Cu,%Dist Overall	Mo,%Dist Overall	MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Slurry	Solids SG	% Sols by Wt	Slurry SG
	COPPER TAILS THICKENER FEED													
	2nd Copper Cleaner Tail	0.74	1.03	1.20	0.88	1.47	45.90	46.0	329.36	375.36	346.36	2.71	12.25	1.08
	Copper Cleaner-Scav. Tail	2.20	0.83	0.80	1.76	2.93	24.50	30.7	263.55	294.22	274.63	2.77	10.42	1.07
	Copper Flotation Tails Thickener Feed	1.32	0.95	2.00	2.64	4.40	70.40	76.7	592.9	669.6	621.0	2.73	11.4	1.08
	COPPER TAILS THICKENER													
	Copper Flotation Tails Thickener Underflow	1.32	0.95	2.00	2.64	4.40	70.40	76.7	62.7	139.4	90.8	2.73	55.0	1.53
	Copper Flotation Tails Thickener Overflow								530.2	530.2	530.2			1.00
	Copper Flotation Tails Thickener Feed	1.32	0.95	2.00	2.64	4.40	70.40	76.7	592.9	669.6	621.0	2.7	11.4	1.08
	COPPER TAILS CONDITIONING TANK FEED													
	Copper Flotation Tails Thickener Underflow	1.32	0.95	2.00	2.64	4.40	70.40	76.7	62.7	139.4	90.8	2.73	55.0	1.53
	Copper Flot.Tails Thick.U'Flow Pump Gld. W	-		-	-				0.8	0.8	0.8	-	-	1.00
	Copper Flot.Tails Conditioning Tank Feed	1.32	0.95	2.00	2.64	4.40	70.40	76.7	63.5	140.2	91.6	2.73	54.7	1.53
	COPPER TAILS CONDITIONING TANK													
	Copper Flot.Tails Conditioning Tank Feed	1.32	0.95	2.00	2.64	4.40	70.40	76.7	63.5	140.2	91.6	2.73	54.7	1.53
	Hot Steam								30.2	30.2	30.2			
	Copper Flot.Tails Conditioning Tank Discharg	1.32	0.95	2.00	2.64	4.40	70.40	76.7	93.7	170.4	121.8	2.73	45.0	1.40
	MOLY-TALC ROUGHER FLOTATION FEED													
	Copper Flot.Tails Conditioning Tank Discharg	1.32	0.95	2.00	2.64	4.40	70.40	76.7	93.7	170.4	121.8	2.73	45.0	1.40
	Moly-Talc Rougher Flot. Pump Seal Water	-		-	-	-			0.8	0.8	0.8	-	-	1.00
	Moly-Talc Rougher Flot. Feed Dilution Water	-		-	-	-			135.5	135.5	135.5	-	-	1.00
	Diluted Moly-Talc Rougher Flotation Feed	1.32	0.95	2.00	2.64	4.40	70.40	76.7	230.0	306.7	258.1	2.73	25.0	1.19
	MOLY-TALC ROUGHER FLOTATION													
	Undiluted Moly-Talc Rougher Flotation Conc	1.30	1.03	1.78	2.31	3.85	68.20	68.2	204.7	272.9	229.7	2.73	25.0	1.19
	Moly-Talc Rougher Flotation Tail	1.50	0.27	0.22	0.33	0.55	2.20	8.43	25.3	33.7	28.4	2.74	25.0	1.19
	Diluted Moly-Talc Rougher Flotation Feed	1.32	0.95	2.00	2.64	4.40	70.40	76.7	230.0	306.7	258.1	2.73	25.0	1.19
	MOLY-TALC ROUGHER FLOT.CONC. LAUNDER WATER													
	Undiluted Moly-Talc Rougher Flotation Conc	1.30	1.03	1.78	2.31	3.85	68.20	68.2	204.7	272.9	229.7	2.73	25.0	1.19
	Moly-Talc Rougher. Flot. Conc. Launder Wat	-		-	-				37.2	37.2	37.2	-	-	1.00
	Diluted Moly-Talc Rougher. Flot. Conc.	1.30	1.03	1.78	2.31	3.85	68.20	68.2	241.9	310.2	266.9	2.73	22.0	1.16
	MOLY-TALC SCAVENGER FLOTATION FEED													
	Moly-Talc Rougher Flotation Tail	1.50	0.27	0.22	0.33	0.55	2.20	8.4	25.30	33.73	28.38	2.74	25.00	1.19
	Moly-Talc Scav. Flot. Feed Pump Seal Water	-		-	-	-			0.1	0.1	0.1	-	-	1.00
	Moly-Talc Scav. Flot. Feed Dilution Water	-		-	-	-			8.3	8.3	8.3	-	-	1.00
	Diluted Moly-Talc Scavenger Flotation Feed	1.50	0.27	0.22	0.33	0.55	2.20	8.4	33.7	42.2	36.8	2.74	20.0	1.15
	MOLY-TALC SCAVENGER FLOTATION													
	Undiluted Moly-Talc Scavenger Conc.	12.00	1.35	0.02	0.24	0.40	1.00	0.8	2.3	3.1	2.5	3.27	25.0	1.21
	Moly-Talc Scavenger Tail	0.45	0.16	0.20	0.09	0.15	1.20	7.7	31.4	39.1	34.3	2.69	19.6	1.14
	Diluted Moly-Talc Scavenger Feed	1.50	0.27	0.22	0.33	0.55	2.20	8.4	33.7	42.2	36.8	2.74	20.0	1.15
	MOLY-TALC SCAV. CONC. LAUNDER WATER													
	Undiluted Moly-Talc Scavenger Conc.	12.00	1.35	0.02	0.24	0.40	1.00	0.8	2.3	3.1	2.5	3.27	25.0	1.21
	Moly-Talc Scav. Conc. Launder Water	-		-	-				0.4	0.4	0.4	-	-	1.00
	Diluted Moly-Talc Scav. Flotation Conc.	12.00	1.35	0.02	0.24	0.40	1.00	0.8	2.7	3.5	3.0	3.27	22.0	1.18
	MOLY-TALC CONCENTRATE THICKENER FEED													
	Diluted Moly-Talc Rougher. Flot. Conc.	1.30	1.03	1.78	2.31	3.85	68.20	68.2	241.9	310.2	266.9	2.73	22.0	1.16
	Moly-Talc Concentrate Filter Filtrate	-		-	-				44.7	44.7	44.7	-	-	1.00
	Moly-Talc Concentrate Thickener Feed	1.30	1.03	1.78	2.31	3.85	68.20	68.2	286.6	354.8	311.6	2.73	19.2	1.14
	MOLY-TALC CONCENTRATE THICKENER													
	Moly-Talc Concentrate Thickener Underflow	1.30	1.03	1.78	2.31	3.85	68.20	68.2	45.5	113.7	70.5	2.73	60.0	1.61
	Moly-Talc Concentrate Thickener Overflow								241.1	241.1	241.1			1.00
	Moly-Talc Concentrate Thickener Feed	1.30	1.03	1.78	2.31	3.85	68.20	68.2	286.6	354.8	311.6	2.7	19.2	1.14

	MOLY-TALC CONCENTRATE SLURRY STORAGE													
	Moly-Talc Concentrate Thickener Underflow	1.30	1.03	1.78	2.31	3.85	68.20	68.2	45.5	113.7	70.5	2.73	60.0	1.61
	Moly-Talc Conc.Thick.U'Flow Pump Gld. Wat	-		-	-				0.7	0.7	0.7	-	-	1.00
	Moly-Talc Conc. Slurry Storage Feed/Dischar	1.30	1.03	1.78	2.31	3.85	68.20	68.2	46.2	114.4	71.2	2.73	59.6	1.61
	MOLY-TALC CONCENTRATE FILTER FEED													
	Moly-Talc Conc. Slurry Storage Feed/Dischar	1.30	1.03	1.78	2.31	3.85	68.20	68.2	46.2	114.4	71.2	2.73	59.6	1.61
	Moly-Talc Conc. Filter Feed Pump Gld. Wate	-		-	-				0.7	0.7	0.7	-	-	1.00
	Moly-Talc Conc. Filter Feed (actual)	1.30	1.03	1.78	2.31			68.2	46.9	115.1	71.9	2.73	59.3	1.60
	Moly-Talc Conc. Filter Wash Water								4.6	4.6	4.6	-	-	1.00
	Moly-Talc Conc. Filter Feed (effective)	1.30	1.03	1.78	2.31	3.85	68.20	68.2	51.4	119.6	76.4	2.73	57.0	1.57
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	MOLY-TALC CONCENTRATE FILTER													
	Filtered Moly-Talc Concentrate	1.30	1.03	1.78	2.31	3.85	68.20	68.2	6.7	75.0	31.8	2.73	91.0	2.36
	Moly-Talc Conc. Filter Filtrate	-	-	-	-				44.7	44.7	44.7	-	-	1.00
	Moly-Talc Conc. Filter Feed	1.30	1.03	1.78	2.31	3.85	68.20	68.2	51.4	119.6	76.4	2.73	57.03	1.57
	MOLY-TALC CONCENTRATE ROASTING													
	Filtered Moly-Talc Concentrate	1.30	1.03	1.78	2.31	3.85	68.20	68.2	6.7	75.0	31.8	2.73	91.0	2.36
	Roaster off gases and vapor								6.1	6.1	6.1			
	Roasted Moly-Talc Concentrate	1.30	1.03	1.78	2.31	3.85	68.20	68.2	0.7	68.9	25.7	2.73	99.0	2.68
	MOLY-TALC CONCENTRATE CONDITIONING TANK													
	Undiluted Roasted Moly-Talc Concentrate	1.30	1.03	1.78	2.31	3.85	68.20	68.2	0.7	68.9	25.7	2.73	99.0	2.68
	Moly-Talc Conc.Conditioning Dilution Water	-		-	-				204.0	204.0	204.0	-	-	1.00
	Diluted Moly-Talc Concentrate	1.30	1.03	1.78	2.31	3.85	68.20	68.2	204.7	272.9	229.7	2.73	25.0	1.19
	TALC ROUGHER FLOTATION FEED													
	Diluted Moly-Talc Concentrate	1.30	1.03	1.78	2.31	3.85	68.20	68.2	204.7	272.9	229.7	2.73	25.0	1.19
	Talc Rougher Flotation Feed Pump Seal Wat	-	-	-	-	-			0.7	0.7	0.7	-	-	1.00
	Talc Rougher Flotation Feed Dilution Water	-	-	-	-	-			36.5	36.5	36.5	-	-	1.00
	Diluted Talc Rougher Flotation Feed	1.30	1.03	1.78	2.31	3.85	68.20	68.2	241.9	310.2	266.9	2.73	22.0	1.16
	TALC ROUGHER FLOTATION													
	Talc Rougher Flotation Concentrate	0.34	0.02	1.22	0.42	0.70	1.00	46.8	148.1	194.9	165.5	2.69	24	1.18
	Talc Rougher Flotation Tail	3.38	3.24	0.56	1.89	3.15	67.20	21.5	93.8	115.3	101.4	2.82	19	1.14
	Diluted Talc Rougher Flotation Feed	1.30	1.03	1.78	2.31	3.85	68.20	68.2	241.9	310.2	266.9	2.73	22.0	1.16
	MOLY ROUGHER FLOTATION FEED													
	Talc Rougher Flotation Tail	3.38	3.24	0.56	1.89	3.15	67.20	21.5	93.8	115.3	101.4	2.82	18.6	1.14
	1st Moly Cleaner Tail	0.91	2.47	0.09	0.08	0.13	8.00	3.4	28.3	31.6	29.5	2.71	10.6	1.07
	Moly Rougher Flot. Pump Seal Water	-		-	-	-			0.2	0.2	0.2	-	-	1.00
	Moly Rougher Flot. Feed Dilution Water	-		-	-	-			5.2	5.2	5.2	-	-	1.00
	Diluted Moly Rougher Flotation Feed	3.04	3.14	0.65	1.97	3.28	75.20	24.8	99.3	124.1	108.2	2.80	20.0	1.15
	MOLY ROUGHER FLOTATION													
	Undiluted Moly Rougher Flotation Conc.	0.85	15.3	0.12	0.10	0.17	68.00	4.6	14.6	19.2	16.3	2.71	24.0	1.18
	Moly Rougher Flotation Tail	3.54	0.37	0.53	1.87	3.11	7.20	20.2	84.7	105.0	91.9	2.83	19.3	1.14
	Diluted Moly Rougher Flotation Feed	3.04	3.14	0.65	1.97	3.28	75.20	24.8	99.3	124.1	108.2	2.80	20.0	1.15
	MOLY ROUGH. CONC. LAUNDER WATER													
	Undiluted Moly Rougher Flotation Conc.	0.85	15.3	0.12	0.10	0.17	68.00	4.6	14.6	19.2	16.3	2.71	24.0	1.18
	Moly Rougher Flot.Conc. Launder Water	-		-	-	-			1.7	1.7	1.7	-	-	1.00
	Diluted Moly Rough. Flot. Conc.	0.85	15.3	0.12	0.10	0.17	68.00	4.6	16.3	20.9	18.0	2.71	22.00	1.16

1ST MOLY CLEANER FEED													
Diluted Moly Rough. Flot. Conc.	0.85	15.3	0.12	0.10	0.17	68.00	4.6	16.3	20.9	18.0	2.71	22.0	1.16
2nd Moly Cleaner Tail	0.91	3.52	0.06	0.05	0.09	7.50	2.2	17.8	20.0	18.6	2.71	11.0	1.07
1st Moly Clnr Feed Pump Seal Water								0.1	0.1	0.1	-	-	1.00
1st Moly Clnr Column Washwater								6.3	6.3	6.3	-	-	1.00
Diluted 1st Moly Cleaner Feed	0.87	11.5	0.18	0.15	0.26	75.50	6.8	40.5	47.3	43.0	2.71	14.39	1.10
1ST MOLY CLEANER FLOTATION													
Undiluted 1st Moly Cleaner Concentrate	0.83	20.3	0.09	0.08	0.13	67.50	3.5	12.2	15.7	13.5	2.71	22.00	1.16
1st Moly Cleaner Tail	0.91	2.47	0.09	0.08	0.13	8.00	3.4	28.3	31.6	29.5	2.71	10.6	1.07
Diluted 1st Moly Cleaner Feed	0.87	11.5	0.18	0.15	0.26	75.50	6.8	40.5	47.3	43.0	2.71	14.4	1.10
1ST.MOLY CLEAN.CONC.LAUND.WATER													
Undiluted 1st. Moly Cleaner Conc.	0.83	20.3	0.09	0.08	0.13	67.50	3.5	12.2	15.7	13.5	2.71	22.0	1.16
1st Moly Cleaner Conc.Launder Water	-		-	-	-			1.6	1.6	1.6	-	-	1.00
Diluted 1st.Moly Cleaner Conc.	0.83	20.3	0.09	0.08	0.13	67.50	3.5	13.8	17.3	15.1	2.71	20.0	1.14
2ND MOLY CLEANER FEED													
Diluted 1st.Moly Cleaner Conc.	0.83	20.3	0.09	0.08	0.13	67.50	3.5	13.8	17.3	15.07	2.71	20.0	1.14
3rd Moly Cleaner Tail	0.88	4.60	0.04	0.03	0.06	6.40	1.4	8.4	9.9	8.94	2.71	14.6	1.10
2nd Moly Clnr Feed Pump Seal Water	-		-	-	-			0.0	0.0	0.05	-	-	1.00
2nd Moly Clnr Column Washwater	-		-	-	-			5.1	5.1	5.09	-	-	1.00
Diluted 2nd Moly Cleaner Feed	0.85	15.6	0.13	0.11	0.18	73.90	4.9	27.3	32.2	29.2	2.71	15.17	1.11
2ND MOLY CLEANER FLOTATION													
Undiluted 2nd Moly Cleaner Concentrate	0.80	25.6	0.07	0.06	0.09	66.40	2.7	9.5	12.2	10.5	2.71	22.0	1.16
2nd Moly Cleaner Tail	0.91	3.52	0.06	0.05	0.09	7.50	2.2	17.8	20.0	18.6	2.71	11.0	1.07
Diluted 2nd Moly Cleaner Feed	0.85	15.6	0.13	0.11	0.18	73.90	4.9	27.3	32.2	29.2	2.71	15.2	1.11
2ND MOLY CLEAN.CONC. LAUNDER WATER													
Undiluted 2nd Moly Cleaner Concentrate	0.80	25.6	0.07	0.06	0.09	66.40	2.7	9.5	12.2	10.5	2.71	22.0	1.16
2nd Moly Cleaner Conc. Launder Water								1.2	1.2	1.2	-	-	1.00
Diluted 2nd Moly Cleaner Concentrate	0.80	25.6	0.07	0.06	0.09	66.40	2.7	10.7	13.4	11.7	2.71	20.00	1.14
4th MOLY CLEANER TAIL THICKENER FEED													
4th Moly Cleaner Tail	0.85	5.18	0.03	0.02	0.04	5.30	1.1	7.0	8.1	7.4	2.71	13.1	1.09
Flocculant													
4th Moly Cleaner Tail Thickener Feed	0.85	5.18	0.03	0.02	0.04	5.30	1.1	7.0	8.1	7.4	2.71	13.1	1.09
4th MOLY CLEANER TAIL THICKENER													
4th Moly Cleaner Tail Thickener Underflow	0.85	5.18	0.03	0.02	0.04	5.30	1.1	0.7	1.8	1.1	2.71	60.0	1.61
4th Moly Cleaner Tail Thickener Overflow								6.3	6.3	6.3			1.00
4th Moly Cleaner Tail Thickener Feed	0.85	5.18	0.03	0.02	0.04	5.30	1.1	7.0	8.1	7.4	2.71	13.1	1.09
3RD MOLY CLEANER FEED													
Diluted 2nd Moly Cleaner Concentrate	0.80	25.6	0.07	0.06	0.09	66.40	2.7	10.7	13.4	11.7	2.71	20.0	1.14
4th Moly Cleaner Tail Thickener Underflow	0.85	5.2	0.03	0.02	0.04	5.30	1.1	0.7	1.8	1.1	2.71	60.0	1.61
3rd Moly Clnr Feed Pump Seal Water	-		-	-	-			0.0	0.0	0.0	-	-	1.00
3rd Moly Clnr Column Washwater	-		-	-	-			5.1	5.1	5.1	-	-	1.00
Diluted 3rd Moly Cleaner Feed	0.81	19.8	0.10	0.08	0.13	71.70	3.7	16.6	20.3	17.9	2.71	18.42	1.13
3RD MOLY CLEANER FLOTATION													
Undiluted 3rd Moly Cleaner Concentrate	0.77	29.4	0.06	0.05	0.08	65.30	2.3	8.2	10.5	9.0	2.71	22.0	1.16
3rd Moly Cleaner Tail	0.88	4.6	0.04	0.03	0.06	6.40	1.4	8.4	9.9	8.9	2.71	14.6	1.10
Diluted 3rd Moly Cleaner Feed	0.81	19.8	0.10	0.08	0.13	71.70	3.7	16.6	20.3	17.9	2.71	18.4	1.13
3RD MOLY CLEAN.CONC. LAUNDER WATER													
Undiluted 3rd Moly Cleaner Concentrate	0.77	29.4	0.06	0.05	0.08	65.30	2.3	8.2	10.5	9.0	2.71	22.0	1.16
3rd Moly Cleaner Conc. Launder Water								1.0	1.0	1.0	-	-	1.00
Diluted 3rd Moly Cleaner Concentrate	0.77	29.4	0.06	0.05	0.08	65.30	2.3	9.2	11.5	10.0	2.71	20.00	1.14
4TH MOLY CLEANER FEED													
Diluted 3rd Moly Cleaner Concentrate	0.77	29.4	0.06	0.05	0.08	65.30	2.3	9.2	11.5	10.0	2.71	20.0	1.14
5th Moly Cleaner Tail Thickener Underflow	0.85	7.8	0.016	0.01	0.02	4.500	0.6	0.4	1.0	0.6	2.71	60.0	1.61
4th Moly Clnr Feed Pump Seal Water	-		-	-	-			0.03	0.03	0.03	-	-	1.00
4th Moly Clnr Column Washwater	-		-	-	-			3.53	3.53	3.53	-	-	1.00
Diluted 4th Moly Cleaner Feed	0.79	24.9	0.08	0.06	0.10	69.80	2.9	13.2	16.1	14.2	2.71	18.04	1.13
4TH MOLY CLEANER FLOTATION													
Undiluted 4th Moly Cleaner Concentrate	0.75	36.3	0.05	0.04	0.06	64.50	1.8	6.2	8.0	6.8	2.71	23.0	1.17
4th Moly Cleaner Tail	0.85	5.2	0.03	0.02	0.04	5.30	1.1	7.0	8.1	7.4	2.71	13.1	1.09
Diluted 4th Moly Cleaner Feed	0.79	24.9	0.08	0.06	0.10	69.80	2.9	13.2	16.1	14.2	2.71	18.0	1.13

4TH MOLY CLEAN.CONC. LAUNDER WATER													
Undiluted 4th Moly Cleaner Concentrate	0.75	36.3	0.05	0.04	0.06	64.50	1.8	6.2	8.0	6.8	2.71	23.0	1.17
4th Moly Cleaner Conc. Launder Water								0.8	0.8	0.8	-	-	1.00
Diluted 4th Moly Cleaner Concentrate	0.75	36.3	0.05	0.04	0.06	64.50	1.8	6.9	8.8	7.6	2.71	21.0	1.15
5TH MOLY CLEANER FEED													
Diluted 4th Moly Cleaner Concentrate	0.75	36.3	0.05	0.04	0.06	64.50	1.8	6.9	8.8	7.6	2.71	21.0	1.15
6th Moly Cleaner Tail	0.81	12.4	0.01	0.01	0.01	3.50	0.3	4.3	4.6	4.4	2.71	6.4	1.04
5th Moly Clnr Feed Pump Seal Water	-		-	-	-			0.02	0.02	0.02	-	-	1.00
5th Moly Clnr Column Washwater	-		-	-	-			3.08	3.08	3.08	-	-	1.00
Diluted 5th Moly Cleaner Feed	0.76	33.0	0.06	0.04	0.07	68.00	2.1	14.3	16.4	15.1	2.71	12.99	1.09
5TH MOLY CLEANER FLOTATION													
Undiluted 5th Moly Cleaner Concentrate	0.72	42.9	0.04	0.03	0.05	63.50	1.5	5.4	7.0	6.0	2.70	22.00	1.16
5th Moly Cleaner Tail	0.85	7.8	0.016	0.01	0.022	4.50	0.6	8.8	9.4	9.1	2.71	6.3	1.04
Diluted 5th Moly Cleaner Feed	0.76	33.0	0.06	0.04	0.07	68.00	2.1	14.3	16.4	15.1	2.71	13.0	1.09
5TH MOLY CLEAN.CONC. LAUNDER WATER													
Undiluted 5th Moly Cleaner Concentrate	0.72	42.9	0.04	0.03	0.05	63.50	1.5	5.4	7.0	6.0	2.70	22.0	1.16
5th Moly Cleaner Conc. Launder Water								0.7	0.7	0.7	-	-	1.00
Diluted 5th Moly Cleaner Concentrate	0.72	42.9	0.04	0.03	0.05	63.50	1.5	6.1	7.7	6.7	2.70	20.0	1.14
5th MOLY CLEANER TAIL THICKENER FEED													
5th Moly Cleaner Tail	0.85	7.8	0.02	0.01	0.02	4.50	0.6	8.8	9.4	9.1	2.71	6.3	1.04
Flocculant													
5th Moly Cleaner Tail Thickener Feed	0.85	7.8	0.02	0.01	0.02	4.50	0.6	8.8	9.4	9.1	2.71	6.3	1.04
5th MOLY CLEANER TAIL THICKENER													
5th Moly Cleaner Tail Thickener Underflow	0.85	7.8	0.02	0.01	0.02	4.50	0.6	0.4	1.0	0.6	2.71	60.0	1.61
5th Moly Cleaner Tail Thickener Overflow								8.4	8.4	8.4			1.00
5th Moly Cleaner Tail Thickener Feed	0.85	7.8	0.02	0.01	0.02	4.50	0.6	8.8	9.4	9.1	2.71	6.3	1.04
6TH MOLY CLEANER FEED													
Diluted 5th Moly Cleaner Concentrate	0.72	42.9	0.04	0.03	0.05	63.50	1.5	6.1	7.7	6.7	2.70	20.0	1.14
6th Moly Clnr Feed Pump Seal Water	-		-	-	-			0.02	0.02	0.02	-	-	1.00
6th Moly Clnr Column Washwater	-		-	-	-			3.08	3.08	3.08	-	-	1.00
Diluted 6th Moly Cleaner Feed	0.72	42.9	0.04	0.03	0.05	63.50	1.5	9.2	10.8	9.8	2.70	14.25	1.10
6TH MOLY CLEANER FLOTATION													
Undiluted 6th Moly Cleaner Concentrate	0.70	50.0	0.03	0.02	0.04	60.00	1.2	5.0	6.2	5.4	2.70	20.0	1.14
6th Moly Cleaner Tail	0.81	12.4	0.01	0.01	0.01	3.50	0.3	4.3	4.6	4.4	2.71	6.4	1.04
Diluted 6th Moly Cleaner Feed	0.72	42.9	0.04	0.03	0.05	63.50	1.5	9.2	10.8	9.8	2.70	14.2	1.10
6TH MOLY CLEAN.CONC. LAUNDER WATER													
Undiluted 6th Moly Cleaner Concentrate	0.70	50.0	0.03	0.02	0.04	60.00	1.2	5.0	6.2	5.4	2.70	20.0	1.14
6th Moly Cleaner Conc. Launder Water								0.7	0.7	0.7	-	-	1.00
Diluted 6th Moly Cleaner Concentrate	0.70	50.0	0.03	0.02	0.04	60.00	1.2	5.7	6.9	6.1	2.70	18.0	1.13
MOLY CONCENTRATE THICKENER FEED													
Diluted 6th Moly Cleaner Concentrate	0.70	50.0	0.03	0.02	0.04	60.00	1.2	5.7	6.9	6.1	2.70	18.0	1.13
Moly Concentrate Filter Filtrate	-		-	-				0.8	0.8	0.8	-	-	1.00
Moly Concentrate Thickener Feed	0.70	50.0	0.03	0.02	0.04	60.00	1.2	6.5	7.7	6.9	2.70	16.1	1.11
MOLY CONCENTRATE THICKENER													
Moly Concentrate Thickener Underflow	0.70	50.0	0.03	0.02	0.04	60.00	1.2	0.8	2.1	1.3	2.70	60.0	1.61
Moly Concentrate Thickener Overflow								5.6	5.6	5.6			1.00
Moly Concentrate Thickener Feed	0.70	50.0	0.03	0.02	0.04	60.00	1.2	6.5	7.7	6.9	2.70	16.1	1.11
MOLY CONCENTRATE SLURRY STORAGE													
Moly Concentrate Thickener Underflow	0.70	50.0	0.03	0.02	0.04	60.00	1.2	0.8	2.1	1.3	2.70	60.0	1.61
Moly Conc.Thick.U'Flow Pump Gld. Water	-		-	-				0.0	0.0	0.0	-	-	1.00
Moly Conc. Slurry Storage Feed/Discharge	0.70	50.00	0.03	0.02	0.04	60.00	1.2	0.8	2.1	1.3	2.70	60.0	1.61
MOLY CONCENTRATE FILTER FEED													
Moly Conc. Slurry Storage Feed/Discharge	0.70	50.0	0.03	0.02	0.04	60.00	1.2	0.8	2.1	1.3	2.70	60.0	1.61
Moly Conc. Filter Feed Pump Gld. Water	-		-	-				0.01	0.01	0.01	-	-	1.00
Moly Conc. Filter Feed (actual)	0.70	50.0	0.03	0.02			1.2	0.8	2.1	1.3	2.70	59.6	1.60
Moly Conc. Filter Wash Water								0.08	0.08	0.08	-	-	1.00
Moly Conc. Filter Feed (effective)	0.70	50.0	0.03	0.02	0.04	60.00	1.2	0.9	2.2	1.4	2.70	57.4	1.57
			9791.93										
MOLY CONCENTRATE FILTER													
Filtered Moly Concentrate	0.70	50.0	0.03	0.02	0.04	60.00	1.2	0.1	1.4	0.6	2.70	91.0	2.34
Moly Conc. Filter Filtrate	-	-	-	-				0.8	0.8	0.8	-	-	1.00
Moly Conc. Filter Feed	0.70	50.0	0.03	0.02	0.04	60.00	1.2	0.9	2.2	1.4	2.70	57.4	1.57

CHECK ON MOLY-TALC FLOTATION CIRCUIT TOTAL WATER & SLURRY:		MTPH	M3/HR
INCOMING		Water	Slurry
2nd Copper Cleaner Tail		329.4	346.4
Copper Cleaner-Scav. Tail		263.6	274.6
Copper Flot.Conc.Thickener Feed Pump Gld. Water		0.8	0.8
Copper Flot.Conc. Thick.U'Flow Pump Gld. Water		0.8	0.8
Copper Flot.Conc. Filter Feed Pump Gld. Water		0.8	0.8
Copper Flot.Conc. Filter Wash Water		5.3	5.3
Copper Flot.Tails Thick.U'Flow Pump Gld. Water		0.8	0.8
Hot Steam		30.2	30.2
Moly-Talc Rougher Flot. Pump Seal Water		0.8	0.8
Moly-Talc Rougher Flot. Feed Dilution Water		135.5	135.5
Moly-Talc Rougher. Flot. Conc. Launder Water		37.2	37.2
Moly-Talc Scav. Flot. Feed Pump Seal Water		0.1	0.1
Moly-Talc Scav. Flot. Feed Dilution Water		8.3	8.3
Moly-Talc Scav. Conc. Launder Water		0.4	0.4
Moly-Talc Conc.Thick.U'Flow Pump Gld. Water		0.7	0.7
Moly-Talc Conc. Filter Feed Pump Gld. Water		0.7	0.7
Moly-Talc Conc. Filter Wash Water		4.6	4.6
Moly-Talc Conc.Conditioning Dilution Water		204.0	204.0
Talc Rougher Flotation Feed Pump Seal Water		0.7	0.7
Talc Rougher Flotation Feed Dilution Water		36.5	36.5
Moly Rougher Flot. Pump Seal Water		0.2	0.2
Moly Rougher Flot. Feed Dilution Water		5.2	5.2
Moly Rougher Flot.Conc. Launder Water		1.7	1.7
1st Moly Clnr Feed Pump Seal Water		0.1	0.1
1st Moly Clnr Column Washwater		6.3	6.3
1st Moly Cleaner Conc.Launder Water		1.6	1.6
2nd Moly Clnr Feed Pump Seal Water		0.0	0.0
2nd Moly Clnr Column Washwater		5.1	5.1
2nd Moly Cleaner Conc. Launder Water		1.2	1.2
3rd Moly Clnr Feed Pump Seal Water		0.0	0.0
3rd Moly Clnr Column Washwater		5.1	5.1
3rd Moly Cleaner Conc. Launder Water		1.0	1.0
4th Moly Clnr Feed Pump Seal Water		0.0	0.0
4th Moly Clnr Column Washwater		3.5	3.5
4th Moly Cleaner Conc. Launder Water		0.8	0.8
5th Moly Clnr Feed Pump Seal Water		0.0	0.0
5th Moly Clnr Column Washwater		3.1	3.1
5th Moly Cleaner Conc. Launder Water		0.7	0.7
6th Moly Clnr Feed Pump Seal Water		0.0	0.0
6th Moly Clnr Column Washwater		3.1	3.1
6th Moly Cleaner Conc. Launder Water		0.7	0.7
	Total In	**1069.6**	**1097.7**
Total Gland water		4.1	
OUTGOING			
Copper Flotation Tails Thickener Overflow		530.2	530.2
Moly-Talc Concentrate Thickener Overflow		241.1	241.1
Roaster off gases and vapor		6.1	6.1
Moly-Talc Scavenger Tail		31.4	34.3
Diluted Moly-Talc Scav. Flotation Conc.		2.7	3.0
Talc Rougher Flotation Concentrate		148.1	165.5
Moly Rougher Flotation Tail		84.7	91.9
4th Moly Cleaner Tail Thickener Overflow		6.3	6.3
5th Moly Cleaner Tail Thickener Overflow		8.4	8.4
Diluted 6th Moly Cleaner Concentrate		5.7	6.1
	Total Out	**1064.7**	**1092.8**
		-4.9	-4.9

Str. No	Description	%Cu	% Mo	%Wt	Cu Units	Cu,%Dist Overall	Mo,%Dist Overall	MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Slurry	Solids SG	% Sols by Wt	Slurry SG
	FINAL FLOTATION TAILS THICKENER FEED													
	Copper Rougher Flotation Tail	0.04	0.01	87.39	3.24	5.40	16.38	3368.4	7859.5	11227.9	9117.7	2.68	30.00	1.23
	1st Copper Cleaner Tail	0.31	0.05	9.11	2.83	4.71	18.22	352.3	1564.6	1916.9	1695.6	2.69	18.38	1.13
	Moly-Talc Scavenger Tail	0.45	0.16	0.20	0.09	0.15	1.20	7.7	31.4	39.1	34.3	2.69	19.6	1.14
	Talc Rougher Flotation Concentrate	0.34	0.02	1.22	0.42	0.70	1.00	46.8	148.1	194.9	165.5	2.69	24.0	
	Final Flotation Tails Thickener Feed	0.07	0.01	97.91	6.58	10.96	36.80	3775.1	9603.7	13378.8	11013.1	2.68	28.2	1.21
	FINAL FLOTATION TAILS THICKENER													
	Final Flotation Tails Thickener Underflow	0.07	0.01	97.91	6.58	10.96	36.80	3775.1	3088.7	6863.8	4498.3	2.68	55.0	1.53
	Final Flotation Tails Thickener Overflow								6515.0	6515.0	6514.8			1.00
	Final Flotation Tails Thickener Feed	0.07	0.01	97.91	6.58	10.96	36.80	3775.1	9603.7	13378.8	11013.1	2.7	28.2	1.21
	FINAL TAILINGS CYCLONE AREA FEED													
	Seal Water to Pumps								27.8	27.8	27.8			
	Final Tailings Thickener Underflow							3775.1	3088.7	6863.8	4498.3	2.68	55.0	1.53
	Cyclone Feed Pump Gland Seal Water								37.8	37.8	37.8	-	-	1.00
	Final Tailings Cyclone Feed							3775.1	3154.3	6929.4	4563.8	2.68	54.5	1.52
	FINAL TAILINGS AREA CYCLONES													
	Final Tailings Cyclone Feed							3775.1	3154.3	6929.4	4563.8	2.68	54.5	1.52
	Final Tailings Cyclone Underflow							2265.1	970.7	3235.8	1816.5	2.68	70.0	1.78
	Final Tailings Cyclone Overflow							1510.0	2183.5	3693.6	2747.3	2.68	40.9	1.34
	TOTAL RECLAIM WATER													
	Copper Flotation Conc. Thickener Overflow	-		-	-	-			279.0	279.0	279.0			1.00
	Copper Flotation Tails Thickener Overflow								530.2	530.2	530.2			1.00
	Moly-Talc Concentrate Thickener Overflow	-		-	-	-			241.1	241.1	241.1			1.00
	4th Moly Cleaner Tail Thickener Overflow								6.3	6.3	6.3			
	5th Moly Cleaner Tail Thickener Overflow								8.4	8.4	8.4			
	Moly Concentrate Thickener Overflow								5.6	5.6	5.6			1.00
	Final Flotation Tails Thickener Overflow								6515.0	6515.0	6514.8			1.00
	Tailings Area Recl.Water	-		-	-	-			2523.4	2523.4	2523.4	-	-	1.00
	TOTAL RECLAIM WATER	-		-	-	-			10109.0	10109.0	10109.0	-	-	1.00

PROCESS FLOW MASS BALANCE

Aker Kvaerner

Nominal Feedrate - 77000 mtpd
Crushing/Conveying Availability = 80.0%
Concentrator Availability = 90.0%
Feed grade - 0.60% Total Cu
Feed grade - Au

TOROMOCHO COPPER-MOLY PROJECT
PRIMARY CRUSHING AND STOCKPILE CIRCUIT
PFD BALANCE

Project No. 180600
Date 18/12/2006
Revision A

Str. No	Description	METALLURGICAL BALANCE %Cu	% Mo	%Wt	Units	%Dist Overall		MASS BALANCE MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Solids	M3/HR Water	M3/HR Slurry	Solids SG	% Sols by Wt	Slurry SG
	PRIMARY CRUSHER															
	Total - ROM Ore from Trucks	0.60	0.03	100.00	60.00	100.00		3850.0	119.1	3969.1	1425.9	119.1	1545.0	2.70	97.0	2.57
	CRUSHER DISCHARGE CONVEYOR															
	Crushed Ore from Discharge Pocket	0.60		100.00	60.00	100.00		3850.0	119.1	3969.1	1425.9	119.1	1545.0	2.70	97.0	2.57
	OVERLAND CONVEYORS															
	Crushed Ore from Crusher	0.60		100.00	60.00	100.00		3850.0	119.1	3969.1	1425.9	119.1	1545.0	2.70	97.0	2.57
	Fresh Water to Coarse Ore Overland Conv Dust. Sup.								2.0	2.0		2.0	2.0			
	Fresh Water Shuttle Conv. Dust Suppression								1.0	1.0		1.0	1.0			
	COARSE ORE STACKER															
	Crushed Ore from Conveyors	0.60		100.00	60.00	100.00		3850.0	119.1	3969.1	1425.9	119.1	1545.0	2.70	97.0	2.57
	COARSE ORE STOCKPILE															
	Coarse Ore from Stacker	0.60		100.00	60.00	100.00		3850.0	119.1	3969.1	1425.9	119.1	1545.0	2.70	97.0	2.57
	Stockpile Reclaim Dust Suppression Water								37.5	37.5		37.5	37.5			
	COARSE ORE FEEDERS															
	New Feed to SAG mill	0.60		100.00	60.00	100.00		3208.3	99.2	3307.6	1188.3	99.2	1287.5	2.70	97.0	2.57

Nominal Feedrate - 77000 mtpd
Crushing/Conveying Availability = 80.0%
Concentrator Availability = 90.0%
Feed grade - 0.60% Total Cu
Feed grade - Au

TOROMOCHO COPPER-MOLY PROJECT
GRINDING & PEBBLE CRUSHING CIRCUIT

Project No. 180600
Date 18/12/2006
Revision A

Str. No	Description	METALLURGICAL BALANCE %Cu	% Mo	%Wt	Units	%Dist Overall		MASS BALANCE MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Solids	M3/HR Water	M3/HR Slurry	Solids SG	% Sols by Wt	Slurry SG
	SAG MILL FEED															
	New Feed from Coarse Ore Stockpile	0.60	0.03	100.00	60.00	100.00		3208.3	99.2	3307.6	1188.3	99.2	1287.5	2.70	97.0	2.57
	Recycled Pebbles	0.60		25.00	15.00	25.00		802.1	200.5	1002.6	297.1	200.5	497.6	2.70	80.0	2.01
	SAG Mill Feed	0.60		125.00	75.00	125.00		4010.4	299.7	4310.2	1485.3	299.7	1785.1	2.70	93.0	2.41
	SAG MILL															
	SAG Mill Feed	0.60		125.00	75.00	125.00		4010.4	299.7	4310.2	1485.3	299.7	1785.1	2.70	93.0	2.41
	SAG Mill Feed Water	-		-	-	-			1419.0	1419.0		1419.0	1419.0	-	-	-
	SAG Mill Discharge	0.60		125.00	75.00	125.00		4010.4	1718.8	5729.2	1485.3	1718.8	3204.1	2.70	70.0	1.79
	SAG TROMMEL FEED															
	SAG Mill Discharge	0.60		125.00	75.00	125.00		4010.4	1718.8	5729.2	1485.3	1718.8	3204.1	2.70	70.0	1.79
	SAG Trommel and screen water	-		-	-	-			440.7	440.7		440.7	440.7	-	-	-
	SAG Trommel Feed	0.60		125.00	75.00	125.00		4010.4	2159.5	6169.9	1485.3	2159.5	3644.8	2.70	65.0	1.69
	SAG TROMMEL															
	SAG Trommel O'Size	0.60		115.00	69.00	115.00		3689.6	1040.7	4730.2	1366.5	1040.7	2407.2	2.70	78.0	1.97
	SAG Trommel U'Size	0.60		10.00	6.00	10.00		320.8	1118.8	1439.6	118.8	1118.8	1237.6	2.70	22.3	1.16
	SAG Trommel Feed	0.60		125.00	75.00	125.00		4010.4	2159.5	6169.9	1485.3	2159.5	3644.8	2.70	65.0	1.69
	SAG SCREEN															
	SAG Discharge Screen O'Size	0.60		25.00	15.00	25.00		802.1	200.5	1002.6	297.1	200.5	497.6	2.70	80.0	2.01
	SAG Discharge Screen U'Size	0.60		90.00	54.00	90.00		2887.5	840.1	3727.6	1069.4	840.1	1909.6	2.70	77.5	1.95
	SAG Discharge Screen Feed	0.60		115.00	69.00	115.00		3689.6	1040.7	4730.2	1366.5	1040.7	2407.2	2.70	78.0	1.97
	PEBBLE CRUSHER FEED															
	SAG Discharge Screen O'Size	0.60		25.00	15.00	25.00		802.1	200.5	1002.6	297.1	200.5	497.6	2.70	80.0	2.01
	Pebble Crusher Feed/Discharge	0.60		25.00	15.00	25.00		802.1	200.5	1002.6	297.1	200.5	497.6	2.70	80.0	2.01
	BALL MILL CYCLONE FEED															
	SAG Trommel U'Size	0.60		10.00	6.00	10.00		320.8	1118.8	1439.6	118.8	1118.8	1237.6	2.70	22.3	1.16
	SAG Discharge Screen U'Size	0.60		90.00	54.00	90.00		2887.5	840.1	3727.6	1069.4	840.1	1909.6	2.70	77.5	1.95
	Ball Mill Cyclone Underflow	0.60		300.00	162.00	270.00	*	9625.0	4125.0	13750.0	3564.8	4125.0	7689.8	2.70	70.0	1.79
	Ball Mill Milk of Lime Feed							15.5	139.8	155.3	7.1	139.8	146.8	2.20	10.0	1.06
	Ball Mill Cyclone Dilution Water	-		-	-	-			5250.4	5250.4		5250.4	5249.1		-	-
	SAG + Ball Mills Cooling Water	-		-	-	-			144.4	144.4		144.4	144.4	-	-	-
	Ball Mill Cyclone Feed Pump Gland Water	-		-	-	-			28.9	28.9		28.9	28.9	-	-	-
	Ball Mill Cyclone Feed	0.60		400.00	216.00	360.00		12848.9	11647.3	24496.2	4758.8	11647.3	16406.2	2.70	52.5	1.49
	BALL MILL CYCLONES															
	Flotation Circuit Feed	0.60		100.00	54.00	90.00		3223.9	7522.3	10746.2	1194.0	7522.3	8716.4	2.70	30.0	1.23
	Ball Mill Cyclone Underflow	0.60		300.00	162.00	270.00		9625.0	4125.0	13750.0	3564.8	4125.0	7689.8	2.70	70.0	1.79
	Ball Mill Cyclone Feed	0.60		400.00	216.00	360.00		12848.9	11647.3	24496.2	4758.8	11647.3	16406.2	2.70	52.5	1.49

CHECK ON GRINDING CIRCUIT TOTAL WATER & SLURRY:		MTPH	M3/HR
INCOMING:		Water	Slurry
Fresh Water to Coarse Ore Overland Conv Dust. Sup.		2	2.0
Fresh Water Shuttle Conv. Dust Suppression		1	1.0
Stockpile Reclaim Dust Suppression Water		38	37.5
New Feed from Coarse Ore Stockpile		99	1287.5
SAG Mill Feed Water		1419	1419.0
SAG Trommel and screen water		441	440.7
Ball Mill Cyclone Dilution Water		5250	5249.1
SAG + Ball Mills Cooling Water		144	144.4
Ball Mill Milk of Lime Feed		140	146.8
Ball Mill Cyclone Feed Pump Gland Water		29	28.9
	Total In	7563	8756.9
OUTGOING:			
Dust Suppression Losses		41	40.5
Flotation Circuit Feed		7522	8716.4
	Total Out	7563	8756.9
		0.0	0.0

Nominal Feedrate - 77000 mtpd
Crushing/Conveying Availability = 80.0%
Concentrator Availability = 90.0%
Feed grade - 0.60% Total Cu
Feed grade - Au

TOROMOCHO COPPER-MOLY PROJECT
BULK FLOTATION AND REGRIND CIRCUIT

Project No. 180600
Date 18/12/2006
Revision A

		METALLURGICAL BALANCE						MASS BALANCE								
		0.85	0.02	1.42	1.20	2.00	1.00									
Str. No	Description	%Cu	% Mo	%Wt	Cu Units	Cu,%Dist Overall	Mo,%Dist Overall	MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Solids	M3/HR Water	M3/HR Slurry	Solids SG	% Sols by Wt	SG
	OVERALL FLOTATION CIRCUIT															
	Copper Flotation Concentrate	26.3	0.04	2.03	53.40	89.00	3.20	65.1						4.40		
	Moly Flotation Concentrate	0.70	50.00	0.03	0.02	0.04	60.00	1.0						3.82		
	Final Flotation Tails	0.07	0	97.94	6.58	10.96	36.80	3157.7						2.68		
	Flotation Circuit Feed	0.60	0.027	100.00	60.00	100.00	100.00	3223.9	7522.3	10746.2	1194.0	7522.3	8716.4	2.70	30.0	1.23
	COPPER ROUGHER FLOTATION															
	Undiluted Copper Rough. Flot. Conc.	4.50	0.18	12.61	56.76	94.60	83.62	404.7	944.2	1348.9	141.1	944.2	1085.3	2.87	30.0	1.24
	Copper Rougher Flotation Tail	0.04	0.01	87.39	3.24	5.40	16.38	2819.2	6578.1	9397.3	1052.9	6578.1	7631.0	2.68	30.0	1.23
	Flotation Circuit Feed	0.60	0.03	100.00	60.00	100.00	100.00	3223.9	7522.3	10746.2	1194.0	7522.3	8716.4	2.70	30.0	1.23
	COPPER ROUGH. CONC. LAUNDER WATER															
	Undiluted Copper Rough. Flot. Conc.	4.50	0.18	12.61	56.76	94.60	83.62	404.7	944.2	1348.9	141.1	944.2	1085.3	2.87	30.0	1.24
	Copper Rougher Flot. Launder Water	-		-	-	-			96.4	96.4		96.4	96.4	-	-	1.00
	Diluted Copper Rough. Flot. Conc.	4.50	0.18	12.61	56.76	94.60	83.62	404.7	1040.6	1445.3	141.1	1040.6	1181.7	2.87	28.0	1.22
	REGRIND CIRCUIT NEW FEED															
	Diluted Copper Rough. Flot. Conc.	4.50	0.18	12.61	56.76	94.60	83.62	404.7	1040.6	1445.3	141.1	1040.6	1181.7	2.87	28.0	1.22
	Diluted Mo-Talc Scavenger Conc.	12.00	1.35	0.02	0.24	0.40	1.00	0.6	2.3	2.9	0.2	2.3	2.5	3.26	22.0	1.18
	Moly Rougher Flotation Tail	3.54	0.37	0.53	1.87	3.11	7.20	16.9	70.9	87.8	6.0	70.9	76.9	2.82	19.3	1.14
	Regrind Mill Cooling Water	-		-	-	-			17.0	17.0		17.0	17.0	-	-	1.00
	Regrind Mill Dilution Water	-		-	-	-			81.2	81.2		81.2	81.2	-	-	1.00
	Regrind Mill Feed Pump Gland Water								0.0	0.0		0.0	0.0		-	1.00
	Milk of Lime to Regrinding Sump							3.2	28.8	32.0	1.5	28.8	30.3	2.20	10.0	1.06
	Regrind Mill Sump Water								356.4	356.4		356.4	356.4	-	-	1.00
	Cycl.Feed Pump Gland Water	-		-	-	-			3.3	3.3		3.3	3.3	-	-	1.00
	Regrind Circuit New Feed	4.47	0.19	13.16	58.87	98.11	91.82	425.4	1600.5	2025.9	148.7	1600.5	1749.2	2.86	21.0	1.16
	REGRIND CYCLONE															
	Regrind Cyclone Overflow	4.47	0.19	13.16	58.87	98.11	91.82	425.4	1600.5	2025.9	148.7	1600.5	1749.2	2.87	21.0	1.16
	Regrind Cyclone Underflow	4.47	0.19	19.74	88.30	147.17	137.73	633.4	341.0	974.4	220.9	341.0	562.0	2.87	65.0	1.73
	Diluted Regrind Cyclone Feed	4.47	0.19	32.90	147.17	245.28	229.55	1058.8	1941.5	3000.4	369.3	1941.5	2310.9	2.87	35.3	1.30
	REGRIND MILL FEED															
	Regrind Cyclone Underflow	4.47	0.19	19.74	88.30	147.17	137.73	633.4	341.0	974.4	220.9	341.0	562.0	2.87	65.0	1.73
	Regrind Mill Dilution Water								81.2	81.2		81.2	81.2		-	1.00
	Diluted Regrind Mill Feed	4.47	0.19	19.74	88.30	147.17	137.73	633.4	422.2	1055.6	220.9	422.2	643.2	2.87	60.0	1.64
	1ST COPPER CLEANER FEED															
	Regrind Cyclone Overflow	4.47	0.19	13.16	58.87	98.11	91.82	425.4	1600.5	2025.9	148.7	1600.5	1749.2	2.87	21.0	1.16
	1st Copper Clnr Feed Pump Seal Water								4.3	4.3		4.3	4.3	-	-	1.00
	1st Copper Clnr Feed Dilution Water								97.0	97.0		97.0	97.0	-	-	1.00
	Diluted 1st Copper Cleaner Feed	4.47	0.19	13.16	58.87	98.11	91.82	425.4	1701.8	2127.2	148.4	1701.8	1850.2	2.87	20.0	1.15
	1ST COPPER CLEANER FLOTATION															
	1st Copper Cleaner Concentrate	13.90	0.49	4.03	56.04	93.40	73.60	129.3	387.9	517.2	38.3	387.9	426.2	3.38	25.0	1.21
	1st Copper Cleaner Tail	0.31	0.05	9.13	2.83	4.71	18.22	296.1	1313.9	1610.0	110.1	1313.9	1423.9	2.69	18.4	1.13
	Diluted 1st Copper Cleaner Feed	4.47	0.19	13.16	58.87	98.11	91.82	425.4	1701.8	2127.2	148.4	1701.8	1850.2	2.87	20.0	1.15
	1ST.COPPER CLEAN.CONC.LAUND.WATER															
	Undiluted 1st.Copper Cleaner Conc.	13.90	0.49	4.03	56.04	93.40	73.60	129.3	387.9	517.2	38.3	387.9	426.2	3.38	25.0	1.21
	1st Copper Clean. Conc.Launder Water	-		-	-	-			98.5	98.5		98.5	98.5	-	-	1.00
	Diluted 1st.Copper Cleaner Conc.	13.90	0.49	4.03	56.04	93.40	73.60	129.3	486.4	615.8	38.3	486.4	524.8	3.38	21.00	1.17
	2ND COPPER CLEANER FEED															
	1st Copper Cleaner Concentrate	13.90	0.49	4.03	56.04	93.40	73.60	129.3	486.4	615.8	38.3	486.45	524.8	3.38	21.0	1.17
	Diluted Copper Cleaner Scav. Conc.	22.0	0.08	0.94	20.64	34.40	2.95	30.1	120.4	150.5	7.6	120.40	128.0	3.98	20.0	1.18
	2nd Copper Clnr Feed Pump Seal Water	-		-	-	-			1.59	1.59		1.59	1.59	-	-	1.00
	2nd Copper Clnr Feed Dilution Water	-		-	-	-			29.2	29.2		29.19	29.2	-	-	1.00
	Diluted 2nd Copper Cleaner Feed	15.43	0.42	4.97	76.68	127.80	76.55	159.4	637.6	797.0	45.9	637.6	683.5	3.47	20.0	1.17

	2ND COPPER CLEANER FLOTATION															
	Undiluted 2nd Copper Cleaner Concentrate	20.11	0.22	3.77	75.80	126.33	30.65	120.9	362.7	483.6	31.6	362.7	394.4	3.82	25.0	1.23
	2nd Copper Cleaner Tail	0.74	1.03	1.20	0.88	1.47	45.90	38.5	274.9	313.4	14.2	274.9	289.1	2.71	12.3	1.08
	Diluted 2nd Copper Cleaner Feed	15.43	0.42	4.97	76.68	127.80	76.55	159.4	637.6	797.0	45.9	637.6	683.5	3.47	20.0	1.17
	2ND COPPER CLEAN.CONC. LAUNDER WATER															
	Undiluted 2nd Copper Cleaner Concentrate	20.11	0.22	3.77	75.80	126.33	30.65	120.9	362.7	483.6	31.6	362.7	394.4	3.82	25.0	1.23
	2nd Copper Cleaner Conc. Launder Water								66.0	66.0		66.0	66.0	-	-	1.00
	Diluted 2nd Copper Cleaner Concentrate	20.11	0.22	3.77	75.80	126.33	30.65	120.9	428.7	549.6	31.6	428.7	460.3	3.82	22.0	1.19
	3RD COPPER CLEANER FEED															
	Diluted 2nd Copper Cleaner Concentrate	20.11	0.22	3.77	75.80	126.33	30.65	120.9	428.7	549.6	31.6	428.7	460.3	3.82	22.0	1.19
	3rd Copper Clnr Feed Pump Seal Water	-		-	-	-			1.2	1.2		1.2	1.2	-	-	1.00
	3rd Copper Clnr Feed Dilution Water	-		-	-	-			102.8	102.8		102.8	102.8	-	-	1.00
	Diluted 3rd Copper Cleaner Feed	20.11	0.22	3.77	75.80	126.33	30.65	120.9	532.7	653.6	31.6	532.7	564.3	3.82	18.50	1.16
	3RD COPPER CLEANER FLOTATION															
	Undiluted 3rd Copper Cleaner Concentrate	26.3	0.04	2.03	53.40	89.00	3.20	65.1	206.3	271.4	14.8	206.3	221.1	4.40	24.0	1.23
	3rd Copper Cleaner Tail	12.89	0.43	1.74	22.40	37.33	27.45	55.8	326.4	382.1	16.8	326.4	343.2	3.31	14.6	1.11
	Diluted 3rd Copper Cleaner Feed	20.11	0.22	3.77	75.80	126.33	30.65	120.9	532.7	653.6	31.6	532.7	564.3	3.82	18.5	1.16
	3RD COPPER CLEAN.CONC. LAUNDER WATER															
	Undiluted 3rd Copper Cleaner Concentrate	26.3	0.04	2.03	53.40	89.00	3.20	65.1	206.3	271.4	14.8	206.3	221.1	4.40	24.0	1.23
	3rd Copper Cleaner Conc. Launder Water								24.7	24.7		24.7	24.7	-	-	1.00
	Final 3rd Copper Cleaner Concentrate	26.3	0.04	2.03	53.40	89.00	3.20	65.1	231.0	296.1	14.8	231.0	245.8	4.40	22.0	1.20
	COPPER CLEANER-SCAV. FLOTATION															
	Undiluted Copper Cleaner-Scav. Conc.	22.0	0.08	0.94	20.64	34.40	2.95	30.1	106.7	136.8	7.6	106.7	114.3	3.98	22.0	1.20
	Copper Cleaner-Scav. Tail	2.20	0.83	0.80	1.76	2.93	24.50	25.7	219.7	245.3	9.3	219.7	228.9	2.77	10.5	1.07
	Copper Cleaner-Scav. Feed	12.89	0.43	1.74	22.40	37.33	27.45	55.8	326.4	382.1	16.8	326.4	343.2	3.3	14.6	1.11
	COPPER CLEAN.SCAV. CONC. LAUNDER WATER															
	Undiluted Copper Cleaner-Scav. Conc.	22.0	0.08	0.94	20.64	34.40	2.95	30.1	106.7	136.8	7.6	106.7	114.3	3.98	22.0	1.20
	Copper Cleaner-Scav. Conc. Launder Water	-		-	-				13.7	13.7		13.7	13.7	-	-	1.00
	Diluted Copper Cleaner-Scav. Conc.	22.0	0.08	0.94	20.64	34.40	2.95	30.1	120.4	150.5	7.6	120.4	128.0	3.98	20.0	1.18
	COPPER FLOTATION CIRCUIT TAILS															
	Copper Rougher Flotation Tail	0.04	0.01	87.39	3.24	5.40	16.38	2819.2	6578.1	9397.3	1052.9	6578.1	7631.0	2.68	30.0	1.23
	1st Copper Cleaner Tail	0.31	0.05	9.13	2.83	4.71	18.22	296.1	1313.9	1610.0	110.1	1313.9	1423.9	2.69	18.4	1.13
	2nd Copper Cleaner Tail	0.74	1.03	1.20	0.88	1.47	45.90	38.5	274.9	313.4	14.2	274.9	289.1	2.71	12.3	1.08
	Copper Cleaner-Scavenger Tail	2.20	0.83	0.80	1.76	2.93	24.50	28.9	219.7	245.3	9.3	219.7	228.9	2.77	11.8	1.07
	OSA Wash Water								518.8	518.8		518.8	518.8	-	-	1.00
	Copper Flotation Circuit Tails	0.09	0.03	98.52	8.71	14.51	105.00	3182.7	8905.3	12084.8	1186.5	8905.3	10091.8	2.68	26.3	1.20
	COPPER FLOTATION CONCENTRATE THICKENER FEED															
	Final 3rd Copper Cleaner Concentrate	26.3	0.04	2.03	53.40	89.00	3.20	65.1	231.0	296.1	14.8	231.0	245.8	4.40	22.0	1.20
	Copper Flot.Conc.Thickener Feed Pump Gld.	-		-	-				0.7	0.7		0.7	0.7	-	-	1.00
	Copper Flotation Conc. Filter Filtrate	-		-	-			0.0	34.3	34.3		34.3	34.3	-	-	1.00
	Copper Flotation Conc. Thickener Feed	26.3	0.04	2.03	53.40	89.00	3.20	65.1	265.9	331.0	14.8	265.9	280.7	4.40	19.7	1.18
	COPPER FLOTATION CONCENTRATE THICKENER															
	Copper Flotation Conc.Thickener Underflow	26.3	0.04	2.03	53.40	89.00	3.20	65.1	35.1	100.2	14.8	35.1	49.9	4.40	65.0	2.01
	Copper Flotation Conc. Thickener Overflow								230.8	230.8		230.8	230.8			1.00
	Copper Flotation Conc. Thickener Feed	26.3	0.04	2.03	53.40	89.00	3.20	65.1	265.9	331.0	14.8	265.9	280.7	4.4	19.7	1.18
	COPPER FLOTATION CONCENTRATE SLURRY STORAGE															
	Copper Flotation Conc. Thickener Underflow	26.3	0.04	2.03	53.40	89.00	3.20	65.1	35.1	100.2	14.8	35.1	49.9	4.40	65.0	2.01
	Copper Flot.Conc. Thick.U'Flow Pump Gld. W	-		-	-				0.7	0.7		0.7	0.7	-	-	1.00
	Copper Flot.Conc. Slurry Storage Feed/Disch	26.3	0.04	2.03	53.40	89.00	3.20	65.1	35.7	100.9	14.8	35.7	50.5	4.40	64.6	2.00
	COPPER FLOTATION CONCENTRATE FILTER FEED															
	Copper Flot.Conc. Slurry Storage Feed/Disch	26.3	0.04	2.03	53.40	89.00	3.20	65.1	35.7	100.9	14.8	35.7	50.5	4.40	64.6	2.00
	Copper Flot.Conc. Filter Feed Pump Gld. Wa	-		-	-				0.7	0.7		0.7	0.7	-	-	1.00
	Copper Flot.Conc. Filter Feed (actual)	26.3	0.04	2.03	53.40			65.1	36.4	101.5	14.8	36.4	51.2	4.40	64.2	1.98
	Copper Flot.Conc. Filter Wash Water								4.4	4.4		4.4	4.4	-	-	1.00
	Copper Flot.Conc. Filter Feed (effective)	26.3	0.04	2.03	53.40	89.00	3.20	65.1	40.7	105.9	14.8	40.7	55.5	4.40	61.5	1.91
	COPPER FLOTATION CONCENTRATE FILTER															
	Filtered Copper Flotation Concentrate	26.3	0.04	2.03	53.40	89.00	3.20	65.1	6.4	71.6	14.8	6.4	21.2	4.40	91.0	3.37
	Copper Flotation Concentrate Filter Filtrate	-		-	-				34.3	34.3		34.3	34.3	-	-	1.00
	Copper Flotation Concentrate Filter Feed	26.3		2.03	53.40	89.00	3.20	65.1	40.7	105.9	14.8	40.7	55.5	4.40	61.53	1.91

TOROMOCHO COPPER-MOLY PROJECT

CHECK ON COPPER FLOTATION TOTAL WATER & SLURRY:		MTPH	M3/HR
INCOMING		Water	Slurry
Flotation Circuit Feed		7522.3	8716.37
Diluted Mo-Talc Scavenger Conc.		2.3	2.47
Moly Rougher Flotation Tail		70.9	76.91
Copper Rougher Flot. Launder Water		96.4	96.35
Copper Cleaner-Scav. Conc. Launder Water		13.7	13.68
Regrind Mill Cooling Water		17.0	17.00
Regrind Mill Dilution Water		81.2	81.20
Regrind Mill Feed Pump Gland Water		0.0	0.00
Regrind Mill Sump Milk of Lime Feed		28.8	30.25
Regrind Mill Sump Water		356.4	356.40
Cycl.Feed Pump Gland Water		3.3	3.30
1st Copper Clnr Feed Pump Seal Water		4.3	4.25
1st Copper Clnr Feed Dilution Water		97.0	97.04
1st Copper Clean. Conc.Launder Water		98.5	98.52
2nd Copper Clnr Feed Pump Seal Water		1.6	1.59
2nd Copper Clnr Feed Dilution Water		29.2	29.19
2nd Copper Cleaner Conc. Launder Water		66.0	65.95
Bulk 3rd Clnr Feed Pump Seal Water		1.2	1.21
Bulk 3rd Clnr Feed Dilution Water		102.8	102.77
Bulk 3rd Cleaner Launder Water		24.7	24.68
OSA Wash Water		518.8	518.78
	Total In	9136	10337.92
OUTGOING			
Final Bulk 3rd Cleaner Concentrate		231	245.77
Copper Flotation Circuit Tails		8905	10091.82
	Total Out	9136	10337.58
		0.0	-0.3

Nominal Feedrate - 77000 mtpd
Crushing/Conveying Availability = 80.0%
Concentrator Availability = 90.0%
Feed grade - 0.60% Total Cu
Feed grade - Au

TOROMOCHO COPPER-MOLY PROJECT
MOLY-TALC FLOTATION CIRCUIT

Project No. 180600
Date 18/12/2006
Revision A

		METALLURGICAL BALANCE						MASS BALANCE								
Str. No	Description	%Cu	% Mo	%Wt	Cu Units	Cu,%Dist Overall	Mo,%Dist Overall	MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Solids	M3/HR Water	M3/HR Slurry	Solids SG	% Sols by Wt	Slurry SG
	COPPER TAILS THICKENER FEED															
	2nd Copper Cleaner Tail	0.74	1.03	1.20	0.88	1.47	45.90	38.5	274.91	313.41	14.23	274.91	289.1	3.64	12.28	1.08
	Copper Cleaner-Scav. Tail	2.20	0.83	0.80	1.76	2.93	24.50	25.7	219.65	245.32	9.28	219.65	228.9	1.22	10.46	1.07
	Copper Flotation Tails Thickener Feed	1.32	0.95	2.00	2.64	4.40	70.40	64.2	494.6	558.7	23.5	494.6	518.1	2.03	11.5	1.08
	COPPER TAILS THICKENER															
	Copper Flotation Tails Thickener Underflow	1.32	0.95	2.00	2.64	4.40	70.40	64.2	48.4	112.6	31.7	48.4	80.1	2.03	57.0	1.41
	Copper Flotation Tails Thickener Overflow								446.2	446.2		446.2	438.0			1.00
	Copper Flotation Tails Thickener Feed	1.32	0.95	2.00	2.64	4.40	70.40	64.2	494.6	558.7	23.5	494.6	518.1	2.0	11.5	1.08
	COPPER TAILS CONDITIONING TANK FEED															
	Copper Flotation Tails Thickener Underflow	1.32	0.95	2.00	2.64	4.40	70.40	64.2	48.4	112.6	31.7	48.4	80.1	2.03	57.0	1.41
	Copper Flot.Tails Thick.U'Flow Pump Gld. W	-		-	-				12.8	12.8		12.8	12.8	-	-	1.00
	Copper Flot.Tails Conditioning Tank Feed	1.32	0.95	2.00	2.64	4.40	70.40	64.2	61.2	125.4	31.7	61.2	92.9	2.03	51.2	1.35
	COPPER TAILS CONDITIONING TANK															
	Copper Flot.Tails Conditioning Tank Feed	1.32	0.95	2.00	2.64	4.40	70.40	64.2	61.2	125.4	31.7	61.2	92.9	2.03	51.2	1.35
	Hot Steam								17.2	17.2		17.2	17.2			
	Copper Flot.Tails Conditioning Tank Discharg	1.32	0.95	2.00	2.64	4.40	70.40	64.2	78.4	142.6	31.7	78.4	110.1	2.03	45.0	1.30
	MOLY-TALC ROUGHER FLOTATION FEED															
	Copper Flot.Tails Conditioning Tank Discharg	1.32	0.95	2.00	2.64	4.40	70.40	64.2	78.4	142.6	31.7	78.4	110.1	2.03	45.0	1.30
	Moly-Talc Rougher Flot. Pump Seal Water	-		-	-	-			0.6	0.6		0.6	0.6	-	-	1.00
	Moly-Talc Rougher Flot. Feed Dilution Water	-		-	-	-			113.4	113.4		113.4	113.4	-	-	1.00
	Diluted Moly-Talc Rougher Flotation Feed	1.32	0.95	2.00	2.64	4.40	70.40	64.2	192.5	256.7	31.7	192.5	224.2	2.03	25.0	1.15
	MOLY-TALC ROUGHER FLOTATION															
	Undiluted Moly-Talc Rougher Flotation Conc	1.30	1.03	1.78	2.31	3.85	68.20	57.1	171.3	228.4	27.7	171.3	199.0	2.06	25.0	1.15
	Moly-Talc Rougher Flotation Tail	1.50	0.27	0.22	0.33	0.55	2.20	7.06	21.2	28.2	4.0	21.2	25.1	1.78	25.0	1.12
	Diluted Moly-Talc Rougher Flotation Feed	1.32	0.95	2.00	2.64	4.40	70.40	64.2	192.5	256.7	31.7	192.5	224.2	2.03	25.0	1.15
	MOLY-TALC ROUGHER FLOT.CONC. LAUNDER WATER															
	Undiluted Moly-Talc Rougher Flotation Conc	1.30	1.03	1.78	2.31	3.85	68.20	57.1	171.3	228.4	27.7	171.3	199.0	2.06	25.0	1.15
	Moly-Talc Rougher. Flot. Conc. Launder Wat	-		-	-				31.2	31.2		31.2	31.2	-	-	1.00
	Diluted Moly-Talc Rougher. Flot. Conc.	1.30	1.03	1.78	2.31	3.85	68.20	57.1	202.5	259.6	27.7	202.5	230.2	2.06	22.0	1.13
	MOLY-TALC SCAVENGER FLOTATION FEED															
	Moly-Talc Rougher Flotation Tail	1.50	0.27	0.22	0.33	0.55	2.20	7.1	21.18	28.23	3.96	21.18	25.1	1.78	25.0	1.12
	Moly-Talc Scav. Flot. Feed Pump Seal Water	-		-	-	-			0.1	0.1		0.1	0.1	-	-	1.00
	Moly-Talc Scav. Flot. Feed Dilution Water	-		-	-	-			7.0	7.0		7.0	7.0	-	-	1.00
	Diluted Moly-Talc Scavenger Flotation Feed	1.50	0.27	0.22	0.33	0.55	2.20	7.1	28.2	35.3	4.0	28.2	32.2	1.78	20.0	1.10
	MOLY-TALC SCAVENGER FLOTATION															
	Undiluted Moly-Talc Scavenger Conc.	12.00	1.35	0.02	0.24	0.40	1.00	0.6	1.9	2.6	2.9	1.9	4.8	0.22	25.0	0.53
	Moly-Talc Scavenger Tail	0.45	0.16	0.20	0.09	0.15	1.20	6.4	26.3	32.7	1.1	26.3	27.4	2.69	19.6	1.19
	Diluted Moly-Talc Scavenger Feed	1.50	0.27	0.22	0.33	0.55	2.20	7.1	28.2	35.3	4.0	28.2	32.2	1.78	20.0	1.10
	MOLY-TALC SCAV. CONC. LAUNDER WATER															
	Undiluted Moly-Talc Scavenger Conc.	12.00	1.35	0.02	0.24	0.40	1.00	0.6	1.9	2.6	2.9	1.9	4.8	0.22	25.0	0.53
	Moly-Talc Scav. Conc. Launder Water	-		-	-				0.4	0.4		0.4	0.4	-	-	1.00
	Diluted Moly-Talc Scav. Flotation Conc.	12.00	1.35	0.02	0.24	0.40	1.00	0.6	2.3	2.9	2.9	2.3	5.2	0.22	22.0	0.57
	MOLY-TALC CONCENTRATE THICKENER FEED															
	Diluted Moly-Talc Rougher. Flot. Conc.	1.30	1.03	1.78	2.31	3.85	68.20	57.1	202.5	259.6	27.7	202.5	230.2	2.06	22.0	1.13
	Moly-Talc Concentrate Filter Filtrate	-		-	-				87.2	87.2		87.2	87.2	-	-	1.00
	Moly-Talc Concentrate Thickener Feed	1.30	1.03	1.78	2.31	3.85	68.20	57.1	289.7	346.8	27.7	289.7	317.4	2.06	16.5	1.09
	MOLY-TALC CONCENTRATE THICKENER															
	Moly-Talc Concentrate Thickener Underflow	1.30	1.03	1.78	2.31	3.85	68.20	57.1	38.1	95.2	27.7	38.1	65.8	2.06	60.0	1.45
	Moly-Talc Concentrate Thickener Overflow								251.7	251.7		251.7	251.7			1.00
	Moly-Talc Concentrate Thickener Feed	1.30	1.03	1.78	2.31	3.85	68.20	57.1	289.7	346.8	27.7	289.7	317.4	2.1	16.5	1.09

	MOLY-TALC CONCENTRATE SLURRY STORAGE															
	Moly-Talc Concentrate Thickener Underflow	1.30	1.03	1.78	2.31	3.85	68.20	57.1	38.1	95.2	27.7	38.1	65.8	2.06	60.0	1.45
	Moly-Talc Conc.Thick.U'Flow Pump Gld. Wat	-		-	-				11.4	11.4		11.4	11.4	-	-	1.00
	Moly-Talc Conc. Slurry Storage Feed/Discha	1.30	1.03	1.78	2.31	3.85	68.20	57.1	49.5	106.6	27.7	49.5	77.2	2.06	53.6	1.38
	MOLY-TALC CONCENTRATE FILTER FEED															
	Moly-Talc Conc. Slurry Storage Feed/Discha	1.30	1.03	1.78	2.31	3.85	68.20	57.1	49.5	106.6	27.7	49.5	77.2	2.06	53.6	1.38
	Moly-Talc Conc. Filter Feed Pump Gld. Wate	-		-	-				3.4	3.4		3.4	3.4	-	-	1.00
	Moly-Talc Conc. Filter Feed (actual)	1.30	1.03	1.78	2.31			57.1	52.9	110.0	27.7	52.9	80.6	2.06	51.9	1.36
	Moly-Talc Conc. Filter Wash Water								40.0	40.0		40.0	40.0	-	-	1.00
	Moly-Talc Conc. Filter Feed (effective)	1.30	1.03	1.78	2.31	3.85	68.20	57.1	92.9	150.0	27.7	92.9	120.6	2.06	38.1	1.24
	MOLY-TALC CONCENTRATE FILTER															
	Filtered Moly-Talc Concentrate	1.30	1.03	1.78	2.31	3.85	68.20	57.1	5.6	62.8	27.7	5.6	33.3	2.06	91.0	1.88
	Moly-Talc Conc. Filter Filtrate	-	-	-	-				87.2	87.2		87.2	87.2	-	-	1.00
	Moly-Talc Conc. Filter Feed	1.30	1.03	1.78	2.31	3.85	68.20	57.1	92.9	150.0	27.7	92.9	120.6	2.06	38.1	1.24
	MOLY-TALC CONCENTRATE ROASTING															
	Filtered Moly-Talc Concentrate	1.30	1.03	1.78	2.31	3.85	68.20	57.1	5.6	62.8	27.7	5.6	33.3	2.06	91.0	1.88
	Roaster off gases and vapor								5.1	5.1		5.1	5.1			
	Roasted Moly-Talc Concentrate	1.30	1.03	1.78	2.31	3.85	68.20	57.1	0.6	57.7	27.7	0.6	28.3	2.06	99.0	2.04
	MOLY-TALC CONCENTRATE CONDITIONING TANK															
	Undiluted Roasted Moly-Talc Concentrate	1.30	1.03	1.78	2.31	3.85	68.20	57.1	0.6	57.7	27.7	0.6	28.3	2.06	99.0	2.04
	Moly-Talc Conc.Conditioning Dilution Water	-		-	-				170.7	170.7		170.7	170.7	-	-	1.00
	Diluted Moly-Talc Concentrate	1.30	1.03	1.78	2.31	3.85	68.20	57.1	171.3	228.4	27.7	171.3	199.0	2.06	25.0	1.15
	TALC ROUGHER FLOTATION FEED															
	Diluted Moly-Talc Concentrate	1.30	1.03	1.78	2.31	3.85	68.20	57.1	171.3	228.4	27.7	171.3	199.0	2.06	25.0	1.15
	Talc Rougher Flotation Feed Pump Seal Wat	-	-	-	-	-			0.6	0.6		0.6	0.6	-	-	1.00
	Talc Rougher Flotation Feed Dilution Water	-	-	-	-	-			30.6	30.6		30.6	30.6	-	-	1.00
	Diluted Talc Rougher Flotation Feed	1.30	1.03	1.78	2.31	3.85	68.20	57.1	202.5	259.6	27.7	202.5	230.2	2.06	22.0	1.13
	TALC ROUGHER FLOTATION															
	Talc Rougher Flotation Concentrate	0.34	0.02	1.22	0.42	0.70	1.00	39.1	123.9	163.1	14.6	123.9	138.5	2.69	24.0	1.18
	Talc Rougher Flotation Tail	3.38	3.24	0.56	1.89	3.15	67.20	18.0	78.5	96.5	22.7	78.5	101.2	0.79	18.6	0.95
	Diluted Talc Rougher Flotation Feed	1.30	1.03	1.78	2.31	3.85	68.20	57.1	202.5	259.6	27.7	202.5	230.2	2.06	22.0	1.13
	MOLY ROUGHER FLOTATION FEED															
	Talc Rougher Flotation Tail	3.38	3.24	0.56	1.89	3.15	67.20	18.0	78.5	96.5	22.7	78.5	101.2	0.79	18.6	0.95
	1st Moly Cleaner Tail	0.91	2.47	0.09	0.08	0.13	8.00	2.8	9.9	12.7	1.0	9.9	10.8	2.96	22.2	1.17
	Moly Rougher Flot. Pump Seal Water	-		-	-	-			0.2	0.2		0.2	0.2	-	-	1.00
	Moly Rougher Flot. Feed Dilution Water	-		-	-	-			4.4	4.4		4.4	4.4	-	-	1.00
	Diluted Moly Rougher Flotation Feed	3.04	3.14	0.65	1.97	3.28	75.20	20.8	83.1	103.9	23.6	83.1	106.7	0.88	20.0	0.97
	MOLY ROUGHER FLOTATION															
	Undiluted Moly Rougher Flotation Conc.	0.85	15.3	0.12	0.10	0.17	68.00	3.9	12.2	16.0	1.2	12.2	13.4	3.15	24.0	1.20
	Moly Rougher Flotation Tail	3.54	0.37	0.53	1.87	3.11	7.20	16.9	70.9	87.8	22.4	70.9	93.3	0.76	19.3	0.94
	Diluted Moly Rougher Flotation Feed	3.04	3.14	0.65	1.97	3.28	75.20	20.8	83.1	103.9	23.6	83.1	106.7	0.88	20.0	0.97
	MOLY ROUGH. CONC. LAUNDER WATER															
	Undiluted Moly Rougher Flotation Conc.	0.85	15.3	0.12	0.10	0.17	68.00	3.9	12.2	16.0	1.2	12.2	13.4	3.15	24.0	1.20
	Moly Rougher Flot.Conc. Launder Water	-		-	-	-			1.5	1.5		1.5	1.5	-	-	1.00
	Diluted Moly Rough. Flot. Conc.	0.85	15.3	0.12	0.10	0.17	68.00	3.9	13.7	17.5	1.2	13.7	14.9	3.15	22.0	1.18

	1ST MOLY CLEANER FEED															
	Diluted Moly Rough. Flot. Conc.	0.85	15.3	0.12	0.10	0.17	68.00	3.9	13.7	17.5	1.2	13.7	14.9	3.15	22.0	1.18
	2nd Moly Cleaner Tail	0.91	3.52	0.06	0.05	0.09	7.50	1.8	6.4	8.3	0.6	6.4	7.0	2.95	22.4	1.17
	1st Moly Clnr Feed Pump Seal Water								0.1	0.1		0.1	0.1	-	-	1.00
	1st Moly Clnr Column Washwater								0.0	0.0		0.0	0.0	-	-	1.00
	Diluted 1st Moly Cleaner Feed	0.87	11.5	0.18	0.15	0.26	75.50	5.7	20.1	25.8	1.9	20.1	22.0	3.08	22.1	1.18
	1ST MOLY CLEANER FLOTATION															
	Undiluted 1st Moly Cleaner Concentrate	0.83	20.3	0.09	0.08	0.13	67.50	2.9	10.2	13.1	0.9	10.2	11.1	3.21	22.0	1.18
	1st Moly Cleaner Tail	0.91	2.47	0.09	0.08	0.13	8.00	2.8	9.9	12.7	1.0	9.9	10.8	2.96	22.2	1.17
	Diluted 1st Moly Cleaner Feed	0.87	11.5	0.18	0.15	0.26	75.50	5.7	20.1	25.8	1.9	20.1	22.0	3.08	22.1	1.18
	1ST.MOLY CLEAN.CONC.LAUND.WATER															
	Undiluted 1st. Moly Cleaner Conc.	0.83	20.3	0.09	0.08	0.13	67.50	2.9	10.2	13.1	0.9	10.2	11.1	3.21	22.0	1.18
	1st Moly Cleaner Conc.Launder Water	-		-	-	-			1.3	1.3		1.3	1.3	-	-	1.00
	Diluted 1st.Moly Cleaner Conc.	0.83	20.3	0.09	0.08	0.13	67.50	2.9	11.6	14.4	0.9	11.6	12.4	3.21	20.0	1.16
	2ND MOLY CLEANER FEED															
	Diluted 1st.Moly Cleaner Conc.	0.83	20.3	0.09	0.08	0.13	67.50	2.9	11.6	14.4	0.9	11.55	12.4	3.21	20.0	1.16
	3rd Moly Cleaner Tail	0.88	4.60	0.04	0.03	0.06	6.40	1.2	2.8	4.0	0.4	2.78	3.2	3.04	30.3	1.25
	2nd Moly Clnr Feed Pump Seal Water	-		-	-	-			0.0	0.0		0.04	0.0	-	-	1.00
	2nd Moly Clnr Column Washwater	-		-	-	-			0.0	0.0		0.00	0.0	-	-	1.00
	Diluted 2nd Moly Cleaner Feed	0.85	15.6	0.13	0.11	0.18	73.90	4.1	14.4	18.5	1.3	14.4	15.7	3.16	22.17	1.18
	2ND MOLY CLEANER FLOTATION															
	Undiluted 2nd Moly Cleaner Concentrate	0.80	25.6	0.07	0.06	0.09	66.40	2.2	8.0	10.2	0.7	8.0	8.6	3.36	22.0	1.18
	2nd Moly Cleaner Tail	0.91	3.52	0.06	0.05	0.09	7.50	1.8	6.4	8.3	0.6	6.4	7.0	2.95	22.4	1.17
	Diluted 2nd Moly Cleaner Feed	0.85	15.6	0.13	0.11	0.18	73.90	4.1	14.4	18.5	1.3	14.4	15.7	3.16	22.2	1.18
	2ND MOLY CLEAN.CONC. LAUNDER WATER															
	Undiluted 2nd Moly Cleaner Concentrate	0.80	25.6	0.07	0.06	0.09	66.40	2.2	8.0	10.2	0.7	8.0	8.6	3.36	22.0	1.18
	2nd Moly Cleaner Conc. Launder Water								1.0	1.0		1.0	1.0	-	-	1.00
	Diluted 2nd Moly Cleaner Concentrate	0.80	25.6	0.07	0.06	0.09	66.40	2.2	9.0	11.2	0.7	9.0	9.7	3.36	20.0	1.16
	4th MOLY CLEANER TAIL THICKENER FEED															
	4th Moly Cleaner Tail	0.85	5.18	0.03	0.02	0.04	5.30	0.9	3.0	3.9	0.3	3.0	3.3	3.14	22.8	1.18
	Flocculant															
	4th Moly Cleaner Tail Thickener Feed	0.85	5.18	0.03	0.02	0.04	5.30	0.9	3.0	3.9	0.3	3.0	3.3	3.14	22.8	1.18
	4th MOLY CLEANER TAIL THICKENER															
	4th Moly Cleaner Tail Thickener Underflow	0.85	5.18	0.03	0.02	0.04	5.30	0.9	0.6	1.5	0.3	0.6	0.9	3.14	60.0	1.69
	4th Moly Cleaner Tail Thickener Overflow								2.4	2.4		2.4	2.4			1.00
	4th Moly Cleaner Tail Thickener Feed	0.85	5.18	0.03	0.02	0.04	5.30	0.9	3.0	3.9	0.3	3.0	3.3	3.14	22.8	1.18
	3RD MOLY CLEANER FEED															
	Diluted 2nd Moly Cleaner Concentrate	0.80	25.6	0.07	0.06	0.09	66.40	2.2	9.0	11.2	0.7	9.0	9.7	3.36	20.0	1.16
	4th Moly Cleaner Tail Thickener Underflow	0.85	5.2	0.03	0.02	0.04	5.30	0.9	0.6	1.5	0.3	0.6	0.9	3.14	60.0	1.69
	3rd Moly Clnr Feed Pump Seal Water	-		-	-	-			0.0	0.0		0.0	0.0	-	-	1.00
	3rd Moly Clnr Column Washwater	-		-	-	-			0.0	0.0		0.0	0.0	-	-	1.00
	Diluted 3rd Moly Cleaner Feed	0.81	19.8	0.10	0.08	0.13	71.70	3.1	9.6	12.7	1.0	9.6	10.6	3.29	24.6	1.21
	3RD MOLY CLEANER FLOTATION															
	Undiluted 3rd Moly Cleaner Concentrate	0.77	29.4	0.06	0.05	0.08	65.30	1.9	6.8	8.8	0.6	6.8	7.4	3.48	22.0	1.19
	3rd Moly Cleaner Tail	0.88	4.6	0.04	0.03	0.06	6.40	1.2	2.8	4.0	0.4	2.8	3.2	3.04	30.3	1.25
	Diluted 3rd Moly Cleaner Feed	0.81	19.8	0.10	0.08	0.13	71.70	3.1	9.6	12.7	1.0	9.6	10.6	3.29	24.6	1.21
	3RD MOLY CLEAN.CONC. LAUNDER WATER															
	Undiluted 3rd Moly Cleaner Concentrate	0.77	29.4	0.06	0.05	0.08	65.30	1.9	6.8	8.8	0.6	6.8	7.4	3.48	22.0	1.19
	3rd Moly Cleaner Conc. Launder Water								0.9	0.9		0.9	0.9	-	-	1.00
	Diluted 3rd Moly Cleaner Concentrate	0.77	29.4	0.06	0.05	0.08	65.30	1.9	7.7	9.6	0.6	7.7	8.3	3.48	20.0	1.17
	4TH MOLY CLEANER FEED															
	Diluted 3rd Moly Cleaner Concentrate	0.77	29.4	0.06	0.05	0.08	65.30	1.9	7.7	9.6	0.6	7.7	8.3	3.48	20.0	1.17
	5th Moly Cleaner Tail Thickener Underflow	0.60	6.1	0.02	0.01	0.02	4.50	0.6	0.4	1.1	0.1	0.4	0.6	4.46	60.0	1.87
	4th Moly Clnr Feed Pump Seal Water	-		-	-	-			0.02	0.02		0.02	0.0	-	-	1.00
	4th Moly Clnr Column Washwater	-		-	-	-			0.00	0.00		0.00	0.0	-	-	1.00
	Diluted 4th Moly Cleaner Feed	0.79	24.9	0.08	0.06	0.10	69.80	2.4	8.2	10.6	0.7	8.2	8.8	3.48	22.9	1.20
	4TH MOLY CLEANER FLOTATION															
	Undiluted 4th Moly Cleaner Concentrate	0.75	36.3	0.05	0.04	0.06	64.50	1.5	5.2	6.7	0.4	5.2	5.6	3.57	23.0	1.20
	4th Moly Cleaner Tail	0.85	5.2	0.03	0.02	0.04	5.30	0.9	3.0	3.9	0.3	3.0	3.3	3.14	22.8	1.18
	Diluted 4th Moly Cleaner Feed	0.79	24.9	0.08	0.06	0.10	69.80	2.4	8.2	10.6	0.7	8.2	8.8	3.40	22.9	1.20

4TH MOLY CLEAN.CONC. LAUNDER WATER																
Undiluted 4th Moly Cleaner Concentrate	0.75	36.3	0.05	0.04	0.06	64.50	1.5	5.2	6.7	0.4	5.2	5.6	3.57	23.0	1.20
4th Moly Cleaner Conc. Launder Water								0.6	0.6		0.6	0.6	-	-	1.00
Diluted 4th Moly Cleaner Concentrate	0.75	36.3	0.05	0.04	0.06	64.50	1.5	5.8	7.3	0.4	5.8	6.2	3.57	21.0	1.18
5TH MOLY CLEANER FEED																
Diluted 4th Moly Cleaner Concentrate	0.75	36.3	0.05	0.04	0.06	64.50	1.5	5.8	7.3	0.4	5.8	6.2	3.57	21.0	1.18
6th Moly Cleaner Tail	0.40	7.9	0.01	0.00	0.01	3.50	0.4	1.0	1.4	0.1	1.0	1.0	6.69	28.0	1.31
5th Moly Clnr Feed Pump Seal Water	-		-	-	-			0.02	0.02		0.02	0.0	-	-	1.00
5th Moly Clnr Column Washwater	-		-	-	-			0.00	0.00		0.00	0.0	-	-	1.00
Diluted 5th Moly Cleaner Feed	0.68	30.6	0.06	0.04	0.07	68.00	1.9	6.8	8.7	0.5	6.8	7.3	3.94	22.1	1.20
5TH MOLY CLEANER FLOTATION																
Undiluted 5th Moly Cleaner Concentrate	0.72	42.9	0.04	0.03	0.05	63.50	1.3	4.6	5.8	0.3	4.6	4.9	3.72	22.0	1.19
5th Moly Cleaner Tail	0.60	6.1	0.02	0.01	0.02	4.50	0.6	2.3	2.9	0.1	2.3	2.4	4.46	22.2	1.21
Diluted 5th Moly Cleaner Feed	0.68	30.6	0.06	0.04	0.07	68.00	1.9	6.8	8.7	0.5	6.8	7.3	3.94	22.1	1.20
5TH MOLY CLEAN.CONC. LAUNDER WATER																
Undiluted 5th Moly Cleaner Concentrate	0.72	42.9	0.04	0.03	0.05	63.50	1.3	4.6	5.8	0.3	4.6	4.9	3.72	22.0	1.19
5th Moly Cleaner Conc. Launder Water								0.6	0.6		0.6	0.6	-	-	1.00
Diluted 5th Moly Cleaner Concentrate	0.72	42.9	0.04	0.03	0.05	63.50	1.3	5.1	6.4	0.3	5.1	5.5	3.72	20.0	1.17
5th MOLY CLEANER TAIL THICKENER FEED																
5th Moly Cleaner Tail	0.60	6.1	0.02	0.01	0.02	4.50	0.6	2.3	2.9	0.1	2.3	2.4	4.46	22.2	1.21
Flocculant																
5th Moly Cleaner Tail Thickener Feed	0.60	6.1	0.02	0.01	0.02	4.50	0.6	2.3	2.9	0.1	2.3	2.4	4.46	22.2	1.21
5th MOLY CLEANER TAIL THICKENER																
5th Moly Cleaner Tail Thickener Underflow	0.60	6.1	0.02	0.01	0.02	4.50	0.6	0.4	1.1	0.1	0.4	0.6	4.46	60.0	1.87
5th Moly Cleaner Tail Thickener Overflow								1.8	1.8		1.8	1.8			1.00
5th Moly Cleaner Tail Thickener Feed	0.60	6.1	0.02	0.01	0.02	4.50	0.6	2.3	2.9	0.1	2.3	2.4	4.46	22.2	1.21
6TH MOLY CLEANER FEED																
Diluted 5th Moly Cleaner Concentrate	0.72	42.9	0.04	0.03	0.05	63.50	1.3	5.1	6.4	0.3	5.1	5.5	3.72	20.0	1.17
6th Moly Clnr Feed Pump Seal Water	-		-	-	-			0.01	0.01		0.01	0.0	-	-	1.00
6th Moly Clnr Column Washwater	-		-	-	-			0.00	0.00		0.00	0.0	-	-	1.00
Diluted 6th Moly Cleaner Feed	0.62	38.6	0.04	0.03	0.05	63.50	1.4	5.1	6.6	0.3	5.1	5.5	4.13	21.68	1.20
6TH MOLY CLEANER FLOTATION																
Undiluted 6th Moly Cleaner Concentrate	0.70	50.0	0.03	0.02	0.04	60.00	1.0	4.2	5.2	0.3	4.2	4.4	3.82	20.0	1.17
6th Moly Cleaner Tail	0.40	7.9	0.01	0.00	0.01	3.50	0.4	1.0	1.4	0.1	1.0	1.0	6.69	28.0	1.31
Diluted 6th Moly Cleaner Feed	0.62	38.6	0.04	0.03	0.05	63.50	1.4	5.1	6.6	0.3	5.1	5.5	4.32	21.7	1.20
6TH MOLY CLEAN.CONC. LAUNDER WATER																
Undiluted 6th Moly Cleaner Concentrate	0.70	50.0	0.03	0.02	0.04	60.00	1.0	4.2	5.2	0.3	4.2	4.4	3.82	20.0	1.17
6th Moly Cleaner Conc. Launder Water								0.6	0.6		0.6	0.6	-	-	1.00
Diluted 6th Moly Cleaner Concentrate	0.70	50.0	0.03	0.02	0.04	60.00	1.0	4.7	5.8	0.3	4.7	5.0	3.82	18.0	1.15
MOLY CONCENTRATE THICKENER FEED																
Diluted 6th Moly Cleaner Concentrate	0.70	50.0	0.03	0.02	0.04	60.00	1.0	4.7	5.8	0.3	4.7	5.0	3.82	18.0	1.15
Moly Concentrate Filter Filtrate	-		-	-				0.7	0.7		0.7	0.7	-	-	1.00
Moly Concentrate Thickener Feed	0.70	50.0	0.03	0.02	0.04	60.00	1.0	5.4	6.4	0.3	5.4	5.7	3.82	16.1	1.14
MOLY CONCENTRATE THICKENER																
Moly Concentrate Thickener Underflow	0.70	50.0	0.03	0.02	0.04	60.00	1.0	0.7	1.7	0.3	0.7	1.0	3.82	60.0	1.80
Moly Concentrate Thickener Overflow								4.7	4.7		4.7	4.7			1.00
Moly Concentrate Thickener Feed	0.70	50.0	0.03	0.02	0.04	60.00	1.0	5.4	6.4	0.3	5.4	5.7	3.82	16.1	1.14
MOLY CONCENTRATE SLURRY STORAGE																
Moly Concentrate Thickener Underflow	0.70	50.0	0.03	0.02	0.04	60.00	1.0	0.7	1.7	0.3	0.7	1.0	3.82	60.0	1.80
Moly Conc.Thick.U'Flow Pump Gld. Water	-		-	-				0.0	0.0		0.0	0.0	-	-	1.00
Moly Conc. Slurry Storage Feed/Discharge	0.70	50.00	0.03	0.02	0.04	60.00	1.0	0.7	1.7	0.3	0.7	1.0	3.82	60.0	1.80
MOLY CONCENTRATE FILTER FEED																
Moly Conc. Slurry Storage Feed/Discharge	0.70	50.0	0.03	0.02	0.04	60.00	1.0	0.7	1.7	0.3	0.7	1.0	3.82	60.0	1.80
Moly Conc. Filter Feed Pump Gld. Water	-		-	-				0.06	0.06		0.06	0.1	-	-	1.00
Moly Conc. Filter Feed (actual)	0.70	50.0	0.03	0.02			1.0	0.8	1.8	0.3	0.8	1.0	3.82	57.9	1.75
Moly Conc. Filter Wash Water								0.07	0.07		0.07	0.1	-	-	1.00
Moly Conc. Filter Feed (effective)	0.70	50.0	0.03	0.02	0.04	60.00	1.0	0.8	1.9	0.3	0.8	1.1	3.82	55.8	1.70
MOLY CONCENTRATE FILTER																
Filtered Moly Concentrate	0.70	50.0	0.03	0.02	0.04	60.00	1.0	0.2	1.2	0.3	0.2	0.4	3.82	87.0	2.80
Moly Conc. Filter Filtrate	-	-	-	-				0.7	0.7		0.7	0.7	-	-	1.00
Moly Conc. Filter Feed	0.70	50.0	0.03	0.02	0.04	60.00	1.0	0.8	1.9	0.3	0.8	1.1	3.82	55.8	1.70

CHECK ON MOLY-TALC FLOTATION CIRCUIT TOTAL WATER & SLURRY:		MTPH	M3/HR
INCOMING		Water	Slurry
2nd Copper Cleaner Tail		274.9	289.1
Copper Cleaner-Scav. Tail		219.7	228.9
Copper Flot.Conc.Thickener Feed Pump Gld. Water		0.7	0.7
Copper Flot.Conc. Thick.U'Flow Pump Gld. Water		0.7	0.7
Copper Flot.Conc. Filter Feed Pump Gld. Water		0.7	0.7
Copper Flot.Conc. Filter Wash Water		4.4	4.4
Copper Flot.Tails Thick.U'Flow Pump Gld. Water		12.8	12.8
Hot Steam		17.2	17.2
Moly-Talc Rougher Flot. Pump Seal Water		0.6	0.6
Moly-Talc Rougher Flot. Feed Dilution Water		113.4	113.4
Moly-Talc Rougher. Flot. Conc. Launder Water		31.2	31.2
Moly-Talc Scav. Flot. Feed Pump Seal Water		0.1	0.1
Moly-Talc Scav. Flot. Feed Dilution Water		7.0	7.0
Moly-Talc Scav. Conc. Launder Water		0.4	0.4
Moly-Talc Conc.Thick.U'Flow Pump Gld. Water		11.4	11.4
Moly-Talc Conc. Filter Feed Pump Gld. Water		3.4	3.4
Moly-Talc Conc. Filter Wash Water		40.0	40.0
Moly-Talc Conc.Conditioning Dilution Water		170.7	170.7
Talc Rougher Flotation Feed Pump Seal Water		0.6	0.6
Talc Rougher Flotation Feed Dilution Water		30.6	30.6
Moly Rougher Flot. Pump Seal Water		0.2	0.2
Moly Rougher Flot. Feed Dilution Water		4.4	4.4
Moly Rougher Flot.Conc. Launder Water		1.5	1.5
1st Moly Clnr Feed Pump Seal Water		0.1	0.1
1st Moly Clnr Column Washwater		0.0	0.0
1st Moly Cleaner Conc.Launder Water		1.3	1.3
2nd Moly Clnr Feed Pump Seal Water		0.0	0.0
2nd Moly Clnr Column Washwater		0.0	0.0
2nd Moly Cleaner Conc. Launder Water		1.0	1.0
3rd Moly Clnr Feed Pump Seal Water		0.0	0.0
3rd Moly Clnr Column Washwater		0.0	0.0
3rd Moly Cleaner Conc. Launder Water		0.9	0.9
4th Moly Clnr Feed Pump Seal Water		0.0	0.0
4th Moly Clnr Column Washwater		0.0	0.0
4th Moly Cleaner Conc. Launder Water		0.6	0.6
5th Moly Clnr Feed Pump Seal Water		0.0	0.0
5th Moly Clnr Column Washwater		0.0	0.0
5th Moly Cleaner Conc. Launder Water		0.6	0.6
6th Moly Clnr Feed Pump Seal Water		0.0	0.0
6th Moly Clnr Column Washwater		0.0	0.0
6th Moly Cleaner Conc. Launder Water		0.6	0.6
	Total In	**921.5**	**945.0**
Total Gland water		29.4	
OUTGOING			
Copper Flotation Tails Thickener Overflow		446.2	438.0
Moly-Talc Concentrate Thickener Overflow		251.7	251.7
Roaster off gases and vapor		5.1	5.1
Moly-Talc Scavenger Tail		26.3	27.4
Diluted Moly-Talc Scav. Flotation Conc.		2.3	5.2
Talc Rougher Flotation Concentrate		123.9	138.5
Moly Rougher Flotation Tail		70.9	93.3
4th Moly Cleaner Tail Thickener Overflow		2.4	2.4
5th Moly Cleaner Tail Thickener Overflow		1.8	1.8
Diluted 6th Moly Cleaner Concentrate		4.7	5.0
	Total Out	**935.3**	**968.3**
		13.8	23.4

Str. No	Description	%Cu	% Mo	%Wt	Cu Units	Cu,%Dist Overall	Mo,%Dist Overall	MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Solids	M3/HR Water	M3/HR Slurry	Solids SG	% Sols by Wt	Slurry SG
	FINAL FLOTATION TAILS THICKENER FEED															
	Copper Rougher Flotation Tail	0.04	0.01	87.39	3.24	5.40	16.38	2819.2	6578.1	9397.3	1052.9	6578.1	7631.0	2.68	30.0	1.23
	1st Copper Cleaner Tail	0.31	0.05	9.13	2.83	4.71	18.22	296.1	1313.9	1610.0	110.1	1313.9	1423.9	2.69	18.39	1.13
	Moly-Talc Scavenger Tail	0.45	0.16	0.20	0.09	0.15	1.20	6.4	26.3	32.7	1.1	26.3	27.4	2.69	19.6	1.19
	Talc Rougher Flotation Concentrate	0.34	0.02	1.22	0.42	0.70	1.00	39.1	123.9	163.1	14.6	123.9	138.5	2.69	24.0	
	Final Flotation Tails Thickener Feed	0.07	0.01	97.94	6.58	10.96	36.80	3160.9	8042.2	11203.1	1178.6	8042.2	9220.9	2.68	28.2	1.21
	FINAL FLOTATION TAILS THICKENER															
	Final Flotation Tails Thickener Underflow	0.07	0.01	97.94	6.58	10.96	36.80	3160.9	2586.2	5747.1	1180.1	2586.2	3766.2	2.68	55.0	1.53
	Final Flotation Tails Thickener Overflow								5456.0	5456.0		5456.0	5454.6			1.00
	Final Flotation Tails Thickener Feed	0.07	0.01	97.94	6.58	10.96	36.80	3160.9	8042.2	11203.1	1178.6	8042.2	9220.9	2.7	28.2	1.21
	FINAL TAILINGS CYCLONE AREA FEED															
	Seal Water to Pumps								27.8	27.8		27.8	27.8			
	Final Tailings Thickener Underflow							3160.9	2586.2	5747.1	1180.1	2586.2	3766.2	2.68	55.0	1.53
	Cyclone Feed Pump Gland Seal Water								31.6	31.6		31.6	31.6	-	-	1.00
	Final Tailings Cyclone Feed							3160.9	2645.6	5806.5	1180.1	2645.6	3825.7	2.68	54.4	1.52
	FINAL TAILINGS AREA CYCLONES															
	Final Tailings Cyclone Feed							3160.9	2645.6	5806.5	1180.1	2645.6	3825.7	2.68	54.4	1.52
	Final Tailings Cyclone Underflow							1896.5	1551.7	3448.2	708.0	1551.7	2259.7	2.68	55.0	1.53
	Final Tailings Cyclone Overflow							1264.4	1093.9	2358.2	472.0	1093.9	1565.9	2.68	53.6	1.51
	TOTAL RECLAIM WATER															
	Copper Flotation Conc. Thickener Overflow	-		-	-	-			230.8	230.8		230.8	230.8			1.00
	Copper Flotation Tails Thickener Overflow								446.2	446.2		446.2	446.2			1.00
	Moly-Talc Concentrate Thickener Overflow	-		-	-	-			251.7	251.7		251.7	251.7			1.00
	4th Moly Cleaner Tail Thickener Overflow								2.4	2.4		2.4	2.4			
	5th Moly Cleaner Tail Thickener Overflow								1.8	1.8		1.8	1.8			
	Moly Concentrate Thickener Overflow								4.7	4.7		4.7	4.7			1.00
	Final Flotation Tails Thickener Overflow								5456.0	5456.0		5456.0	5454.6			1.00
	Tailings Area Recl.Water	-		-	-	-			2116.5	2116.5		2116.5	2116.5	-	-	1.00
	TOTAL RECLAIM WATER	-		-	-	-			8510.1	8510.1		8510.1	8510.1	-	-	1.00

PROCESS FLOW MASS BALANCE

Aker Kvaerner

Nominal Feedrate - 65000 mtpd
Crushing/Conveying Availability = 80.0%
Concentrator Availability = 90.0%
Feed grade - 0.60% Total Cu
Feed grade - Au

TOROMOCHO COPPER-MOLY PROJECT
PRIMARY CRUSHING AND STOCKPILE CIRCUIT

Project No. 180600
Date 18/12/2006
Revision A

METALLURGICAL BALANCE

Str. No	Description	%Cu	% Mo	%Wt	Cu,%Dist Overall	Mo,%Dist Overall	MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Slurry	Solids SG	% Sols by Wt	Slurry SG
	PRIMARY CRUSHER												
	Total - ROM Ore from Trucks	0.60	0.03	100.00	100.00		3250.0	100.5	3350.5	1304.2	2.70	97.0	2.57
	CRUSHER DISCHARGE CONVEYOR												
	Crushed Ore from Discharge Pocket	0.60		100.00	100.00		3250.0	100.5	3350.5	1304.2	2.70	97.0	2.57
	OVERLAND CONVEYORS												
	Crushed Ore from Crusher	0.60		100.00	100.00		3250.0	100.5	3350.5	1304.2	2.70	97.0	2.57
	Fresh Water to Coarse Ore Overland Conv Dust. Sup.							2.0	2.0	2.0			
	Fresh Water Shuttle Conv. Dust Suppression							1.0	1.0	1.0			
	COARSE ORE STACKER												
	Crushed Ore from Conveyors	0.60		100.00	100.00		3250.0	100.5	3350.5	1304.2	2.70	97.0	2.57
	COARSE ORE STOCKPILE												
	Coarse Ore from Stacker	0.60		100.00	100.00		3250.0	100.5	3350.5	1304.2	2.70	97.0	2.57
	Stockpile Reclaim Dust Suppression Water							37.5	37.5	37.5			
	COARSE ORE FEEDERS												
	New Feed to SAG mill	0.60		100.00	100.00		2708.3	83.8	2792.1	1086.8	2.70	97.0	2.57

Nominal Feedrate - 65000 mtpd
Crushing/Conveying Availability = 80.0%
Concentrator Availability = 90.0%
Feed grade - 0.60% Total Cu
Feed grade - Au

TOROMOCHO COPPER-MOLY PROJECT
GRINDING & PEBBLE CRUSHING CIRCUIT

Project No. 180600
Date 18/12/2006
Revision A

METALLURGICAL BALANCE

Str. No	Description	%Cu	% Mo	%Wt	Cu,%Dist Overall	Mo,%Dist Overall	MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Slurry	Solids SG	% Sols by Wt	Slurry SG
	SAG MILL FEED												
	New Feed from Coarse Ore Stockpile	0.60	0.03	100.00	100.00		2708.3	83.8	2792.1	1086.8	2.70	97.0	2.57
	Recycled Pebbles	0.60		25.00	25.00		677.1	0.0	677.1	250.8	2.70	100.0	2.70
	SAG Mill Feed	0.60		125.00	125.00		3385.4	83.8	3469.2	1337.6	2.70	97.6	2.59
	SAG MILL												
	SAG Mill Feed	0.60		125.00	125.00		3385.4	83.8	3469.2	1337.6	2.70	97.6	2.59
	SAG Mill Feed Water	-		-	-			1044.7	1044.7	1044.7	-	-	-
	SAG Mill Discharge	0.60		125.00	125.00		3385.4	1128.5	4513.9	2382.3	2.70	75.0	1.89
	SAG TROMMEL FEED												
	SAG Mill Discharge	0.60		125.00	125.00		3385.4	1128.5	4513.9	2382.3	2.70	75.0	1.89
	SAG Trommel and screen water	-		-	-			694.4	694.4	694.4	-	-	-
	SAG Trommel Feed	0.60		125.00	125.00		3385.4	1822.9	5208.3	3076.8	2.70	65.0	1.69
	SAG TROMMEL												
	SAG Trommel O'Size	0.60		115.00	115.00		3114.6	878.5	3993.1	2032.0	2.70	78.0	1.97
	SAG Trommel U'Size	0.60		10.00	10.00		270.8	944.4	1215.3	1044.8	2.70	22.3	1.16
	SAG Trommel Feed	0.60		125.00	125.00		3385.4	1822.9	5208.3	3076.8	2.70	65.0	1.69
	SAG SCREEN												
	SAG Discharge Screen O'Size	0.60		25.00	25.00		677.1	0.0	677.1	250.8	2.70	100.0	2.70
	SAG Discharge Screen U'Size	0.60		90.00	90.00		2437.5	878.5	3316.0	1781.3	2.70	73.5	1.86
	SAG Discharge Screen Feed	0.60		115.00	115.00		3114.6	878.5	3993.1	2032.0	2.70	78.0	1.97
	PEBBLE CRUSHER FEED												
	SAG Discharge Screen O'Size	0.60		25.00	25.00		677.1	0.0	677.1	250.8	2.70	100.0	2.70
	Pebble Crusher Feed/Discharge	0.60		25.00	25.00		677.1	0.0	677.1	250.8	2.70	100.0	2.70
	BALL MILL CYCLONE FEED						2708.3						
	SAG Trommel U'Size	0.60		10.00	10.00		270.8	944.4	1215.3	1044.8	2.70	22.3	1.16
	SAG Discharge Screen U'Size	0.60		90.00	90.00		2437.5	878.5	3316.0	1781.3	2.70	73.5	1.86
	Ball Mill Cyclone Underflow	0.60		300.00	270.00	*	8125.0	3482.1	11607.1	6491.4	2.70	70.0	1.79
	Ball Mill Milk of Lime Feed						13.1	118.0	131.1	123.9	2.20	10.0	1.06
	Ball Mill Cyclone Dilution Water	-		-	-			4262.9	4262.9	4261.8		-	-
	SAG + Ball Mills Cooling Water	-		-	-			121.9	121.9	121.9	-	-	-
	Ball Mill Cyclone Feed Pump Gland Water	-		-	-			24.4	24.4	24.4	-	-	-
	Ball Mill Cyclone Feed	0.60		400.00	360.00		10846.4	9832.2	20678.6	13849.4	2.70	52.5	1.49
	BALL MILL CYCLONES												
	Flotation Circuit Feed	0.60		100.00	90.00		2721.4	6350.0	9071.5	7358.0	2.70	30.0	1.23
	Ball Mill Cyclone Underflow	0.60		300.00	270.00		8125.0	3482.1	11607.1	6491.4	2.7	70.0	1.79
	Ball Mill Cyclone Feed	0.60		400.00	360.00		10846.4	9832.2	20678.6	13849.4	2.7	52.5	1.49

CHECK ON GRINDING CIRCUIT TOTAL WATER & SLURRY:		MTPH	M3/HR
INCOMING:		Water	Slurry
Fresh Water to Coarse Ore Overland Conv Dust. Sup.		2	2
Fresh Water Shuttle Conv. Dust Suppression		1	1
Stockpile Reclaim Dust Suppression Water		38	38
New Feed from Coarse Ore Stockpile		84	1087
SAG Mill Feed Water		1045	1045
SAG Trommel and screen water		694	694
Ball Mill Cyclone Dilution Water		4263	4262
SAG + Ball Mills Cooling Water		122	122
Ball Mill Milk of Lime Feed		118	124
Ball Mill Cyclone Feed Pump Gland Water		24	24
	Total In	6391	7398
OUTGOING:			
Dust Suppression Losses		41	41
Flotation Circuit Feed		6350	7358
	Total Out	6391	7398
		0.0	0.0

Nominal Feedrate - 65000 mtpd
Crushing/Conveying Availability = 80.0%
Concentrator Availability = 90.0%
Feed grade - 0.60% Total Cu
Feed grade - Au

TOROMOCHO COPPER-MOLY PROJECT
BULK FLOTATION AND REGRIND CIRCUIT

Project No. 180600
Date 18/12/2006
Revision A

METALLURGICAL BALANCE

Str. No	Description	0.85 %Cu	0.02 % Mo	1.42 %Wt	2.00 Cu,%Dist Overall	1.00 Mo,%Dist Overall	MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Slurry	Solids SG	% Sols by Wt	SG
	OVERALL FLOTATION CIRCUIT												
	Copper Flotation Concentrate	26.3	0.04	2.03	89.00	3.20	55.0				4.40		
	Moly Flotation Concentrate	0.70	50.00	0.03	0.04	60.00	0.9				2.70		
	Final Flotation Tails	0.07	0	97.94	10.96	36.80	2665.6				2.68		
	Flotation Circuit Feed	0.60	0.03	100.00	100.00	100.00	2721.4	6350.0	9071.5	7358.0	2.70	30.0	1.23
	COPPER ROUGHER FLOTATION												
	Undiluted Copper Rough. Flot. Conc.	4.50	0.18	12.61	94.60	83.62	341.6	797.1	1138.7	916.2	2.87	30.0	1.24
	Copper Rougher Flotation Tail	0.04	0.01	87.39	5.40	16.38	2379.8	5552.9	7932.8	6441.8	2.68	30.0	1.23
	Flotation Circuit Feed	0.60	0.03	100.00	100.00	100.00	2721.4	6350.0	9071.5	7358.0	2.70	30.0	1.23
	COPPER ROUGH. CONC. LAUNDER WATER												
	Undiluted Copper Rough. Flot. Conc.	4.50	0.18	12.61	94.60	83.62	341.6	797.1	1138.7	916.2	2.87	30.0	1.24
	Copper Rougher Flot. Launder Water	-		-	-			81.3	81.3	81.3	-	-	1.00
	Diluted Copper Rough. Flot. Conc.	4.50	0.18	12.61	94.60	83.62	341.6	878.4	1220.0	997.5	2.87	28.00	1.22
	REGRIND CIRCUIT NEW FEED												
	Diluted Copper Rough. Flot. Conc.	4.50	0.18	12.61	94.60	83.62	341.6	878.4	1220.0	997.5	2.87	28.0	1.22
	Diluted Mo-Talc Scavenger Conc.	12.00	1.35	0.02	0.40	1.00	0.5	1.9	2.5	2.1	3.26	22.0	1.18
	Moly Rougher Flotation Tail	3.54	0.37	0.53	3.11	7.20	14.3	59.9	74.2	64.9	2.82	19.3	1.14
	Regrind Mill Cooling Water	-		-	-			17.0	17.0	17.0	-	-	1.00
	Regrind Mill Dilution Water	-		-	-			68.5	68.5	68.5	-	-	1.00
	Regrind Mill Feed Pump Gland Water							0.0	0.0	0.0		-	1.00
	Milk of Lime to Regrinding Sump						3.2	28.8	32.0	30.3	2.20	10.0	1.06
	Regrind Mill Sump Water							295.1	295.1	295.1	-	-	1.00
	Cycl.Feed Pump Gland Water	-		-	-			3.3	3.3	3.3	-	-	1.00
	Regrind Circuit New Feed	4.47	0.19	13.16	98.11	91.82	359.6	1352.9	1712.6	1478.7	2.86	21.0	1.16
	REGRIND CYCLONE												
	Regrind Cyclone Overflow	4.47	0.19	13.16	98.11	91.82	359.6	1352.9	1712.6	1478.7	2.87	21.0	1.16
	Regrind Cyclone Underflow	4.47	0.19	19.74	147.17	137.73	534.7	287.9	822.6	474.4	2.87	65.0	1.73
	Diluted Regrind Cyclone Feed	4.47	0.19	32.90	245.28	229.55	894.3	1640.8	2535.1	1952.8	2.87	35.3	1.30
	REGRIND MILL FEED												
	Regrind Cyclone Underflow	4.47	0.19	19.74	147.17	137.73	534.7	287.9	822.6	474.4	2.87	65.0	1.73
	Regrind Mill Dilution Water							68.5	68.5	68.5	-	-	1.00
	Diluted Regrind Mill Feed	4.47	0.19	19.74	147.17	137.73	534.7	356.4	891.1	542.9	2.87	60.0	1.64
	1ST COPPER CLEANER FEED												
	Regrind Cyclone Overflow	4.47	0.19	13.16	98.11	91.82	359.6	1352.9	1712.6	1478.7	2.87	21.0	1.16
	1st Copper Clnr Feed Pump Seal Water							3.6	3.6	3.6	-	-	1.00
	1st Copper Clnr Feed Dilution Water							82.0	82.0	82.0	-	-	1.00
	Diluted 1st Copper Cleaner Feed	4.47	0.19	13.16	98.11	91.82	359.6	1438.6	1798.2	1564.0	2.87	20.00	1.15
	1ST COPPER CLEANER FLOTATION												
	1st Copper Cleaner Concentrate	13.90	0.49	4.03	93.40	73.60	109.2	327.5	436.6	359.8	3.38	25.00	1.21
	1st Copper Cleaner Tail	0.31	0.05	9.13	4.71	18.22	250.5	1111.1	1361.6	1204.2	2.69	18.4	1.13
	Diluted 1st Copper Cleaner Feed	4.47	0.19	13.16	98.11	91.82	359.6	1438.6	1798.2	1564.0	2.87	20.0	1.15
	1ST.COPPER CLEAN.CONC.LAUND.WATER												
	Undiluted 1st.Copper Cleaner Conc.	13.90	0.49	4.03	93.40	73.60	109.2	327.5	436.6	359.8	3.38	25.0	1.21
	1st Copper Clean. Conc.Launder Water	-		-	-			83.2	83.2	83.2	-	-	1.00
	Diluted 1st.Copper Cleaner Conc.	13.90	0.49	4.03	93.40	73.60	109.2	410.6	519.8	443.0	3.38	21.00	1.17
	2ND COPPER CLEANER FEED												
	1st Copper Cleaner Concentrate	13.90	0.49	4.03	93.40	73.60	109.2	410.6	519.8	442.98	3.38	21.0	1.17
	Diluted Copper Cleaner Scav. Conc.	22.0	0.08	0.94	34.40	2.95	25.4	101.6	127.0	108.02	3.98	20.0	1.18
	2nd Copper Clnr Feed Pump Seal Water	-		-	-			1.3	1.3	1.35	-	-	1.00
	2nd Copper Clnr Feed Dilution Water	-		-	-			24.6	24.6	24.64	-	-	1.00
	Diluted 2nd Copper Cleaner Feed	15.43	0.42	4.97	127.80	76.55	134.6	538.3	672.8	577.0	3.47	20.00	1.17

2ND COPPER CLEANER FLOTATION												
Undiluted 2nd Copper Cleaner Concentrate	20.11	0.22	3.77	126.33	30.65	102.1	306.2	408.3	332.9	3.82	25.00	1.23
2nd Copper Cleaner Tail	0.74	1.03	1.20	1.47	45.90	32.5	232.1	264.6	244.1	2.71	12.3	1.08
Diluted 2nd Copper Cleaner Feed	15.43	0.42	4.97	127.80	76.55	134.6	538.3	672.8	577.0	3.47	20.0	1.17
2ND COPPER CLEAN.CONC. LAUNDER WATER												
Undiluted 2nd Copper Cleaner Concentrate	20.11	0.22	3.77	126.33	30.65	102.1	306.2	408.3	332.9	3.82	25.0	1.23
2nd Copper Cleaner Conc. Launder Water							55.7	55.7	55.7	-	-	1.00
Diluted 2nd Copper Cleaner Concentrate	20.11	0.22	3.77	126.33	30.65	102.1	361.9	463.9	388.6	3.82	22.00	1.19
3RD COPPER CLEANER FEED												
Diluted 2nd Copper Cleaner Concentrate	20.11	0.22	3.77	126.33	30.65	102.1	361.9	463.9	388.6	3.82	22.0	1.19
3rd Copper Clnr Feed Pump Seal Water	-		-	-			1.0	1.0	1.0	-	-	1.00
3rd Copper Clnr Feed Dilution Water	-		-	-			86.8	86.8	86.8	-	-	1.00
Diluted 3rd Copper Cleaner Feed	20.11	0.22	3.77	126.33	30.65	102.1	449.6	551.7	476.4	3.82	18.50	1.16
3RD COPPER CLEANER FLOTATION												
Undiluted 3rd Copper Cleaner Concentrate	26.3	0.04	2.03	89.00	3.20	55.0	174.1	229.1	186.6	4.40	24.00	1.23
3rd Copper Cleaner Tail	12.89	0.43	1.74	37.33	27.45	47.1	275.5	322.6	289.7	3.31	14.6	1.11
Diluted 3rd Copper Cleaner Feed	20.11	0.22	3.77	126.33	30.65	102.1	449.6	551.7	476.4	3.82	18.5	1.16
3RD COPPER CLEAN.CONC. LAUNDER WATER												
Undiluted 3rd Copper Cleaner Concentrate	26.3	0.04	2.03	89.00	3.20	55.0	174.1	229.1	186.6	4.40	24.0	1.23
3rd Copper Cleaner Conc. Launder Water							20.8	20.8	20.8	-	-	1.00
Final 3rd Copper Cleaner Concentrate	26.3	0.04	2.03	89.00	3.20	55.0	195.0	250.0	207.5	4.40	22.00	1.20
COPPER CLEANER-SCAV. FLOTATION												
Undiluted Copper Cleaner-Scav. Conc.	22.0	0.08	0.94	34.40	2.95	25.4	90.1	115.5	96.5	3.98	22.0	1.20
Copper Cleaner-Scav. Tail	2.20	0.83	0.80	2.93	24.50	21.7	185.4	207.1	193.3	2.77	10.5	1.07
Copper Cleaner-Scav. Feed	12.89	0.43	1.74	37.33	27.45	47.1	275.5	322.6	289.7	3.3	14.6	1.11
COPPER CLEAN.SCAV. CONC. LAUNDER WATER												
Undiluted Copper Cleaner-Scav. Conc.	22.0	0.08	0.94	34.40	2.95	25.4	90.1	115.5	96.5	3.98	22.0	1.20
Copper Cleaner-Scav. Conc. Launder Water	-		-				11.5	11.5	11.5	-	-	1.00
Diluted Copper Cleaner-Scav. Conc.	22.0	0.08	0.94	34.40	2.95	25.4	101.6	127.0	108.0	3.98	20.0	1.18
COPPER FLOTATION CIRCUIT TAILS												
Copper Rougher Flotation Tail	0.04	0.01	87.39	5.40	16.38	2379.8	5552.9	7932.8	6441.8	2.68	30.0	1.23
1st Copper Cleaner Tail	0.31	0.05	9.13	4.71	18.22	250.5	1111.1	1361.6	1204.2	2.69	18.4	1.13
2nd Copper Cleaner Tail	0.74	1.03	1.20	1.47	45.90	32.5	232.1	264.6	244.1	2.7	12.3	1.08
Copper Cleaner-Scavenger Tail	2.20	0.83	0.80	2.93	24.50	24.9	185.4	207.1	193.3	2.77	12.0	1.07
OSA Wash Water							438.1	438.1	438.1	-	-	1.00
Copper Flotation Circuit Tails	0.09	0.03	98.52	14.51	105.00	2687.7	7519.6	10204.1	8521.4	2.68	26.3	1.20
COPPER FLOTATION CONCENTRATE THICKENER FEED												
Final 3rd Copper Cleaner Concentrate	26.3	0.04	2.03	89.00	3.20	55.0	195.0	250.0	207.5	4.40	22.0	1.20
Copper Flot.Conc.Thickener Feed Pump Gld.	-		-				0.5	0.5	0.5	-	-	1.00
Copper Flotation Conc. Filter Filtrate	-		-			0.0	28.9	28.9	28.9	-	-	1.00
Copper Flotation Conc. Thickener Feed	26.3	0.04	2.03	89.00	3.20	55.0	224.5	279.5	237.0	4.40	19.7	1.18
COPPER FLOTATION CONCENTRATE THICKENER												
Copper Flotation Conc.Thickener Underflow	26.3	0.04	2.03	89.00	3.20	55.0	29.6	84.6	42.1	4.40	65.0	2.01
Copper Flotation Conc. Thickener Overflow							194.9	194.9	194.9			1.00
Copper Flotation Conc. Thickener Feed	26.3	0.04	2.03	89.00	3.20	55.0	224.5	279.5	237.0	4.4	19.7	1.18
COPPER FLOTATION CONCENTRATE SLURRY STORAGE												
Copper Flotation Conc. Thickener Underflow	26.3	0.04	2.03	89.00	3.20	55.0	29.6	84.6	42.1	4.40	65.0	2.01
Copper Flot.Conc. Thick.U'Flow Pump Gld. V	-		-				0.5	0.5	0.5	-	-	1.00
Copper Flot.Conc. Slurry Storage Feed/Disch	26.3	0.04	2.03	89.00	3.20	55.0	30.2	85.2	42.7	4.40	64.6	2.00
COPPER FLOTATION CONCENTRATE FILTER FEED												
Copper Flot.Conc. Slurry Storage Feed/Disch	26.3	0.04	2.03	89.00	3.20	55.0	30.2	85.2	42.7	4.40	64.6	2.00
Copper Flot.Conc. Filter Feed Pump Gld. Wa	-		-				0.5	0.5	0.5	-	-	1.00
Copper Flot.Conc. Filter Feed (actual)	26.3	0.04	2.03			55.0	30.7	85.7	43.2	4.40	64.2	1.98
Copper Flot.Conc. Filter Wash Water							3.7	3.7	3.7	-	-	1.00
Copper Flot.Conc. Filter Feed (effective)	26.3	0.04	2.03	89.00	3.20	55.0	34.4	89.4	46.9	4.40	61.5	1.91
COPPER FLOTATION CONCENTRATE FILTER												
Filtered Copper Flotation Concentrate	26.3	0.04	2.03	89.00	3.20	55.0	5.4	60.4	17.9	4.40	91.0	3.37
Copper Flotation Concentrate Filter Filtrate	-		-				28.9	28.9	28.9	-	-	1.00
Copper Flotation Concentrate Filter Feed	26.3		2.03	89.00	3.20	55.0	34.4	89.4	46.9	4.40	61.53	1.91

TOROMOCHO COPPER-MOLY PROJECT

CHECK ON COPPER FLOTATION TOTAL WATER & SLURRY:		MTPH	M3/HR
INCOMING		Water	Slurry
Flotation Circuit Feed		6350.0	7358
Diluted Mo-Talc Scavenger Conc.		1.9	2
Moly Rougher Flotation Tail		59.9	65
Copper Rougher Flot. Launder Water		81.3	81
Copper Cleaner-Scav. Conc. Launder Water		11.5	12
Regrind Mill Cooling Water		17.0	17
Regrind Mill Dilution Water		68.5	69
Regrind Mill Feed Pump Gland Water		0.0	0
Regrind Mill Sump Milk of Lime Feed		28.8	30
Regrind Mill Sump Water		295.1	295
Cycl.Feed Pump Gland Water		3.3	3
1st Copper Clnr Feed Pump Seal Water		3.6	4
1st Copper Clnr Feed Dilution Water		82.0	82
1st Copper Clean. Conc.Launder Water		83.2	83
2nd Copper Clnr Feed Pump Seal Water		1.3	1
2nd Copper Clnr Feed Dilution Water		24.6	25
2nd Copper Cleaner Conc. Launder Water		55.7	56
Bulk 3rd Clnr Feed Pump Seal Water		1.0	1.0
Bulk 3rd Clnr Feed Dilution Water		86.8	87
Bulk 3rd Cleaner Launder Water		20.8	21
OSA Wash Water		438.1	438
	Total In	7715	8729
OUTGOING			
Final Bulk 3rd Cleaner Concentrate		195	207
Copper Flotation Circuit Tails		7520	8521
	Total Out	7715	8729
		0.0	-0.3

Nominal Feedrate - 65000 mtpd
Crushing/Conveying Availability = 80.0%
Concentrator Availability = 90.0%
Feed grade - 0.60% Total Cu
Feed grade - Au

TOROMOCHO COPPER-MOLY PROJECT
MOLY-TALC FLOTATION CIRCUIT

Project No. 180600
Date 18/12/2006
Revision A

METALLURGICAL BALANCE

Str. No	Description	%Cu	% Mo	%Wt	Cu,%Dist Overall	Mo,%Dist Overall	MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Slurry	Solids SG	% Sols by Wt	Slurry SG
	COPPER TAILS THICKENER FEED												
	2nd Copper Cleaner Tail	0.74	1.03	1.20	1.47	45.90	32.5	232.07	264.57	244.08	2.71	12.28	1.08
	Copper Cleaner-Scav. Tail	2.20	0.83	0.80	2.93	24.50	21.7	185.42	207.09	193.25	2.77	10.46	1.07
	Copper Flotation Tails Thickener Feed	1.32	0.95	2.00	4.40	70.40	54.2	417.5	471.7	437.3	2.73	11.5	1.08
	COPPER TAILS THICKENER												
	Copper Flotation Tails Thickener Underflow	1.32	0.95	2.00	4.40	70.40	54.2	40.9	95.0	60.7	2.73	57.0	1.57
	Copper Flotation Tails Thickener Overflow							376.6	376.6	376.6			1.00
	Copper Flotation Tails Thickener Feed	1.32	0.95	2.00	4.40	70.40	54.2	417.5	471.7	437.3	2.7	11.5	1.08
	COPPER TAILS CONDITIONING TANK FEED												
	Copper Flotation Tails Thickener Underflow	1.32	0.95	2.00	4.40	70.40	54.2	40.9	95.0	60.7	2.73	57.0	1.57
	Copper Flot.Tails Thick.U'Flow Pump Gld. W	-		-				10.8	10.8	10.8	-	-	1.00
	Copper Flot.Tails Conditioning Tank Feed	1.32	0.95	2.00	4.40	70.40	54.2	51.7	105.9	71.5	2.73	51.2	1.48
	COPPER TAILS CONDITIONING TANK												
	Copper Flot.Tails Conditioning Tank Feed	1.32	0.95	2.00	4.40	70.40	54.2	51.7	105.9	71.5	2.73	51.2	1.48
	Hot Steam							14.5	14.5	14.5			
	Copper Flot.Tails Conditioning Tank Dischar	1.32	0.95	2.00	4.40	70.40	54.2	66.2	120.4	86.0	2.73	45.0	1.40
	MOLY-TALC ROUGHER FLOTATION FEED												
	Copper Flot.Tails Conditioning Tank Dischar	1.32	0.95	2.00	4.40	70.40	54.2	66.2	120.4	86.0	2.73	45.0	1.40
	Moly-Talc Rougher Flot. Pump Seal Water	-		-	-			0.5	0.5	0.5	-	-	1.00
	Moly-Talc Rougher Flot. Feed Dilution Wate	-		-	-			95.8	95.8	95.8	-	-	1.00
	Diluted Moly-Talc Rougher Flotation Feed	1.32	0.95	2.00	4.40	70.40	54.2	162.5	216.7	182.3	2.73	25.0	1.19
	MOLY-TALC ROUGHER FLOTATION												
	Undiluted Moly-Talc Rougher Flotation Conc	1.30	1.03	1.78	3.85	68.20	48.2	144.6	192.8	162.3	2.73	25.0	1.19
	Moly-Talc Rougher Flotation Tail	1.50	0.27	0.22	0.55	2.20	5.96	17.9	23.8	20.1	2.74	25.0	1.19
	Diluted Moly-Talc Rougher Flotation Feed	1.32	0.95	2.00	4.40	70.40	54.2	162.5	216.7	182.3	2.73	25.0	1.19
	MOLY-TALC ROUGHER FLOT.CONC. LAUNDER WATER												
	Undiluted Moly-Talc Rougher Flotation Conc	1.30	1.03	1.78	3.85	68.20	48.2	144.6	192.8	162.3	2.73	25.0	1.19
	Moly-Talc Rougher. Flot. Conc. Launder Wat	-		-				26.3	26.3	26.3	-	-	1.00
	Diluted Moly-Talc Rougher. Flot. Conc.	1.30	1.03	1.78	3.85	68.20	48.2	170.9	219.1	188.6	2.73	22.0	1.16
	MOLY-TALC SCAVENGER FLOTATION FEED												
	Moly-Talc Rougher Flotation Tail	1.50	0.27	0.22	0.55	2.20	6.0	17.88	23.83	20.05	2.74	25.00	1.19
	Moly-Talc Scav. Flot. Feed Pump Seal Wate	-		-	-			0.1	0.1	0.1	-	-	1.00
	Moly-Talc Scav. Flot. Feed Dilution Water	-		-	-			5.9	5.9	5.9	-	-	1.00
	Diluted Moly-Talc Scavenger Flotation Feed	1.50	0.27	0.22	0.55	2.20	6.0	23.8	29.8	26.0	2.74	20.0	1.15
	MOLY-TALC SCAVENGER FLOTATION												
	Undiluted Moly-Talc Scavenger Conc.	12.00	1.35	0.02	0.40	1.00	0.5	1.6	2.2	1.8	3.26	25.0	1.21
	Moly-Talc Scavenger Tail	0.45	0.16	0.20	0.15	1.20	5.4	22.2	27.6	24.2	2.69	19.6	1.14
	Diluted Moly-Talc Scavenger Feed	1.50	0.27	0.22	0.55	2.20	6.0	23.8	29.8	26.0	2.74	20.0	1.15
	MOLY-TALC SCAV. CONC. LAUNDER WATER												
	Undiluted Moly-Talc Scavenger Conc.	12.00	1.35	0.02	0.40	1.00	0.5	1.6	2.2	1.8	3.26	25.0	1.21
	Moly-Talc Scav. Conc. Launder Water	-		-				0.3	0.3	0.3	-	-	1.00
	Diluted Moly-Talc Scav. Flotation Conc.	12.00	1.35	0.02	0.40	1.00	0.5	1.9	2.5	2.1	3.26	22.0	1.18
	MOLY-TALC CONCENTRATE THICKENER FEED												
	Diluted Moly-Talc Rougher. Flot. Conc.	1.30	1.03	1.78	3.85	68.20	48.2	170.9	219.1	188.6	2.73	22.0	1.16
	Moly-Talc Concentrate Filter Filtrate	-		-				73.7	73.7	73.7	-	-	1.00
	Moly-Talc Concentrate Thickener Feed	1.30	1.03	1.78	3.85	68.20	48.2	244.6	292.8	262.2	2.73	16.5	1.12
	MOLY-TALC CONCENTRATE THICKENER												
	Moly-Talc Concentrate Thickener Underflow	1.30	1.03	1.78	3.85	68.20	48.2	32.1	80.3	49.8	2.73	60.0	1.61
	Moly-Talc Concentrate Thickener Overflow							212.4	212.4	212.4			1.00
	Moly-Talc Concentrate Thickener Feed	1.30	1.03	1.78	3.85	68.20	48.2	244.6	292.8	262.2	2.7	16.5	1.12

	MOLY-TALC CONCENTRATE SLURRY STORAGE												
	Moly-Talc Concentrate Thickener Underflow	1.30	1.03	1.78	3.85	68.20	48.2	32.1	80.3	49.8	2.73	60.0	1.61
	Moly-Talc Conc.Thick.U'Flow Pump Gld. Wat	-		-				9.6	9.6	9.6	-	-	1.00
	Moly-Talc Conc. Slurry Storage Feed/Dischar	1.30	1.03	1.78	3.85	68.20	48.2	41.8	90.0	59.4	2.73	53.6	1.51
	MOLY-TALC CONCENTRATE FILTER FEED												
	Moly-Talc Conc. Slurry Storage Feed/Dischar	1.30	1.03	1.78	3.85	68.20	48.2	41.8	90.0	59.4	2.73	53.6	1.51
	Moly-Talc Conc. Filter Feed Pump Gld. Wate	-		-				2.9	2.9	2.9	-	-	1.00
	Moly-Talc Conc. Filter Feed (actual)	1.30	1.03	1.78			48.2	44.7	92.9	62.3	2.73	51.9	1.49
	Moly-Talc Conc. Filter Wash Water							33.7	33.7	33.7	-	-	1.00
	Moly-Talc Conc. Filter Feed (effective)	1.30	1.03	1.78	3.85	68.20	48.2	78.4	126.6	96.1	2.73	38.1	1.32
	MOLY-TALC CONCENTRATE FILTER												
	Filtered Moly-Talc Concentrate	1.30	1.03	1.78	3.85	68.20	48.2	4.8	53.0	22.4	2.73	91.0	2.36
	Moly-Talc Conc. Filter Filtrate	-	-	-				73.7	73.7	73.7	-	-	1.00
	Moly-Talc Conc. Filter Feed	1.30	1.03	1.78	3.85	68.20	48.2	78.4	126.6	96.1	2.73	38.07	1.32
	MOLY-TALC CONCENTRATE ROASTING												
	Filtered Moly-Talc Concentrate	1.30	1.03	1.78	3.85	68.20	48.2	4.8	53.0	22.4	2.73	91.0	2.36
	Roaster off gases and vapor							4.3	4.3	4.3			
	Roasted Moly-Talc Concentrate	1.30	1.03	1.78	3.85	68.20	48.2	0.5	48.7	18.2	2.73	99.0	2.68
	MOLY-TALC CONCENTRATE CONDITIONING TANK												
	Undiluted Roasted Moly-Talc Concentrate	1.30	1.03	1.78	3.85	68.20	48.2	0.5	48.7	18.2	2.73	99.0	2.68
	Moly-Talc Conc.Conditioning Dilution Water	-		-				144.1	144.1	144.1	-	-	1.00
	Diluted Moly-Talc Concentrate	1.30	1.03	1.78	3.85	68.20	48.2	144.6	192.8	162.3	2.73	25.0	1.19
	TALC ROUGHER FLOTATION FEED												
	Diluted Moly-Talc Concentrate	1.30	1.03	1.78	3.85	68.20	48.2	144.6	192.8	162.3	2.73	25.0	1.19
	Talc Rougher Flotation Feed Pump Seal Wat	-	-	-	-			0.5	0.5	0.5	-	-	1.00
	Talc Rougher Flotation Feed Dilution Water	-	-	-	-			25.8	25.8	25.8	-	-	1.00
	Diluted Talc Rougher Flotation Feed	1.30	1.03	1.78	3.85	68.20	48.2	170.9	219.1	188.6	2.73	22.00	1.16
	TALC ROUGHER FLOTATION												
	Talc Rougher Flotation Concentrate	0.34	0.02	1.22	0.70	1.00	33.0	104.6	137.7	116.9	2.69	24.00	1.18
	Talc Rougher Flotation Tail	3.38	3.24	0.56	3.15	67.20	15.2	66.3	81.5	71.7	2.82	18.6	1.14
	Diluted Talc Rougher Flotation Feed	1.30	1.03	1.78	3.85	68.20	48.2	170.9	219.1	188.6	2.73	22.0	1.16
	MOLY ROUGHER FLOTATION FEED												
	Talc Rougher Flotation Tail	3.38	3.24	0.56	3.15	67.20	15.2	66.3	81.5	71.7	2.82	18.6	1.14
	1st Moly Cleaner Tail	0.91	2.47	0.09	0.13	8.00	2.4	8.3	10.7	9.2	2.71	22.2	1.16
	Moly Rougher Flot. Pump Seal Water	-		-	-			0.2	0.2	0.2	-	-	1.00
	Moly Rougher Flot. Feed Dilution Water	-		-	-			3.7	3.7	3.7	-	-	1.00
	Diluted Moly Rougher Flotation Feed	3.04	3.14	0.65	3.28	75.20	17.5	70.2	87.7	76.4	2.80	20.00	1.15
	MOLY ROUGHER FLOTATION												
	Undiluted Moly Rougher Flotation Conc.	0.85	15.3	0.12	0.17	68.00	3.3	10.3	13.5	11.5	2.71	24.0	1.18
	Moly Rougher Flotation Tail	3.54	0.37	0.53	3.11	7.20	14.3	59.9	74.2	64.9	2.82	19.3	1.14
	Diluted Moly Rougher Flotation Feed	3.04	3.14	0.65	3.28	75.20	17.5	70.2	87.7	76.4	2.80	20.0	1.15
	MOLY ROUGH. CONC. LAUNDER WATER												
	Undiluted Moly Rougher Flotation Conc.	0.85	15.3	0.12	0.17	68.00	3.3	10.3	13.5	11.5	2.71	24.0	1.18
	Moly Rougher Flot.Conc. Launder Water	-		-	-			1.2	1.2	1.2	-	-	1.00
	Diluted Moly Rough. Flot. Conc.	0.85	15.3	0.12	0.17	68.00	3.3	11.5	14.8	12.7	2.71	22.00	1.16

	1ST MOLY CLEANER FEED												
	Diluted Moly Rough. Flot. Conc.	0.85	15.3	0.12	0.17	68.00	3.3	11.5	14.8	12.7	2.71	22.0	1.16
	2nd Moly Cleaner Tail	0.91	3.52	0.06	0.09	7.50	1.6	5.4	7.0	6.0	2.71	22.4	1.16
	1st Moly Clnr Feed Pump Seal Water							0.0	0.0	0.0	-	-	1.00
	1st Moly Clnr Column Washwater							0.0	0.0	0.0	-	-	1.00
	Diluted 1st Moly Cleaner Feed	0.87	11.5	0.18	0.26	75.50	4.8	17.0	21.8	18.8	2.71	22.07	1.16
	1ST MOLY CLEANER FLOTATION												
	Undiluted 1st Moly Cleaner Concentrate	0.83	20.3	0.09	0.13	67.50	2.4	8.6	11.1	9.5	2.71	22.00	1.16
	1st Moly Cleaner Tail	0.91	2.47	0.09	0.13	8.00	2.4	8.3	10.7	9.2	2.71	22.2	1.16
	Diluted 1st Moly Cleaner Feed	0.87	11.5	0.18	0.26	75.50	4.8	17.0	21.8	18.8	2.71	22.1	1.16
	1ST.MOLY CLEAN.CONC.LAUND.WATER												
	Undiluted 1st. Moly Cleaner Conc.	0.83	20.3	0.09	0.13	67.50	2.4	8.6	11.1	9.5	2.71	22.0	1.16
	1st Moly Cleaner Conc.Launder Water	-		-	-			1.1	1.1	1.1	-	-	1.00
	Diluted 1st.Moly Cleaner Conc.	0.83	20.3	0.09	0.13	67.50	2.4	9.8	12.2	10.6	2.71	20.0	1.14
	2ND MOLY CLEANER FEED												
	Diluted 1st.Moly Cleaner Conc.	0.83	20.3	0.09	0.13	67.50	2.4	9.8	12.2	10.65	2.71	20.0	1.14
	3rd Moly Cleaner Tail	0.88	4.60	0.04	0.06	6.40	1.0	2.3	3.4	2.72	2.71	30.3	1.24
	2nd Moly Clnr Feed Pump Seal Water	-		-	-			0.0	0.0	0.03	-	-	1.00
	2nd Moly Clnr Column Washwater	-		-	-			0.0	0.0	0.00	-	-	1.00
	Diluted 2nd Moly Cleaner Feed	0.85	15.6	0.13	0.18	73.90	3.5	12.1	15.6	13.4	2.71	22.17	1.16
	2ND MOLY CLEANER FLOTATION												
	Undiluted 2nd Moly Cleaner Concentrate	0.80	25.6	0.07	0.09	66.40	1.9	6.7	8.6	7.4	2.71	22.0	1.16
	2nd Moly Cleaner Tail	0.91	3.52	0.06	0.09	7.50	1.6	5.4	7.0	6.0	2.71	22.4	1.16
	Diluted 2nd Moly Cleaner Feed	0.85	15.6	0.13	0.18	73.90	3.5	12.1	15.6	13.4	2.71	22.2	1.16
	2ND MOLY CLEAN.CONC. LAUNDER WATER												
	Undiluted 2nd Moly Cleaner Concentrate	0.80	25.6	0.07	0.09	66.40	1.9	6.7	8.6	7.4	2.71	22.0	1.16
	2nd Moly Cleaner Conc. Launder Water							0.9	0.9	0.9	-	-	1.00
	Diluted 2nd Moly Cleaner Concentrate	0.80	25.6	0.07	0.09	66.40	1.9	7.6	9.5	8.3	2.71	20.00	1.14
	4th MOLY CLEANER TAIL THICKENER FEED												
	4th Moly Cleaner Tail	0.85	5.18	0.03	0.04	5.30	0.7	2.5	3.3	2.8	2.71	22.8	1.17
	Flocculant												
	4th Moly Cleaner Tail Thickener Feed	0.85	5.18	0.03	0.04	5.30	0.7	2.5	3.3	2.8	2.71	22.8	1.17
	4th MOLY CLEANER TAIL THICKENER												
	4th Moly Cleaner Tail Thickener Underflow	0.85	5.18	0.03	0.04	5.30	0.7	0.5	1.2	0.8	2.71	60.0	1.61
	4th Moly Cleaner Tail Thickener Overflow							2.0	2.0	2.0			1.00
	4th Moly Cleaner Tail Thickener Feed	0.85	5.18	0.03	0.04	5.30	0.7	2.5	3.3	2.8	2.71	22.8	1.17
	3RD MOLY CLEANER FEED												
	Diluted 2nd Moly Cleaner Concentrate	0.80	25.6	0.07	0.09	66.40	1.9	7.6	9.5	8.3	2.71	20.0	1.14
	4th Moly Cleaner Tail Thickener Underflow	0.85	5.2	0.03	0.04	5.30	0.7	0.5	1.2	0.8	2.71	60.0	1.61
	3rd Moly Clnr Feed Pump Seal Water	-		-	-			0.0	0.0	0.0	-	-	1.00
	3rd Moly Clnr Column Washwater	-		-	-			0.0	0.0	0.0	-	-	1.00
	Diluted 3rd Moly Cleaner Feed	0.81	19.8	0.10	0.13	71.70	2.6	8.1	10.8	9.1	2.71	24.59	1.18
	3RD MOLY CLEANER FLOTATION												
	Undiluted 3rd Moly Cleaner Concentrate	0.77	29.4	0.06	0.08	65.30	1.6	5.8	7.4	6.4	2.71	22.0	1.16
	3rd Moly Cleaner Tail	0.88	4.6	0.04	0.06	6.40	1.0	2.3	3.4	2.7	2.71	30.3	1.24
	Diluted 3rd Moly Cleaner Feed	0.81	19.8	0.10	0.13	71.70	2.6	8.1	10.8	9.1	2.71	24.6	1.18
	3RD MOLY CLEAN.CONC. LAUNDER WATER												
	Undiluted 3rd Moly Cleaner Concentrate	0.77	29.4	0.06	0.08	65.30	1.6	5.8	7.4	6.4	2.71	22.0	1.16
	3rd Moly Cleaner Conc. Launder Water							0.7	0.7	0.7	-	-	1.00
	Diluted 3rd Moly Cleaner Concentrate	0.77	29.4	0.06	0.08	65.30	1.6	6.5	8.1	7.1	2.71	20.00	1.14
	4TH MOLY CLEANER FEED												
	Diluted 3rd Moly Cleaner Concentrate	0.77	29.4	0.06	0.08	65.30	1.6	6.5	8.1	7.1	2.71	20.0	1.14
	5th Moly Cleaner Tail Thickener Underflow	0.60	6.1	0.02	0.02	4.50	0.5	0.4	0.9	0.6	2.70	60.0	1.61
	4th Moly Clnr Feed Pump Seal Water	-		-	-			0.02	0.02	0.02	-	-	1.00
	4th Moly Clnr Column Washwater	-		-	-			0.00	0.00	0.00	-	-	1.00
	Diluted 4th Moly Cleaner Feed	0.79	24.9	0.08	0.10	69.80	2.0	6.9	8.9	7.7	2.56	22.93	1.16
	4TH MOLY CLEANER FLOTATION												
	Undiluted 4th Moly Cleaner Concentrate	0.75	36.3	0.05	0.06	64.50	1.3	4.4	5.7	4.8	2.71	23.0	1.17
	4th Moly Cleaner Tail	0.85	5.2	0.03	0.04	5.30	0.7	2.5	3.3	2.8	2.71	22.8	1.17
	Diluted 4th Moly Cleaner Feed	0.79	24.9	0.08	0.10	69.80	2.0	6.9	8.9	7.7	2.71	22.9	1.16

4TH MOLY CLEAN.CONC. LAUNDER WATER												
Undiluted 4th Moly Cleaner Concentrate	0.75	36.3	0.05	0.06	64.50	1.3	4.4	5.7	4.8	2.71	23.0	1.17
4th Moly Cleaner Conc. Launder Water							0.5	0.5	0.5	-	-	1.00
Diluted 4th Moly Cleaner Concentrate	0.75	36.3	0.05	0.06	64.50	1.3	4.9	6.2	5.4	2.71	21.0	1.15
5TH MOLY CLEANER FEED												
Diluted 4th Moly Cleaner Concentrate	0.75	36.3	0.05	0.06	64.50	1.3	4.9	6.2	5.4	2.71	21.0	1.15
6th Moly Cleaner Tail	0.40	7.9	0.01	0.01	3.50	0.3	0.8	1.2	1.0	2.69	28.0	1.21
5th Moly Clnr Feed Pump Seal Water	-		-	-			0.02	0.02	0.02	-	-	1.00
5th Moly Clnr Column Washwater	-		-	-			0.00	0.00	0.00	-	-	1.00
Diluted 5th Moly Cleaner Feed	0.68	30.6	0.06	0.07	68.00	1.6	5.7	7.4	6.3	2.70	22.06	1.16
5TH MOLY CLEANER FLOTATION												
Undiluted 5th Moly Cleaner Concentrate	0.72	42.9	0.04	0.05	63.50	1.1	3.8	4.9	4.2	2.70	22.00	1.16
5th Moly Cleaner Tail	0.60	6.1	0.02	0.02	4.50	0.5	1.9	2.4	2.1	2.70	22.2	1.16
Diluted 5th Moly Cleaner Feed	0.68	30.6	0.06	0.07	68.00	1.6	5.7	7.4	6.3	2.70	22.1	1.16
5TH MOLY CLEAN.CONC. LAUNDER WATER												
Undiluted 5th Moly Cleaner Concentrate	0.72	42.9	0.04	0.05	63.50	1.1	3.8	4.9	4.2	2.70	22.0	1.16
5th Moly Cleaner Conc. Launder Water							0.5	0.5	0.5	-	-	1.00
Diluted 5th Moly Cleaner Concentrate	0.72	42.9	0.04	0.05	63.50	1.1	4.3	5.4	4.7	2.70	20.0	1.14
5th MOLY CLEANER TAIL THICKENER FEED												
5th Moly Cleaner Tail	0.60	6.1	0.02	0.02	4.50	0.5	1.9	2.4	2.1	2.70	22.2	1.16
Flocculant												
5th Moly Cleaner Tail Thickener Feed	0.60	6.1	0.02	0.02	4.50	0.5	1.9	2.4	2.1	2.70	22.2	1.16
5th MOLY CLEANER TAIL THICKENER												
5th Moly Cleaner Tail Thickener Underflow	0.60	6.1	0.02	0.02	4.50	0.5	0.4	0.9	0.6	2.70	60.0	1.61
5th Moly Cleaner Tail Thickener Overflow							1.5	1.5	1.5			1.00
5th Moly Cleaner Tail Thickener Feed	0.60	6.1	0.02	0.02	4.50	0.5	1.9	2.4	2.1	2.70	22.2	1.16
6TH MOLY CLEANER FEED												
Diluted 5th Moly Cleaner Concentrate	0.72	42.9	0.04	0.05	63.50	1.1	4.3	5.4	4.7	2.70	20.0	1.14
6th Moly Clnr Feed Pump Seal Water	-		-	-			0.01	0.01	0.01	-	-	1.00
6th Moly Clnr Column Washwater	-		-	-			0.00	0.00	0.00	-	-	1.00
Diluted 6th Moly Cleaner Feed	0.62	38.6	0.04	0.05	63.50	1.2	4.3	5.5	4.7	3.00	21.68	1.17
6TH MOLY CLEANER FLOTATION												
Undiluted 6th Moly Cleaner Concentrate	0.70	50.0	0.03	0.04	60.00	0.9	3.5	4.4	3.8	2.70	20.0	1.14
6th Moly Cleaner Tail	0.40	7.9	0.01	0.01	3.50	0.3	0.8	1.2	1.0	2.69	28.0	1.21
Diluted 6th Moly Cleaner Feed	0.62	38.6	0.04	0.05	63.50	1.2	4.3	5.5	4.7	2.70	21.7	1.17
6TH MOLY CLEAN.CONC. LAUNDER WATER												
Undiluted 6th Moly Cleaner Concentrate	0.70	50.0	0.03	0.04	60.00	0.9	3.5	4.4	3.8	2.70	20.0	1.14
6th Moly Cleaner Conc. Launder Water							0.5	0.5	0.5	-	-	1.00
Diluted 6th Moly Cleaner Concentrate	0.70	50.0	0.03	0.04	60.00	0.9	4.0	4.9	4.3	2.70	18.0	1.13
MOLY CONCENTRATE THICKENER FEED												
Diluted 6th Moly Cleaner Concentrate	0.70	50.0	0.03	0.04	60.00	0.9	4.0	4.9	4.3	2.70	18.0	1.13
Moly Concentrate Filter Filtrate	-		-				0.6	0.6	0.6	-	-	1.00
Moly Concentrate Thickener Feed	0.70	50.0	0.03	0.04	60.00	0.9	4.6	5.4	4.9	2.70	16.1	1.11
MOLY CONCENTRATE THICKENER												
Moly Concentrate Thickener Underflow	0.70	50.0	0.03	0.04	60.00	0.9	0.6	1.5	0.9	2.70	60.0	1.61
Moly Concentrate Thickener Overflow							4.0	4.0	4.0			1.00
Moly Concentrate Thickener Feed	0.70	50.0	0.03	0.04	60.00	0.9	4.6	5.4	4.9	2.70	16.1	1.11
MOLY CONCENTRATE SLURRY STORAGE												
Moly Concentrate Thickener Underflow	0.70	50.0	0.03	0.04	60.00	0.9	0.6	1.5	0.9	2.70	60.0	1.61
Moly Conc.Thick.U'Flow Pump Gld. Water	-		-				0.0	0.0	0.0	-	-	1.00
Moly Conc. Slurry Storage Feed/Discharge	0.70	50.00	0.03	0.04	60.00	0.9	0.6	1.5	0.9	2.70	60.0	1.61
MOLY CONCENTRATE FILTER FEED												
Moly Conc. Slurry Storage Feed/Discharge	0.70	50.0	0.03	0.04	60.00	0.9	0.6	1.5	0.9	2.70	60.0	1.61
Moly Conc. Filter Feed Pump Gld. Water	-		-				0.05	0.05	0.05	-	-	1.00
Moly Conc. Filter Feed (actual)	0.70	50.0	0.03			0.9	0.6	1.5	1.0	2.70	57.9	1.57
Moly Conc. Filter Wash Water							0.06	0.06	0.06	-	-	1.00
Moly Conc. Filter Feed (effective)	0.70	50.0	0.03	0.04	60.00	0.9	0.7	1.6	1.0	2.70	55.8	1.54
MOLY CONCENTRATE FILTER												
Filtered Moly Concentrate	0.70	50.0	0.03	0.04	60.00	0.9	0.1	1.0	0.5	2.70	87.0	2.21
Moly Conc. Filter Filtrate	-	-	-				0.6	0.6	0.6	-	-	1.00
Moly Conc. Filter Feed	0.70	50.0	0.03	0.04	60.00	0.9	0.7	1.6	1.0	2.70	55.8	1.54

CHECK ON MOLY-TALC FLOTATION CIRCUIT TOTAL WATER & SLURRY:		MTPH	M3/HR
INCOMING		Water	Slurry
2nd Copper Cleaner Tail		232.1	244.1
Copper Cleaner-Scav. Tail		185.4	193.3
Copper Flot.Conc.Thickener Feed Pump Gld. Water		0.5	0.5
Copper Flot.Conc. Thick.U'Flow Pump Gld. Water		0.5	0.5
Copper Flot.Conc. Filter Feed Pump Gld. Water		0.5	0.5
Copper Flot.Conc. Filter Wash Water		3.7	3.7
Copper Flot.Tails Thick.U'Flow Pump Gld. Water		10.8	10.8
Hot Steam		14.5	14.5
Moly-Talc Rougher Flot. Pump Seal Water		0.5	0.5
Moly-Talc Rougher Flot. Feed Dilution Water		95.8	95.8
Moly-Talc Rougher. Flot. Conc. Launder Water		26.3	26.3
Moly-Talc Scav. Flot. Feed Pump Seal Water		0.1	0.1
Moly-Talc Scav. Flot. Feed Dilution Water		5.9	5.9
Moly-Talc Scav. Conc. Launder Water		0.3	0.3
Moly-Talc Conc.Thick.U'Flow Pump Gld. Water		9.6	9.6
Moly-Talc Conc. Filter Feed Pump Gld. Water		2.9	2.9
Moly-Talc Conc. Filter Wash Water		33.7	33.7
Moly-Talc Conc.Conditioning Dilution Water		144.1	144.1
Talc Rougher Flotation Feed Pump Seal Water		0.5	0.5
Talc Rougher Flotation Feed Dilution Water		25.8	25.8
Moly Rougher Flot. Pump Seal Water		0.2	0.2
Moly Rougher Flot. Feed Dilution Water		3.7	3.7
Moly Rougher Flot.Conc. Launder Water		1.2	1.2
1st Moly Clnr Feed Pump Seal Water		0.0	0.0
1st Moly Clnr Column Washwater		0.0	0.0
1st Moly Cleaner Conc.Launder Water		1.1	1.1
2nd Moly Clnr Feed Pump Seal Water		0.0	0.0
2nd Moly Clnr Column Washwater		0.0	0.0
2nd Moly Cleaner Conc. Launder Water		0.9	0.9
3rd Moly Clnr Feed Pump Seal Water		0.0	0.0
3rd Moly Clnr Column Washwater		0.0	0.0
3rd Moly Cleaner Conc. Launder Water		0.7	0.7
4th Moly Clnr Feed Pump Seal Water		0.0	0.0
4th Moly Clnr Column Washwater		0.0	0.0
4th Moly Cleaner Conc. Launder Water		0.5	0.5
5th Moly Clnr Feed Pump Seal Water		0.0	0.0
5th Moly Clnr Column Washwater		0.0	0.0
5th Moly Cleaner Conc. Launder Water		0.5	0.5
6th Moly Clnr Feed Pump Seal Water		0.0	0.0
6th Moly Clnr Column Washwater		0.0	0.0
6th Moly Cleaner Conc. Launder Water		0.5	0.5
	Total In	**777.9**	**797.7**
Total Gland water		24.8	
OUTGOING			
Copper Flotation Tails Thickener Overflow		376.6	376.6
Moly-Talc Concentrate Thickener Overflow		212.4	212.4
Roaster off gases and vapor		4.3	4.3
Moly-Talc Scavenger Tail		22.2	24.2
Diluted Moly-Talc Scav. Flotation Conc.		1.9	2.1
Talc Rougher Flotation Concentrate		104.6	116.9
Moly Rougher Flotation Tail		59.9	64.9
4th Moly Cleaner Tail Thickener Overflow		2.0	2.0
5th Moly Cleaner Tail Thickener Overflow		1.5	1.5
Diluted 6th Moly Cleaner Concentrate		4.0	4.3
	Total Out	**789.5**	**809.4**
		11.7	11.7

Str. No	Description	%Cu	% Mo	%Wt	Cu,%Dist Overall	Mo,%Dist Overall	MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Slurry	Solids SG	% Sols by Wt	Slurry SG
	FINAL FLOTATION TAILS THICKENER FEED												
	Copper Rougher Flotation Tail	0.04	0.01	87.39	5.40	16.38	2379.8	5552.9	7932.8	6441.8	2.68	30.00	1.23
	1st Copper Cleaner Tail	0.31	0.05	9.13	4.71	18.22	250.5	1111.1	1361.6	1204.2	2.69	18.40	1.13
	Moly-Talc Scavenger Tail	0.45	0.16	0.20	0.15	1.20	5.4	22.2	27.6	24.2	2.69	19.6	1.14
	Talc Rougher Flotation Concentrate	0.34	0.02	1.22	0.70	1.00	33.0	104.6	137.7	116.9	2.69	24.0	
	Final Flotation Tails Thickener Feed	0.07	0.01	97.94	10.96	36.80	2668.8	6790.9	9459.6	7787.1	2.68	28.2	1.21
	FINAL FLOTATION TAILS THICKENER												
	Final Flotation Tails Thickener Underflow	0.07	0.01	97.94	10.96	36.80	2668.8	2183.5	4852.3	3179.9	2.68	55.0	1.53
	Final Flotation Tails Thickener Overflow							4607.3	4607.3	4607.2			1.00
	Final Flotation Tails Thickener Feed	0.07	0.01	97.94	10.96	36.80	2668.8	6790.9	9459.6	7787.1	2.7	28.2	1.21
	FINAL TAILINGS CYCLONE AREA FEED												
	Seal Water to Pumps							27.8	27.8	27.8			
	Final Tailings Thickener Underflow						2668.8	2183.5	4852.3	3179.9	2.68	55.0	1.53
	Cyclone Feed Pump Gland Seal Water							26.7	26.7	26.7	-	-	1.00
	Final Tailings Cyclone Feed						2668.8	2238.0	4906.8	3234.4	2.68	54.4	1.52
	FINAL TAILINGS AREA CYCLONES												
	Final Tailings Cyclone Feed						2668.8	2238.0	4906.8	3234.4	2.68	54.4	1.52
	Final Tailings Cyclone Underflow						1601.3	686.3	2287.5	1284.1	2.68	70.0	1.78
	Final Tailings Cyclone Overflow						1067.5	1551.8	2619.3	1950.3	2.68	40.8	1.34
	TOTAL RECLAIM WATER												
	Copper Flotation Conc. Thickener Overflow	-		-	-			194.9	194.9	194.9			1.00
	Copper Flotation Tails Thickener Overflow							376.6	376.6	376.6			1.00
	Moly-Talc Concentrate Thickener Overflow	-		-	-			212.4	212.4	212.4			1.00
	4th Moly Cleaner Tail Thickener Overflow							2.0	2.0	2.0			
	5th Moly Cleaner Tail Thickener Overflow							1.5	1.5	1.5			
	Moly Concentrate Thickener Overflow							4.0	4.0	4.0			1.00
	Final Flotation Tails Thickener Overflow							4607.3	4607.3	4607.2			1.00
	Tailings Area Recl.Water	-		-	-			1790.4	1790.4	1790.4	-	-	1.00
	TOTAL RECLAIM WATER	-		-	-			7189.2	7189.2	7189.2	-	-	1.00

PROCESS FLOW MASS BALANCE

Aker Kvaerner

Nominal Feedrate - 130000 mtpd
Crushing/Conveying Availability = 80.0%
Concentrator Availability = 90.0%
Feed grade - 0.60% Total Cu
Feed grade - Au

TOROMOCHO COPPER-MOLY PROJECT
PRIMARY CRUSHING & CONVEYING CIRCUIT

Project No. 180600
Date 18/12/2006
Revision A

Str. No	Description	METALLURGICAL BALANCE %Cu	% Mo	%Wt	%Dist Overall		MASS BALANCE MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Solids	M3/HR Water	M3/HR Slurry	Solids SG	% Sols by Wt	Slurry SG
	PRIMARY CRUSHER														
	Total - ROM Ore from Trucks	0.60	0.03	100.00	100.00		6500.0	201.0	6701.0	2407.4	201.0	2608.4	2.70	97.0	2.57
	CRUSHER DISCHARGE CONVEYOR														
	Crushed Ore from Discharge Pocket	0.60		100.00	100.00		6500.0	201.0	6701.0	2407.4	201.0	2608.4	2.70	97.0	2.57
	OVERLAND CONVEYORS														
	Crushed Ore from Crusher	0.60		100.00	100.00		6500.0	201.0	6701.0	2407.4	201.0	2608.4	2.70	97.0	2.57
	Fresh Water to Coarse Ore Overland Conv Dust. Sup.							2.0	2.0		2.0	2.0			
	Fresh Water Shuttle Conv. Dust Suppression							1.0	1.0		1.0	1.0			
	COARSE ORE STACKER														
	Crushed Ore from Conveyors	0.60		100.00	100.00		6500.0	201.0	6701.0	2407.4	201.0	2608.4	2.70	97.0	2.57
	COARSE ORE STOCKPILE														
	Coarse Ore from Stacker	0.60		100.00	100.00		6500.0	201.0	6701.0	2407.4	201.0	2608.4	2.70	97.0	2.57
	Stockpile Reclaim Dust Suppression Water							37.5	37.5		37.5	37.5			
	COARSE ORE FEEDERS														
	New Feed to SAG mill	0.60		100.00	100.00		5416.7	167.5	5584.2	2006.2	167.5	2173.7	2.70	97.0	2.57

Nominal Feedrate - 130000 mtpd
Crushing/Conveying Availability = 80.0%
Concentrator Availability = 90.0%
Feed grade - 0.60% Total Cu
Feed grade - Au

TOROMOCHO COPPER-MOLY PROJECT
GRINDING & PEBBLE CRUSHING CIRCUIT

Project No. 180600
Date 18/12/2006
Revision A

Str. No	Description	METALLURGICAL BALANCE %Cu	% Mo	%Wt	%Dist Overall		MASS BALANCE MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Solids	M3/HR Water	M3/HR Slurry	Solids SG	% Sols by Wt	Slurry SG
	SAG MILL FEED														
	New Feed from Coarse Ore Stockpile	0.60	0.03	100.00	100.00		5416.7	167.5	5584.2	2006.2	167.5	2173.7	2.70	97.0	2.57
	Recycled Pebbles	0.60		25.00	25.00		1354.2	338.5	1692.7	501.5	338.5	840.1	2.70	80.0	2.01
	SAG Mill Feed	0.60		125.00	125.00		6770.8	506.1	7276.9	2507.7	506.1	3013.8	2.70	93.0	2.41
	SAG MILL														
	SAG Mill Feed	0.60		125.00	125.00		6770.8	506.1	7276.9	2507.7	506.1	3013.8	2.70	93.0	2.41
	SAG Mill Feed Water	-		-	-			2395.7	2395.7		2395.7	2395.7	-	-	-
	SAG Mill Discharge	0.60		125.00	125.00		6770.8	2901.8	9672.6	2507.7	2901.8	5409.5	2.70	70.0	1.79
	SAG TROMMEL FEED														
	SAG Mill Discharge	0.60		125.00	125.00		6770.8	2901.8	9672.6	2507.7	2901.8	5409.5	2.70	70.0	1.79
	SAG Trommel and screen water	-		-	-			744.0	744.0		744.0	744.0	-	-	-
	SAG Trommel Feed	0.60		125.00	125.00		6770.8	3645.8	10416.7	2507.7	3645.8	6153.5	2.70	65.0	1.69
	SAG TROMMEL														
	SAG Trommel O'Size	0.60		115.00	115.00		6229.2	1756.9	7986.1	2307.1	1756.9	4064.0	2.70	78.0	1.97
	SAG Trommel U'Size	0.60		10.00	10.00		541.7	1888.9	2430.6	200.6	1888.9	2089.5	2.70	22.3	1.16
	SAG Trommel Feed	0.60		125.00	125.00		6770.8	3645.8	10416.7	2507.7	3645.8	6153.5	2.70	65.0	1.69
	SAG SCREEN														
	SAG Discharge Screen O'Size	0.60		25.00	25.00		1354.2	338.5	1692.7	501.5	338.5	840.1	2.70	80.0	2.01
	SAG Discharge Screen U'Size	0.60		90.00	90.00		4875.0	1418.4	6293.4	1805.6	1418.4	3224.0	2.70	77.5	1.95
	SAG Discharge Screen Feed	0.60		115.00	115.00		6229.2	1756.9	7986.1	2307.1	1756.9	4064.0	2.70	78.0	1.97
	PEBBLE CRUSHER FEED														
	SAG Discharge Screen O'Size	0.60		25.00	25.00		1354.2	338.5	1692.7	501.5	338.5	840.1	2.70	80.0	2.01
	Pebble Crusher Feed/Discharge	0.60		25.00	25.00		1354.2	338.5	1692.7	501.5	338.5	840.1	2.70	80.0	2.01
	BALL MILL CYCLONE FEED						5416.7								
	SAG Trommel U'Size	0.60		10.00	10.00		541.7	1888.9	2430.6	200.6	1888.9	2089.5	2.70	22.3	1.16
	SAG Discharge Screen U'Size	0.60		90.00	90.00		4875.0	1418.4	6293.4	1805.6	1418.4	3224.0	2.70	77.5	1.95
	Ball Mill Cyclone Underflow	0.60		300.00	270.00	*	16250.0	6964.3	23214.3	6018.5	6964.3	12982.8	2.70	70.0	1.79
	Ball Mill Milk of Lime Feed						26.2	236.0	262.2	11.9	236.0	247.9	2.20	10.0	1.06
	Ball Mill Cyclone Dilution Water	-		-	-			8864.3	8864.3		8864.3	8862.1		-	-
	SAG + Ball Mills Cooling Water	-		-	-			243.8	243.8		243.8	243.8	-	-	-
	Ball Mill Cyclone Feed Pump Gland Water	-		-	-			48.8	48.8		48.8	48.8	-	-	-
	Ball Mill Cyclone Feed	0.60		400.00	360.00		21692.9	19664.3	41357.2	8034.4	19664.3	27698.7	2.70	52.5	1.49
	BALL MILL CYCLONES														
	Flotation Circuit Feed	0.60		100.00	90.00		5442.9	12700.1	18142.9	2015.9	12700.1	14715.9	2.70	30.0	1.23
	Ball Mill Cyclone Underflow	0.60		300.00	270.00		16250.0	6964.3	23214.3	6018.5	6964.3	12982.8	2.7	70.0	1.79
	Ball Mill Cyclone Feed	0.60		400.00	360.00		21692.9	19664.3	41357.2	8034.4	19664.3	27698.7	2.7	52.5	1.49

CHECK ON GRINDING CIRCUIT TOTAL WATER & SLURRY:		MTPH	M3/HR
INCOMING:		Water	Slurry
Fresh Water to Coarse Ore Overland Conv Dust. Sup.		2	2
Fresh Water Shuttle Conv. Dust Suppression		1	1
Stockpile Reclaim Dust Suppression Water		38	38
New Feed from Coarse Ore Stockpile		168	2174
SAG Mill Feed Water		2396	2396
SAG Trommel and screen water		744	744
Ball Mill Cyclone Dilution Water		8864	8862
SAG + Ball Mills Cooling Water		244	244
Ball Mill Milk of Lime Feed		236	248
Ball Mill Cyclone Feed Pump Gland Water		49	49
	Total In	12741	14756
OUTGOING:			
Dust Suppression Losses		41	41
Flotation Circuit Feed		12700	14716
	Total Out	12741	14756
		0.0	0.0

Nominal Feedrate - 130000 mtpd
Crushing/Conveying Availability = 80.0%
Concentrator Availability = 90.0%
Feed grade - 0.60% Total Cu
Feed grade - Au

TOROMOCHO COPPER-MOLY PROJECT
BULK COPPER FLOTATION & REGRIND CIRCUIT

Project No. 180600
Date 18/12/2006
Revision A

		METALLURGICAL BALANCE					MASS BALANCE								
		0.85	0.02	1.42	2.00	1.00									
Str. No	Description	%Cu	% Mo	%Wt	Cu,%Dist Overall	Mo,%Dist Overall	MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Solids	M3/HR Water	M3/HR Slurry	Solids SG	% Sols by Wt	SG
	OVERALL FLOTATION CIRCUIT														
	Copper Flotation Concentrate	26.3	0.04	2.03	89.00	3.20	110.0						4.40		
	Moly Flotation Concentrate	0.70	50.00	0.03	0.04	60.00	1.8						2.70		
	Final Flotation Tails	0.07	0	97.94	10.96	36.80	5331.1						2.68		
	Flotation Circuit Feed	0.60	0.03	100.00	100.00	100.00	5442.9	12700.1	18142.9	2015.9	12700.1	14715.9	2.70	30.0	1.23
	COPPER ROUGHER FLOTATION														
	Undiluted Copper Rough. Flot. Conc.	4.50	0.18	12.61	94.60	83.62	683.2	1594.2	2277.4	238.2	1594.2	1832.4	2.87	30.0	1.24
	Copper Rougher Flotation Tail	0.04	0.01	87.39	5.40	16.38	4759.7	11105.9	15865.5	1777.7	11105.9	12883.5	2.68	30.0	1.23
	Flotation Circuit Feed	0.60	0.03	100.00	100.00	100.00	5442.9	12700.1	18142.9	2015.9	12700.1	14715.9	2.70	30.0	1.23
	COPPER ROUGH. CONC. LAUNDER WATER														
	Undiluted Copper Rough. Flot. Conc.	4.50	0.18	12.61	94.60	83.62	683.2	1594.2	2277.4	238.2	1594.2	1832.4	2.87	30.0	1.24
	Copper Rougher Flot. Launder Water	-		-	-			162.7	162.7		162.7	162.7	-	-	1.00
	Diluted Copper Rough. Flot. Conc.	4.50	0.18	12.61	94.60	83.62	683.2	1756.9	2440.1	238.2	1756.9	1995.1	2.87	28.00	1.22
	REGRIND CIRCUIT NEW FEED														
	Diluted Copper Rough. Flot. Conc.	4.50	0.18	12.61	94.60	83.62	683.2	1756.9	2440.1	238.2	1756.9	1995.1	2.87	28.0	1.22
	Diluted Mo-Talc Scavenger Conc.	12.00	1.35	0.02	0.40	1.00	1.1	3.8	4.9	0.3	3.8	4.2	3.26	22.0	1.18
	Moly Rougher Flotation Tail	3.54	0.37	0.53	3.11	7.20	28.6	119.7	148.3	10.1	119.7	129.8	2.82	19.3	1.14
	Regrind Mill Cooling Water	-		-	-			17.0	17.0		17.0	17.0	-	-	1.00
	Regrind Mill Dilution Water	-		-	-			137.1	137.1		137.1	137.1	-	-	1.00
	Regrind Mill Feed Pump Gland Water							0.0	0.0		0.0	0.0		-	1.00
	Milk of Lime to Regrinding Sump						3.2	28.8	32.0	1.5	28.8	30.3	2.20	10.0	1.06
	Regrind Mill Sump Water							627.2	627.2		627.2	627.2	-	-	1.00
	Cycl.Feed Pump Gland Water	-		-	-			3.3	3.3		3.3	3.3	-	-	1.00
	Regrind Circuit New Feed	4.47	0.19	13.16	98.11	91.82	716.1	2693.8	3409.9	250.1	2693.8	2944.0	2.86	21.0	1.16
	REGRIND CYCLONE														
	Regrind Cyclone Overflow	4.47	0.19	13.16	98.11	91.82	716.1	2693.8	3409.9	250.1	2693.8	2944.0	2.87	21.0	1.16
	Regrind Cyclone Underflow	4.47	0.19	19.74	147.17	137.73	1069.3	575.8	1645.1	373.0	575.8	948.8	2.87	65.0	1.73
	Diluted Regrind Cyclone Feed	4.47	0.19	32.90	245.28	229.55	1785.4	3269.6	5055.0	622.8	3269.6	3892.4	2.87	35.3	1.30
	REGRIND MILL FEED														
	Regrind Cyclone Underflow	4.47	0.19	19.74	147.17	137.73	1069.3	575.8	1645.1	373.0	575.8	948.8	2.87	65.0	1.73
	Regrind Mill Dilution Water							137.1	137.1		137.1	137.1	-	-	1.00
	Diluted Regrind Mill Feed	4.47	0.19	19.74	147.17	137.73	1069.3	712.9	1782.2	373.0	712.9	1085.9	2.87	60.0	1.64
	1ST COPPER CLEANER FEED														
	Regrind Cyclone Overflow	4.47	0.19	13.16	98.11	91.82	716.1	2693.8	3409.9	250.1	2693.8	2944.0	2.87	21.0	1.16
	1st Copper Clnr Feed Pump Seal Water							7.2	7.2		7.2	7.2	-	-	1.00
	1st Copper Clnr Feed Dilution Water							163.3	163.3		163.3	163.3	-	-	1.00
	Diluted 1st Copper Cleaner Feed	4.47	0.19	13.16	98.11	91.82	716.1	2864.3	3580.4	249.8	2864.3	3114.1	2.87	20.00	1.15
	1ST COPPER CLEANER FLOTATION														
	1st Copper Cleaner Concentrate	13.90	0.49	4.03	93.40	73.60	218.3	654.9	873.3	64.7	654.9	719.6	3.38	25.00	1.21
	1st Copper Cleaner Tail	0.31	0.05	9.13	4.71	18.22	497.8	2209.4	2707.2	185.1	2209.4	2394.5	2.69	18.4	1.13
	Diluted 1st Copper Cleaner Feed	4.47	0.19	13.16	98.11	91.82	716.1	2864.3	3580.4	249.8	2864.3	3114.1	2.87	20.0	1.15
	1ST.COPPER CLEAN.CONC.LAUND.WATER														
	Undiluted 1st.Copper Cleaner Conc.	13.90	0.49	4.03	93.40	73.60	218.3	654.9	873.3	64.7	654.9	719.6	3.38	25.0	1.21
	1st Copper Clean. Conc.Launder Water	-		-	-			166.3	166.3		166.3	166.3	-	-	1.00
	Diluted 1st.Copper Cleaner Conc.	13.90	0.49	4.03	93.40	73.60	218.3	821.3	1039.6	64.7	821.3	886.0	3.38	21.00	1.17
	2ND COPPER CLEANER FEED														
	1st Copper Cleaner Concentrate	13.90	0.49	4.03	93.40	73.60	218.3	821.3	1039.6	64.7	821.28	885.96	3.38	21.0	1.17
	Diluted Copper Cleaner Scav. Conc.	22.0	0.08	0.94	34.40	2.95	50.8	203.3	254.1	12.8	203.27	216.04	3.98	20.0	1.18
	2nd Copper Clnr Feed Pump Seal Water	-		-	-			2.7	2.7		2.69	2.69	-	-	1.00
	2nd Copper Clnr Feed Dilution Water	-		-	-			49.3	49.3		49.29	49.29	-	-	1.00
	Diluted 2nd Copper Cleaner Feed	15.43	0.42	4.97	127.80	76.55	269.1	1076.5	1345.7	77.5	1076.5	1154.0	3.47	20.00	1.17

2ND COPPER CLEANER FLOTATION															
Undiluted 2nd Copper Cleaner Concentrate	20.11	0.22	3.77	126.33	30.65	204.1	612.4	816.5	53.4	612.4	665.8	3.82	25.00	1.23
2nd Copper Cleaner Tail	0.74	1.03	1.20	1.47	45.90	65.0	464.1	529.1	24.0	464.1	488.2	2.71	12.3	1.08
Diluted 2nd Copper Cleaner Feed	15.43	0.42	4.97	127.80	76.55	269.1	1076.5	1345.7	77.5	1076.5	1154.0	3.47	20.0	1.17
2ND COPPER CLEAN.CONC. LAUNDER WATER														
Undiluted 2nd Copper Cleaner Concentrate	20.11	0.22	3.77	126.33	30.65	204.1	612.4	816.5	53.4	612.4	665.8	3.82	25.0	1.23
2nd Copper Cleaner Conc. Launder Water							111.3	111.3		111.3	111.3	-	-	1.00
Diluted 2nd Copper Cleaner Concentrate	20.11	0.22	3.77	126.33	30.65	204.1	723.7	927.9	53.4	723.7	777.2	3.82	22.00	1.19
3RD COPPER CLEANER FEED														
Diluted 2nd Copper Cleaner Concentrate	20.11	0.22	3.77	126.33	30.65	204.1	723.7	927.9	53.4	723.7	777.2	3.82	22.0	1.19
3rd Copper Clnr Feed Pump Seal Water	-		-	-			2.0	2.0		2.0	2.0	-	-	1.00
3rd Copper Clnr Feed Dilution Water	-		-	-			173.5	173.5		173.5	173.5	-	-	1.00
Diluted 3rd Copper Cleaner Feed	20.11	0.22	3.77	126.33	30.65	204.1	899.3	1103.4	53.4	899.3	952.7	3.82	18.50	1.16
3RD COPPER CLEANER FLOTATION														
Undiluted 3rd Copper Cleaner Concentrate	26.3	0.04	2.03	89.00	3.20	110.0	348.3	458.3	25.0	348.3	373.3	4.40	24.00	1.23
3rd Copper Cleaner Tail	12.89	0.43	1.74	37.33	27.45	94.2	551.0	645.2	28.4	551.0	579.4	3.31	14.6	1.11
Diluted 3rd Copper Cleaner Feed	20.11	0.22	3.77	126.33	30.65	204.1	899.3	1103.4	53.4	899.3	952.7	3.82	18.5	1.16
3RD COPPER CLEAN.CONC. LAUNDER WATER														
Undiluted 3rd Copper Cleaner Concentrate	26.3	0.04	2.03	89.00	3.20	110.0	348.3	458.3	25.0	348.3	373.3	4.40	24.0	1.23
3rd Copper Cleaner Conc. Launder Water							41.7	41.7		41.7	41.7	-	-	1.00
Final 3rd Copper Cleaner Concentrate	26.3	0.04	2.03	89.00	3.20	110.0	389.9	499.9	25.0	389.9	414.9	4.40	22.00	1.20
COPPER CLEANER-SCAV. FLOTATION														
Undiluted Copper Cleaner-Scav. Conc.	22.0	0.08	0.94	34.40	2.95	50.8	180.2	231.0	12.8	180.2	192.9	3.98	22.0	1.20
Copper Cleaner-Scav. Tail	2.20	0.83	0.80	2.93	24.50	43.3	370.8	414.2	15.7	370.8	386.5	2.77	10.5	1.07
Copper Cleaner-Scav. Feed	12.89	0.43	1.74	37.33	27.45	94.2	551.0	645.2	28.4	551.0	579.4	3.3	14.6	1.11
COPPER CLEAN.SCAV. CONC. LAUNDER WATER														
Undiluted Copper Cleaner-Scav. Conc.	22.0	0.08	0.94	34.40	2.95	50.8	180.2	231.0	12.8	180.2	192.9	3.98	22.0	1.20
Copper Cleaner-Scav. Conc. Launder Wate	-		-				23.1	23.1		23.1	23.1	-	-	1.00
Diluted Copper Cleaner-Scav. Conc.	22.0	0.08	0.94	34.40	2.95	50.8	203.3	254.1	12.8	203.3	216.0	3.98	20.0	1.18
COPPER FLOTATION CIRCUIT TAILS														
Copper Rougher Flotation Tail	0.04	0.01	87.39	5.40	16.38	4759.7	11105.9	15865.5	1777.7	11105.9	12883.5	2.68	30.0	1.23
1st Copper Cleaner Tail	0.31	0.05	9.13	4.71	18.22	497.8	2209.4	2707.2	185.1	2209.4	2394.5	2.69	18.4	1.13
2nd Copper Cleaner Tail	0.74	1.03	1.20	1.47	45.90	65.0	464.1	529.1	24.0	464.1	488.2	2.7	12.3	1.08
Copper Cleaner-Scavenger Tail	2.20	0.83	0.80	2.93	24.50	46.5	370.8	414.2	15.7	370.8	386.5	2.77	11.2	1.07
OSA Wash Water							875.1	875.1		875.1	875.1	-	-	1.00
Copper Flotation Circuit Tails	0.09	0.03	98.52	14.51	105.00	5369.0	15025.4	20391.1	2002.5	15025.4	17027.8	2.68	26.3	1.20
COPPER FLOTATION CONCENTRATE THICKENER FEED														
Final 3rd Copper Cleaner Concentrate	26.3	0.04	2.03	89.00	3.20	110.0	389.9	499.9	25.0	389.9	414.9	4.40	22.0	1.20
Copper Flot.Conc.Thickener Feed Pump Gl	-		-				1.1	1.1		1.1	1.1	-	-	1.00
Copper Flotation Conc. Filter Filtrate	-		-			0.0	57.9	57.9		57.9	57.9	-	-	1.00
Copper Flotation Conc. Thickener Feed	26.3	0.04	2.03	89.00	3.20	110.0	448.9	558.9	25.0	448.9	473.9	4.40	19.7	1.18
COPPER FLOTATION CONCENTRATE THICKENER														
Copper Flotation Conc.Thickener Underflow	26.3	0.04	2.03	89.00	3.20	110.0	59.2	169.2	25.0	59.2	84.2	4.40	65.0	2.01
Copper Flotation Conc. Thickener Overflow							389.7	389.7		389.7	389.7			1.00
Copper Flotation Conc. Thickener Feed	26.3	0.04	2.03	89.00	3.20	110.0	448.9	558.9	25.0	448.9	473.9	4.4	19.7	1.18
COPPER FLOTATION CONCENTRATE SLURRY STORAGE														
Copper Flotation Conc. Thickener Underflo	26.3	0.04	2.03	89.00	3.20	110.0	59.2	169.2	25.0	59.2	84.2	4.40	65.0	2.01
Copper Flot.Conc. Thick.U'Flow Pump Gld.	-		-				1.1	1.1		1.1	1.1	-	-	1.00
Copper Flot.Conc. Slurry Storage Feed/Dis	26.3	0.04	2.03	89.00	3.20	110.0	60.3	170.3	25.0	60.3	85.3	4.40	64.6	2.00
COPPER FLOTATION CONCENTRATE FILTER FEED														
Copper Flot.Conc. Slurry Storage Feed/Dis	26.3	0.04	2.03	89.00	3.20	110.0	60.3	170.3	25.0	60.3	85.3	4.40	64.6	2.00
Copper Flot.Conc. Filter Feed Pump Gld. W	-		-				1.1	1.1		1.1	1.1	-	-	1.00
Copper Flot.Conc. Filter Feed (actual)	26.3	0.04	2.03			110.0	61.4	171.4	25.0	61.4	86.4	4.40	64.2	1.98
Copper Flot.Conc. Filter Wash Water							7.3	7.3		7.3	7.3	-	-	1.00
Copper Flot.Conc. Filter Feed (effective)	26.3	0.04	2.03	89.00	3.20	110.0	68.8	178.7	25.0	68.8	93.8	4.40	61.5	1.91
COPPER FLOTATION CONCENTRATE FILTER														
Filtered Copper Flotation Concentrate	26.3	0.04	2.03	89.00	3.20	110.0	10.9	120.9	25.0	10.9	35.9	4.40	91.0	3.37
Copper Flotation Concentrate Filter Filtrate	-		-				57.9	57.9		57.9	57.9	-	-	1.00
Copper Flotation Concentrate Filter Feed	26.3		2.03	89.00	3.20	110.0	68.8	178.7	25.0	68.8	93.8	4.40	61.53	1.91

TOROMOCHO COPPER-MOLY PROJECT

CHECK ON COPPER FLOTATION TOTAL WATER & SLURRY:		MTPH	M3/HR
INCOMING		Water	Slurry
Flotation Circuit Feed		12700.1	14716
Diluted Mo-Talc Scavenger Conc.		3.8	4
Moly Rougher Flotation Tail		119.7	130
Copper Rougher Flot. Launder Water		162.7	163
Copper Cleaner-Scav. Conc. Launder Water		23.1	23
Regrind Mill Cooling Water		17.0	17
Regrind Mill Dilution Water		137.1	137
Regrind Mill Feed Pump Gland Water		0.0	0
Regrind Mill Sump Milk of Lime Feed		28.8	30
Regrind Mill Sump Water		627.2	627
Cycl.Feed Pump Gland Water		3.3	3
1st Copper Clnr Feed Pump Seal Water		7.2	7
1st Copper Clnr Feed Dilution Water		163.3	163
1st Copper Clean. Conc.Launder Water		166.3	166
2nd Copper Clnr Feed Pump Seal Water		2.7	3
2nd Copper Clnr Feed Dilution Water		49.3	49
2nd Copper Cleaner Conc. Launder Water		111.3	111
Bulk 3rd Clnr Feed Pump Seal Water		2.0	2.0
Bulk 3rd Clnr Feed Dilution Water		173.5	174
Bulk 3rd Cleaner Launder Water		41.7	42
OSA Wash Water		875.1	875
	Total In	15415	17443
OUTGOING			
Final Bulk 3rd Cleaner Concentrate		390	415
Copper Flotation Circuit Tails		15025	17028
	Total Out	15415	17443
		0.0	-0.3

Nominal Feedrate - 130000 mtpd
Crushing/Conveying Availability = 80.0%
Concentrator Availability = 90.0%
Feed grade - 0.60% Total Cu
Feed grade - Au

TOROMOCHO COPPER-MOLY PROJECT
MOLY-TALC FLOTATION CIRCUIT

Project No. 180600
Date 18/12/2006
Revision A

		METALLURGICAL BALANCE					MASS BALANCE								
Str. No	Description	%Cu	% Mo	%Wt	Cu,%Dist Overall	Mo,%Dist Overall	MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Solids	M3/HR Water	M3/HR Slurry	Solids SG	% Sols by Wt	Slurry SG
	COPPER TAILS THICKENER FEED														
	2nd Copper Cleaner Tail	0.74	1.03	1.20	1.47	45.90	65.0	464.13	529.13	24.03	464.13	488.16	2.71	12.28	1.08
	Copper Cleaner-Scav. Tail	2.20	0.83	0.80	2.93	24.50	43.3	370.84	414.17	15.66	370.84	386.50	2.77	10.46	1.07
	Copper Flotation Tails Thickener Feed	1.32	0.95	2.00	4.40	70.40	108.3	835.0	943.3	39.7	835.0	874.7	2.73	11.5	1.08
	COPPER TAILS THICKENER														
	Copper Flotation Tails Thickener Underflow	1.32	0.95	2.00	4.40	70.40	108.3	81.7	190.1	39.7	81.7	121.4	2.73	57.0	1.57
	Copper Flotation Tails Thickener Overflow							753.2	753.2		753.2	753.2			1.00
	Copper Flotation Tails Thickener Feed	1.32	0.95	2.00	4.40	70.40	108.3	835.0	943.3	39.7	835.0	874.7	2.7	11.5	1.08
	COPPER TAILS CONDITIONING TANK FEED														
	Copper Flotation Tails Thickener Underflow	1.32	0.95	2.00	4.40	70.40	108.3	81.7	190.1	39.7	81.7	121.4	2.73	57.0	1.57
	Copper Flot.Tails Thick.U'Flow Pump Gld. V	-		-				21.7	21.7		21.7	21.7	-	-	1.00
	Copper Flot.Tails Conditioning Tank Feed	1.32	0.95	2.00	4.40	70.40	108.3	103.4	211.7	39.7	103.4	143.1	2.73	51.2	1.48
	COPPER TAILS CONDITIONING TANK														
	Copper Flot.Tails Conditioning Tank Feed	1.32	0.95	2.00	4.40	70.40	108.3	103.4	211.7	39.7	103.4	143.1	2.73	51.2	1.48
	Hot Steam							29.0	29.0		29.0	29.0			
	Copper Flot.Tails Conditioning Tank Discha	1.32	0.95	2.00	4.40	70.40	108.3	132.4	240.7	39.7	132.4	172.1	2.73	45.0	1.40
	MOLY-TALC ROUGHER FLOTATION FEED														
	Copper Flot.Tails Conditioning Tank Discha	1.32	0.95	2.00	4.40	70.40	108.3	132.4	240.7	39.7	132.4	172.1	2.73	45.0	1.40
	Moly-Talc Rougher Flot. Pump Seal Water	-		-	-			1.1	1.1		1.1	1.1	-	-	1.00
	Moly-Talc Rougher Flot. Feed Dilution Wat	-		-	-			191.5	191.5		191.5	191.5	-	-	1.00
	Diluted Moly-Talc Rougher Flotation Feed	1.32	0.95	2.00	4.40	70.40	108.3	325.0	433.3	39.7	325.0	364.7	2.73	25.0	1.19
	MOLY-TALC ROUGHER FLOTATION														
	Undiluted Moly-Talc Rougher Flotation Con	1.30	1.03	1.78	3.85	68.20	96.4	289.3	385.7	35.3	289.3	324.6	2.73	25.0	1.19
	Moly-Talc Rougher Flotation Tail	1.50	0.27	0.22	0.55	2.20	11.92	35.7	47.7	4.4	35.7	40.1	2.74	25.0	1.19
	Diluted Moly-Talc Rougher Flotation Feed	1.32	0.95	2.00	4.40	70.40	108.3	325.0	433.3	39.7	325.0	364.7	2.73	25.0	1.19
	MOLY-TALC ROUGHER FLOT.CONC. LAUNDER WATER														
	Undiluted Moly-Talc Rougher Flotation Con	1.30	1.03	1.78	3.85	68.20	96.4	289.3	385.7	35.3	289.3	324.6	2.73	25.0	1.19
	Moly-Talc Rougher. Flot. Conc. Launder Wa	-		-				52.6	52.6		52.6	52.6	-	-	1.00
	Diluted Moly-Talc Rougher. Flot. Conc.	1.30	1.03	1.78	3.85	68.20	96.4	341.8	438.3	35.3	341.8	377.2	2.73	22.0	1.16
	MOLY-TALC SCAVENGER FLOTATION FEED														
	Moly-Talc Rougher Flotation Tail	1.50	0.27	0.22	0.55	2.20	11.9	35.75	47.67	4.35	35.75	40.10	2.74	25.00	1.19
	Moly-Talc Scav. Flot. Feed Pump Seal Wat	-		-	-			0.1	0.1		0.1	0.1	-	-	1.00
	Moly-Talc Scav. Flot. Feed Dilution Water	-		-	-			11.8	11.8		11.8	11.8	-	-	1.00
	Diluted Moly-Talc Scavenger Flotation Feed	1.50	0.27	0.22	0.55	2.20	11.9	47.7	59.6	4.4	47.7	52.0	2.74	20.0	1.15
	MOLY-TALC SCAVENGER FLOTATION														
	Undiluted Moly-Talc Scavenger Conc.	12.00	1.35	0.02	0.40	1.00	1.1	3.3	4.3	0.3	3.3	3.6	3.26	25.0	1.21
	Moly-Talc Scavenger Tail	0.45	0.16	0.20	0.15	1.20	10.8	44.4	55.3	4.0	44.4	48.4	2.69	19.6	1.14
	Diluted Moly-Talc Scavenger Feed	1.50	0.27	0.22	0.55	2.20	11.9	47.7	59.6	4.4	47.7	52.0	2.74	20.0	1.15
	MOLY-TALC SCAV. CONC. LAUNDER WATER														
	Undiluted Moly-Talc Scavenger Conc.	12.00	1.35	0.02	0.40	1.00	1.1	3.3	4.3	0.3	3.3	3.6	3.26	25.0	1.21
	Moly-Talc Scav. Conc. Launder Water	-		-				0.6	0.6		0.6	0.6	-	-	1.00
	Diluted Moly-Talc Scav. Flotation Conc.	12.00	1.35	0.02	0.40	1.00	1.1	3.8	4.9	0.3	3.8	4.2	3.26	22.0	1.18
	MOLY-TALC CONCENTRATE THICKENER FEED														
	Diluted Moly-Talc Rougher. Flot. Conc.	1.30	1.03	1.78	3.85	68.20	96.4	341.8	438.3	35.3	341.8	377.2	2.73	22.0	1.16
	Moly-Talc Concentrate Filter Filtrate	-		-				147.3	147.3		147.3	147.3	-	-	1.00
	Moly-Talc Concentrate Thickener Feed	1.30	1.03	1.78	3.85	68.20	96.4	489.1	585.6	35.3	489.1	524.5	2.73	16.5	1.12
	MOLY-TALC CONCENTRATE THICKENER														
	Moly-Talc Concentrate Thickener Underflow	1.30	1.03	1.78	3.85	68.20	96.4	64.3	160.7	35.3	64.3	99.6	2.73	60.0	1.61
	Moly-Talc Concentrate Thickener Overflow							424.9	424.9		424.9	424.9			1.00
	Moly-Talc Concentrate Thickener Feed	1.30	1.03	1.78	3.85	68.20	96.4	489.1	585.6	35.3	489.1	524.5	2.7	16.5	1.12

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	MOLY-TALC CONCENTRATE SLURRY STORAGE														
	Moly-Talc Concentrate Thickener Underflow	1.30	1.03	1.78	3.85	68.20	96.4	64.3	160.7	35.3	64.3	99.6	2.73	60.0	1.61
	Moly-Talc Conc.Thick.U'Flow Pump Gld. W	-		-				19.3	19.3		19.3	19.3	-	-	1.00
	Moly-Talc Conc. Slurry Storage Feed/Disch	1.30	1.03	1.78	3.85	68.20	96.4	83.6	180.0	35.3	83.6	118.9	2.73	53.6	1.51
	MOLY-TALC CONCENTRATE FILTER FEED														
	Moly-Talc Conc. Slurry Storage Feed/Disch	1.30	1.03	1.78	3.85	68.20	96.4	83.6	180.0	35.3	83.6	118.9	2.73	53.6	1.51
	Moly-Talc Conc. Filter Feed Pump Gld. Wa	-		-				5.8	5.8		5.8	5.8	-	-	1.00
	Moly-Talc Conc. Filter Feed (actual)	1.30	1.03	1.78			96.4	89.3	185.8	35.3	89.3	124.7	2.73	51.9	1.49
	Moly-Talc Conc. Filter Wash Water							67.5	67.5		67.5	67.5	-	-	1.00
	Moly-Talc Conc. Filter Feed (effective)	1.30	1.03	1.78	3.85	68.20	96.4	156.8	253.3	35.3	156.8	192.2	2.73	38.1	1.32
	MOLY-TALC CONCENTRATE FILTER														
	Filtered Moly-Talc Concentrate	1.30	1.03	1.78	3.85	68.20	96.4	9.5	106.0	35.3	9.5	44.9	2.73	91.0	2.36
	Moly-Talc Conc. Filter Filtrate	-	-	-				147.3	147.3		147.3	147.3	-	-	1.00
	Moly-Talc Conc. Filter Feed	1.30	1.03	1.78	3.85	68.20	96.4	156.8	253.3	35.3	156.8	192.2	2.73	38.07	1.32
	MOLY-TALC CONCENTRATE ROASTING														
	Filtered Moly-Talc Concentrate	1.30	1.03	1.78	3.85	68.20	96.4	9.5	106.0	35.3	9.5	44.9	2.73	91.0	2.36
	Roaster off gases and vapor							8.6	8.6		8.6	8.6			
	Roasted Moly-Talc Concentrate	1.30	1.03	1.78	3.85	68.20	96.4	1.0	97.4	35.3	1.0	36.3	2.73	99.0	2.68
	MOLY-TALC CONCENTRATE CONDITIONING TANK														
	Undiluted Roasted Moly-Talc Concentrate	1.30	1.03	1.78	3.85	68.20	96.4	1.0	97.4	35.3	1.0	36.3	2.73	99.0	2.68
	Moly-Talc Conc.Conditioning Dilution Water	-		-				288.3	288.3		288.3	288.3	-	-	1.00
	Diluted Moly-Talc Concentrate	1.30	1.03	1.78	3.85	68.20	96.4	289.3	385.7	35.3	289.3	324.6	2.73	25.0	1.19
	TALC ROUGHER FLOTATION FEED														
	Diluted Moly-Talc Concentrate	1.30	1.03	1.78	3.85	68.20	96.4	289.3	385.7	35.3	289.3	324.6	2.73	25.0	1.19
	Talc Rougher Flotation Feed Pump Seal W	-	-	-	-			1.0	1.0		1.0	1.0	-	-	1.00
	Talc Rougher Flotation Feed Dilution Wate	-	-	-	-			51.6	51.6		51.6	51.6	-	-	1.00
	Diluted Talc Rougher Flotation Feed	1.30	1.03	1.78	3.85	68.20	96.4	341.8	438.3	35.3	341.8	377.2	2.73	22.00	1.16
	TALC ROUGHER FLOTATION														
	Talc Rougher Flotation Concentrate	0.34	0.02	1.22	0.70	1.00	66.1	209.3	275.3	24.6	209.3	233.8	2.69	24.00	1.18
	Talc Rougher Flotation Tail	3.38	3.24	0.56	3.15	67.20	30.3	132.6	162.9	10.8	132.6	143.3	2.82	18.6	1.14
	Diluted Talc Rougher Flotation Feed	1.30	1.03	1.78	3.85	68.20	96.4	341.8	438.3	35.3	341.8	377.2	2.73	22.0	1.16
	MOLY ROUGHER FLOTATION FEED														
	Talc Rougher Flotation Tail	3.38	3.24	0.56	3.15	67.20	30.3	132.6	162.9	10.8	132.6	143.3	2.82	18.6	1.14
	1st Moly Cleaner Tail	0.91	2.47	0.09	0.13	8.00	4.7	16.7	21.4	1.7	16.7	18.4	2.71	22.2	1.16
	Moly Rougher Flot. Pump Seal Water	-		-	-			0.4	0.4		0.4	0.4	-	-	1.00
	Moly Rougher Flot. Feed Dilution Water	-		-	-			7.4	7.4		7.4	7.4	-	-	1.00
	Diluted Moly Rougher Flotation Feed	3.04	3.14	0.65	3.28	75.20	35.1	140.3	175.4	12.5	140.3	152.8	2.80	20.00	1.15
	MOLY ROUGHER FLOTATION														
	Undiluted Moly Rougher Flotation Conc.	0.85	15.3	0.12	0.17	68.00	6.5	20.6	27.1	2.4	20.6	23.0	2.71	24.0	1.18
	Moly Rougher Flotation Tail	3.54	0.37	0.53	3.11	7.20	28.6	119.7	148.3	10.1	119.7	129.8	2.82	19.3	1.14
	Diluted Moly Rougher Flotation Feed	3.04	3.14	0.65	3.28	75.20	35.1	140.3	175.4	12.5	140.3	152.8	2.80	20.0	1.15
	MOLY ROUGH. CONC. LAUNDER WATER														
	Undiluted Moly Rougher Flotation Conc.	0.85	15.3	0.12	0.17	68.00	6.5	20.6	27.1	2.4	20.6	23.0	2.71	24.0	1.18
	Moly Rougher Flot.Conc. Launder Water	-		-	-			2.5	2.5		2.5	2.5	-	-	1.00
	Diluted Moly Rough. Flot. Conc.	0.85	15.3	0.12	0.17	68.00	6.5	23.0	29.5	2.4	23.0	25.4	2.71	22.00	1.16

1ST MOLY CLEANER FEED														
Diluted Moly Rough. Flot. Conc.	0.85	15.3	0.12	0.17	68.00	6.5	23.0	29.5	2.4	23.0	25.4	2.71	22.0	1.16
2nd Moly Cleaner Tail	0.91	3.52	0.06	0.09	7.50	3.1	10.8	13.9	1.2	10.8	12.0	2.71	22.4	1.16
1st Moly Clnr Feed Pump Seal Water							0.1	0.1		0.1	0.1	-	-	1.00
1st Moly Clnr Column Washwater							0.0	0.0		0.0	0.0	-	-	1.00
Diluted 1st Moly Cleaner Feed	0.87	11.5	0.18	0.26	75.50	9.6	34.0	43.6	3.5	34.0	37.5	2.71	22.07	1.16
1ST MOLY CLEANER FLOTATION														
Undiluted 1st Moly Cleaner Concentrate	0.83	20.3	0.09	0.13	67.50	4.9	17.3	22.2	1.8	17.3	19.1	2.71	22.00	1.16
1st Moly Cleaner Tail	0.91	2.47	0.09	0.13	8.00	4.7	16.7	21.4	1.7	16.7	18.4	2.71	22.2	1.16
Diluted 1st Moly Cleaner Feed	0.87	11.5	0.18	0.26	75.50	9.6	34.0	43.6	3.5	34.0	37.5	2.71	22.1	1.16
1ST.MOLY CLEAN.CONC.LAUND.WATER														
Undiluted 1st. Moly Cleaner Conc.	0.83	20.3	0.09	0.13	67.50	4.9	17.3	22.2	1.8	17.3	19.1	2.71	22.0	1.16
1st Moly Cleaner Conc.Launder Water	-		-	-			2.2	2.2		2.2	2.2	-	-	1.00
Diluted 1st.Moly Cleaner Conc.	0.83	20.3	0.09	0.13	67.50	4.9	19.5	24.4	1.8	19.5	21.3	2.71	20.0	1.14
2ND MOLY CLEANER FEED														
Diluted 1st.Moly Cleaner Conc.	0.83	20.3	0.09	0.13	67.50	4.9	19.5	24.4	1.8	19.50	21.30	2.71	20.0	1.14
3rd Moly Cleaner Tail	0.88	4.60	0.04	0.06	6.40	2.0	4.7	6.7	0.8	4.69	5.44	2.71	30.3	1.24
2nd Moly Clnr Feed Pump Seal Water	-		-	-			0.1	0.1		0.07	0.07	-	-	1.00
2nd Moly Clnr Column Washwater	-		-	-			0.0	0.0		0.00	0.00	-	-	1.00
Diluted 2nd Moly Cleaner Feed	0.85	15.6	0.13	0.18	73.90	6.9	24.3	31.2	2.6	24.3	26.8	2.71	22.17	1.16
2ND MOLY CLEANER FLOTATION														
Undiluted 2nd Moly Cleaner Concentrate	0.80	25.6	0.07	0.09	66.40	3.8	13.4	17.2	1.4	13.4	14.8	2.71	22.0	1.16
2nd Moly Cleaner Tail	0.91	3.52	0.06	0.09	7.50	3.1	10.8	13.9	1.2	10.8	12.0	2.71	22.4	1.16
Diluted 2nd Moly Cleaner Feed	0.85	15.6	0.13	0.18	73.90	6.9	24.3	31.2	2.6	24.3	26.8	2.71	22.2	1.16
2ND MOLY CLEAN.CONC. LAUNDER WATER														
Undiluted 2nd Moly Cleaner Concentrate	0.80	25.6	0.07	0.09	66.40	3.8	13.4	17.2	1.4	13.4	14.8	2.71	22.0	1.16
2nd Moly Cleaner Conc. Launder Water							1.7	1.7		1.7	1.7	-	-	1.00
Diluted 2nd Moly Cleaner Concentrate	0.80	25.6	0.07	0.09	66.40	3.8	15.2	19.0	1.4	15.2	16.6	2.71	20.00	1.14
4th MOLY CLEANER TAIL THICKENER FEED														
4th Moly Cleaner Tail	0.85	5.18	0.03	0.04	5.30	1.5	5.1	6.6	0.6	5.1	5.6	2.71	22.8	1.17
Flocculant														
4th Moly Cleaner Tail Thickener Feed	0.85	5.18	0.03	0.04	5.30	1.5	5.1	6.6	0.6	5.1	5.6	2.71	22.8	1.17
4th MOLY CLEANER TAIL THICKENER														
4th Moly Cleaner Tail Thickener Underflow	0.85	5.18	0.03	0.04	5.30	1.5	1.0	2.5	0.6	1.0	1.5	2.71	60.0	1.61
4th Moly Cleaner Tail Thickener Overflow							4.1	4.1		4.1	4.1			1.00
4th Moly Cleaner Tail Thickener Feed	0.85	5.18	0.03	0.04	5.30	1.5	5.1	6.6	0.6	5.1	5.6	2.71	22.8	1.17
3RD MOLY CLEANER FEED														
Diluted 2nd Moly Cleaner Concentrate	0.80	25.6	0.07	0.09	66.40	3.8	15.2	19.0	1.4	15.2	16.6	2.71	20.0	1.14
4th Moly Cleaner Tail Thickener Underflow	0.85	5.2	0.03	0.04	5.30	1.5	1.0	2.5	0.6	1.0	1.5	2.71	60.0	1.61
3rd Moly Clnr Feed Pump Seal Water	-		-	-			0.1	0.1		0.1	0.1	-	-	1.00
3rd Moly Clnr Column Washwater	-		-	-			0.0	0.0		0.0	0.0	-	-	1.00
Diluted 3rd Moly Cleaner Feed	0.81	19.8	0.10	0.13	71.70	5.3	16.2	21.5	2.0	16.2	18.2	2.71	24.59	1.18
3RD MOLY CLEANER FLOTATION														
Undiluted 3rd Moly Cleaner Concentrate	0.77	29.4	0.06	0.08	65.30	3.3	11.5	14.8	1.2	11.5	12.7	2.71	22.0	1.16
3rd Moly Cleaner Tail	0.88	4.6	0.04	0.06	6.40	2.0	4.7	6.7	0.8	4.7	5.4	2.71	30.3	1.24
Diluted 3rd Moly Cleaner Feed	0.81	19.8	0.10	0.13	71.70	5.3	16.2	21.5	2.0	16.2	18.2	2.71	24.6	1.18
3RD MOLY CLEAN.CONC. LAUNDER WATER														
Undiluted 3rd Moly Cleaner Concentrate	0.77	29.4	0.06	0.08	65.30	3.3	11.5	14.8	1.2	11.5	12.7	2.71	22.0	1.16
3rd Moly Cleaner Conc. Launder Water							1.5	1.5		1.5	1.5	-	-	1.00
Diluted 3rd Moly Cleaner Concentrate	0.77	29.4	0.06	0.08	65.30	3.3	13.0	16.3	1.2	13.0	14.2	2.71	20.00	1.14
4TH MOLY CLEANER FEED														
Diluted 3rd Moly Cleaner Concentrate	0.77	29.4	0.06	0.08	65.30	3.3	13.0	16.3	1.2	13.0	14.2	2.71	20.0	1.14
5th Moly Cleaner Tail Thickener Underflow	0.60	6.1	0.02	0.02	4.50	1.1	0.7	1.8	0.4	0.7	1.1	2.70	60.0	1.61
4th Moly Clnr Feed Pump Seal Water	-		-	-			0.04	0.04		0.04	0.04	-	-	1.00
4th Moly Clnr Column Washwater	-		-	-			0.00	0.00		0.00	0.00	-	-	1.00
Diluted 4th Moly Cleaner Feed	0.79	24.9	0.08	0.10	69.80	4.1	13.8	17.9	1.6	13.8	15.4	2.56	22.93	1.16
4TH MOLY CLEANER FLOTATION														
Undiluted 4th Moly Cleaner Concentrate	0.75	36.3	0.05	0.06	64.50	2.6	8.7	11.3	1.0	8.7	9.7	2.71	23.0	1.17
4th Moly Cleaner Tail	0.85	5.2	0.03	0.04	5.30	1.5	5.1	6.6	0.6	5.1	5.6	2.71	22.8	1.17
Diluted 4th Moly Cleaner Feed	0.79	24.9	0.08	0.10	69.80	4.1	13.8	17.9	1.6	13.8	15.4	2.71	22.9	1.16

4TH MOLY CLEAN.CONC. LAUNDER WATER															
Undiluted 4th Moly Cleaner Concentrate	0.75	36.3	0.05	0.06	64.50	2.6	8.7	11.3	1.0	8.7	9.7	2.71	23.0	1.17
4th Moly Cleaner Conc. Launder Water							1.1	1.1		1.1	1.1	-	-	1.00
Diluted 4th Moly Cleaner Concentrate	0.75	36.3	0.05	0.06	64.50	2.6	9.8	12.4	1.0	9.8	10.7	2.71	21.0	1.15
5TH MOLY CLEANER FEED														
Diluted 4th Moly Cleaner Concentrate	0.75	36.3	0.05	0.06	64.50	2.6	9.8	12.4	1.0	9.8	10.7	2.71	21.0	1.15
6th Moly Cleaner Tail	0.40	7.9	0.01	0.01	3.50	0.7	1.7	2.3	0.2	1.7	1.9	2.69	28.0	1.21
5th Moly Clnr Feed Pump Seal Water	-		-	-			0.03	0.03		0.03	0.03	-	-	1.00
5th Moly Clnr Column Washwater	-		-	-			0.00	0.00		0.00	0.00	-	-	1.00
Diluted 5th Moly Cleaner Feed	0.68	30.6	0.06	0.07	68.00	3.3	11.5	14.7	1.2	11.5	12.7	2.70	22.06	1.16
5TH MOLY CLEANER FLOTATION														
Undiluted 5th Moly Cleaner Concentrate	0.72	42.9	0.04	0.05	63.50	2.2	7.7	9.8	0.8	7.7	8.5	2.70	22.00	1.16
5th Moly Cleaner Tail	0.60	6.1	0.02	0.02	4.50	1.1	3.8	4.9	0.4	3.8	4.2	2.70	22.2	1.16
Diluted 5th Moly Cleaner Feed	0.68	30.6	0.06	0.07	68.00	3.3	11.5	14.7	1.2	11.5	12.7	2.70	22.1	1.16
5TH MOLY CLEAN.CONC. LAUNDER WATER														
Undiluted 5th Moly Cleaner Concentrate	0.72	42.9	0.04	0.05	63.50	2.2	7.7	9.8	0.8	7.7	8.5	2.70	22.0	1.16
5th Moly Cleaner Conc. Launder Water							1.0	1.0		1.0	1.0	-	-	1.00
Diluted 5th Moly Cleaner Concentrate	0.72	42.9	0.04	0.05	63.50	2.2	8.7	10.8	0.8	8.7	9.5	2.70	20.0	1.14
5th MOLY CLEANER TAIL THICKENER FEED														
5th Moly Cleaner Tail	0.60	6.1	0.02	0.02	4.50	1.1	3.8	4.9	0.4	3.8	4.2	2.70	22.2	1.16
Flocculant														
5th Moly Cleaner Tail Thickener Feed	0.60	6.1	0.02	0.02	4.50	1.1	3.8	4.9	0.4	3.8	4.2	2.70	22.2	1.16
5th MOLY CLEANER TAIL THICKENER														
5th Moly Cleaner Tail Thickener Underflow	0.60	6.1	0.02	0.02	4.50	1.1	0.7	1.8	0.4	0.7	1.1	2.70	60.0	1.61
5th Moly Cleaner Tail Thickener Overflow							3.1	3.1		3.1	3.1			1.00
5th Moly Cleaner Tail Thickener Feed	0.60	6.1	0.02	0.02	4.50	1.1	3.8	4.9	0.4	3.8	4.2	2.70	22.2	1.16
6TH MOLY CLEANER FEED														
Diluted 5th Moly Cleaner Concentrate	0.72	42.9	0.04	0.05	63.50	2.2	8.7	10.8	0.8	8.7	9.5	2.70	20.0	1.14
6th Moly Clnr Feed Pump Seal Water	-		-	-			0.02	0.02		0.02	0.02	-	-	1.00
6th Moly Clnr Column Washwater	-		-	-			0.00	0.00		0.00	0.00	-	-	1.00
Diluted 6th Moly Cleaner Feed	0.62	38.6	0.04	0.05	63.50	2.4	8.7	11.1	0.8	8.7	9.5	3.00	21.68	1.17
6TH MOLY CLEANER FLOTATION														
Undiluted 6th Moly Cleaner Concentrate	0.70	50.0	0.03	0.04	60.00	1.8	7.0	8.8	0.6	7.0	7.7	2.70	20.0	1.14
6th Moly Cleaner Tail	0.40	7.9	0.01	0.01	3.50	0.7	1.7	2.3	0.2	1.7	1.9	2.69	28.0	1.21
Diluted 6th Moly Cleaner Feed	0.62	38.6	0.04	0.05	63.50	2.4	8.7	11.1	0.8	8.7	9.5	2.70	21.7	1.17
6TH MOLY CLEAN.CONC. LAUNDER WATER														
Undiluted 6th Moly Cleaner Concentrate	0.70	50.0	0.03	0.04	60.00	1.8	7.0	8.8	0.6	7.0	7.7	2.70	20.0	1.14
6th Moly Cleaner Conc. Launder Water							1.0	1.0		1.0	1.0	-	-	1.00
Diluted 6th Moly Cleaner Concentrate	0.70	50.0	0.03	0.04	60.00	1.8	8.0	9.8	0.6	8.0	8.6	2.70	18.0	1.13
MOLY CONCENTRATE THICKENER FEED														
Diluted 6th Moly Cleaner Concentrate	0.70	50.0	0.03	0.04	60.00	1.8	8.0	9.8	0.6	8.0	8.6	2.70	18.0	1.13
Moly Concentrate Filter Filtrate	-		-				1.1	1.1		1.1	1.1	-	-	1.00
Moly Concentrate Thickener Feed	0.70	50.0	0.03	0.04	60.00	1.8	9.1	10.9	0.6	9.1	9.8	2.70	16.1	1.11
MOLY CONCENTRATE THICKENER														
Moly Concentrate Thickener Underflow	0.70	50.0	0.03	0.04	60.00	1.8	1.2	2.9	0.6	1.2	1.8	2.70	60.0	1.61
Moly Concentrate Thickener Overflow							8.0	8.0		8.0	8.0			1.00
Moly Concentrate Thickener Feed	0.70	50.0	0.03	0.04	60.00	1.8	9.1	10.9	0.6	9.1	9.8	2.70	16.1	1.11
MOLY CONCENTRATE SLURRY STORAGE														
Moly Concentrate Thickener Underflow	0.70	50.0	0.03	0.04	60.00	1.8	1.2	2.9	0.6	1.2	1.8	2.70	60.0	1.61
Moly Conc.Thick.U'Flow Pump Gld. Water	-		-				0.0	0.0		0.0	0.0	-	-	1.00
Moly Conc. Slurry Storage Feed/Discharge	0.70	50.00	0.03	0.04	60.00	1.8	1.2	2.9	0.6	1.2	1.8	2.70	60.0	1.61
MOLY CONCENTRATE FILTER FEED														
Moly Conc. Slurry Storage Feed/Discharge	0.70	50.0	0.03	0.04	60.00	1.8	1.2	2.9	0.6	1.2	1.8	2.70	60.0	1.61
Moly Conc. Filter Feed Pump Gld. Water	-		-				0.11	0.11		0.11	0.11	-	-	1.00
Moly Conc. Filter Feed (actual)	0.70	50.0	0.03			1.8	1.3	3.0	0.6	1.3	1.9	2.70	57.9	1.57
Moly Conc. Filter Wash Water							0.12	0.12		0.12	0.12	-	-	1.00
Moly Conc. Filter Feed (effective)	0.70	50.0	0.03	0.04	60.00	1.8	1.4	3.1	0.6	1.4	2.0	2.70	55.8	1.54
MOLY CONCENTRATE FILTER														
Filtered Moly Concentrate	0.70	50.0	0.03	0.04	60.00	1.8	0.3	2.0	0.6	0.3	0.9	2.70	87.0	2.21
Moly Conc. Filter Filtrate	-	-	-				1.1	1.1		1.1	1.1	-	-	1.00
Moly Conc. Filter Feed	0.70	50.0	0.03	0.04	60.00	1.8	1.4	3.1	0.6	1.4	2.0	2.70	55.8	1.54

CHECK ON MOLY-TALC FLOTATION CIRCUIT TOTAL WATER & SLURRY:		MTPH	M3/HR
INCOMING		Water	Slurry
2nd Copper Cleaner Tail		464.1	488.2
Copper Cleaner-Scav. Tail		370.8	386.5
Copper Flot.Conc.Thickener Feed Pump Gld. Water		1.1	1.1
Copper Flot.Conc. Thick.U'Flow Pump Gld. Water		1.1	1.1
Copper Flot.Conc. Filter Feed Pump Gld. Water		1.1	1.1
Copper Flot.Conc. Filter Wash Water		7.3	7.3
Copper Flot.Tails Thick.U'Flow Pump Gld. Water		21.7	21.7
Hot Steam		29.0	29.0
Moly-Talc Rougher Flot. Pump Seal Water		1.1	1.1
Moly-Talc Rougher Flot. Feed Dilution Water		191.5	191.5
Moly-Talc Rougher. Flot. Conc. Launder Water		52.6	52.6
Moly-Talc Scav. Flot. Feed Pump Seal Water		0.1	0.1
Moly-Talc Scav. Flot. Feed Dilution Water		11.8	11.8
Moly-Talc Scav. Conc. Launder Water		0.6	0.6
Moly-Talc Conc.Thick.U'Flow Pump Gld. Water		19.3	19.3
Moly-Talc Conc. Filter Feed Pump Gld. Water		5.8	5.8
Moly-Talc Conc. Filter Wash Water		67.5	67.5
Moly-Talc Conc.Conditioning Dilution Water		288.3	288.3
Talc Rougher Flotation Feed Pump Seal Water		1.0	1.0
Talc Rougher Flotation Feed Dilution Water		51.6	51.6
Moly Rougher Flot. Pump Seal Water		0.4	0.4
Moly Rougher Flot. Feed Dilution Water		7.4	7.4
Moly Rougher Flot.Conc. Launder Water		2.5	2.5
1st Moly Clnr Feed Pump Seal Water		0.1	0.1
1st Moly Clnr Column Washwater		0.0	0.0
1st Moly Cleaner Conc.Launder Water		2.2	2.2
2nd Moly Clnr Feed Pump Seal Water		0.1	0.1
2nd Moly Clnr Column Washwater		0.0	0.0
2nd Moly Cleaner Conc. Launder Water		1.7	1.7
3rd Moly Clnr Feed Pump Seal Water		0.1	0.1
3rd Moly Clnr Column Washwater		0.0	0.0
3rd Moly Cleaner Conc. Launder Water		1.5	1.5
4th Moly Clnr Feed Pump Seal Water		0.0	0.0
4th Moly Clnr Column Washwater		0.0	0.0
4th Moly Cleaner Conc. Launder Water		1.1	1.1
5th Moly Clnr Feed Pump Seal Water		0.0	0.0
5th Moly Clnr Column Washwater		0.0	0.0
5th Moly Cleaner Conc. Launder Water		1.0	1.0
6th Moly Clnr Feed Pump Seal Water		0.0	0.0
6th Moly Clnr Column Washwater		0.0	0.0
6th Moly Cleaner Conc. Launder Water		1.0	1.0
	Total In	**1555.7**	**1595.4**
Total Gland water		49.6	
OUTGOING			
Copper Flotation Tails Thickener Overflow		753.2	753.2
Moly-Talc Concentrate Thickener Overflow		424.9	424.9
Roaster off gases and vapor		8.6	8.6
Moly-Talc Scavenger Tail		44.4	48.4
Diluted Moly-Talc Scav. Flotation Conc.		3.8	4.2
Talc Rougher Flotation Concentrate		209.3	233.8
Moly Rougher Flotation Tail		119.7	129.8
4th Moly Cleaner Tail Thickener Overflow		4.1	4.1
5th Moly Cleaner Tail Thickener Overflow		3.1	3.1
Diluted 6th Moly Cleaner Concentrate		8.0	8.6
	Total Out	**1579.1**	**1618.8**
		23.4	23.4

Str. No	Description	%Cu	% Mo	%Wt	Cu,%Dist Overall	Mo,%Dist Overall	MTPH Solids	MTPH Water	MTPH Slurry	M3/HR Solids	M3/HR Water	M3/HR Slurry	Solids SG	% Sols by Wt	Slurry SG
	FINAL FLOTATION TAILS THICKENER FEED														
	Copper Rougher Flotation Tail	0.04	0.01	87.39	5.40	16.38	4759.7	11105.9	15865.5	1777.7	11105.9	12883.5	2.68	30.00	1.23
	1st Copper Cleaner Tail	0.31	0.05	9.13	4.71	18.22	497.8	2209.4	2707.2	185.1	2209.4	2394.5	2.69	18.39	1.13
	Moly-Talc Scavenger Tail	0.45	0.16	0.20	0.15	1.20	10.8	44.4	55.3	4.0	44.4	48.4	2.69	19.6	1.14
	Talc Rougher Flotation Concentrate	0.34	0.02	1.22	0.70	1.00	66.1	209.3	275.3	24.6	209.3	233.8	2.69	24.0	
	Final Flotation Tails Thickener Feed	0.07	0.01	97.94	10.96	36.80	5334.3	13568.9	18903.3	1991.4	13568.9	15560.3	2.68	28.2	1.21
	FINAL FLOTATION TAILS THICKENER														
	Final Flotation Tails Thickener Underflow	0.07	0.01	97.94	10.96	36.80	5334.3	4364.5	9698.8	1991.5	4364.5	6356.0	2.68	55.0	1.53
	Final Flotation Tails Thickener Overflow							9204.5	9204.5		9204.5	9204.3			1.00
	Final Flotation Tails Thickener Feed	0.07	0.01	97.94	10.96	36.80	5334.3	13568.9	18903.3	1991.4	13568.9	15560.3	2.7	28.2	1.21
	FINAL TAILINGS CYCLONE AREA FEED														
	Seal Water to Pumps							27.8	27.8		27.8	27.8			
	Final Tailings Thickener Underflow						5334.3	4364.5	9698.8	1991.5	4364.5	6356.0	2.68	55.0	1.53
	Cyclone Feed Pump Gland Seal Water							53.3	53.3		53.3	53.3	-	-	1.00
	Final Tailings Cyclone Feed						5334.3	4445.6	9780.0	1991.5	4445.6	6437.1	2.68	54.5	1.52
	FINAL TAILINGS AREA CYCLONES														
	Final Tailings Cyclone Feed						5334.3	4445.6	9780.0	1991.5	4445.6	6437.1	2.68	54.5	1.52
	Final Tailings Cyclone Underflow						3200.6	1371.7	4572.3	1194.9	1371.7	2566.6	2.68	70.0	1.78
	Final Tailings Cyclone Overflow						2133.7	3073.9	5207.7	796.6	3073.9	3870.5	2.68	41.0	1.35
	TOTAL RECLAIM WATER														
	Copper Flotation Conc. Thickener Overflow	-		-	-			389.7	389.7		389.7	389.7			1.00
	Copper Flotation Tails Thickener Overflow							753.2	753.2		753.2	753.2			1.00
	Moly-Talc Concentrate Thickener Overflow	-		-	-			424.9	424.9		424.9	424.9			1.00
	4th Moly Cleaner Tail Thickener Overflow							4.1	4.1		4.1	4.1			
	5th Moly Cleaner Tail Thickener Overflow							3.1	3.1		3.1	3.1			
	Moly Concentrate Thickener Overflow							8.0	8.0		8.0	8.0			1.00
	Final Flotation Tails Thickener Overflow							9204.5	9204.5		9204.5	9204.3			1.00
	Tailings Area Recl.Water	-		-	-			3556.5	3556.5		3556.5	3556.5	-	-	1.00
	TOTAL RECLAIM WATER	-		-	-			14343.9	14343.9		14343.9	14343.9	-	-	1.00

Appendix C
Equipment List

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.

Project No. 180600

Project: Toromocho Copper Project

Date: 18-Dec-06

Case: 92000 tpd

Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
		200	**Primary Crushing Area**					
A	200	RB-001	Rock Breaker	1	each	29.8	22.4	
A	200	BN-001	Dump Hopper Capacity 2 trucks 700 t Capacity 438 m³ Dumping width m Height m	1	each			Concrete Rockbox Hopper Abrasion resistant plate lining vertical walls with flow splitter
A	200	CR-001	Primary Crusher Capacity 4600 t/h Model Traylor 60 - 113 Maximum feed size 1000 mm Open side setting 163 mm	1	each	932.5	750.0	Gyratory crusher Traylor 60-113 60' * 113'
A	200	CH-001	Primary Crusher Discharge Chute Capacity 5750 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	200	FE-001	Primary Crusher Discharge Feeder Capacity 5750 t/h Belt width 2489 mm Belt speed 0.6 m/s Length (Horiz. C to C) 5 m Lift height 0 m Troughing angle 0 deg.	1	each	74.6	59.7	Belt feeder, variable speed
A	200	CH-002	Primary Crusher Discharge Feeder Chute Capacity 5750 t/h	1	each			Carbon Steel Abrasion resistant plate lining
B	200	CV-001	Crushed Ore Transfer Conveyor Capacity 5750 t/h Belt width 1600 mm Belt speed 3.3 m/s Length (Horiz. C to C) 20 m Lift height 1 m Troughing angle 35 deg.	1	each	111.9	100.0	Belt conveyor, variable speed
B	200	CH-003	Crushed Ore Transfer Conveyor Discharge Chute Capacity 5750 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	200	CV-002	Crushed Ore Overland Conveyor # 1 Capacity 5750 t/h Belt width 1600 mm Belt speed 3.3 m/s Length (Horiz. C to C) 1026 m Lift height 162 m Troughing angle 35 deg.	1	each	3730.0	3000.0	Belt conveyor, variable speed

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
Case: 92000 tpd
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	200	CH-004	Crushed Ore Overland Conveyor # 1 Discharge Chute Capacity 5750 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	200	CV-003	Crushed Ore Overland Conveyor # 2 Capacity 5750 t/h Belt width 1600 mm Belt speed 3.30 m/s Length (Horiz. C to C) 1274 m Lift height 82.0 m Troughing angle 35 deg.	1	each	2611.0	2500.0	
A	200	CH-005	Overland Conveyor # 2 Discharge Chute Capacity 5750 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	200	SL-001	Belt Scale Capacity 7000 t/h	1	each	2.2	1.1	
A	200	MA-001	Iron Removal Magnet Capacity	1	each	5.6	3.7	
A	200	CN-001	Primary Crusher Overhead Crane Capacity 75 t 20 t	1	each	130.6	111.9	75/20 Main Hoist - 75 kW, Auxiliary Hoist - 20 kW, Trolley & Bridge Travel - 15.7kW total / 4 motors
A	200	CN-002	Monorail Crane Capacity 1 t	1	each	1.1	0.7	
A	200	BN-002	Trash Bin Capacity 2 m^3	1	each			
A	200	DC-001	Primary Crusher Dust Suppression System Capacity	1	each	1.1	0.7	
A	200	DC-002	Primary Crushing Area Baghouse Air flow rate 36000 m3/h	1	each	3.7	2.2	Pulse-jet baghouse
A	200	ZM-001	Dust Rotary Valve Capacity	1	each	0.4	0.2	
A	200	GC-001	Primary Crushing Area Air Compressor Capacity 4 Nm^3/min Pressure 700 kPa	1	each	37.3	29.8	1 operating, 1 stage, air cooled oil-free rotary screw type package including air filter and air receiver
			Area total connected power Area total operating power			**7,672** **5,169**		

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 92000 tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
		210	**Coarse Ore Storage**					
A	210	ST-001	Coarse Ore Stockpile Capacity (live) 92000 t Capacity (total) 586732 t Base dia 129 m Height 50 m	1	each			
A	210	CH-001 CH-002 CH-003	Coarse Ore Stockpile Discharge Chutes Capacity 5208 t/h	3	each			Carbon Steel Abrasion resistant plate lining
A	210	FE-001 FE-002 FE-003	Coarse Ore Stockpile Discharge Belt Feeders Capacity 5208 t/h Belt width 2489 mm Belt speed 0.6 m/s Length (Horiz. C to C) 6 m Lift height 0 m Troughing angle 0 deg.	3	each	56.0	44.76	Belt feeder, variable speed
A	210	CH-005 CH-006 CH-007	Belt Feeders Discharge Chutes Capacity 5208 t/h	3	each			Carbon Steel Abrasion resistant plate lining
A	210	DC-001	Coarse Ore Stockpile Dust Suppression System Capacity	1	each	1.1	0.7	
			Area total connected power Area total operating power			**169** **108**		
		220	**Grinding Circuit**					
A	220	CV-001	SAG Mill Feed Conveyor Capacity 4792 t/h Belt width 1219 mm Belt speed 3.0 m/s Length (Horiz. C to C) 302 m Lift height 26.7 m Troughing angle 35 deg.	1	each	186.5	149.2	
A	220	MD-001	Metal Detector	1	each			
A	220	MA-001	Self Cleaning Electromagnet	1	each	18.7	15.0	

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
Case: 92000 tpd
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	220	SL-001	Belt Scale Capacity 7000 t/h	1	each	2.2	1.1	
A	220	CH-001	SAG Mill Feed Conveyor Discharge Chute Capacity 4792 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
A	220	BN-001	SAG Mill Ball Bin 1711 t Length 12.0 m Width 8.0 m Height 5.5 m Volume 523.3 m³	1				
B	220	CH-002	SAG Mill Balls Bin Discharge Chute Capacity 3.0 t/h	1	each			Carbon Steel Abrasion resistant plate lining
B	220	CV-002	SAG Mill Balls Bin Conveyor Capacity 3.0 t/h Belt width 600 mm Belt speed 0.12 m/s Length (Horiz. C to C) 5 m Lift height 0.0 m Troughing angle deg.	1	each	1.1	0.5	Belt Conveyor
B	220	CH-004	SAG Mill Balls Bin Conveyor Discharge Chute Capacity 3 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
B	220	CV-003	SAG Mill Balls Transfer Conveyor Capacity 3.0 t/h Belt width 600 mm Belt speed 0.12 m/s Length (Horiz. C to C) 22 m Lift height 4.1 m Troughing angle deg.	1	each	1.1	0.8	Belt Conveyor
A	220	SL-002	Belt Scale Capacity 7000 t/h	1	each	2.2	1.1	
B	220	CH-006	SAG Mill Balls Transfer Conveyor Discharge Chute Capacity 3.0 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
A	220	CH-008	SAG Mill Feed Chute, Capacity 6437 t/h wet	1	each			C.S. shell, 3 CR 12 S.S.liner
A	220	ML-001	SAG Mill Capacity 4167 t/h dry Diameter 12.2 m Length 7.9 m	1	each	34316.0	28000	Overflow. Ring Motor drive inside liners 40' * 24' SAG Mill (EGL)
A	220	SN-001	SAG Mill Trommel Screen Capacity 9214.7 t/h wet Slot width 12 mm Slot length 36 mm Angle of incline 5 Screen dimensions 3 x 7 m	1	each			Trommel Screen

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
Case: 92000 tpd
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	220	CH-010	SAG Mill Trommel Discharge O/S Chute Capacity 7065 t/h wet	1	each			C.S. shell, 3 CR 12, S.S. Liner
A	220	CH-011	SAG Mill Trommel Discharge U/S Chute Capacity 2150 t/h wet	1	each			C.S. shell, 3 CR 12, S.S. Liner
A	220	ZM-001	Ball Charge for SAG Mill Diameter 100 mm Quantity 620 t	1	lot			Forged steel balls
A	DC-001	BN-002	SAG Mill Ball Bucket 51 t Diameter 2.4 m Height 2.5 m Volume 11.3 m^3	2				
A	220	SN-002 SN-003	SAG Mill Screens Capacity 7065 t/h wet Top screen opening 2.5 mm Bottom screen opening 1.1 mm Angle of incline 5 degree Screen dimensions 3.55 x 7.0 m	2	each	56.0	45	XXH duty, double deck VFSM 60/24
A	220	CH-012 CH-013	SAG Mill Screen Undersize Chutes Capacity 2784 t/h wet	2	each			Carbon Steel Abrasion resistant plate lining
A	220	CH-014 CH-015	SAG Mill Screen Oversize Chutes Capacity 749 t/h wet	2	each			Carbon Steel Abrasion resistant plate lining
A	220	CV-004	Pebble Collector Conveyor Capacity 1497 t/h wet Belt width 1372 mm Belt speed 2.00 m/s Length 32 m Lift height 0 m Troughing angle 35 deg.	1	each	44.8	37.3	belt conveyor
A	220	CH-016	Pebble Collector Conveyor Discharge Chute Capacity 1497 t/h wet	1	each			C.S. shell, 3 CR 12, S.S. Liner
A	220	CV-005	Pebble Transfer Conveyor Capacity 1497 t/h wet Belt width 1372 mm Belt speed 2.00 m/s Length 201 m Lift height 18 m Troughing angle 35 deg.	1	each	186.5	149.2	belt conveyor High Angle Conveyor
A	220	CH-017	Pebble Transfer Conveyor Discharge Chute Capacity 1497 t/h wet	1	each			C.S. shell, 3 CR 12, S.S. Liner

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
Case: 92000 tpd
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	220	BN-002	Pebble Crusher Feed Bin 1497 t wet Length 10.0 m Width 7.0 m Height 7.2 m	1				30 min
A	220	CH-020 CH-021	Pebble Crusher Feed Bin Discharge Chutes Capacity 749 t/h wet	2	each			C.S. shell, 3 CR 12, S.S. Liner
A	220	FE-001 FE-002	Pebble Crusher Feeders Capacity 749 t/h wet Belt width 1372 mm Belt speed 0.40 m/s Length 9 m Lift height 0 m Troughing angle 0 deg.	2	each	29.8	22.4	Belt feeder, variable speed
A	220	CH-024 CH-025	Pebble Crusher Feeder Discharge Chutes Capacity 749 t/h wet	2	each			C.S. shell, 3 CR 12, S.S. Liner
A	220	CR-001 CR-002	Pebble Crushers Capacity 749 t/h Model MP 1000 sh Maximum feed size 152 mm Open side setting 13 mm	2	each	932.5	745.0	Pebble Crusher MP 1000 sh
A	220	CH-028 CH-029	Pebble Crushers Discharge Chutes Capacity 749 t/h	2	each			Carbon Steel Abrasion resistant plate lining
A	220	CV-006	Pebble Recirculating Conveyor Capacity 1497 t/h Belt width 914 mm Belt speed 2.0 m/s Length (Horiz. C to C) 35 m Lift height 4.0 m Troughing angle 35 deg.	1	each	37.3	29.8	Belt conveyor
A	220	CH-032	Pebble Recirculating Conveyor Discharge Chute Belt speed 1497 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	220	CH-034 CH-035	Ball Mill Feed Chutes Capacity 10268 t/h wet	2	each			R.L.C.S.
A	220	ML-002 ML-003	Ball Mills Capacity each 2083 t/h new feed Diameter 8.5 m Length 12.2 m	2	each	24618.0	20000	Overflow. Twin pinion drive 28' x 40' Mill
B	220	BN-003 BN-004	Ball Mill Ball Bins 8760 t Length 16.0 m Width 12.0 m Height 11.5 m Volume 2214.1 m^3	2				For forged steel balls 100 mm diam.

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
Case: 92000 tpd
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
B	220	CH-038	Ball Mill Balls Bin Conveyor Feed Chuts Capacity 15.4 t/h	2	each			C.S. shell, 3 CR 12 S.S. Liner
B	220	CV-008	Ball Mill Balls Bin Conveyor Capacity 15.4 t/h Belt width 500 mm Belt speed 0.12 m/s Length (Horiz. C to C) 7 m Lift height 0.0 m Troughing angle deg.	1	each	1.1	0.8	Belt Conveyor
B	220	CH-040	Ball Mill Balls Bin Conveyor Discharge Chute Capacity 15.4 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
B	220	CV-009	Ball Mill Balls Transfer Conveyor # 1 Capacity 15.4 t/h Belt width 500 mm Belt speed 0.12 m/s Length (Horiz. C to C) 46.5 m Lift height 18.1 m Troughing angle deg.	1	each	2.2	1.5	Belt Conveyor
A	220	SL-003	Belt Scale Capacity 40 t/h	1	each	2.2	1.1	
B	220	CH-042	Ball Mill Balls Transfer Conveyor # 1 Discharge Chute Capacity 15.4 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
B	220	CV-010	Ball Mill Balls Transfer Conveyor # 2 Capacity 15.4 t/h Belt width 500 mm Belt speed 0.12 m/s Length (Horiz. C to C) 48.0 m Lift height 0.0 m Troughing angle deg.	1	each	2.2	1.5	Belt Conveyor
B	220	CH-044	Ball Mill Balls Transfer Conveyor # 2 Discharge Chute Capacity 15.4 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
A	220	CH-046 CH-047	Ball Mill Discharge Chutes Capacity 10268 t/h wet	2	each			R.L.C.S.
A	220	TK-001	Ball Mill Cyclone Feed Pumpbox Capacity 864 m^3 Width 12.0 m Length 12.0 m Height 6.0 m	1	each			Concrete Rockbox Hopper 2 min retention

002600

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600

Project: Toromocho Copper Project | **Date:** 18-Dec-06

Case: 92000 tpd | **Rev.** B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	220	PP-001 PP-002 PP-003 PP-004 PP-101	Ball Mill Cyclone Feed Pumps Capacity 6126 m³/h Fluid s.g. 1.5 Head 30 m Inlet size 762 mm Outlet size 660 mm	5	each	932.5	752.0	MMC 650, horizontal centrifugal. 4 operating/1 un-installed spare. VFD
A	220	CY-001 CY-002 CY-003 CY-004	Ball Mill Cyclone Clusters Feed capacity (each cluster) 6126 m³/h No. of cyclones in cluster 15 Cyclone Diameter 600 mm	4	each			13 operating /2 standby per Cluster RLCS including gate valves, launders, distributor and feed and overflow pipes
A	220	CN-001	Grinding Area Overhead Crane Capacity 75 t 20 t	1	each	130.6	111.9	75/20 Main Hoist - 75 kW, Auxiliary Hoist - 20 kW, Trolley & Bridge Travel - 15.7 kW total/ 4 motors
A	220	ES-001/101	Grinding Area Safety Showers and Eyewash Stations	1	each			
A	220	PP-008 PP-009	Grinding Area Sump Pumps Capacity 200 m³/h Head 20.0 m Fluid S.G. 2.0 Inlet size 175 mm Outlet size 100 mm	2	each	29.8	27.5	Vertical centrifugal R.L.C.S. SP-100
			Area total connected power Area total operating power			**140,166** **64,594**		
		230	**Copper Flotation Area**					
B	230	TK-001	Copper Rougher Flotation Feed Pumpbox Capacity 480.0 m³ Width 8.0 m Lengh 10.0 Height 6.0 m	1	each			C.S. 2 min retention
B	230	SA-001	Copper Flotation Feed Sampler	1	each	1.1	0.5	autosampler
A	230	PP-001 PP-101 PP-002 PP-102	Copper Rougher Flotation Feed Pumps Capacity 6509 m³/h Head 20 m Fluid S.G. 1.23 Inlet size 762 mm Outlet size 660 mm	4	each	596.8	509.8	MMC 650, Horizontal centrifugal R.L.C.S. VFD 2 operating, 2 standby.
B	230	DI-001 Di-002	Copper Rougher Flotation Feed Rotary Distributors Capacity 5988 m³/h Size 100.0 m³	2	each			Rubber Lined C.S. Self-Propelled Feed Distrbutor
A	230	FO-001 to FO-028	Copper Rougher Flotation Cells Capacity 11977 m³/h Cell size 200.0 m³	28	each	223.8	215.0	OK-200 XHD, Tank cells with splitter, feed and discharge boxes, impellor / difuser, froth crowder. C/w level control. CS.

002601

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
Case: 92000 tpd
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	230	TK-004	Copper Rougher Tail Pumpbox Capacity 406 m^3 Length 7.0 m Width 6.4 m Height 9.0 m	1	each			2 min retention
A	230	PP-004 PP-104	Copper Rougher Tail Pumps Capacity 11397 m^3/h Head 10.0 m Fluid S.G. 1.23 Inlet size 1200 mm Outlet size 1000 mm	2	each	932.5	795.0	GSL 1000, Horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	230	MX-001	Copper Rougher Tails Flocculant In-Line Mixer Capacity 200 m^3/h Diameter 150 mm	1	each			SAF 2507
A	230	TK-006	Regrind Cyclones Feed Pumpbox Capacity 128.8 m^3 Width 4.0 m Lengh 7.0 m Height 4.6 m	1	each			C.S. 2 min retention
A	230	PP-006 PP-007 PP-008 PP-106	Regrind Cyclone Feed Pumps Capacity 1149 m^3/h Head 30.0 m Fluid S.G. 1.3 Inlet size 305 mm Outlet size 254 mm	4	each	186.5	150.1	Warman AH 12/10, horizontal centrifugal R.L.C.S. VFD 3 operating, 1 standby.
A	230	CY-001 CY-002 CY-003	Regrind Mill Cyclone Clusters Feed capacity (each cluster) 1149 m^3/h No. of cyclones in cluster 9 Total number of cyclones 27 Cyclone Diameter 250 mm	3	each			7 operating /2 standby per Cluster RLCS including gate valves, launders, distributor and feed and overflow pipes
A	230	ML-001 to ML-006	Regrind Mill Packages Capacity 635 t/h Model VTM-1500	5	each	1306	1119	Tower Mill VTM-1500
A	230	ZM-001	Ball Charges for Regrind Mill Diameter 25 mm Quantity 100 t	1	lot			Forged steel balls
A	230	TK-010	1st Cleaner Feed Pumpbox Capacity 99.7 m^3 Diameter 4.6 m Height 6.0 m	1	each			C.S. 2 min retention

002602

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.

Project No. 180600

Project: Toromocho Copper Project

Date: 18-Dec-06

Case: 92000 tpd

Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	230	PP-010 PP-110	1st Cleaner Feed Pumps Capacity 2760 m³/h Head 20.0 m Fluid S.G. 1.15 Inlet size 508 mm Outlet size 457 mm	2	each	223.8	208.8	Warman AH 20/18, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	230	FO-030 to FO-034	1st Cleaner Flotation Cells Capacity 2539 m³/h Cell size 100.0 m³	5	each	111.9	110.0	OK-100 XHD Tank cells with feed and discharge,impell froth crowder. C/w level control. CS.
A	230	TK-014	1st Cleaner Tails Pumpbox Capacity 76.0 m³ Diameter 4.4 m Height 5.0 m	1	each			C.S. 2 min retention
A	230	PP-014 PP-114	1st Cleaner Tails Pumps Capacity 2120 m³/h Head 20.0 m Fluid S.G. 1.13 Inlet size 406 mm Outlet size 356 mm	2	each	186.5	167.6	Warman AH 16/14, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	230	TK-016 TK-017	2nd Cleaner Feed Conditioning Tanks Capacity 90 m³ Diameter 4.8 m Height 5.0 m	2	each			10 min retention Handles both 1st Clean. conc & Clnr Scav. Conc.
A	230	AG-016 AG-017	2nd Cleaner Feed Conditioning Tank Agitators Diameter 1.7 m Power Basis 1.0 kW/10 m³	2	each	11.2	9.4	R.L.C.S.
A	230	PP-016 PP-116	2nd Cleaner Feed Pumps Capacity 1026 m³/h Head 20.0 m Fluid S.G. 1.17 t/m3 Inlet size 305 mm Outlet size 254 mm	2	each	93.3	79.2	Warman AH 12/10, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	230	DI-004	2nd Cleaner Feed Rotary Distributor Capacity 943 m³/h Size 16.0 m³	1	each			Rubber Lined C.S. Self-Propelled Feed Distrbutor
B	230	FO-038 to FO-044	2nd Cleaner Flotation Cells Design Solid Flow 249 t/h Cell size 5.0 m dia	7	each			Column 5 x 14 m

002603

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.

Project No. 180600

Project: Toromocho Copper Project

Date: 18-Dec-06

Case: 92000 tpd

Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	230	TK-018	3rd Cleaner Feed Pumpbox Capacity 226.2 m³ Diameter 6.0 m Height 8.0 m	1	each			C.S. 2 min retention
A	230	PP-018 PP-118	3rd Cleaner Feed Pumps Capacity 848 m³/h Head 20.0 m Fluid S.G. 1.16 Inlet size 305 mm Outlet size 254 mm	2	each	74.6	66.8	Warman AH 12/10, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	230	TK-020	2nd Cleaner Tails Pumpbox Capacity 16.3 m³ Diameter 2.4 m Height 3.6 m	1	each			C.S. 2 min retention
A	230	PP-020 PP-120	2nd Cleaner Tails Pumps Capacity 433 m³/h Head 20.0 m Fluid S.G. 1.08 Inlet size 203 mm Outlet size 152 mm	2	each	37.3	36.7	Warman AH 8/6, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	230	DI-006	3rd Cleaner Feed Rotary Distributor Capacity 780 m³/h Size 14.0 m³	1	each			Rubber Lined C.S. Self-Propelled Feed Distrbutor
B	230	FO-050 to FO-054	3rd Cleaner Flotation Cells Design Solid Flow 189 t/h Cell size 5.0 m dia	5	each			Column 5 x 14 m
A	230	TK-022	Copper Conc Thickener Feed Pumpbox Capacity 13.6 m³ Diameter 2.4 m Height 3.0 m	1	each			C.S. 2 min retention
A	230	PP-022 PP-122	Copper Conc Thickener Feed Pumps Capacity 371 m³/h Head 20.0 m Fluid S.G. 1.20 Inlet size 203 mm Outlet size 152 mm	2	each	37.3	32.0	Warman AH 8/6, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	230	TK-024	Copper Cleaner Scavenger Feed Pumpbox Capacity 18.1 m³ Diameter 2.6 m Height 3.4 m	1	each			C.S. 2 min retention

002604

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
Case: 92000 tpd
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	230	PP-024 PP-124	Copper Cleaner Scavenger Feed Pumps Capacity 514 m³/h Head 20.0 m Fluid S.G. 1.11 Inlet size 254 mm Outlet size 203 mm	2	each	56.0	46.8	Warman AH 10/8, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	230	FO-058 to FO-061	Copper Cleaner Scavenger Flotation Cells Capacity 534 m³/h Cell size 16.0 m³	4	each	56.0	55.0	OK-16HG Tank cells with feed and discharge,impeller/ froth crowder. C/w level control. CS.
A	230	TK-026	Copper Cleaner Scavenger Tails Pumpbox Capacity 13.6 m³ Diameter 2.4 m Height 3.0 m	1	each			C.S. 2 min retention
A	230	PP-026 PP-126	Copper Cleaner Scavenger Tails Pumps Capacity 343 m³/h Head 20.0 m Fluid S.G. 1.07 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	29.1	Warman AH 8/6, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	230	TK-028	Copper Tails Thickener Feed Pumpbox Capacity 28 m³ Diameter 3.0 m Height 4.0 m	1	each			2 min retention Handles both 2nd Clean. Tails & Clnr Scav. Tails.
A	230	PP-028 PP-128	Copper Tails Thickener Feed Pumps Capacity 776 m³/h Head 20.0 m Fluid S.G. 1.08 Inlet size 254 mm Outlet size 203 mm	2	each	74.6	60.6	Warman AH 10/8, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	230	SA-002	Copper Rougher/1st Cleaner Tails Sampler	1	each	1.1	0.5	autosampler
A	230	SA-003	Copper Tails Thickener Feed Sampler	1	each	1.1	0.5	autosampler
A	230	ES-001/101 to ES-003/103	Flotation Safety Showers and Eyewash Stations	3	each			for various locations
A	230	GB-001 GB-002 GB-101	Copper Flotation Air Blowers Capacity 70,320 Nm³/h Delivery pressure (min.) 48 kPa(g) Number of operating Air Blowers 2	3	each	1305.5	1200.0	Hoffman 791 multistage centrifugal 2 operating / 1 standby

002605

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.

Project No. 180600

Project: Toromocho Copper Project

Date: 18-Dec-06

Case: 92000 tpd

Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	230	ES-001/101	Copper Flotation Area Safety Shower and Eyewash Station	2	each			
A	230	PP-030 PP-031	Flotation Area Sump Pumps Capacity 200 m^3/h Head 20.0 m Fluid S.G. 1.2 Inlet size 175 mm Outlet size 100 mm	2	each	29.8	22.6	Vertical centrifugal R.L.C.S. Warman SP 100
			Area total connected power Area total operating power			**24,202** **10,664**		
		240	**Copper Concentrate Handling**					
A	240	TK-001	Copper Concentrate Thickener Tank Diameter 18 m Side wall height 3.6 m	1.0	each			C.S High Rate Thickener
A	240	TM-001	Copper Concentrate Thickener Mechanism Diameter 18 m	1	each	3.7	3.0	RLCS c/w bridge, drive
A	240	TK-002	Copper Concentrate Thickener Overflow Pumpbox Capacity 11.4 m^3 Diameter 2.2 m Height 3.0 m	1	each			C.S. 2 minute retention Same height as the thickener
A	240	PP-002 PP-102	Copper Concentrate Thickener Overflow Pumps Capacity 349 m^3/h Head 20 m Fluid S.G. 1.0 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	26.7	Warman AH 8/6, horizontal centrifugal, C.I. 1 operating/1 standby
A	240	MX-001	Copper Concentrate Thickener Flocculant In-Line Mixer Capacity TBD m^3/h Diameter TBD mm	1	each			
A	240	PP-004 PP-104	Copper Concentrate Thickener Underflow Pumps Capacity 75 m^3/h Head 20 m Fluid S.G. 2.01 Inlet size 76 mm Outlet size 51 mm	2	each	11.2	7.4	Warman AH 3/2, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
A	240	TK-006	Copper Concentrate Storage Tank Capacity (excl. F/B) 1810 m^3 Diameter 12.0 m Height 16.0 m Tank ret. time 24 h Operating Temp. 20 deg. C	1	each			C.S.

002606

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
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REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	240	AG-006	Copper Concentrate Storage Tank Agitator Diameter 4.3 m Power Basis 1.5 kW/10 m³	1	each	298.4	268.0	R.L.C.S.
A	240	PP-006 PP-106	Copper Concentrate Filter Feed Pumps Capacity 76 m³/h Head 50 m Fluid S.G. 2.00 Inlet size 76 mm Outlet size 51 mm	2	each	22.4	20.4	Warman AH 4/3, horizontal centrifugal, C.I. VFD or 2 speed 1 operating/1 standby
A	240	FL-001 FL-002	Copper Concentrate Filters Capacity 120.4 t/h solids Chamber Volume 165.0 L Required number of chambers 39 Minimum Number of Filter Required 1 Number of operating chambers per Filter 39 Spare Chambers available per Filter 1 Total Number of Chambers per Filter 40 Filter Model VPA 2040-40 Compressor model Atlas Copco ZR 700 VSD	2	each	932.5	699.7	Press Filter, Package to include air compressor 1 operating/1 standby Filter Model: VPA 2040-40 Compressor Model: Atlas Copco ZR 700 VSD
A	240	TK-008	Copper Concentrate Filtrate Return Pumpbox Capacity 1.7 m³ Diameter 1.2 m Height 1.5 m	1	each			2 minute retention
A	240	PP-008 PP-108	Copper Concentrate Filtrate Return Pumps Capacity 52 m³/h Head 20 m Fluid S.G. 1.0 Inlet size 76 mm Outlet size 51 mm	2	each	5.6	4.6	Warman AH 3/2, horizontal centrifugal, polymer impelle VFD 1 operating/1 standby
A	240	CH-001	Copper Concentrate Filter Discharge Chute Capacity 98 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	240	SA-001	Copper Concentrate Sampler	1	each	1.1	0.5	autosampler
A	240	ZM-001	Front-End Loader Capacity 5 t	1	each			
A	240	ES-001/101	Copper Concentrate Thickener Safety Shower and Eyewash Station	1	each			
A	240	PP-014	Copper Concentrate Thickener Sump Pump Capacity 100 m³/h Head 10 m Fluid S.G. 1.23 Inlet size 175 mm Outlet size 100 mm	1	each	7.5	6.1	Vertical centrifugal R.L.C.S. Emergency power
			Area total connected power Area total operating power			**2,314** **825**		

002607

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
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REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
		250	**Moly-Talc Circuit**					
B	250	TK-001	Copper Tails Thickener Tank Diameter 22 m Side wall height 3.6 m	1.0	each			C.S High Rate Thickener
A	250	TM-001	Copper Tails Thickener Mechanism Diameter 22 m	1	each	3.7	3.0	RLCS c/w bridge, drive
A	250	TK-002	Copper Tails Thickener Overflow Pumpbox Capacity 22.8 m^3 Diameter 2.8 m Height 3.7 m	1	each			C.S. 2 minute retention Same height as the thickener
A	250	PP-002 PP-102	Copper Tails Thickener Overflow Pumps Capacity 663 m^3/h Head 20 m Fluid S.G. 1.0 Inlet size 254 mm Outlet size 203 mm	2	each	74.6	57.1	Warman AH 10/8, horizontal centrifugal, C.I. 1 operating/1 standby
A	250	MX-001	Copper Tails Thickener Flocculant In-Line Mixer Capacity TBD m^3/h Diameter TBD mm	1	each			
A	250	PP-004 PP-104	Copper Tails Thickener Underflow Pumps Capacity 114 m^3/h Head 20 m Fluid S.G. 1.53 Inlet size 102 mm Outlet size 76 mm	2	each	11.2	9.5	Warman AH 4/3, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
A	250	TK-004 TK-005 TK-006	Copper Tails Storage Tank Capacity 28 m^3 Diameter 3.0 m Height 4.0 m Tank ret. time 0.5 h Operating Temp. 85 deg. C	3	each			C.S.
A	250	AG-004 AG-005 AG-006	Copper Tails Storage Tank Agitator Diameter 1.0 m Power Basis 0.8 kW/10 m^3	3	each	3.7	2.2	R.L.C.S.
A	250	PP-012	Copper Tails Thickener Sump Pump Capacity 100 m^3/h Head 10 m Fluid S.G. 1.20 Inlet size 175 mm Outlet size 100 mm	1	each	7.5	6.1	Vertical centrifugal R.L.C.S. Emergency power

002608

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.

Project No. 180600

Project: Toromocho Copper Project

Date: 18-Dec-06

Case: 92000 tpd

Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	TK-008	Moly-Talc Rougher Flotation Feed Pumpbox Capacity 10 m³ Diameter 2.2 m Height 3.0 m	1	each			2 min retention
A	250	PP-008 PP-108	Moly-Talc Rougher Flotation Feed Pumps Capacity 323 m³/h Head 20.0 m Fluid S.G. 1.19 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	28.5	Warman AH 8/6, horizontal centrifugal, C.I. VFD 1 operating, 1 standby.
A	250	FO-001 to FO-004	Moly-Talc Rougher Flotation Cells Capacity 297 m³/h Cell size 20.0 m³	4	each	56.0	45.0	OK-20-TC Tank cells with splitter, feed and discharge boxes, impellor / difuser, froth crowder. C/w level control. CS.
A	250	TK-010	Moly-Talc Scavenger Flotation Feed Pumpbox Capacity 1.8 m³ Diameter 1.2 m Height 1.6 m	1	each			C.S. 2 min retention
A	250	PP-010 PP-110	Moly-Talc Scavenger Flotation Feed Pumps Capacity 46 m³/h Head 20.0 m Fluid S.G. 1.15 Inlet size 76 mm Outlet size 51 mm	2	each	5.6	4.6	Warman AH 3/2, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-008 FO-009	Moly-Talc Scavenger Flotation Cells Capacity 48 m³/h Cell size 5.0 m³	2	each	18.7	15.0	OK-5-TC Tank cells with feed and discharge,impeller/d froth crowder. C/w level control. CS.
A	250	TK-012	Moly-Talc Scavenger Tails Pumpbox Capacity 1.6 m³ Diameter 1.0 m Height 2.0 m	1	each			C.S. 2 min retention
A	250	PP-012 PP-112	Moly-Talc Scavenger Tails Pumps Capacity 43 m³/h Head 20.0 m Fluid S.G. 1.14 Inlet size 76 mm Outlet size 51 mm	2	each	5.6	4.2	Warman AH3/2, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	TK-014	Moly-Talc Concentrate Thickener Feed Pumpbox Capacity 12 m³ Diameter 2.2 m Height 3.2 m	1	each			2 min retention

002609

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
Case: 92000 tpd
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	PP-014 PP-114	Moly-Talc Concentrate Thickener Feed Pumps Capacity 334 m^3/h Head 20.0 m Fluid S.G. 1.16 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	29.0	Warman AH 8/6, horizontal centrifugal, C.I. 1 operating, 1 standby.
B	250	TK-016	Moly-Talc Concentrate Thickener Tank Diameter 22 m Side wall height 3.6 m	1	each			C.S High Rate Thickener
A	250	TM-016	Moly-Talc Concentrate Thickener Mechanism Diameter 22 m	1	each	3.7	3.0	RLCS c/w bridge, drive
A	250	TK-018	Moly-Talc Concentrate Thickener Overflow Pumpbox Capacity 10.7 m^3 Diameter 2.0 m Height 3.4 m	1	each			C.S. 2 minute retention Same height as the thickener
A	250	PP-018 PP-118	Moly-Talc Concentrate Thickener Overflow Pumps Capacity 301 m^3/h Head 20 m Fluid S.G. 1.0 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	25.9	Warman AH 8/6, horizontal centrifugal, C.I. 1 operating/1 standby
A	250	MX-002	Moly-Talc Concentrate Thickener Flocculant In-Line Mixer Capacity TBD m^3/h Diameter TBD mm	1	each			
A	250	PP-016 PP-116	Moly-Talc Concentrate Thickener Underflow Pumps Capacity 70 m^3/h Head 20 m Fluid S.G. 1.61 Inlet size 102 mm Outlet size 76 mm	2	each	7.5	7.0	Warman AH 4/3, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
A	250	TK-020	Moly-Talc Concentrate Storage Tank Capacity 1235 m^3 Diameter 10.6 m Height 14.0 m Tank ret. time 12.0 h Operating Temp. 18 deg. C	1	each			C.S.
A	250	AG-020	Moly-Talc Concentrate Storage Tank Agitator Diameter 3.6 m Power Basis 1.6 kW/10 m^3	0	each	149.2	134.8	R.L.C.S.

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
Case: 92000 tpd
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	PP-020 PP-120	Moly-Talc Concentrate Filter Feed Pumps Capacity 12 m³/h Head 50 m Fluid S.G. 1.61 Inlet size 76 mm Outlet size 51 mm	2	each	29.8	23.2	Warman AH 3/2, horizontal centrifugal, C.I. VFD or 2 speed 1 operating/1 standby
A	250	FL-001 FL-002 FL-101	Moly-Talc Concentrate Filters Capacity 98.6 t/h solids Required Filter Volume 7822 Required number of chambers 61 Total Number of Chambers per Filter 34 Spare Chambers available per Filter 3 Filter Model VPA 2030-36 Compressor Model Atlas Copco ZR 500	3	each	447.6	373.0	Press Filter, Package to include air compressor 2 operating/1 standby Filter Model: VPA 2030-36 Compressor Model: Atlas Copco ZR 500
A	250	CH-004	Moly-Talc Concentrate Filter Discharge Chute Capacity 85 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	250	TK-022	Moly-Talc Concentrate Filtrate Return Pumpbox Capacity 2.5 m³ Diameter 1.2 m Height 2.2 m	1	each			2 minute retention
A	250	PP-022 PP-122	Moly-Talc Concentrate Filtrate Return Pumps Capacity 56 m³/h Head 20 m Fluid S.G. 1.0 Inlet size 76 mm Outlet size 51 mm	2	each	5.6	5.3	Warman AH 3/2, horizontal centrifugal, polymer impelle VFD 1 operating/1 standby
A	250	KN-001 KN-002	Moly-Talc Concentrate Rotary Kiln Capacity 68.2 t/h Residence time 20.0 min Gharge design 12.0 % Roast volume 66.3 m3 Diameter 2.5 m Lengh 13.5 m	2	each	37.3	35.0	Indirect Heat Rotary Kiln
A	250	TK-026	Moly-Talc Concentrate Storage Tank Capacity 1330 m³ Diameter 11.0 m Height 14.0 m Tank ret. time 12 h Operating Temp. 18 deg. C	1	each			C.S.
A	250	AG-026	Moly-Talc Concentrate Storage Tank Agitator Diameter 3.6 m Power Basis 1.0 kW/10 m³	1	each	149.2	134.8	R.L.C.S.

002611

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
Case: 92000 tpd
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	PP-026 PP-126	Talc Rougher Flotation Feed Pump Capacity 334 m³/h Head 20.0 m Fluid S.G. 1.16 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	29.0	Warman AH 8/6, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-012 to FO-015	Talc Rougher Flotation Cells Capacity 267 m³/h Cell size 20.0 m³	4	each	56.0	45.0	OK-20-TC Tank cells with splitter, feed and discharge boxes, impellor / difuser, froth crowder. C/w level control. CS.
A	250	TK-028	Talc Rougher Concentrate Pumpbox Capacity 7.6 m³ Diameter 1.8 m Height 3.0 m	1	each			C.S. 2 min retention
A	250	PP-028 PP-128	Talc Rougher Concentrate Pumps Capacity 207 m³/h Head 20.0 m Fluid S.G. 1.18 Inlet size 152 mm Outlet size 102 mm	2	each	18.7	17.7	Warman AH 6/4, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	TK-030	Talc Rougher Tails Pumpbox Capacity 101.4 m³ Diameter 1.6 m Height 2.4 m	1	each			C.S. 2 min retention
A	250	PP-030 PP-130	Talc Rougher Tails Pumps Capacity 127 m³/h Head 20.0 m Fluid S.G. 1.1 Inlet size 152 mm Outlet size 102 mm	2	each	14.9	11.7	Warman AH 6/4, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-018 to FO-023	Moly Rougher Flotation Cell Capacity 108 m³/h Cell size 5.0 m³	6	each	18.7	15.0	OK-5-TC Tank cells with feed and discharge,impeller/d froth crowder. C/w level control. CS.
A	250	TK-032	Moly Rougher Flotation Feed Pumpbox Capacity 5 m³ Diameter 1.6 m Height 2.4 m	1	each			2 min retention
A	250	PP-032 PP-132	Moly Rougher Flotation Feed Pumps Capacity 135 m³/h Head 20.0 m Fluid S.G. 1.15 Inlet size 152 mm Outlet size 102 mm	2	each	14.9	12.3	Warman AH 6/4, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.

002612

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.

Project No. 180600

Project: Toromocho Copper Project

Date: 18-Dec-06

Case: 92000 tpd

Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	TK-034	Moly Rougher Tails Pumpbox Capacity 4.8 m³ Diameter 1.6 m Height 2.4 m	1	each			C.S. 2 min retention
A	250	PP-034 PP-134	Moly Rougher Tails Pumps Capacity 119 m³/h Head 20.0 m Fluid S.G. 1.15 Inlet size 102 mm Outlet size 76 mm	2	each	11.2	9.3	Warman AH 4/3, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	TK-036	1st Moly Cleaner Feed Pumpbox Capacity 43.0 m³ Diameter 1.2 m Height 2.0 m	1	each			C.S. 2 min retention
A	250	PP-036 PP-136	1st Moly Cleaner Feed Pumps Capacity 54 m³/h Head 20.0 m Fluid S.G. 1.10 Inlet size 76 mm Outlet size 51 mm	2	each	14.9	11.2	Warman AH 3/2, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-026	1st Moly Cleaner Flotation Column Design Solid Flow 7 t/h Cell size 2.0 m dia	1	each			Column 2 m dia
A	250	TK-038	2nd Moly Cleaner Feed Pumpbox Capacity 1.3 m³ Diameter 1.0 m Height 1.6 m	1	each			C.S. 2 min retention
A	250	PP-038 PP-138	2nd Moly Cleaner Feed Pumps Capacity 36 m³/h Head 15.0 m Fluid S.G. 1.11 Inlet size 51 mm Outlet size 38 mm	2	each	5.6	4.1	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-028	2nd Moly Cleaner Flotation Column Design Solid Flow 6 t/h Cell size 1.8 m dia	1	each			Column 1.8 m dia
A	250	TK-040	3rd Moly Cleaner Feed Pumpbox Capacity 0.8 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention

002613

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 92000 tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	PP-040 PP-140	3rd Moly Cleaner Feed Pumps Capacity 22 m³/h Head 20.0 m Fluid S.G. 1.13 Inlet size 38 mm Outlet size 25 mm	2	each	3.7	2.1	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-030	3rd Moly Cleaner Flotation Column Design Solid Flow 4 t/h Cell size 1.8 m dia	1	each			Column 1.8 m dia
A	250	TK-042	4th Moly Cleaner Feed Pumpbox Capacity 14.2 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
A	250	PP-042 PP-142	4th Moly Cleaner Feed Pumps Capacity 18 m³/h Head 20.0 m Fluid S.G. 1.13 Inlet size 50 mm Outlet size 38 mm	2	each	3.7	1.9	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-032	4th Moly Cleaner Flotation Column Design Solid Flow 3 t/h Cell size 1.5 m dia	1	each			Column 1.5 x 14 m
A	250	TK-044	4th Moly Cleaner Tail Thickener Feed Pumpbox Capacity 7.4 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
A	250	PP-044 PP-144	4th Moly Cleaner Tail Thickener Pumps Capacity 9 m³/h Head 20.0 m Fluid S.G. 1.09 Inlet size 38 mm Outlet size 25 mm	2	each	2.2	1.3	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
B	250	TK-046	4th Moly Cleaner Tail Thickener Tank Diameter 3 m Side wall height 2.0 m	1	each			C.S High Rate Thickener
A	250	TM-046	4th Moly Cleaner Tail Thickener Mechanism Diameter 3 m	1	each	3.7	3.0	RLCS c/w bridge, drive
A	250	TK-048	4th Moly Cleaner Tail Thickener Overflow Pumpbox Capacity 0.8 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 minute retention

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
Case: 92000 tpd
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	PP-048 PP-148	4th Moly Cleaner Tails Thickener Overflow Pumps Capacity 8 m^3/h Head 20 m Fluid S.G. 1.0 Inlet size 38 mm Outlet size 25 mm	2	each	2.2	1.2	Warman AH 1.5/1, horizontal centrifugal, C.I. VFD 1 operating/1 standby
A	250	MX-003	4th Moly Cleaner Tail Thickener Flocculant In-Line Mixer Capacity TBD m^3/h Diameter TBD mm	1	each			
A	250	PP-046 PP-146	4th Moly Cleaner Tail Thickener Underflow Pumps Capacity 1.4 m^3/h Head 10 m Fluid S.G. 1.61 Inlet size 40 mm Outlet size 20 mm	2	each	1.1	0.4	Warman L 20, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
A	250	TK-052	5th Moly Cleaner Feed Pumpbox Capacity 0.8 m^3 Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
A	250	PP-052 PP-152	5th Moly Cleaner Feed Pumps Capacity 19 m^3/h Head 20.0 m Fluid S.G. 1.09 Inlet size 51 mm Outlet size 38 mm	2	each	3.7	2.6	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-034	5th Moly Cleaner Flotation Column Design Solid Flow 3 t/h Cell size 1.4 m dia	1	each			Column 1.4 x 14 m
A	250	TK-054	5th Moly Cleaner Tail Thickener Feed Pumpbox Capacity 0.8 m^3 Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
A	250	PP-054 PP-154	5th Moly Cleaner Tail Thickener Pumps Capacity 11 m^3/h Head 20.0 m Fluid S.G. 1.04 Inlet size 38 mm Outlet size 25 mm	2	each	2.2	1.4	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
B	250	TK-056	5th Moly Cleaner Tail Thickener Tank Diameter 2 m Side wall height 1.6 m	1	each			C.S High Rate Thickener

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
Case: 92000 tpd
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	TM-056	5th Moly Cleaner Tail Thickener Mechanism Diameter 2 m	1	each	3.7	3.0	RLCS c/w bridge, drive
A	250	TK-060	5th Moly Cleaner Tail Thickener Overflow Pumpbox Capacity 8.4 m^3 Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 minute retention
A	250	PP-060 PP-160	5th Moly Cleaner Tails Thickener Overflow Pumps Capacity 11 m^3/h Head 20 m Fluid S.G. 1.0 Inlet size 38 mm Outlet size 25 mm	2	each	2.2	1.4	Warman AH 1.5/1, horizontal centrifugal, C.I. VFD 1 operating/1 standby
A	250	MX-004	5th Moly Cleaner Tail Thickener Flocculant In-Line Mixer Capacity TBD m^3/h Diameter TBD mm	1	each			
A	250	PP-056 PP-156	5th Moly Cleaner Tail Thickener Underflow Pumps Capacity 1 m^3/h Head 10 m Fluid S.G. 1.61 Inlet size 40 mm Outlet size 20 mm	2	each	1.1	0.5	Warman 20L, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
A	250	TK-062	6th Moly Cleaner Feed Pumpbox Capacity 0.8 m^3 Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
A	250	PP-062 PP-162	6th Moly Cleaner Feed Pumps Capacity 12 m^3/h Head 20.0 m Fluid S.G. 1.10 Inlet size 38 mm Outlet size 25 mm	2	each	2.2	1.4	Warman AH 1.5/1, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-036	6th Moly Cleaner Flotation Column Design Solid Flow 2 t/h Cell size 1.4 m dia	1	each			Column 1.4 x 14 m
A	250	GB-001 GB-101	Moly Flotation Air Blowers Capacity 5,760 Nm^3/h Delivery pressure (min.) 24 kPa(g) Number of operating Air Blowers 1	2	each	223.8	200.0	Hoffman 741 multistage centrifugal 1 operating / 1 standby Oil-free

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
Case: 92000 tpd
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	GC-001/002/003 GC-101	Column Air Compressor Capacity 8,845 Nm³/h Delivery pressure (min.) 100 kPa(g) Number of operating Air Blowers 3	4	each	932.5	900.0	ZR 160-900 VSD Atlas Copco 1 operating / 1 standby Oil-free rotary screw compressor
A	250	SA-001	Moly Rougher Flotation Feed Sampler	1	each	1.1	0.5	autosampler
A	250	ES-001/101 to ES-003/103	Moly Flotation Safety Showers and Eyewash Stations	3	each			for various locations
A	250	PP-068 PP-067	Moly Flotation Area Sump Pump Capacity 50 m³/h Head 15.0 m Fluid S.G. 1.2 Size 120 x 65 mm	2	each	5.6	4.9	Warman SP 65 Vertical centrifugal R.L.C.S.
			Area total connected power Area total operating power			**7,115** **3,698**		
		250	**Moly Concentrate Handling**					
A	250	TK-070	Moly Concentrate Thickener Feed Pumpbox Capacity 0.8 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
A	250	PP-070 PP-170	Moly Concentrate Thickener Feed Pumps Capacity 9 m³/h Head 20.0 m Fluid S.G. 1.11 Inlet size 38 mm Outlet size 25 mm	2	each	2.2	1.3	Warman AH 1.5/1, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
B	250	TK-072	Moly Concentrate Thickener Tank Diameter 4 m Side wall height 2.4 m	1.0	each			C.S High Rate Thickener
A	250	TM-072	Moly Concentrate Thickener Mechanism Diameter 4 m	1	each	3.7	3.0	RLCS c/w bridge, drive
A	250	TK-074	Moly Concentrate Thickener Overflow Pumpbox Capacity 0.8 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 minute retention Same height as the thickener

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600

Project: Toromocho Copper Project | **Date:** 18-Dec-06

Case: 92000 tpd | **Rev.** B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	PP-074 PP-174	Moly Concentrate Thickener Overflow Pumps Capacity 7 m^3/h Head 20 m Fluid S.G. 1.0 Inlet size 40 mm Outlet size 20 mm	2	each	2.2	1.2	Warman 20 L, horizontal centrifugal, C.I. 1 operating/1 standby
A	250	MX-006	Moly Concentrate Thickener Flocculant In-Line Mixer Capacity TBD m^3/h Diameter TBD mm	1	each			
A	250	PP-072 PP-172	Moly Concentrate Thickener Underflow Pumps Capacity 2 m^3/h Head 10 m Fluid S.G. 1.61 Inlet size 40 mm Outlet size 20 mm	2	each	1.1	0.4	Warman 20 L, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
A	250	TK-076	Moly Concentrate Storage Tank Capacity 28 m^3 Diameter 3.0 m Height 4.0 m Tank ret. time 12 h Operating Temp. 20 deg. C	1	each			C.S.
A	250	AG-076	Moly Concentrate Storage Tank Agitator Diameter 1.0 m Power Basis 0.9 kW/10 m^3	1	each	3.7	2.5	R.L.C.S.
A	250	PP-076 PP-176	Moly Concentrate Filter Feed Pumps Capacity 1.7 m^3/h Head 60 m Fluid S.G. 1.57 Inlet size 102 mm Outlet size 76 mm	2	each	93.3	75.0	Warman AH 4/3, horizontal centrifugal, C.I. VFD or 2 speed 1 operating/1 standby
A	250	FL-004 FL-104	Moly Concentrate Filters Capacity 1.9 t/h solids Chamber Volume 20.0 L Required Filter Volume 144 Required number of chambers 8 Total Number of Chambers per Filter 10 Filter Model VPA 1030-10 Compressor Model Atlas Copco ZR 110	2	each	130.6	111.9	Press Filter, Package to include air compressor 1 operating/1 standby Filter Model: VPA 1030-10 Compressor Model: Atlas Copco ZR 110
A	250	TK-078	Moly Concentrate Filtrate Return Pumpbox Capacity 0.9 m^3 Diameter 0.4 m Height 0.6 m	1	each			2 minute retention

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
Case: 92000 tpd
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	PP-078 PP-178	Moly Concentrate Filtrate Return Pumps Capacity 1 m³/h Head 10 m Fluid S.G. 1.0 Inlet size 40 mm Outlet size 20 mm	2	each	1.1	0.5	Warman 20 L, horizontal centrifugal, C.I. 1 operating/1 standby
A	250	CH-001	Moly Concentrate Filter Discharge Chute Capacity 2 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	250	SA-002	Moly Concentrate Sampler	1	each	1.1	0.5	autosampler
A	250	ZM-001	Front-End Loader Capacity 2 t	1	each			
A	250	ES-004/104	Moly Concentrate Area Safety Shower and Eyewash Station	1	each			
A	250	PP-080	Moly Concentrate Thickener Sump Pump Capacity 50 m³/h Head 10 m Fluid S.G. 1.20 Size 120 x 65	1	each	5.6	4.9	Warman SP 65 Vertical centrifugal R.L.C.S. Emergency power
			Area total connected power Area total operating power			**475** **158**		
	260		**Tailings Handling**					
A	260	TK-001	Final Tailings Thickener Feed Pumpbox Capacity 502.7 m³ Diameter 8.0 m Height 10.0 m	1	each			C.S. 2 min retention
A	260	PP-001 PP-101 PP-002	Final Tailings Thickener Feed Pumps Capacity 6883 m³/h Head 20.0 m Fluid S.G. 1.21 Inlet size 762 mm Outlet size 660 mm	3	each	671.4	531.4	Warman MMC-650, horizontal centrifugal R.L.C.S. VFD 2 operating, 1 standby.
B	260	TK-004 TK-005	Final Tailings Thickener Tanks Diameter 100 m Side wall height 9.0 m	2	each			C.S. Inground Conventional
A	260	TM-004	Final Tailings Thickener Mechanism Diameter 100 m	2	each	93.3	74.6	RLCS center pier type, drive

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project No. 180600
Project: Toromocho Copper Project
Date: 18-Dec-06
Case: 92000 tpd
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	260	TK-006	Final Tailings Thickener Overflow Pumpbox Capacity 160 m³ Diameter 5.4 m Height 7.0 m Retention time 2 min	1	each			C.S. 2 minute retention Same height as the thickener
A	260	PP-006 PP-106	Final Tailings Thickener Overflow Pumps Capacity 8144 m³/h Head 20 m Inlet size 800 mm Outlet size 700 mm	2	each	671.4	537.1	Warman GSL 700, horizontal centrifugal, C.I. 1 operating/1 standby
A	260	PP-004/104 PP-005/105	Final Tailings Thickener U'Flow Pumps Capacity 2811 m³/h Head 20 m each Fluid S.G. 1.53 Inlet size 508 mm Outlet size 457 mm	4	each	261.1	246.5	Warman AH 20/18, horizontal centrifugal VFD, 2operating / 2 standby emergency power
A	260	MX-001	Final Tailings Thickener Flocculant In-Line Mixer					
A	260	SA-001	Final Flotation Tails Sampler	1		1.1	0.7	
A	260	ES-001/101	Final Tailings Area Safety Shower and Eyewash Station	1	each			
			Area total connected power Area total operating power			**4,589** **1,794**		
		260	**Tailings Disposal**					
A	260	TK-008	Tailings Cyclone Feed Pumpbox Capacity 218 m³ Diameter 6.0 m Height 7.7 m	1	each			2 min retention RLCS
A	260	PP-008 PP-108	Tailings Cyclone Feed Pumps Capacity 5623 m³/h Head 30.0 m Fluid S.G. 1.53 Inlet size 762 mm Outlet size 660 mm	2	each	932.5	749.0	Warman D 30/26, Horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	260	CY-001 to CY-008 CY-101 to CY-104	Tailings Cyclones Feed capacity 5623 m³/h Number of operating cyclones 8 Cyclone Diameter 762 mm	12	each			8 operating / 4 standby Skid mounted RLCS
			Area total connected power Area total operating power			**1,865** **599**		
			Total Plant Connected Power (derated) **Total Plant Operating Power**			**186,702** **87,010**		

002620

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
		200	**Primary Crushing Area**					
A	200	RB-001	Rock Breaker	1	each	29.8	22.4	
A	200	BN-001	Dump Hopper Capacity 2 trucks 700 t Capacity 438 m^3 Dumping width m Height m	1	each			Concrete Rockbox Hopper Abrasion resistant plate lining vertical walls with flow splitter
A	200	CR-001	Primary Crusher Capacity 3850 t/h Model Superior MK-II 80-110 Maximum feed size 1000 mm Open side setting 234 mm	1	each	932.5	700.0	Gyratory crusher Superior MK-II 80-110
A	200	CH-001	Primary Crusher Discharge Chute Capacity 4813 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	200	FE-001	Primary Crusher Discharge Feeder Capacity 4813 t/h Belt width 2489 mm Belt speed 0.6 m/s Length (Horiz. C to C) 5 m Lift height 0 m Troughing angle 0 deg.	1	each	74.6	59.7	Belt feeder, variable speed
A	200	CH-002	Primary Crusher Discharge Feeder Chute Capacity 4813 t/h	1	each			Carbon Steel Abrasion resistant plate lining
B	200	CV-001	Crushed Ore Transfer Conveyor Capacity 4813 t/h Belt width 1600 mm Belt speed 3.3 m/s Length (Horiz. C to C) 20 m Lift height 1 m Troughing angle 35 deg.	1	each	111.9	100.0	Belt conveyor, variable speed
B	200	CH-003	Crushed Ore Transfer Conveyor Discharge Chute Capacity 4813 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	200	CV-002	Crushed Ore Transfer Conveyor # 1 Capacity 4813 t/h Belt width 1600 mm Belt speed 3.3 m/s Length (Horiz. C to C) 1026 m Lift height 162 m Troughing angle 35 deg.	1	each	3357.0	2700.0	Belt conveyor, variable speed

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
B	200	CH-004	Crushed Ore Transfer Conveyor # 1 Discharge Chute Capacity 4813 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	200	CV-003	Crushed Ore Overland Conveyor Capacity 4813 t/h Belt width 1600 mm Belt speed 3.30 m/s Length (Horiz. C to C) 1274 m Lift height 162.0 m Troughing angle 35 deg.	1	each	2611.0	2300.0	
A	200	CH-005	Overland Conveyor Discharge Chute Capacity 4813 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	200	SL-001	Belt Scale Capacity 7000 t/h	1	each	2.2	1.1	
A	200	MA-001	Iron Removal Magnet Capacity	1	each	5.6	3.7	
A	200	CN-001	Primary Crusher Overhead Crane Capacity 75 t 20 t	1	each	130.6	111.9	75/20 Main Hoist - 75 kW, Auxiliary Hoist - 20 kW, Trolley & Bridge Travel - 15.7kW total / 4 motors
A	200	CN-002	Monorail Crane Capacity 1 t	1	each	1.1	0.7	
A	200	BN-002	Trash Bin Capacity 2 m^3	1	each			
A	200	DC-001	Primary Crusher Dust Suppression System Capacity	1	each	1.1	0.7	
A	200	DC-002	Primary Crushing Area Baghouse Air flow rate 36000 m3/h	1	each	3.7	2.2	Pulse-jet baghouse
A	200	ZM-001	Dust Rotary Valve Capacity	1	each	0.4	0.2	
A	200	GC-001	Primary Crushing Area Air Compressor Capacity 4 Nm^3/min Pressure 700 kPa	1	each	37.3	29.8	1 operating, 1 stage, air cooled oil-free rotary screw type package including air filter and air receiver
			Area total connected power Area total operating power			**7,299** **4,729**		

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
		210	**Coarse Ore Storage**					
A	210	ST-001	Coarse Ore Stockpile Capacity (live) 77000 t Capacity (total) 491069 t Base dia 121 m Height 47 m	1	each			
A	210	CH-001 CH-002 CH-003	Coarse Ore Stockpile Discharge Chutes Capacity 4323 t/h	3	each			Carbon Steel Abrasion resistant plate lining
A	210	FE-001 FE-002 FE-003	Coarse Ore Stockpile Discharge Belt Feeders Capacity 4323 t/h Belt width 2489 mm Belt speed 0.6 m/s Length (Horiz. C to C) 6 m Lift height 0 m Troughing angle 0 deg.	3	each	56.0	44.76	Belt feeder, variable speed
A	210	CH-005 CH-006 CH-007	Belt Feeders Discharge Chutes Capacity 4323 t/h	3	each			Carbon Steel Abrasion resistant plate lining
A	210	DC-001	Coarse Ore Stockpile Dust Suppression System Capacity	1	each	1.1	0.7	
			Area total connected power Area total operating power			**169** **108**		
		220	**Grinding Circuit**					
A	220	CV-001	SAG Mill Feed Conveyor Capacity 4010 t/h Belt width 1219 mm Belt speed 3.0 m/s Length (Horiz. C to C) 302 m Lift height 26.7 m Troughing angle 35 deg.	1	each	186.5	149.2	
A	220	MD-001	Metal Detector	1	each			
A	220	MA-001	Self Cleaning Electromagnet	1	each	18.7	15.0	

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MECHANICAL EQUIPMENT LIST

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REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	220	SL-001	Belt Scale Capacity 7000 t/h	1	each	2.2	1.1	
A	220	CH-001	SAG Mill Feed Conveyor Discharge Chute Capacity 4010 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
A	220	BN-001	SAG Mill Ball Bin 1420 t Length 12.0 m Width 8.0 m Height 4.5 m Volume 434.4 m^3	1				
B	220	CH-002	SAG Mill Balls Bin Discharge Feeder Chute Capacity 2.5 t/h	1	each			Carbon Steel Abrasion resistant plate lining
B	220	CV-002	SAG Mill Balls Bin Conveyor Capacity 2.5 t/h Belt width 600 mm Belt speed 0.12 m/s Length (Horiz. C to C) 5 m Lift height 0.0 m Troughing angle deg.	1	each	1.1	0.5	Belt Conveyor
B	220	CH-004	SAG Mill Balls Bin Conveyor Discharge Chute Capacity 3 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
B	220	CV-003	SAG Mill Balls Transfer Conveyor Capacity 2.5 t/h Belt width 600 mm Belt speed 0.12 m/s Length (Horiz. C to C) 22 m Lift height 4.1 m Troughing angle deg.	1	each	1.1	0.8	Belt Conveyor
A	220	SL-002	Belt Scale Capacity 20 t/h	1	each	2.2	1.1	
B	220	CH-006	SAG Mill Balls Transfer Conveyor Discharge Chute Capacity 2.5 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
A	220	CH-008	SAG Mill Feed Chute Capacity 5388 t/h wet	1	each			C.S. shell, 3 CR 12 S.S.liner
A	220	ML-001	SAG Mill Capacity 3458 t/h dry Diameter 11.6 m Length 7.6 m	1	each	28348.0	23000	Overflow. Ring Motor drive inside liners 38' * 23' SAG Mill (EGL)
A	220	SN-001	SAG Mill Trommel Screen Capacity 7712.3 t/h wet Slot width 12 mm Slot length 36 mm Angle of incline 5 Screen dimensions 3 x 7 m	1	each			

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
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Case: 77000tpd

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REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	220	CH-010	SAG Mill Trommel Discharge O/S Chute Capacity 5913 t/h wet	1	each			C.S. shell, 3 CR 12, S.S. Liner
A	220	CH-011	SAG Mill Trommel Discharge U/S Chute Capacity 1800 t/h wet	1	each			C.S. shell, 3 CR 12, S.S. Liner
A	220	ZM-001	Ball Charge for SAG Mill Diameter 100 mm Quantity 620 t	1	lot			Forged steel balls
A	DC-001	BN-002	SAG Mill Ball Bucket 51 t Diameter 2.4 m Height 2.5 m Volume 11.3 m^3	2				
A	220	SN-002 SN-003	SAG Mill Screens Capacity 5913 t/h wet Top screen opening 2.5 mm Bottom screen opening 1.1 mm Angle of incline 5 degree Screen dimensions 3.55 x 7.0 m	2	each	56.0	45	XXH duty, double deck VFSM 60/24
A	220	CH-012 CH-013	SAG Mill Screen Undersize Chutes Capacity 2330 t/h wet	2	each			Carbon Steel Abrasion resistant plate lining
A	220	CH-014 CH-015	SAG Mill Screen Oversize Chutes Capacity 627 t/h wet	2	each			Carbon Steel Abrasion resistant plate lining
A	220	CV-004	Pebble Collector Conveyor Capacity 1253 t/h wet Belt width 1372 mm Belt speed 2.00 m/s Length 32 m Lift height 0 m Troughing angle 35 deg.	1	each	44.8	37.3	belt conveyor
A	220	CH-016	Pebble Collector Conveyor Discharge Chute Capacity 1253 t/h wet	1	each			C.S. shell, 3 CR 12, S.S. Liner
A	220	CV-005	Pebble Transfer Conveyor Capacity 1253 t/h wet Belt width 1372 mm Belt speed 2.00 m/s Length 201 m Lift height 18 m Troughing angle 35 deg.	1	each	186.5	149.2	belt conveyor High Angle Conveyor
A	220	CH-017	Pebble Transfer Conveyor Discharge Chute Capacity 1253 t/h wet	1	each			C.S. shell, 3 CR 12, S.S. Liner

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
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Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	220	BN-002	Pebble Crusher Feed Bin 1253 t/h wet Length 12.0 m Width 6.6 m Height 6.0 m	1				30 min Retention time
A	220	CH-020 CH-021	Pebble Crusher Feed Bin Discharge Chutes Capacity 627 t/h wet	2	each			C.S. shell, 3 CR 12, S.S. Liner
A	220	FE-001 FE-002	Pebble Crusher Feeders Capacity 627 t/h wet Belt width 1372 mm Belt speed 0.40 m/s Length 9 m Lift height 0 m Troughing angle 0 deg.	2	each	29.8	22.4	Belt feeder, variable speed
A	220	CH-024 CH-025	Pebble Crusher Feeder Discharge Chutes Capacity 627 t/h wet	2	each			C.S. shell, 3 CR 12, S.S. Liner
A	220	CR-001 CR-002	Pebble Crushers Capacity 627 t/h Model MP 1000 sh Maximum feed size 152 mm Open side setting 8 mm	2	each	932.5	745.0	Pebble Crusher MP 1000 sh
A	220	CH-028 CH-029	Pebble Crushers Discharge Chutes Capacity 627 t/h	2	each			Carbon Steel Abrasion resistant plate lining
A	220	CV-006	Pebble Recirculating Conveyor Capacity 1253 t/h Belt width 914 mm Belt speed 2.0 m/s Length (Horiz. C to C) 35 m Lift height 4.0 m Troughing angle 35 deg.	1	each	37.3	29.8	Belt conveyor
A	220	CH-032	Pebble Recirculating Conveyor Discharge Chute Belt speed 1253 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	220	CH-034 CH-035	Ball Mill Feed Chutes Capacity 8594 t/h wet	2	each			R.L.C.S.
A	220	ML-002 ML-003	Ball Mills Capacity each 1729 t/h new feed Diameter 7.9 m Length 12.2 m	2	each	20888.0	17000.0	Overflow. Twin pinion drive 26' x 40' Mill
A	220	BN-003 BN-004	Ball Mill Ball Bin 6362 t Length 20.0 m Width 10.0 m Height 8.0 m Volume 1608.0 m^3	1				

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
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REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
B	220	CH-038	Ball Mill Balls Bin Conveyor Feed Chuts Capacity 6.4 t/h	2	each			C.S. shell, 3 CR 12 S.S. Liner
B	220	CV-008	Ball Mill Balls Bin Conveyor Capacity 12.8 t/h Belt width 500 mm Belt speed 0.12 m/s Length (Horiz. C to C) 7 m Lift height 0.0 m Troughing angle deg.	1	each	1.1	0.8	Belt Conveyor
B	220	CH-040	Ball Mill Balls Bin Conveyor Discharge Chute Capacity 12.8 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
B	220	CV-009	Ball Mill Balls Transfer Conveyor # 1 Capacity 12.8 t/h Belt width 500 mm Belt speed 0.12 m/s Length (Horiz. C to C) 46.5 m Lift height 18.1 m Troughing angle deg.	1	each	2.2	1.5	Belt Conveyor
A	220	SL-003	Belt Scale Capacity 40 t/h	1	each	2.2	1.1	
B	220	CH-042	Ball Mill Balls Transfer Conveyor # 1 Discharge Chute Capacity 12.8 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
B	220	CV-010	Ball Mill Balls Transfer Conveyor # 2 Capacity 12.8 t/h Belt width 500 mm Belt speed 0.12 m/s Length (Horiz. C to C) 48.0 m Lift height 0.0 m Troughing angle deg.	1	each	2.2	1.5	Belt Conveyor
B	220	CH-044	Ball Mill Balls Transfer Conveyor # 2 Discharge Chute Capacity 12.8 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
A	220	CH-046 CH-047	Ball Mill Discharge Chutes Capacity 8594 t/h wet	2	each			R.L.C.S.
A	220	TK-001	Ball Mill Cyclone Feed Pumpbox Capacity 736 m^3 Width 8.0 m Length 8.0 m Height 11.5 m	1	each			Concrete Rockbox Hopper 2 min retention

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
Date: 18-Dec-06
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REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	220	PP-001 PP-002 PP-003 PP-004 PP-101	Ball Mill Cyclone Feed Pumps Capacity 5127 m³/h Fluid s.g. 1.5 Head 30 m Inlet size 762 mm Outlet size 660 mm	5	each	746.0	633.3	MMC 550, horizontal centrifugal. 4 operating/1 un-installed spare. VFD
A	220	CY-001 CY-002 CY-003 CY-004	Ball Mill Cyclone Clusters Feed capacity (each cluster) 5127 m³/h No. of cyclones in cluster 13 Cyclone Diameter 600 mm	4	each			11 operating /2 standby per Cluster RLCS including gate valves, launders, distributor and feed and overflow pipes
A	220	CN-001	Grinding Area Overhead Crane Capacity 75 t 20 t	1	each	130.6	111.9	75/20 Main Hoist - 75 kW, Auxiliary Hoist - 20 kW, Trolley & Bridge Travel - 15.7 kW total/ 4 motors
A	220	ES-001/101	Grinding Area Safety Showers and Eyewash Stations	1	each			
A	220	PP-008 PP-009	Grinding Area Sump Pumps Capacity 200 m³/h Head 20.0 m Fluid S.G. 2.0 Inlet size 175.0 mm Outlet size 100.0 mm	2	each	29.8	27.5	Vertical centrifugal R.L.C.S. SP-100
			Area total connected power Area total operating power			**118,345** **54,314**		
		230	**Copper Flotation Area**					
B	230	TK-001	Copper Rougher Flotation Feed Pumpbox Capacity 400 m³ Lengh 10.0 m Width 8.0 Height 5.0 m	1	each			10 min retention
A	230	SA-001	Copper Flotation Feed Sampler	1	each	1.1	0.5	autosampler
B	230	PP-001 PP-101 PP-002 PP-102	Copper Rougher Flotation Feed Pumps Capacity 5448 m³/h Head 20.0 m Fluid S.G. 1.23 Inlet size 762 mm Outlet size 660 mm	4	each	447.6	415.5	MMC 650, Horizontal centrifugal R.L.C.S. VFD 2 operating, 2 standby.
B	230	DI-001 DI-002	Copper Rougher Flotation Feed Rotary Distributors Capacity 5012 m³/h Size 84.0 m³	2	each			Rubber Lined C.S. Self-Propelled Feed Distrbutor
A	230	FO-001 to FO-024	Copper Rougher Flotation Cells Capacity 8716 m³/h Cell size 200.0 m³	24	each	223.8	215.0	OK-200 XHD, Tank cells with splitter, feed and discharge boxes, impellor / difuser, froth crowder. C/w level control. CS.

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
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REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	230	TK-004	Copper Rougher Tail Pumpbox Capacity 332 m^3 Length 6.9 m Width 6.3 m Height 7.6 m	1	each			2 min retention
A	230	PP-004 PP-104	Copper Rougher Tail Pumps Capacity 4769 m^3/h Head 10.0 m Fluid S.G. 1.23 Inlet size 800 mm Outlet size 700 mm	2	each	186.5	174.3	GSL 700, Horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	230	MX-001	Copper Rougher Tails Thickener Flocculant In-Line Mixer Capacity 200 m^3/h Diameter 150 mm	1	each			SAF 2507
A	230	TK-006	Regrind Cyclones Feed Pumpbox Capacity 110.4 m^3 Width 4.0 m Lengh 6.0 m Height 4.6 m	1	each			C.S. 2 min retention
A	230	PP-006 PP-007 PP-008 PP-106	Regrind Cyclone Feed Pumps Capacity 963 m^3/h Head 30.0 m Fluid S.G. 1.3 Inlet size 254 mm Outlet size 203 mm	4	each	130.6	125.2	Warman AH 10/8, horizontal centrifugal R.L.C.S. VFD 3 operating, 1 standby.
A	230	CY-001 CY-002 CY-003	Regrind Mill Cyclone Clusters Feed capacity (each cluster) 963 m^3/h No. of cyclones in cluster 8 Total number of cyclones 24 Cyclone Diameter 250 mm	3	each			6 operating /2 standby per Cluster RLCS including gate valves, launders, distributor and feed and overflow pipes
A	230	ML-001 to ML-006	Regrind Mill Packages Capacity 532 t/h Model VTM-1250	5	each	1119	933	Tower Mill VTM 1250
A	230	ZM-001	Ball Charges for Regrind Mill Diameter 25 mm Quantity 100 t	1	lot			Forged steel balls
A	230	TK-010	1st Cleaner Feed Pumpbox Capacity 82.8 m^3 Diameter 4.3 m Height 5.7 m	1	each			C.S. 2 min retention

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
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REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	230	PP-010 PP-110	1st Cleaner Feed Pumps Capacity 2313 m³/h Head 15.0 m Fluid S.G. 1.15 Inlet size 508 mm Outlet size 457 mm	2	each	149.2	147.8	Warman AH 20/18, horizontal centrifugal R.L.C.S VFD 1 operating, 1 standby.
A	230	FO-030 to FO-033	1st Cleaner Flotation Cells Capacity 2128 m³/h Cell size 100.0 m³	4	each	111.9	110.0	Tank cells with feed and discharge,impeller/difuse froth crowder. C/w level control. CS.
A	230	TK-014	1st Cleaner Tails Pumpbox Capacity 63.3 m³ Diameter 3.9 m Height 5.3 m	1	each			C.S. 2 min retention
A	230	PP-014 PP-114	1st Cleaner Tails Pumps Capacity 1780 m³/h Head 15.0 m Fluid S.G. 1.13 Inlet size 406 mm Outlet size 356 mm	2	each	111.9	105.7	Warman AH 20/18, horizontal centrifugal R.L.C.S VFD 1 operating, 1 standby.
A	230	TK-016 TK-017	2nd Cleaner Feed Conditioning Tanks Capacity 76 m³ Diameter 4.6 m Height 4.6 m	2	each			10 min retention
A	230	AG-016 AG-017	2nd Cleaner Feed Conditioning Tank Agitators Diameter 1.7 m Power Basis 0.4 kW/10 m³	2	each	5.6	4.5	R.L.C.S.
A	230	PP-016 PP-116	2nd Cleaner Feed Pumps Capacity 854 m³/h Head 20.0 m Fluid S.G. 1.17 t/m3 Inlet size 305 mm Outlet size 254 mm	2	each	74.6	65.7	Warman AH 12/10, horizontal centrifugal R.L.C.S VFD 1 operating, 1 standby.
A	230	DI-004	2nd Cleaner Feed Rotary Distributor Capacity 854 m³/h Size 15.0 m³	1	each			Rubber Lined C.S. Self-Propelled Feed Distrbutor
A	230	FO-038 to FO-043	2nd Cleaner Flotation Cells Design Solid Flow 207 t/h Cell size 5.0 m dia	6	each			Column 5 x 14 m

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MECHANICAL EQUIPMENT LIST

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Company: Peru Copper Inc.
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Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	230	TK-018	3rd Cleaner Feed Pumpbox Capacity 176.5 m^3 Diameter 5.3 m Height 8.0 m	1	each			C.S. 2 min retention
A	230	PP-018 PP-118	3rd Cleaner Feed Pumps Capacity 705 m^3/h Head 20.0 m Fluid S.G. 1.16 Inlet size 305 mm Outlet size 254 mm	2	each	74.6	66.8	Warman AH 12/10, horizontal centrifugal R.L.C.S VFD 1 operating, 1 standby.
A	230	TK-020	2nd Cleaner Tails Pumpbox Capacity 12.5 m^3 Diameter 2.1 m Height 3.6 m	1	each			C.S. 2 min retention
A	230	PP-020 PP-120	2nd Cleaner Tails Pumps Capacity 361 m^3/h Head 20.0 m Fluid S.G. 1.08 Inlet size 203 mm Outlet size 152 mm	2	each	22.4	20.0	Warman AH 8/6, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	230	DI-006	3rd Cleaner Feed Rotary Distributor Capacity 649 m^3/h Size 11.0 m^3	1	each			Rubber Lined C.S. Self-Propelled Feed Distrbutor
A	230	FO-050 to FO-053	3rd Cleaner Flotation Cells Design Solid Flow 157 t/h Cell size 5.0 m dia	4	each			Column 5 x 14 m
A	230	TK-022	Copper Conc Thickener Feed Pumpbox Capacity 11.8 m^3 Diameter 2.4 m Height 2.6 m	1	each			C.S. 2 min retention
A	230	PP-022 PP-122	Copper Conc Thickener Feed Pumps Capacity 307 m^3/h Head 20.0 m Fluid S.G. 1.20 Inlet size 203 mm Outlet size 152 mm	2	each	37.3	32.0	Warman AH 8/6, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	230	TK-024	Copper Cleaner Scavenger Feed Pumpbox Capacity 15.9 m^3 Diameter 2.6 m Height 3.0 m	1	each			C.S. 2 min retention

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
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Case: 77000tpd

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Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	230	PP-024 PP-124	Copper Cleaner Scavenger Feed Pumps Capacity 429 m³/h Head 20.0 m Fluid S.G. 1.11 Inlet size 254 mm Outlet size 203 mm	2	each	56.0	46.8	Warman AH 10/8, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	230	FO-058 to FO-063	Copper Cleaner Scavenger Flotation Cells Capacity 343 m³/h Cell size 8.0 m³	6	each	44.8	37.0	OK-8 HG Tank cells with feed and discharge,impe froth crowder. C/w level control. CS.
A	230	TK-026	Copper Cleaner Scavenger Tails Pumpbox Capacity 10.4 m³ Diameter 2.0 m Height 3.3 m	1	each			C.S. 2 min retention
A	230	PP-026 PP-126	Copper Cleaner Scavenger Tails Pumps Capacity 286 m³/h Head 20.0 m Fluid S.G. 1.07 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	29.1	Warman AH 8/6, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	230	TK-028	Copper Tails Thickener Feed Pumpbox Capacity 28 m³ Diameter 3.0 m Height 4.0 m	1	each			2 min retention Handles both 2nd Clean. Tails & Clnr Scav. Tails.
A	230	PP-028 PP-128	Copper Tails Thickener Feed Pumps Capacity 648 m³/h Head 20.0 m Fluid S.G. 1.08 Inlet size 254 mm Outlet size 203 mm	2	each	74.6	60.6	Warman AH 10/8, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	230	SA-002	Copper Rougher/1st Cleaner Tails Sampler	1	each	1.1	0.5	autosampler
A	230	SA-004	Copper Tails Thickener Feed Sampler	1	each	1.1	0.5	autosampler
A	230	ES-001/101 to ES-003/103	Flotation Safety Showers and Eyewash Stations	3	each			for various locations
	230	GB-001 GB-101	Flotation Air Blowers Capacity 40,680 Nm³/h Delivery pressure (min.) 48 kPa(g) Number of Operating air blowers 1	2	each	1305.5	1200.0	Hoffman 791 multistage centrifugal 1 operating / 1 standby

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	230	ES-001/101	Copper Flotation Area Safety Shower and Eyewash Station	2	each			
A	230	PP-030 PP-031	Flotation Area Sump Pumps Capacity 200 m^3/h Head 20.0 m Fluid S.G. 1.2 Inlet size 175 mm Outlet size 100 mm	2	each	29.8	22.6	Vertical centrifugal R.L.C.S. Warman SP 100
			Area total connected power Area total operating power			**18,314** **7,943**		
		240	**Copper Concentrate Handling**					
A	240	TK-001	Copper Concentrate Thickener Tank Diameter 16 m Side wall height 3.6 m	1.0	each			C.S High Rate Thickener
A	240	TM-001	Copper Concentrate Thickener Mechanism Diameter 16 m	1	each	3.7	3.0	RLCS c/w bridge, drive
A	240	TK-002	Copper Concentrate Thickener Overflow Pumpbox Capacity 9.4 m^3 Diameter 2.0 m Height 3.0 m	1	each			C.S. 2 minute retention Same height as the thickener
A	240	PP-002 PP-102	Copper Concentrate Thickener Overflow Pumps Capacity 289 m^3/h Head 20 m Fluid S.G. 1.0 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	23.3	Warman AH 8/6, horizontal centrifugal, polymer 1 operating/1 standby
A	240	MX-001	Copper Concentrate Thickener Flocculant In-Line Mixer Capacity TBD m^3/h Diameter TBD mm	1	each			
A	240	PP-004 PP-104	Copper Concentrate Thickener Underflow Pumps Capacity 62 m^3/h Head 20 m Fluid S.G. 2.01 Inlet size 76 mm Outlet size 51 mm	2	each	11.2	7.4	Warman AH 3/2, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
A	240	TK-006	Copper Concentrate Storage Tank Capacity (excl. F/B) 1473 m^3 Diameter 12.0 m Height 16.0 m Tank ret. time 24 h Operating Temp. 20 deg. C	1	each			C.S.

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
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Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	240	AG-006	Copper Concentrate Storage Tank Agitator Diameter 4.0 m Power Basis 0.7 kW/10 m³	1	each	111.9	110.4	R.L.C.S.
A	240	PP-006 PP-106	Copper Concentrate Filter Feed Pumps Capacity 69 m³/h Head 50 m Fluid S.G. 1.98 Inlet size 76 mm Outlet size 51 mm	2	each	22.4	20.4	Warman AH 4/3, horizontal centrifugal, C.I. VFD or 2 speed 1 operating/1 standby
A	240	FL-001 FL-002	Copper Concentrate Filters Capacity 65.1 t/h solids Capacity design factor for equipment s 1.3 L Design Solid Flow 100 Minimum Number of Filter Required 1 Number of operating chambers per Filt 41 Chamber Volume 129 Required number of chambers 41 Filter Model VPA 2030-41 Compressor model Atlas Copco ZR 700 VSD	2	each	746.0	600.0	Press Filter, Package to include air compressor 1 operating/1 standby Fliter Model: VPA 2030-41 Compressor Model: Atlas Copco ZR 700 VSD Oil free, 60 Hz, 8.6 bar
A	240	TK-008	Copper Concentrate Filtrate Return Pumpbox Capacity 1.4 m³ Diameter 1.2 m Height 1.2 m	1	each			2 minute retention
A	240	PP-008 PP-108	Copper Concentrate Filtrate Return Pumps Capacity 43 m³/h Head 20 m Fluid S.G. 1.0 Inlet size 76 mm Outlet size 51 mm	2	each	5.6	3.7	Warman AH 3/2, horizontal centrifugal, polymer ir VFD 1 operating/1 standby
A	240	CH-001	Copper Concentrate Filter Discharge Chute Capacity 81 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	240	SA-002	Copper Concentrate Sampler	1	each	1.1	0.5	autosampler
A	240	ZM-001	Front-End Loader Capacity 5 t	1	each			
A	240	ES-001/101	Copper Concentrate Thickener Safety Shower and Eyewash Station	1	each			
A	240	PP-014	Copper Concentrate Thickener Sump Pump Capacity 100 m³/h Head 10 m Fluid S.G. 1.23 Inlet size 175 mm Outlet size 100 mm	1	each	7.5	6.1	Vertical centrifugal R.L.C.S. Emergency power
			Area total connected power Area total operating power			**1,754** **616**		

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
Date: 18-Dec-06
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REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
		250	**Moly-Talc Circuit**					
A	250	TK-001	Copper Tails Thickener Tank Diameter 24 m Side wall height 4.6 m	1	each			C.S High Rate Thickener
A	250	TM-001	Copper Tails Thickener Mechanism Diameter 24 m	1	each	3.7	3.0	RLCS c/w bridge, drive
A	250	TK-002	Copper Tails Thickener Overflow Pumpbox Capacity 22.8 m^3 Diameter 2.8 m Height 3.7 m	1	each			C.S. 2 minute retention Same height as the thickener
A	250	PP-002 PP-102	Copper Tails Thickener Overflow Pumps Capacity 548 m^3/h Head 20 m Fluid S.G. 1.0 Inlet size 254 mm Outlet size 203 mm	2	each	44.8	41.5	Warman AH 10/8, horizontal centrifugal, C.I. 1 operating/1 standby
A	250	MX-001	Copper Tails Thickener Flocculant In-Line Mixer Capacity TBD m^3/h Diameter TBD mm	1	each			
A	250	PP-004 PP-104	Copper Tails Thickener Underflow Pumps Capacity 100 m^3/h Head 20 m Fluid S.G. 1.41 Inlet size 102 mm Outlet size 76 mm	2	each	11.2	9.5	Warman AH 4/3, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
A	250	TK-004 TK-005 TK-006	Copper Tails Storage Tank Capacity 28 m^3 Diameter 3.0 m Height 4.0 m Tank ret. time 0.5 h Operating Temp. 85 deg. C	3	each			C.S.
A	250	AG-004 AG-005 AG-006	Copper Tails Storage Tank Agitator Diameter 1.0 m Power Basis 0.4 kW/10 m^3	3	each	2.2	1.3	R.L.C.S.
A	250	PP-012	Copper Concentrate Thickener Sump Pump Capacity 100 m^3/h Head 10 m Fluid S.G. 1.20 Inlet size 175 mm Outlet size 100 mm	1	each	7.5	6.1	Vertical centrifugal R.L.C.S. Emergency power

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
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Case: 77000tpd

Project No. 180600
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REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	TK-008	Moly-Talc Rougher Flotation Feed Pumpbox Capacity 11 m³ Diameter 2.2 m Height 3.0 m	1	each			2 min retention
A	250	PP-008 PP-108	Moly-Talc Rougher Flotation Feed Pumps Capacity 280 m³/h Head 20 m Fluid S.G. 1 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	28.5	Warman AH 8/6, horizontal centrifugal, C.I. VFD 1 operating, 1 standby.
A	250	FO-001 to FO-006	Moly-Talc Rougher Flotation Cells Capacity 258 m³/h Cell size 10.0 m³	6	each	37.3	30.0	OK-10-TC Tank cells with splitter, feed and discharge boxes, impellor / difuser, froth crowder. C/w level control. CS.
A	TK-001	TK-010	Moly-Talc Scavenger Flotation Feed Pumpbox Capacity 1.4 m³ Diameter 1.1 m Height 1.5 m	1	each			C.S. 2 min retention
A	TK-001	PP-010 PP-110	Moly-Talc Scavenger Flotation Feed Pumps Capacity 40 m³/h Head 20.0 m Fluid S.G. 1.10 Inlet size 76 mm Outlet size 51 mm	2	each	5.6	4.6	Warman AH 3/2, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	TK-001	FO-008 FO-009	Moly-Talc Scavenger Flotation Cells Capacity 42 m³/h Cell size 5.0 m³	2	each	18.7	15.0	OK-5-TC Tank cells with feed and discharge,impe froth crowder. C/w level control. CS.
A	TK-001	TK-012	Moly-Talc Scavenger Tails Pumpbox Capacity 1.6 m³ Diameter 1.0 m Height 2.0 m	1	each			C.S. 2 min retention
A	TK-001	PP-012 PP-112	Moly-Talc Scavenger Tails Pumps Capacity 34 m³/h Head 20.0 m Fluid S.G. 1.19 Inlet size 76 mm Outlet size 51 mm	2	each	5.6	4.2	Warman AH3/2, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	TK-014	Moly-Talc Concentrate Thickener Feed Pumpbox Capacity 11 m³ Diameter 2.1 m Height 3.1 m	1	each			2 min retention

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	PP-014 PP-114	Moly-Talc Concentrate Thickener Feed Pumps Capacity 288 m^3/h Head 20 m Fluid S.G. 1 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	29.0	Warman AH 8/6, horizontal centrifugal, C.I. 1 operating, 1 standby.
A	250	TK-016	Moly-Talc Concentrate Thickener Tank Diameter 16 m Side wall height 3.6 m	1	each			C.S High Rate Thickener
A	250	TM-016	Moly-Talc Concentrate Thickener Mechanism Diameter 16 m	1	each	3.7	3.0	RLCS c/w bridge, drive
A	250	TK-018	Moly-Talc Concentrate Thickener Overflow Pumpbox Capacity 11.0 m^3 Diameter 2.0 m Height 3.5 m	1	each			C.S. 2 minute retention Same height as the thickener
A	250	PP-018 PP-118	Moly-Talc Concentrate Thickener Overflow Pumps Capacity 315 m^3/h Head 20 m Fluid S.G. 1 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	25.9	Warman AH 8/6, horizontal centrifugal, C.I. 1 operating/1 standby
A	250	MX-001	Moly-Talc Concentrate Thickener Flocculant In-Line Mixer Capacity TBD m^3/h Diameter TBD mm	1	each			
A	250	PP-016 PP-116	Moly-Talc Concentrate Thickener Underflow Pumps Capacity 66 m^3/h Head 20 m Fluid S.G. 1 Inlet size 102 mm Outlet size 76 mm	2	each	7.5	7.0	Warman AH 3/2, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
A	250	TK-020	Moly-Talc Concentrate Storage Tank Capacity 1235 m^3 Diameter 10.6 m Height 14.0 m Tank ret. time 12.0 h Operating Temp. 18 deg. C	1	each			C.S.
A	250	AG-020	Moly-Talc Concentrate Storage Tank Agitator Diameter 3.6 m Power Basis 0.8 kW/10 m^3	1	each	74.6	73.1	R.L.C.S.

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
Date: 18-Dec-06
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REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	PP-020 PP-120	Moly-Talc Concentrate Filter Feed Pumps Capacity 101 m³/h Head 50 m Fluid S.G. 1.4 Inlet size 76 mm Outlet size 51 mm	2	each	29.8	23.2	Warman AH 4/3, horizontal centrifugal, C.I. VFD or 2 speed 1 operating/1 standby
A	250	FL-001 FL-101	Moly-Talc Concentrate Filters Capacity 82.5 t/h solids Required Filter Volume 6547 L Required number of chambers 97 Total Number of Chambers per Filter 54 Spare Chambers available per Filter 5 Filter Model VPA 1540-54 Compressor model Atlas Copco ZR 900 VSD	2	each	447.6	373.0	Press Filter, Package to include air compressor 1 operating/1 standby Filter Model: VPA 1540-54 Compressor model: Atlas Copco ZR 900 VSD
A	250	CH-004	Moly-Talc Concentrate Filter Discharge Chute Capacity 71 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	250	TK-022	Moly-Talc Concentrate Filtrate Return Pumpbox Capacity 4.6 m³ Diameter 1.5 m Height 2.6 m	1	each			2 minute retention
A	250	PP-022 PP-122	Moly-Talc Concentrate Filtrate Return Pumps Capacity 109 m³/h Head 20 m Fluid S.G. 1 Inlet size 76 mm Outlet size 51 mm	2	each	5.6	5.3	Warman AH 3/2, horizontal centrifugal, polymer in VFD 1 operating/1 standby
A	250	KN-001 KN-002	Moly-Talc Concentrate Rotary Kiln Capacity 57.1 t/h Residence time 20.0 min Charge design 12.0 % Roast volume 53.4 m3 Diameter 2.0 m Lengh 17.0 m	3	each	37.3	30.0	Indirect Heat Rotary Kiln
A	250	TK-026	Moly-Talc Concentrate Storage Tank Capacity 1330 m³ Diameter 11.0 m Height 14.0 m Tank ret. time 12 h Operating Temp. 18 deg. C	1	each			C.S.
A	250	AG-026	Moly-Talc Concentrate Storage Tank Agitator Diameter 3.6 m Power Basis 0.5 kW/10 m³	1	each	74.6	73.1	R.L.C.S.

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
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REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	PP-026 PP-126	Talc Rougher Flotation Feed Pump Capacity 288 m³/h Head 20 m Fluid S.G. 1.13 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	29.0	Warman AH 8/6, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-012 to FO-015	Talc Rougher Flotation Cells Capacity 265 m³/h Cell size 20.0 m³	4	each	56.0	45.0	Tank cells with feed and discharge,impeller/difuse froth crowder. C/w level control. CS.
A	250	TK-028	Talc Rougher Concentrate Pumpbox Capacity 7.6 m³ Diameter 1.8 m Height 3.0 m	1	each			C.S. 2 min retention
A	250	PP-028 PP-128	Talc Rougher Concentrate Pumps Capacity 173 m³/h Head 20 m Fluid S.G. 1.18 Inlet size 152 mm Outlet size 102 mm	2	each	18.7	17.7	Warman AH 6/4, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	TK-030	Talc Rougher Tails Pumpbox Capacity 4.8 m³ Diameter 1.6 m Height 2.4 m	1	each			C.S. 2 min retention
A	250	PP-030 PP-130	Talc Rougher Tails Pumps Capacity 126 m³/h Head 20 m Fluid S.G. 1 Inlet size 152 mm Outlet size 102 mm	2	each	14.9	11.7	Warman AH 6/4, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-018 to FO-022	Moly Rougher Flotation Cell Capacity 107 m³/h Cell size 5.0 m³	5	each	18.7	15.0	OK-5 TC Tank cells with feed and discharge,impe froth crowder. C/w level control. CS.
A	250	TK-032	Moly Rougher Flotation Feed Pumpbox Capacity 5 m³ Diameter 1.6 m Height 2.4 m	1	each			2 min retention
A	250	PP-032 PP-132	Moly Rougher Flotation Feed Pumps Capacity 133 m³/h Head 20 m Fluid S.G. 1 Inlet size 152 mm Outlet size 102 mm	2	each	14.9	12.3	Warman AH 6/4, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
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Project No. 180600
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REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	TK-034	Moly Rougher Tails Pumpbox Capacity 4.8 m^3 Diameter 1.6 m Height 2.4 m	1	each			C.S. 2 min retention
A	250	PP-034 PP-134	Moly Rougher Tails Pumps Capacity 151 m^3/h Head 20 m Fluid S.G. 1 Inlet size 102 mm Outlet size 76 mm	2	each	11.2	9.3	Warman AH 4/3, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	TK-036	1st Moly Cleaner Feed Pumpbox Capacity 2.3 m^3 Diameter 1.2 m Height 2.0 m	1	each			C.S. 2 min retention
A	250	PP-036 PP-136	1st Moly Cleaner Feed Pumps Capacity 27 m^3/h Head 20 m Fluid S.G. 1 Inlet size 76 mm Outlet size 51 mm	2	each	14.9	11.2	Warman AH 3/2, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-026	1st Moly Cleaner Flotation Column Design Solid Flow 7 t/h Cell size 2.0 m dia	1	each			Column 2 m dia
A	250	TK-038	2nd Moly Cleaner Feed Pumpbox Capacity 1.3 m^3 Diameter 1.0 m Height 1.6 m	1	each			C.S. 2 min retention
A	250	PP-038 PP-138	2nd Moly Cleaner Feed Pumps Capacity 20 m^3/h Head 15 m Fluid S.G. 1 Inlet size 51 mm Outlet size 38 mm	2	each	5.6	4.1	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-028	2nd Moly Cleaner Flotation Column Design Solid Flow 5 t/h Cell size 1.8 m dia	1	each			Column 1.8 m dia
A	250	TK-040	3rd Moly Cleaner Feed Pumpbox Capacity 0.8 m^3 Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention

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MECHANICAL EQUIPMENT LIST

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Company: Peru Copper Inc.
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Project No. 180600
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REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	PP-040 PP-140	3rd Moly Cleaner Feed Pumps Capacity 13 m³/h Head 20 m Fluid S.G. 1.21 Inlet size 38 mm Outlet size 25 mm	2	each	3.7	2.1	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-030	3rd Moly Cleaner Flotation Column Design Solid Flow 4 t/h Cell size 1.8 m dia	1	each			Column 1.8 m dia
A	250	TK-042	4th Moly Cleaner Feed Pumpbox Capacity 0.8 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
A	250	PP-042 PP-142	4th Moly Cleaner Feed Pumps Capacity 11 m³/h Head 20 m Fluid S.G. 1 Inlet size 50 mm Outlet size 38 mm	2	each	3.7	1.9	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-032	4th Moly Cleaner Flotation Column Design Solid Flow 3 t/h Cell size 1.5 m dia	1	each			Column 1.5 x 14 m
A	250	TK-044	4th Moly Cleaner Tail Thickener Feed Pumpbox Capacity 0.8 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
A	250	PP-044 PP-144	4th Moly Cleaner Tail Thickener Pumps Capacity 4 m³/h Head 20 m Fluid S.G. 1.18 Inlet size 38 mm Outlet size 25 mm	2	each	2.2	1.3	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	TK-046	4th Moly Cleaner Tail Thickener Tank Diameter 3 m Side wall height 2.0 m	1	each			C.S High Rate Thickener
A	250	TM-046	4th Moly Cleaner Tail Thickener Mechanism Diameter 3 m	1	each	3.7	3.0	RLCS c/w bridge, drive
A	250	TK-048	4th Moly Cleaner Tail Thickener Overflow Pumpbox Capacity 0.8 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 minute retention

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
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Project No. 180600
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REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	PP-048 PP-148	4th Moly Cleaner Tails Thickener Overflow Pumps Capacity 3 m^3/h Head 20 m Fluid S.G. 1 Inlet size 38 mm Outlet size 25 mm	2	each	2.2	1.2	Warman AH 1.5/1, horizontal centrifugal, C.I. VFD 1 operating/1 standby
A	250	MX-003	4th Moly Cleaner Tail Thickener Flocculant In-Line Mixer Capacity TBD m^3/h Diameter TBD mm	1	each			
A	250	PP-046 PP-146	4th Moly Cleaner Tail Thickener Underflow Pumps Capacity 1 m^3/h Head 10 m Fluid S.G. 1.7 Inlet size 40 mm Outlet size 20 mm	2	each	1.1	0.4	Warman AH 3/2, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
A	250	TK-052	5th Moly Cleaner Feed Pumpbox Capacity 0.8 m^3 Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
A	250	PP-052 PP-152	5th Moly Cleaner Feed Pumps Capacity 9 m^3/h Head 20 m Fluid S.G. 1.2 Inlet size 51 mm Outlet size 38 mm	2	each	3.7	2.6	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-034	5th Moly Cleaner Flotation Column Design Solid Flow 3 t/h Cell size 1.3 m dia	1	each			Column 1.3 x 14 m
A	250	TK-054	5th Moly Cleaner Tail Thickener Feed Pumpbox Capacity 0.8 m^3 Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
A	250	PP-054 PP-154	5th Moly Cleaner Tail Thickener Pumps Capacity 3 m^3/h Head 20.0 m Fluid S.G. 1 Inlet size 38.0 mm Outlet size 25 mm	2	each	2.2	1.4	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	TK-056	5th Moly Cleaner Tail Thickener Tank Diameter 2 m Side wall height 1.6 m	1	each			C.S High Rate Thickener

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MECHANICAL EQUIPMENT LIST

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Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
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Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	TM-056	5th Moly Cleaner Tail Thickener Mechanism Diameter 2 m	1	each	3.7	3.0	RLCS c/w bridge, drive
A	250	TK-060	5th Moly Cleaner Tail Thickener Overflow Pumpbox Capacity 0.8 m^3 Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 minute retention
A	250	PP-060 PP-160	5th Moly Cleaner Tails Thickener Overflow Pumps Capacity 2 m^3/h Head 20 m Fluid S.G. 1.0 Inlet size 38 mm Outlet size 25 mm	2	each	2.2	1.4	Warman AH 1.5/1, horizontal centrifugal, C.I. VFD 1 operating/1 standby
A	250	MX-004	5th Moly Cleaner Tail Thickener Flocculant In-Line Mixer Capacity TBD m^3/h Diameter TBD mm	1	each			
A	250	PP-056 PP-156	5th Moly Cleaner Tail Thickener Underflow Pumps Capacity 1 m^3/h Head 10 m Fluid S.G. 1.87 Inlet size 40 mm Outlet size 20 mm	2	each	1.1	0.5	Warman 20L, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
A	250	TK-062	6th Moly Cleaner Feed Pumpbox Capacity 0.8 m^3 Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
A	250	PP-062 PP-162	6th Moly Cleaner Feed Pumps Capacity 7 m^3/h Head 20.0 m Fluid S.G. 1.20 Inlet size 38 mm Outlet size 25 mm	2	each	2.2	1.4	Warman AH 1.5/1, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	FO-036	6th Moly Cleaner Flotation Column Design Solid Flow 2 t/h Cell size 1.0 m dia	1	each			Column 1.0 x 14 m
A	250	GB-001 GB-101	Moly Flotation Air Blowers Capacity 5,220 Nm^3/h Delivery pressure (min.) 24 kPa(g) Number of operating Air Blowers 1	2	each	186.5	180.0	Hoffman 741 multistage centrifugal 1 operating / 1 standby Oil-free

002643

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	GC-001/002/003 GC-101	Column Air Compressor Capacity 8,845 Nm³/h Delivery pressure (min.) 100 kPa(g) Number of operating Air Blowers 2	3	each	932.5	800.0	ZR 160-900 VSD Atlas Copco 2 operating / 1 standby Oil-free rotary screw compressor
A	250	SA-002	Moly Concentrate Sampler	1	each	1.1	0.5	autosampler
A	250	ES-001/101 to ES-003/103	Moly Flotation Safety Showers and Eyewash Stations	3	each			for various locations
A	250	PP-068 PP-067	Moly Flotation Area Sump Pump Capacity 50 m³/h Head 15.0 m Fluid S.G. 1.2 Size 120 x 65 mm	2	each	5.6	4.9	Warman SP 65 Vertical centrifugal R.L.C.S.
			Area total connected power Area total operating power			**5,616** **2,506**		
		250	**Moly Concentrate Handling**					
A	250	TK-070	Moly Concentrate Thickener Feed Pumpbox Capacity 0.8 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
A	250	PP-070 PP-170	Moly Concentrate Thickener Feed Pumps Capacity 7 m³/h Head 20.0 m Fluid S.G. 1.14 Inlet size 38 mm Outlet size 25 mm	2	each	2.2	1.3	Warman AH 1.5/1, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
A	250	TK-072	Moly Concentrate Thickener Tank Diameter 10 m Side wall height 3.6 m	1.0	each			C.S High Rate Thickener
A	250	TM-072	Moly Concentrate Thickener Mechanism Diameter 10 m	1	each	3.7	3.0	RLCS c/w bridge, drive
A	250	TK-074	Moly Concentrate Thickener Overflow Pumpbox Capacity 0.8 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 minute retention Same height as the thickener

002644

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	PP-074 PP-174	Moly Concentrate Thickener Overflow Pumps Capacity 6 m³/h Head 20 m Fluid S.G. 1.0 Inlet size 40 mm Outlet size 20 mm	2	each	2.2	1.2	Warman 20 L, horizontal centrifugal, C.I. 1 operating/1 standby
A	250	MX-006	Moly Concentrate Thickener Flocculant In-Line Mixer Capacity TBD m^3/h Diameter TBD mm	1	each			
A	250	PP-072 PP-172	Moly Concentrate Thickener Underflow Pumps Capacity 1 m³/h Head 10 m Fluid S.G. 1.80 Inlet size 40 mm Outlet size 20 mm	2	each	2.2	1.2	Warman 20 L, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
A	250	TK-076	Moly Concentrate Storage Tank Capacity 28 m^3 Diameter 3.0 m Height 4.0 m Tank ret. time 12 h Operating Temp. 20 deg. C	1	each			C.S.
A	250	AG-076	Moly Concentrate Storage Tank Agitator Diameter 1.0 m Power Basis 0.4 kW/10 m³	1	each	1.1	1.0	R.L.C.S.
A	250	PP-076 PP-176	Moly Concentrate Filter Feed Pumps Capacity 1.4 m³/h Head 60 m Fluid S.G. 2 Inlet size 102 mm Outlet size 76 mm	2	each	74.6	70.0	Warman AH 4/3, horizontal centrifugal, C.I. VFD or 2 speed 1 operating/1 standby
A	250	FL-004 FL-104	Moly Concentrate Filters Capacity 1.6 t/h solids Capacity design factor for equipment s 1.3 Filter availability 85 % Required Filter Volume 120 L Required number of chambers 7 Filter Model VPA 1030-10 Compressor Model Atlas Copco ZR 110	2	each	130.6	111.9	Press Filter, Package to include air compressor 1 operating/1 standby Filter Model: VPA 1030-10 Compressor Model: Atlas Copco ZR 110
A	250	TK-078	Moly Concentrate Filtrate Return Pumpbox Capacity 0.1 m³ Diameter 0.4 m Height 0.6 m	1	each			2 minute retention

002645

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	250	PP-078 PP-178	Moly Concentrate Filtrate Return Pumps Capacity 1 m³/h Head 10 m Fluid S.G. 1.0 Inlet size 40 mm Outlet size 20 mm	2	each	1.1	0.5	Warman 20 L, horizontal centrifugal, C.I. 1 operating/1 standby
A	250	CH-001	Moly Concentrate Filter Discharge Chute Capacity 1 t/h	1	each			Carbon Steel Abrasion resistant plate lining
A	250	SA-003	Moly Concentrate Sampler	1	each	1.1	0.5	autosampler
A	250	ZM-001	Front-End Loader Capacity 2 t	1	each			
A	250	ES-004/104	Moly Concentrate Area Safety Shower and Eyewash Station	1	each			
A	250	PP-080	Moly Concentrate Thickener Sump Pump Capacity 50 m³/h Head 10 m Fluid S.G. 1.20 Size 120 x 65	1	each	5.6	4.9	Warman SP 65 Vertical centrifugal R.L.C.S. Emergency power
			Area total connected power Area total operating power			**438** **153**		
		260	**Tailings Handling**					
A	260	TK-001	Final Tailings Thickener Feed Pumpbox Capacity 406.0 m³ Diameter 7.3 m Height 9.7 m	1	each			C.S. 2 min retention
A	260	PP-001 PP-101 PP-002	Final Tailings Thickener Feed Pumps Capacity 5763 m³/h Head 20.0 m Fluid S.G. 1.21 Inlet size 762 mm Outlet size 660 mm	3	each	596.8	481.7	Warman D30/26, horizontal centrifugal VFD 2 operating, 1 standby.
A	260	TK-004	Final Tailings Thickener Tank Diameter 92 m Side wall height 9.0 m	2	each			C.S. High Rate thickener
A	260	TM-004	Final Tailings Thickener Mechanism Diameter 92 m	2	each	93.3	74.6	RLCS center pier type, drive

002646

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 77000tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
A	260	TK-006	Final Tailings Thickener Overflow Pumpbox Capacity 160 m³ Diameter 5.4 m Height 7.0 m Retention time 2 min	1	each			C.S. 2 minute retention Same height as the thickener
A	260	PP-006 PP-106	Final Tailings Thickener Overflow Pumps Capacity 6818 m³/h Head 20 m Fluid S.G. 1 mm Inlet size 762 mm Outlet size 660 mm	2	each	671.4	526.4	Warman D30/26, horizontal centrifugal 1 operating/1 standby
A	260	PP-004/104 PP-005/105	Final Tailings Thickener U'Flow Pumps Capacity 2354 m³/h Head 20 m each Fluid S.G. 1.53 Inlet size 406 mm Outlet size 356 mm	4	each	223.8	194.5	Warman AH 20/18, horizontal centrifugal VFD, 2operating / 2 standby emergency power
	260	MX-002	Final Tailings Thickener Flocculant In-Line Mixer					
	260	SA-002	Final Flotation Tails Sampler	1		1.1	0.7	
A	260	ES-001/101	Final Tailings Area Safety Shower and Eyewash Station	1	each			
			Area total connected power Area total operating power			**4,216** **1,623**		
		260	**Tailings Disposal**					
A	260	TK-008	Tailings Cyclone Feed Pumpbox Capacity 181 m³ Diameter 5.5 m Height 7.6 m	1	each			2 min retention RLCS
A	260	PP-008 PP-108	Tailings Cyclone Feed Pumps Capacity 4708 m³/h Head 30.0 m Fluid S.G. 1.53 Inlet size 508 mm Outlet size 457 mm	2	each	671.4	555.9	Warman AH 20/18, Horizontal centrifugal R.L.C.S VFD 1 operating, 1 standby.
A	260	CY-001 to CY-008 CY-101 to CY-104	Tailings Cyclones Feed capacity 3766 m³/h Number of operating cyclones 12 Cyclone Diameter 762 mm	1	each			8 operating / 4 standby Skid mounted RLCS
			Area total connected power Area total operating power			**1,343** **445**		
			Total Plant Connected Power (derated) **Total Plant Operating Power**			**156,150** **71,992**		

002647

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 65,000 tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
	200	**Primary Crushing Area**					
200	RB-001	Rock Breaker	1	each	29.8	22.4	
200	BN-001	Dump Hopper Capacity 2 trucks 700 t Capacity 438 m³ Dumping width m Height m	1	each			Concrete Rockbox Hopper Abrasion resistant plate lining vertical walls with flow splitter
200	CR-001	Primary Crusher Capacity 3250 t/h Model Superior MK-II 80-110 Maximum feed size 1000 mm Open side setting 175 mm	1	each	932.5	750.0	Gyratory crusher Superior MK-II 80-110
200	CH-001	Primary Crusher Discharge Chute Capacity 4063 t/h	1	each			Carbon Steel Abrasion resistant plate lining
200	FE-001	Primary Crusher Discharge Feeder Capacity 4063 t/h Belt width 2489 mm Belt speed 0.6 m/s Length (Horiz. C to C) 5 m Lift height 0 m Troughing angle 0 deg.	1	each	74.6	59.7	Belt feeder, variable speed
200	CH-002	Primary Crusher Discharge Feeder Chute Capacity 4063 t/h	1	each			Carbon Steel Abrasion resistant plate lining
200	CV-001	Crushed Ore Transfer Conveyor Capacity 4063 t/h Belt width 1600 mm Belt speed 3.3 m/s Length (Horiz. C to C) 20 m Lift height 1 m Troughing angle 35 deg.	1	each	111.9	100.0	Belt conveyor, variable speed
200	CH-003	Crushed Ore Transfer Conveyor Discharge Chute Capacity 4063 t/h	1	each			Carbon Steel Abrasion resistant plate lining
200	CV-002	Crushed Ore Overland Conveyor # 1 Capacity 4063 t/h Belt width 1600 mm Belt speed 3.30 m/s Length (Horiz. C to C) 1026 m Lift height 162.0 m Troughing angle 35 deg.	1	each	2238.0	2100.0	

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
200	CH-004	Crushed Ore Overland Conveyor # 1 Discharge Chute Capacity 4063 t/h	1	each			Carbon Steel Abrasion resistant plate lining
200	CV-003	Crushed Ore Overland Conveyor Capacity 4063 t/h Belt width 1600 mm Belt speed 3.30 m/s Length (Horiz. C to C) 1274 m Lift height 162.0 m Troughing angle 35 deg.	1	each	2611.0	2300.0	
200	CH-005	Overland Conveyor Discharge Chute Capacity 4063 t/h	1	each			Carbon Steel Abrasion resistant plate lining
200	SL-001	Belt Scale Capacity 7000 t/h	1	each	2.2	1.1	
200	MA-001	Iron Removal Magnet Capacity	1	each	5.6	3.7	
200	CN-001	Primary Crusher Overhead Crane Capacity 75 t 20 t	1	each	130.6	111.9	75/20 Main Hoist - 75 kW, Auxiliary Hoist - 20 kW, Trolley & Bridge Travel - 15.7kW total / 4 motors
200	CN-002	Monorail Crane Capacity 1 t	1	each	1.1	0.7	
200	BN-002	Trash Bin Capacity 2 m^3	1	each			
200	DC-001	Primary Crusher Dust Suppression System Capacity	1	each	1.1	0.7	
200	DC-002	Primary Crushing Area Baghouse Air flow rate 36000 m3/h	1	each	3.7	2.2	Pulse-jet baghouse
200	ZM-001	Dust Rotary Valve Capacity	1	each	0.4	0.2	
200	GC-001	Primary Crushing Area Air Compressor Capacity 4 Nm^3/min Pressure 700 kPa	1	each	37.3	29.8	1 operating, 1 stage, air cooled oil-free rotary screw type package including air filter and air receiver
		Area total connected power Area total operating power			**6,180** **4,289**		

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 65,000 tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
	210	**Coarse Ore Storage**					
210	ST-001	Coarse Ore Stockpile	1	each			
		Capacity (live) 65000 t					
		Capacity (total) 414539 t					
		Base dia 115 m					
		Height 45 m					
210	CH-001 CH-002 CH-003	Coarse Ore Stockpile Discharge Chutes Capacity 3385 t/h	3	each			Carbon Steel Abrasion resistant plate lining
210	FE-001 FE-002 FE-003	Coarse Ore Stockpile Discharge Belt Feeders	3	each	56.0	44.76	Belt feeder, variable speed
		Capacity 3385 t/h					
		Belt width 2489 mm					
		Belt speed 0.6 m/s					
		Length (Horiz. C to C) 6 m					
		Lift height 0 m					
		Troughing angle 0 deg.					
210	CH-005 CH-006 CH-007	Belt Feeders Discharge Chutes Capacity 3385 t/h	3	each			Carbon Steel Abrasion resistant plate lining
210	DC-001	Coarse Ore Stockpile Dust Suppression System Capacity	1	each	1.1	0.7	
		Area total connected power			**169**		
		Area total operating power			**108**		
	220	**Grinding Circuit**					
220	CV-001	SAG Mill Feed Conveyor	1	each	186.5	149.2	
		Capacity 3385 t/h					
		Belt width 1219 mm					
		Belt speed 3.0 m/s					
		Length (Horiz. C to C) 302 m					
		Lift height 26.7 m					
		Troughing angle 35 deg.					
220	MD-001	Metal Detector	1	each			
220	MA-001	Self Cleaning Electromagnet	1	each	18.7	15.0	

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 65,000 tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
220	SL-001	Belt Scale Capacity 7000 t/h	1	each	2.2	1.1	
220	CH-001	SAG Mill Feed Conveyor Discharge Chute Capacity 3385 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
220	BN-001	SAG Mill Ball Bin 1420 t Length 12.0 m Width 8.0 m Height 0.7 m Volume 65.3 m^3	1				
220	CH-002	SAG Mill Balls Bin Discharge Feeder Chute Capacity 2.1 t/h	1	each			Carbon Steel Abrasion resistant plate lining
220	CV-002	SAG Mill Balls Bin Conveyor Capacity 2.1 t/h Belt width 600 mm Belt speed 0.12 m/s Length (Horiz. C to C) 5 m Lift height 0.0 m Troughing angle deg.	1	each	1.1	0.5	Belt Conveyor
220	CH-004	SAG Mill Balls Bin Conveyor Discharge Chute Capacity 2 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
220	CV-003	SAG Mill Balls Transfer Conveyor Capacity 2.1 t/h Belt width 600 mm Belt speed 0.12 m/s Length (Horiz. C to C) 22 m Lift height 4.1 m Troughing angle deg.	1	each	1.1	0.8	Belt Conveyor
220	SL-002	Belt Scale Capacity 20 t/h	1	each	2.2	1.1	
220	CH-006	SAG Mill Balls Transfer Conveyor Discharge Chute Capacity 2.1 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
220	CH-008	SAG Mill Feed Chute Capacity 4336 t/h wet	1	each			C.S. shell, 3 CR 12 S.S.liner
220	ML-001	SAG Mill Capacity 2708 t/h dry Diameter 11.0 m Length 7.3 m	1	each	24618.0	20000	Overflow. Ring Motor drive inside liners 36ft *22ft (EGL)
220	SN-001	SAG Mill Trommel Screen Capacity 6510.4 t/h wet Slot width 12 mm Slot length 36 mm Angle of incline 5 Screen dimensions 3 x 7 m	1	each			Trommel Screen 3*7m

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
220	CH-010	SAG Mill Trommel Discharge O/S Chute Capacity 4991 t/h wet	1	each			C.S. shell, 3 CR 12, S.S. Liner
220	CH-011	SAG Mill Trommel Discharge U/S Chute Capacity 1519 t/h wet	1	each			C.S. shell, 3 CR 12, S.S. Liner
220	ZM-001	Ball Charge for SAG Mill Diameter 100 mm Quantity 620 t	1	lot			Forged steel balls
220	BN-002	SAG Mill Ball Backet 51 t Diameter 2.4 m Height 2.5 m Volume 11.3 m³	2				
220	SN-002 SN-003	SAG Mill Screens Capacity 4991 t/h wet Top screen opening 2.5 mm Bottom screen opening 1.1 mm Angle of incline 5 degree Screen dimensions 3.55 x 7.0 m	2	each	56.0	45	XXH duty, double deck VFSM 60/24
220	CH-012 CH-013	SAG Mill Screen Undersize Chutes Capacity 2072 t/h wet	2	each			Carbon Steel Abrasion resistant plate lining
220	CH-014 CH-015	SAG Mill Screen Oversize Chutes Capacity 423 t/h wet	2	each			Carbon Steel Abrasion resistant plate lining
220	CV-004	Pebble Collector Conveyor Capacity 846 t/h wet Belt width 1372 mm Belt speed 2.00 m/s Length 32 m Lift height 0 m Troughing angle 35 deg.	1	each	44.8	37.3	belt conveyor
220	CH-016	Pebble Collector Conveyor Discharge Chute Capacity 846 t/h wet	1	each			C.S. shell, 3 CR 12, S.S. Liner
220	CV-005	Pebble Transfer Conveyor Capacity 846 t/h wet Belt width 1372 mm Belt speed 2.00 m/s Length 201 m Lift height 18 m Troughing angle 35 deg.	1	each	130.6	120.0	belt conveyor High Angle Conveyor
220	CH-017	Pebble Transfer Conveyor Discharge Chute Capacity 846 t/h wet	1	each			C.S. shell, 3 CR 12, S.S. Liner

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION		QTY	UNIT	kW (derated)	kW	Remarks
220	BN-002	Pebble Crusher Feed Bin	846 t/h wet	1				30 min residence time
		Length	7.5 m					
		Width	6.0 m					
		Height	6.8 m					
220	CH-020	Pebble Crusher Feed Bin Discharge Chutes		2	each			C.S. shell, 3 CR 12, S.S. Liner
	CH-021	Capacity	423 t/h wet					
220	FE-001	Pebble Crusher Feeders		2	each	29.8	22.4	Belt feeder, variable speed
	FE-002	Capacity	423 t/h wet					
		Belt width	1372 mm					
		Belt speed	0.40 m/s					
		Length	9 m					
		Lift height	0 m					
		Troughing angle	0 deg.					
220	CH-024	Pebble Crusher Feeder Discharge Chutes		2	each			C.S. shell, 3 CR 12, S.S. Liner
	CH-025	Capacity	423 t/h wet					
220	CR-001	Pebble Crushers		2	each	746.0	600.0	Pebble Crusher MP800 sh
	CR-002	Capacity	423 t/h					
		Model	MP 800 sh					
		Maximum feed size	152 mm					
		Open side setting	8 mm					
220	CH-028	Pebble Crushers Discharge Chutes		2	each			Carbon Steel
	CH-029	Capacity	423 t/h					Abrasion resistant plate lining
220	CV-006	Pebble Recirculating Conveyor		1	each	37.3	29.8	Belt conveyor
		Capacity	846 t/h					
		Belt width	914 mm					
		Belt speed	2.0 m/s					
		Length (Horiz. C to C)	35 m					
		Lift height	4.0 m					
		Troughing angle	35 deg.					
220	CH-032	Pebble Recirculating Conveyor Discharge Chute		1	each			Carbon Steel
		Belt speed	846 t/h					Abrasion resistant plate lining
220	CH-034	Ball Mill Feed Chutes		2	each			R.L.C.S.
	CH-035	Capacity	7254 t/h wet					
220	ML-002	Ball Mills		2	each	17158.0	14000.0	Overflow. Twin pinion drive
	ML-003	Capacity each	1354 t/h new feed					24' x 40' Mill
		Diameter	7.3 m					
		Length	12.2 m					
220	BN-003	Ball Mill Ball Bin	874 t	1				
	BN-004	Length	6.0 m					
		Width	8.0 m					
		Height	4.0 m					
		Volume	192.0 m^3					

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 65,000 tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
220	CH-038	Ball Mill Balls Bin Conveyor Feed Chuts Capacity 5.4 t/h	2	each			C.S. shell, 3 CR 12 S.S. Liner
220	CV-008	Ball Mill Balls Bin Conveyor Capacity 10.8 t/h Belt width 500 mm Belt speed 0.12 m/s Length (Horiz. C to C) 7 m Lift height 0.0 m Troughing angle deg.	1	each	1.1	0.8	Belt Conveyor
220	CH-040	Ball Mill Balls Bin Conveyor Discharge Chute Capacity 10.8 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
220	CV-009	Ball Mill Balls Transfer Conveyor # 1 Capacity 10.8 t/h Belt width 500 mm Belt speed 0.12 m/s Length (Horiz. C to C) 46.5 m Lift height 18.1 m Troughing angle deg.	1	each	2.2	1.5	Belt Conveyor
220	SL-003	Belt Scale Capacity 40 t/h	1	each	2.2	1.1	
220	CH-042	Ball Mill Balls Transfer Conveyor # 1 Discharge Chute Capacity 10.8 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
220	CV-010	Ball Mill Balls Transfer Conveyor # 2 Capacity 10.8 t/h Belt width 500 mm Belt speed 0.12 m/s Length (Horiz. C to C) 48.0 m Lift height 0.0 m Troughing angle deg.	1	each	2.2	1.5	Belt Conveyor
220	CH-044	Ball Mill Balls Transfer Conveyor # 2 Discharge Chute Capacity 10.8 t/h	1	each			C.S. shell, 3 CR 12 S.S. Liner
220	CH-046 CH-047	Ball Mill Discharge Chutes Capacity 7254 t/h wet	2	each			R.L.C.S.
220	TK-001	Ball Mill Cyclone Feed Pumpbox Capacity 602 m^3 Width 7.3 m Length 6.6 m Height 12.5 m	1	each			Concrete Rockbox Hopper 2 min retention

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
220	PP-001 PP-002 PP-003 PP-004 PP-101	Ball Mill Cyclone Feed Pumps Capacity 4328 m³/h Fluid s.g. 1.5 Head 30 m Inlet size 660 mm Outlet size 559 mm	5	each	596.8	487.4	MMC 550, horizontal centrifugal. 4 operating/1 un-installed spare. VFD
220	CY-001 CY-002 CY-003 CY-004	Ball Mill Cyclone Clusters Feed capacity (each cluster) 4328 m³/h No. of cyclones in cluster 11 Cyclone Diameter 600 mm	4	each			9 operating /2 standby per Cluster RLCS including gate valves, launders, distributor and feed and overflow pipes
220	CN-001	Grinding Area Overhead Crane Capacity 75 t 20 t	1	each	130.6	111.9	75/20 Main Hoist - 75 kW, Auxiliary Hoist - 20 kW, Trolley & Bridge Travel - 15.7 kW total/ 4 motors
220	ES-001/101	Grinding Area Safety Showers and Eyewash Stations	1	each			
220	PP-008 PP-009	Grinding Area Sump Pumps Capacity 200 m³/h Head 20.0 m Fluid S.G. 2.0 Inlet size 175.0 Outlet size 100.0	2	each	29.8 mm mm	27.5	Vertical centrifugal R.L.C.S. SP-100
		Area total connected power Area total operating power			**98,411** **45,608**		
	230	**Copper Flotation Area**					
230	TK-001	Copper Rougher Flotation Conditioning Tanks Capacity 815 m³ Diameter 10 m Height 12 m	2	each			10 min retention
230	SA-001	Copper Flotation Feed Sampler	1	each	1.1	0.5	autosampler
230	PP-001 PP-101 PP-002 PP-102	Copper Rougher Flotation Feed Pumps Capacity 4599 m³/h Head 20.0 m Fluid S.G. 1.23 Inlet size 762 mm Outlet size 660 mm	4	each	447.6	375.0	MMC 650, Horizontal centrifugal R.L.C.S. VFD 2 operating, 2 standby.
230	DI-001 DI-002	Copper Rougher Flotation Feed Rotary Distributors Capacity 4231 m³/h Size 71.0 m³	2	each			Rubber Lined C.S. Self-Propelled Feed Distrbutor
230	FO-001 to FO-020	Copper Rougher Flotation Cells Capacity 7358 m³/h Cell size 200.0 m³	20	each	223.8	200.0	OK-200 XHD, Tank cells with splitter, feed and discharge boxes, impellor / difuser, froth crowder. C/w level control. CS.

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 65,000 tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
230	TK-004	Copper Rougher Tail Pumpbox Capacity 332 m^3 Length 6.9 m Width 6.3 m Height 7.6 m	1	each			2 min retention
230	PP-004 PP-104	Copper Rougher Tail Pumps Capacity 4026 m^3/h Head 10.0 m Fluid S.G. 1.23 Inlet size 800 mm Outlet size 700 mm	2	each	373.0	298.4	GSL 700, Horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
230	MX-001	Copper Rougher Tails Thickener Flocculant In-Line Mixer Capacity 200 m^3/h Diameter 150 mm	1	each			SAF 2507
230	TK-006	Regrind Cyclones Feed Pumpbox Capacity 83.6 m^3 Diameter 4.4 m Height 5.5 m	1	each			C.S. 2 min retention
230	PP-006 PP-007 PP-008 PP-106	Regrind Cyclone Feed Pumps Capacity 1220 m^3/h Head 30.0 m Fluid S.G. 1.3 Inlet size 305 mm Outlet size 254 mm	2	each	186.5	150.1	Warman AH 12/10, horizontal centrifugal R.L.C.S. VFD 2 operating, 1 standby.
230	CY-001 CY-002	Regrind Mill Cyclone Clusters Feed capacity (each cluster) 1220 m^3/h No. of cyclones in cluster 17 Total number of cyclones 34 Cyclone Diameter 250 mm	2	each			15 operating /2 standby per Cluster RLCS including gate valves, launders, distributor and feed and overflow pipes
230	ML-004 to ML-007	Regrind Mill Packages Capacity 450 t/h Model VTM-1500	4	each	1306	1119	Tower Mill VTM-1500
230	ZM-001	Ball Charges for Regrind Mill Diameter 25 mm Quantity 100 t	1	lot			Forged steel balls
230	TK-010	1st Cleaner Feed Pumpbox Capacity 82.8 m^3 Diameter 4.3 m Height 5.7 m	1	each			C.S. 2 min retention

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 65,000 tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
230	PP-010 PP-110	1st Cleaner Feed Pumps Capacity 1955 m³/h Head 15.0 m Fluid S.G. 1.15 Inlet size 508 mm Outlet size 457 mm	2	each	130.6	129.6	Warman AH 20/18, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
230	FO-021 to FO-024	1st Cleaner Flotation Cells Capacity 1799 m³/h Cell size 100.0 m³	4	each	149.2	132.0	Tank cells with feed and discharge,impeller/difuser, froth crowder. C/w level control. CS.
230	TK-014	1st Cleaner Tails Pumpbox Capacity 63.3 m³ Diameter 3.9 m Height 5.3 m	1	each			C.S. 2 min retention
230	PP-014 PP-114	1st Cleaner Tails Pumps Capacity 1505 m³/h Head 15.0 m Fluid S.G. 1.13 Inlet size 406 mm Outlet size 356 mm	2	each	93.3	86.1	Warman AH 16/14, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
230	TK-016 TK-017	2nd Cleaner Feed Conditioning Tanks Capacity 61.0 m³ Diameter 4.2 m Height 4.4 m	2	each			C.S. 2 min retention Handles both 1st Clean. conc & Clnr Scav. Conc.
230	AG-016 AG-017	2nd Cleaner Feed Conditioning Tank Agitators Diameter 1.7 m Power Basis 0.8 kW/10 m³	2	each	5.6	3.8	R.L.C.S.
230	PP-016 PP-116	2nd Cleaner Feed Pumps Capacity 721 m³/h Head 20.0 m Fluid S.G. 1.17 Inlet size 305 mm Outlet size 254 mm	2	each	56.0	53.6	Warman AH 12/10, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
230	DI-004	2nd Cleaner Feed Rotary Distributor Capacity 721 m³/h Size 13.0 m³	1	each			Rubber Lined C.S. Self-Propelled Feed Distrbutor
230	FO-030 to FO-034	2nd Cleaner Flotation Cells Design Solid Flow 175 t/h Cell size 5.0 m dia	5	each			Column 5 x 14 m

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 65,000 tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
230	TK-018	3rd Cleaner Feed Pumpbox Capacity 176.5 m³ Diameter 5.3 m Height 8.0 m	1	each			C.S. 2 min retention
230	PP-018 PP-118	3rd Cleaner Feed Pumps Capacity 595 m³/h Head 20.0 m Fluid S.G. 1.16 Inlet size 305 mm Outlet size 254 mm	2	each	74.6	66.8	Warman AH 12/10, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
230	TK-020	2nd Cleaner Tails Pumpbox Capacity 12.5 m³ Diameter 2.1 m Height 3.6 m	1	each			C.S. 2 min retention
230	PP-020 PP-120	2nd Cleaner Tails Pumps Capacity 305 m³/h Head 20.0 m Fluid S.G. 1.08 Inlet size 203 mm Outlet size 152 mm	2	each	37.3	36.7	Warman AH 8/6, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
230	DI-006	3rd Cleaner Feed Rotary Distributor Capacity 548 m³/h Size 10.0 m³	1	each			Rubber Lined C.S. Self-Propelled Feed Distrbutor
230	FO-042 to FO-045	3rd Cleaner Flotation Cells Design Solid Flow 133 t/h Cell size 5.0 m dia	5	each			Column 5 x 14 m
230	TK-022	Copper Conc Thickener Feed Pumpbox Capacity 11.3 m³ Diameter 2.4 m Height 2.5 m	1	each			C.S. 2 min retention
230	PP-022 PP-122	Copper Conc Thickener Feed Pumps Capacity 259 m³/h Head 20.0 m Fluid S.G. 1.20 Inlet size 203 mm Outlet size 152 mm	2	each	37.3	32.0	Warman AH 8/6, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
230	TK-024	Copper Cleaner Scavenger Feed Pumpbox Capacity 15.9 m³ Diameter 2.6 m Height 3.0 m	1	each			C.S. 2 min retention

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
230	PP-024 PP-124	Copper Cleaner Scavenger Feed Pumps Capacity 362 m³/h Head 20.0 m Fluid S.G. 1.11 Inlet size 254 mm Outlet size 203 mm	2	each	56.0	46.8	Warman AH 10/8, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
230	FO-050 to FO-054	Copper Cleaner Scavenger Flotation Cells Capacity 290 m³/h Cell size 8.0 m³	5	each	44.8	37.0	Tank cells with feed and discharge,impeller/difuser, froth crowder. C/w level control. CS.
230	TK-026	Copper Cleaner Scavenger Tails Pumpbox Capacity 10.4 m³ Diameter 2.0 m Height 3.3 m	1	each			C.S. 2 min retention
230	PP-026 PP-126	Copper Cleaner Scavenger Tails Pumps Capacity 242 m³/h Head 20.0 m Fluid S.G. 1.07 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	29.1	Warman AH 8/6, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
230	TK-028	Copper Tails Thickener Feed Pumpbox Capacity 28 m³ Diameter 3.0 m Height 4.0 m	1	each			2 min retention Handles both 2nd Clean. Tails & Clnr Scav. Tails.
230	PP-028 PP-128	Copper Tails Thickener Feed Pumps Capacity 547 m³/h Head 20.0 m Fluid S.G. 1.08 Inlet size 254 mm Outlet size 203 mm	2	each	44.8	41.7	Warman AH 10/8, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
230	SA-002	Copper Rougher/1st Cleaner Tails Sampler	1	each	1.1	0.5	autosampler
230	SA-003	Copper Tails Thickener Feed Sampler	1	each	1.1	0.5	autosampler
230	ES-001/101 to ES-003/103	Flotation Safety Showers and Eyewash Stations	3	each			for various locations
230	GB-001 GB-101	Flotation Air Blowers Capacity 35,100 Nm³/h Delivery pressure (min.) 48 kPa(g) Number of operating blowers 1	2	each	932.5	900.0	Hoffman 791 multistage centrifugal 1 operating / 1 standby

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Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 65,000 tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
230	ES-001/101	Copper Flotation Area Safety Shower and Eyewash Station	2	each			
230	PP-030 PP-031	Flotation Area Sump Pumps Capacity 200 m³/h Head 20.0 m Fluid S.G. 1.2 Inlet size 175 mm Outlet size 100 mm	2	each	29.8	22.6	Vertical centrifugal R.L.C.S. Warman SP 100
		Area total connected power Area total operating power			**16,486** **6,776**		
	240	**Copper Concentrate Handling**					
240	TK-001	Copper Concentrate Thickener Tank Diameter 14 m Side wall height 3.6 m	1.0	each			C.S High Rate Thickener
240	TM-001	Copper Concentrate Thickener Mechanism Diameter 14 m	1	each	3.7	3.0	RLCS c/w bridge, drive
240	TK-002	Copper Concentrate Thickener Overflow Pumpbox Capacity 11.8 m³ Diameter 2.2 m Height 3.1 m	1	each			C.S. 2 minute retention Same height as the thickener
240	PP-002 PP-102	Copper Concentrate Thickener Overflow Pumps Capacity 244 m³/h Head 20 m Fluid S.G. 1.0 Inlet size 203 mm Outlet size 152 mm	2	each	22.4	20.8	Warman AH 8/6, horizontal centrifugal, C.I. 1 operating/1 standby
240	MX-001	Copper Concentrate Thickener Flocculant In-Line Mixer Capacity TBD m³/h Diameter TBD mm	1	each			
240	PP-004 PP-104	Copper Concentrate Thickener Underflow Pumps Capacity 53 m³/h Head 20 m Fluid S.G. 2.01 Inlet size 76 mm Outlet size 51 mm	2	each	11.2	7.4	Warman AH 3/2, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
240	TK-003	Copper Concentrate Storage Tank Capacity (excl. F/B) 1299 m³ Diameter 11.0 m Height 15.0 m Tank ret. time 24 h Operating Temp. 20 deg. C	1	each			C.S.

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
240	AG-003	Copper Concentrate Storage Tank Agitator Diameter 3.6 m Power Basis 0.7 kW/10 m³	1	each	111.9	94.6	R.L.C.S.
240	PP-006 PP-106	Copper Concentrate Filter Feed Pumps Capacity 59 m³/h Head 50 m Fluid S.G. 1.98 Inlet size 76 mm Outlet size 51 mm	2	each	22.4	20.4	Warman AH 4/3, horizontal centrifugal, C.I. VFD or 2 speed 1 operating/1 standby
240	FL-001 FL-002	Copper Concentrate Filters Capacity 55.0 t/h solids Capacity design factor for equipment sizing 1.3 L Design Solid Flow 84 Minimum Number of Filter Required 1 Number of operating chambers per Filter 35 Chamber Volume 129 Required number of chambers 35 Filter Model VPA 2030-34 Compressor model Atlas Copco ZR 630	2	each	746.0	596.8	Press Filter, Package to include air compressor 1 operating/1 standby Filter Model: VPA 2030-4 Compressor Model: Atlas Copco ZR 630 oil free, 60 Hz, 8.6 bar
240	TK-008	Copper Concentrate Filtrate Return Pumpbox Capacity 1.1 m³ Diameter 1.1 m Height 1.2 m	1	each			2 minute retention
240	PP-008 PP-108	Copper Concentrate Filtrate Return Pumps Capacity 36 m³/h Head 20 m Fluid S.G. 1.0 Inlet size 76 mm Outlet size 51 mm	2	each	3.7	3.2	Warman AH 3/2, horizontal centrifugal, polymer imp VFD 1 operating/1 standby
240	CH-001	Copper Concentrate Filter Discharge Chute Capacity 69 t/h	1	each			Carbon Steel Abrasion resistant plate lining
240	SA-001	Copper Concentrate Sampler	1	each	1.1	0.5	autosampler
240	ZM-001	Front-End Loader Capacity 5 t	1	each			
240	ES-001/101	Copper Concentrate Thickener Safety Shower and Eyewash Station	1	each			
240	PP-014	Copper Concentrate Thickener Sump Pump Capacity 100 m³/h Head 10 m Fluid S.G. 1 Inlet size 175 mm Outlet size 100 mm	1	each	7.5	6.1	Vertical centrifugal R.L.C.S. Emergency power
		Area total connected power Area total operating power			**1,736** **598**		

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
	250	**Moly-Talc Circuit**					
250	TK-001	Copper Tails Thickener Tank Diameter 22 m Side wall height 3.6 m	1	each			C.S High Rate Thickener
250	TM-001	Copper Tails Thickener Mechanism Diameter 22 m	1	each	3.7	3.0	RLCS c/w bridge, drive
250	TK-002	Copper Tails Thickener Overflow Pumpbox Capacity 22.8 m^3 Diameter 2.8 m Height 3.7 m	1	each			C.S. 2 minute retention Same height as the thickener
250	PP-002 PP-102	Copper Tails Thickener Overflow Pumps Capacity 471 m^3/h Head 20 m Fluid S.G. 1.0 Inlet size 254 mm Outlet size 203 mm	2	each	37.3	36.5	Warman AH 10/8, horizontal centrifugal, C.I. 1 operating/1 standby
250	MX-001	Copper Tails Thickener Flocculant In-Line Mixer Capacity TBD m^3/h Diameter TBD mm	1	each			
250	PP-004 PP-104	Copper Tails Thickener Underflow Pumps Capacity 76 m^3/h Head 20 m Fluid S.G. 1.57 Inlet size 102 mm Outlet size 76 mm	2	each	11.2	9.5	Warman AH 4/3, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
250	TK-004 TK-005 TK-006	Copper Tails Storage Tank Capacity 28 m^3 Diameter 3.0 m Height 4.0 m Tank ret. time 0.5 h Operating Temp. 85 deg. C	3	each			C.S.
250	AG-004 AG-005 AG-006	Copper Tails Storage Tank Agitator Diameter 1.0 m Power Basis 0.3 kW/10 m^3	3	each	1.1	0.9	R.L.C.S.
250	PP-012	Copper Concentrate Thickener Sump Pump Capacity 100 m^3/h Head 10 m Fluid S.G. 1.20 Inlet size 175 mm Outlet size 100 mm	1	each	7.5	6.1	Vertical centrifugal R.L.C.S. Emergency power

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
250	TK-008	Moly-Talc Rougher Flotation Feed Pumpbox Capacity 8 m³ Diameter 1.8 m Height 3.1 m	1	each			2 min retention
250	PP-008 PP-108	Moly-Talc Rougher Flotation Feed Pumps Capacity 228 m³/h Head 20 m Fluid S.G. 1 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	28.5	Warman AH 8/6, horizontal centrifugal, C.I. VFD 1 operating, 1 standby.
250	FO-001 to FO-003	Moly-Talc Rougher Flotation Cells Capacity 210 m³/h Cell size 20.0 m³	3	each	56.0	45.0	OK-20-TC Tank cells with splitter, feed and discharge boxes, impellor / difuser, froth crowder. C/w level control. CS.
250	TK-010	Moly-Talc Scavenger Flotation Feed Pumpbox Capacity 1.2 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
250	PP-010 PP-110	Moly-Talc Scavenger Flotation Feed Pumps Capacity 33 m³/h Head 20.0 m Fluid S.G. 1.15 Inlet size 76 mm Outlet size 51 mm	2	each	5.6	4.6	Warman AH 3/2, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
250	FO-008 FO-009	Moly-Talc Scavenger Flotation Cells Capacity 34 m³/h Cell size 5.0 m³	2	each	18.7	15.0	OK-5-TC Tank cells with feed and discharge,impelle froth crowder. C/w level control. CS.
250	TK-012	Moly-Talc Scavenger Tails Pumpbox Capacity 1.6 m³ Diameter 1.0 m Height 2.0 m	1	each			C.S. 2 min retention
250	PP-012 PP-112	Moly-Talc Scavenger Tails Pumps Capacity 30 m³/h Head 20.0 m Fluid S.G. 1.14 Inlet size 76 mm Outlet size 51 mm	2	each	5.6	4.2	Warman AH3/2, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
250	TK-014	Moly-Talc Concentrate Thickener Feed Pumpbox Capacity 9 m³ Diameter 2.0 m Height 3.0 m	1	each			2 min retention

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
250	PP-014 PP-114	Moly-Talc Concentrate Thickener Feed Pumps Capacity 236 m^3/h Head 20 m Fluid S.G. 1 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	29.0	Warman AH 8/6, horizontal centrifugal, C.I. 1 operating, 1 standby.
250	TK-016	Moly-Talc Concentrate Thickener Tank Diameter 14 m Side wall height 3.0 m	1	each			C.S High Rate Thickener
250	TM-016	Moly-Talc Concentrate Thickener Mechanism Diameter 14 m	1	each	3.7	3.0	RLCS c/w bridge, drive
250	TK-018	Moly-Talc Concentrate Thickener Overflow Pumpbox Capacity 9.9 m^3 Diameter 1.9 m Height 3.5 m	1	each			C.S. 2 minute retention Same height as the thickener
250	PP-018 PP-118	Moly-Talc Concentrate Thickener Overflow Pumps Capacity 266 m^3/h Head 20 m Fluid S.G. 1 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	25.9	Warman AH 8/6, horizontal centrifugal, C.I. 1 operating/1 standby
250	MX-001	Moly-Talc Concentrate Thickener Flocculant In-Line Mixer Capacity TBD m^3/h Diameter TBD mm	1	each			
250	PP-016 PP-116	Moly-Talc Concentrate Thickener Underflow Pumps Capacity 50 m^3/h Head 20 m Fluid S.G. 2 Inlet size 102 mm Outlet size 76 mm	2	each	7.5	7.0	Warman AH 3/2, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
250	TK-020	Moly-Talc Concentrate Storage Tank Capacity 1021 m^3 Diameter 10.0 m Height 13.0 m Tank ret. time 12.0 h Operating Temp. 18 deg. C	1	each			C.S.
250	AG-020	Moly-Talc Concentrate Storage Tank Agitator Diameter 1.0 m Power Basis 0.8 kW/10 m^3	1	each	1.1	1.1	R.L.C.S.

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
250	PP-020 PP-120	Moly-Talc Concentrate Filter Feed Pumps Capacity 78 m³/h Head 50 m Fluid S.G. 1.5 Inlet size 76 mm Outlet size 51 mm	2	each	29.8	23.2	Warman AH 4/3, horizontal centrifugal, C.I. VFD or 2 speed 1 operating/1 standby
250	FL-001 FL-101	Moly-Talc Concentrate Filters Capacity 69.6 t/h solids Required Filter Volume 5275 L Required number of chambers 41 Total Number of Chambers per Filter 50 Spare Chambers available per Filter 9 Filter Model VPA 2030-50 Compressor model Atlas Copco ZR 900 VSD	2	each	447.6	373.0	Press Filter, Package to include air compressor 1 operating/1 standby Filter Model: VPA 2030-50 Compressor Model: Atlas Copco ZR 900 VSD oil free, 60 Hz, 8.6 bar
250	CH-004	Moly-Talc Rougher Concentrate Filter Discharge Chute Capacity 60 t/h	1	each			Carbon Steel Abrasion resistant plate lining
250	TK-022	Moly-Talc Concentrate Filtrate Return Pumpbox Capacity 4.0 m³ Diameter 1.4 m Height 2.6 m	1	each			2 minute retention
250	PP-022 PP-122	Moly-Talc Concentrate Filtrate Return Pumps Capacity 92 m³/h Head 20 m Fluid S.G. 1 Inlet size 76 mm Outlet size 51 mm	2	each	5.6	5.3	Warman AH 3/2, horizontal centrifugal, polymer imp VFD 1 operating/1 standby
250	KN-001 KN-002	Moly-Talc Rougher Concentrate Rotary Kiln Capacity 48.2 t/h Residence time 20.0 min Charge design 12.0 % Roast volume 40.8 m3 Diameter 2.0 m Length 13.0 m	2	each	22.4	20.0	Indirect Heat Rotary Kiln
250	TK-026	Moly-Talc Rougher Concentrate Storage Tank Capacity 28 m³ Diameter 3.0 m Height 4.0 m Tank ret. time 0.1 h Operating Temp. 18 deg. C	1	each			C.S.
250	AG-026	Moly-Talc Rougher Concentrate Storage Tank Agitator Diameter 1.0 m Power Basis 0.4 kW/10 m³	1	each	1.1	1.1	R.L.C.S.

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
250	PP-026 PP-126	Talc Rougher Flotation Feed Pump Capacity 236 m³/h Head 20 m Fluid S.G. 1 Inlet size 203 mm Outlet size 152 mm	2	each	29.8	29.0	Warman AH 8/6, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
250	FO-005 to FO-007	Talc Rougher Flotation Cells Capacity 217 m³/h Cell size 20.0 m³	3	each	56.0	45.0	OK-20 TC Tank cells with feed and discharge,impel froth crowder. C/w level control. CS.
250	TK-028	Talc Rougher Concentrate Pumpbox Capacity 5.3 m³ Diameter 1.5 m Height 3.0 m	1	each			C.S. 2 min retention
250	PP-028 PP-128	Talc Rougher Concentrate Pumps Capacity 146 m³/h Head 20 m Fluid S.G. 1.18 Inlet size 152 mm Outlet size 102 mm	2	each	18.7	17.7	Warman AH 6/4, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
250	TK-030	Talc Rougher Tails Pumpbox Capacity 3.2 m³ Diameter 1.3 m Height 2.4 m	1	each			C.S. 2 min retention
250	PP-030 PP-130	Talc Rougher Tails Pumps Capacity 90 m³/h Head 20 m Fluid S.G. 1 Inlet size 152 mm Outlet size 102 mm	2	each	14.9	11.7	Warman AH 6/4, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
250	FO-024 to FO-027	Moly Rougher Flotation Cell Capacity 76 m³/h Cell size 5.0 m³	4	each	18.7	15.0	Tank cells with feed and discharge,impeller/difuser, froth crowder. C/w level control. CS.
250	TK-032	Moly Rougher Flotation Feed Pumpbox Capacity 5 m³ Diameter 1.6 m Height 2.4 m	1	each			2 min retention
250	PP-032 PP-132	Moly Rougher Flotation Feed Pumps Capacity 96 m³/h Head 20 m Fluid S.G. 1 Inlet size 152 mm Outlet size 102 mm	2	each	14.9	12.3	Warman AH 6/4, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc.
Project: Toromocho Copper Project
Case: 65,000 tpd

Project No. 180600
Date: 18-Dec-06
Rev. B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
250	TK-034	Moly Rougher Tails Pumpbox Capacity 4.2 m³ Diameter 1.5 m Height 2.4 m	1	each			C.S. 2 min retention
250	PP-034 PP-134	Moly Rougher Tails Pumps Capacity 111 m³/h Head 20 m Fluid S.G. 1 Inlet size 102 mm Outlet size 76 mm	2	each	11.2	9.3	Warman AH 4/3, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
250	TK-036	1st Moly Cleaner Feed Pumpbox Capacity 18.8 m³ Diameter 1.0 m Height 2.0 m	1	each			C.S. 2 min retention
250	PP-036 PP-136	1st Moly Cleaner Feed Pumps Capacity 23 m³/h Head 20 m Fluid S.G. 1 Inlet size 76 mm Outlet size 51 mm	2	each	14.9	11.2	Warman AH 3/2, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
250	FO-030	1st Moly Cleaner Flotation Column Design Solid Flow 6 t/h Cell size 1.8 m dia	1	each			Column 1.8 m dia
250	TK-038	2nd Moly Cleaner Feed Pumpbox Capacity 0.8 m³ Diameter 0.8 m Height 1.6 m	1	each			C.S. 2 min retention
250	PP-038 PP-138	2nd Moly Cleaner Feed Pumps Capacity 17 m³/h Head 15 m Fluid S.G. 1 Inlet size 51 mm Outlet size 38 mm	2	each	5.6	4.1	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
250	FO-031	2nd Moly Cleaner Flotation Column Design Solid Flow 4 t/h Cell size 1.8 m dia	1	each			Column 1.8 m dia
250	TK-040	3rd Moly Cleaner Feed Pumpbox Capacity 0.8 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
250	PP-021 PP-121	3rd Moly Cleaner Feed Pumps Capacity 11 m³/h Head 20 m Fluid S.G. 1 Inlet size 38 mm Outlet size 25 mm	2	each	3.7	2.1	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
250	FO-033	3rd Moly Cleaner Flotation Column Design Solid Flow 3 t/h Cell size 1.5 m dia	1	each			Column 1.5 m dia
250	TK-042	4th Moly Cleaner Feed Pumpbox Capacity 0.8 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
250	PP-042 PP-142	4th Moly Cleaner Feed Pumps Capacity 10 m³/h Head 20 m Fluid S.G. 1 Inlet size 50 mm Outlet size 38 mm	2	each	3.7	1.9	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
250	FO-034	4th Moly Cleaner Flotation Column Design Solid Flow 3 t/h Cell size 1.3 m dia	1	each			Column 1.3 x 14 m
250	TK-044	4th Moly Cleaner Tail Thickener Feed Pumpbox Capacity 0.8 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
250	PP-044 PP-144	4th Moly Cleaner Tail Thickener Pumps Capacity 4 m³/h Head 20 m Fluid S.G. 1 Inlet size 38 mm Outlet size 25 mm	2	each	2.2	1.3	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
250	TK-046	4th Moly Cleaner Tail Thickener Tank Diameter 8 m Side wall height 3.0 m	1	each			C.S High Rate Thickener
250	TM-046	4th Moly Cleaner Tail Thickener Mechanism Diameter 8 m	1	each	3.7	3.0	RLCS c/w bridge, drive
250	TK-048	4th Moly Cleaner Tail Thickener Overflow Pumpbox Capacity 0.8 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 minute retention

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
250	PP-048 PP-148	4th Moly Cleaner Tails Thickener Overflow Pumps Capacity 3 m^3/h Head 20 m Fluid S.G. 1 Inlet size 38 mm Outlet size 25 mm	2	each	2.2	1.2	Warman AH 1.5/1, horizontal centrifugal, C.I. VFD 1 operating/1 standby
250	MX-003	4th Moly Cleaner Tail Thickener Flocculant In-Line Mixer Capacity TBD m^3/h Diameter TBD mm	1	each			
250	PP-046 PP-146	4th Moly Cleaner Tail Thickener Underflow Pumps Capacity 1 m^3/h Head 10 m Fluid S.G. 1.6 Inlet size 40 mm Outlet size 20 mm	2	each	1.1	0.4	Warman AH 3/2, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
250	TK-052	5th Moly Cleaner Feed Pumpbox Capacity 0.8 m^3 Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
250	PP-052 PP-152	5th Moly Cleaner Feed Pumps Capacity 8 m^3/h Head 20 m Fluid S.G. 1 Inlet size 51 mm Outlet size 38 mm	2	each	3.7	2.6	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
250	FO-034	5th Moly Cleaner Flotation Column Design Solid Flow 2 t/h Cell size 1.0 m dia	1	each			Column 1.0 x 14 m
250	TK-054	5th Moly Cleaner Tail Thickener Feed Pumpbox Capacity 0.8 m^3 Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
250	PP-054 PP-154	5th Moly Cleaner Tail Thickener Pumps Capacity 3 m^3/h Head 20.0 m Fluid S.G. 1 Inlet size 38.0 mm Outlet size 25 mm	2	each	2.2	1.4	Warman AH 2/1.5, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
250	TK-056	5th Moly Cleaner Tail Thickener Tank Diameter 6 m Side wall height 3.0 m	1	each			C.S High Rate Thickener

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
250	TM-056	5th Moly Cleaner Tail Thickener Mechanism Diameter 6 m	1	each	3.7	3.0	RLCS c/w bridge, drive
250	TK-060	5th Moly Cleaner Tail Thickener Overflow Pumpbox Capacity 0.2 m^3 Diameter 0.5 m Height 1.0 m	1	each			C.S. 2 minute retention
250	PP-060 PP-160	5th Moly Cleaner Tails Thickener Overflow Pumps Capacity 2 m^3/h Head 20 m Fluid S.G. 1.0 Inlet size 38 mm Outlet size 25 mm	2	each	2.2	1.4	Warman AH 1.5/1, horizontal centrifugal, C.I. VFD 1 operating/1 standby
250	MX-004	5th Moly Cleaner Tail Thickener Flocculant In-Line Mixer Capacity TBD m^3/h Diameter TBD mm	1	each			
250	PP-056 PP-156	5th Moly Cleaner Tail Thickener Underflow Pumps Capacity 1 m^3/h Head 10 m Fluid S.G. 1.61 Inlet size 40 mm Outlet size 20 mm	2	each	1.1	0.5	Warman 20L, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
250	TK-062	6th Moly Cleaner Feed Pumpbox Capacity 0.8 m^3 Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
250	PP-062 PP-162	6th Moly Cleaner Feed Pumps Capacity 6 m^3/h Head 20.0 m Fluid S.G. 1.17 Inlet size 38 mm Outlet size 25 mm	2	each	2.2	1.4	Warman AH 1.5/1, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
250	FO-034	6th Moly Cleaner Flotation Column Design Solid Flow 2 t/h Cell size 1.0 m dia	1	each			Column 1.0 x 14 m
250	GB-001 GB-101	Moly Flotation Air Blowers Capacity 3,960 Nm^3/h Delivery pressure (min.) 24 kPa(g) Number of operating Air Blowers 1	2	each	186.5	180.0	Hoffman 741 multistage centrifugal 1 operating / 1 standby Oil-free

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
250	GC-001/002/003 GC-101	Column Air Compressor Capacity 8,845 Nm³/h Delivery pressure (min.) 100 kPa(g) Number of operating Air Blowers 1	2	each	932.5	900.0	ZR 160-900 VSD Atlas Copco 1 operating / 1 standby Oil-free rotary screw compressor
250	SA-002	Moly Concentrate Sampler	1	each	1.1	0.5	autosampler
250	ES-001/101 to ES-003/103	Moly Flotation Safety Showers and Eyewash Stations	3	each			for various locations
250	PP-068 PP-067	Moly Flotation Area Sump Pump Capacity 50 m³/h Head 15.0 m Fluid S.G. 1.2 Size 120 x 65 mm	2	each	5.6	4.9	Warman SP 65 Vertical centrifugal R.L.C.S.
		Area total connected power Area total operating power			**4,320** **1,710**		
	250	**Moly Concentrate Handling**					
250	TK-070	Moly Concentrate Thickener Feed Pumpbox Capacity 0.8 m³ Diameter 1.0 m Height 1.0 m	1	each			C.S. 2 min retention
250	PP-070 PP-170	Moly Concentrate Thickener Feed Pumps Capacity 6 m³/h Head 20.0 m Fluid S.G. 1.11 Inlet size 38 mm Outlet size 25 mm	2	each	2.2	1.3	Warman AH 1.5/1, horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
250	TK-072	Moly Concentrate Thickener Tank Diameter 8 m Side wall height 3.0 m	1.0	each			C.S High Rate Thickener
250	TM-072	Moly Concentrate Thickener Mechanism Diameter 8 m	1	each	3.7	3.0	RLCS c/w bridge, drive
250	TK-074	Moly Concentrate Thickener Overflow Pumpbox Capacity 0.2 m³ Diameter 0.5 m Height 1.0 m	1	each			C.S. 2 minute retention Same height as the thickener

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MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
250	PP-074 PP-174	Moly Concentrate Thickener Overflow Pumps Capacity 5 m³/h Head 20 m Fluid S.G. 1.0 Inlet size 40 mm Outlet size 20 mm	2	each	2.2	1.2	Warman 20 L, horizontal centrifugal, C.I. 1 operating/1 standby
250	MX-006	Moly Concentrate Thickener Flocculant In-Line Mixer Capacity TBD m³/h Diameter TBD mm	1	each			
250	PP-072 PP-172	Moly Concentrate Thickener Underflow Pumps Capacity 1 m³/h Head 10 m Fluid S.G. 1.61 Inlet size 40 mm Outlet size 20 mm	2	each	1.1	0.4	Warman 20 L, horizontal centrifugal, C.I. VFD, 1 operating/1 standby emergency power
250	TK-076	Moly Concentrate Storage Tank Capacity 28 m³ Diameter 3.0 m Height 4.0 m Tank ret. time 12 h Operating Temp. 20 deg. C	1	each			C.S.
250	AG-076	Moly Concentrate Storage Tank Agitator Diameter 1.0 m Power Basis 0.3 kW/10 m³	1	each	1.1	0.9	R.L.C.S.
250	PP-076 PP-176	Moly Concentrate Filter Feed Pumps Capacity 1.3 m³/h Head 60 m Fluid S.G. 2 Inlet size 102 mm Outlet size 76 mm	2	each	74.6	65.0	Warman AH 4/3, horizontal centrifugal, C.I. VFD or 2 speed 1 operating/1 standby
250	FL-004 FL-104	Moly Concentrate Filters Capacity 0.9 t/h solids Capacity design factor for equipment sizing 1.3 L Filter availability 85 % Design Solid Flow 1.34 Required number of chambers 6 Filter Model VPA 1030-10 Compressor model Atlas Copco ZR 110	2	each	130.6	111.9	Press Filter, Package to include air compressor 1 operating/1 standby Filter Model: VPA 1030-10 Compressor Model: Atlas Copco ZR 110 Oil free, 60 Hz, 7 bar
250	TK-078	Moly Concentrate Filtrate Return Pumpbox Capacity 0.1 m³ Diameter 0.4 m Height 0.6 m	1	each			2 minute retention

002672

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
250	PP-078 PP-178	Moly Concentrate Filtrate Return Pumps Capacity 1 m³/h Head 10 m Fluid S.G. 1.0 Inlet size 40 mm Outlet size 20 mm	2	each	1.1	0.5	Warman 20 L, horizontal centrifugal, C.I. 1 operating/1 standby
250	CH-001	Moly Concentrate Filter Discharge Chute Capacity 1 t/h	1	each			Carbon Steel Abrasion resistant plate lining
250	SA-003	Moly Concentrate Sampler	1	each	1.1	0.5	autosampler
250	ZM-001	Front-End Loader Capacity 2 t	1	each			
250	ES-004/104	Moly Concentrate Area Safety Shower and Eyewash Station	1	each			
250	PP-080	Moly Concentrate Thickener Sump Pump Capacity 50 m³/h Head 10 m Fluid S.G. 1.20 Size 120 x 65	1	each	5.6	4.9	Warman SP 65 Vertical centrifugal R.L.C.S. Emergency power
		Area total connected power Area total operating power			**435** **149**		
	260	**Tailings Handling**					
260	TK-001	Final Tailings Thickener Feed Pumpbox Capacity 365.6 m³ Diameter 7.0 m Height 9.5 m	1	each			C.S. 2 min retention
260	PP-001 PP-101 PP-002	Final Tailings Thickener Feed Pumps Capacity 4867 m³/h Head 20.0 m Fluid S.G. 1.21 Inlet size 762 mm Outlet size 660 mm	3	each	447.6	427.0	Warman MMC-650, horizontal centrifugal R.L.C.S. VFD 2 operating, 1 standby.
260	TK-004	Final Tailings Thickener Tank Diameter 84 m Side wall height 9.0 m	2	each			C.S. High Rate thickener
260	TM-004	Final Tailings Thickener Mechanism Diameter 84 m	2	each	93.3	74.6	RLCS centre pier type, drive

002673

MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: Peru Copper Inc. | **Project No.** 180600
Project: Toromocho Copper Project | **Date:** 18-Dec-06
Case: 65,000 tpd | **Rev.** B

WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
260	TK-006	Final Tailings Thickener Overflow Pumpbox Capacity 221 m³ Diameter 6.0 m Height 7.8 m Retention time 2 min	1	each			C.S. 2 minute retention Same height as the thickener
260	PP-006 PP-106	Final Tailings Thickener Overflow Pumps Capacity 5759 m³/h Head 20 m Fluid S.G. 1 mm Inlet size 762 mm Outlet size 660 mm	2	each	447.6	386.6	Warman GSL 700, horizontal centrifugal, C.I. 1 operating/1 standby
260	PP-004/104 PP-005/105	Final Tailings Thickener U'Flow Pumps Capacity 1987 m³/h Head 20 m each Fluid S.G. 1.53 Inlet size 406 mm Outlet size 356 mm	4	each	186.5	164.4	Warman D30/26, horizontal centrifugal VFD, 2operating / 2 standby emergency power
260	MX-002	Final Tailings Thickener Flocculant In-Line Mixer					
260	SA-001	Final Flotation Tails Sampler	1		1.1	0.7	
260	ES-001/101	Final Tailings Area Safety Shower and Eyewash Station	1	each			
		Area total connected power Area total operating power			**3,172** **1,375**		
	260	**Tailings Disposal**					
260	TK-008	Tailings Cyclone Feed Pumpbox Capacity 159 m³ Diameter 5.2 m Height 7.5 m	1	each			2 min retention RLCS
260	PP-008 PP-108	Tailings Cyclone Feed Pumps Capacity 3975 m³/h Head 30.0 m Fluid S.G. 1.53 Inlet size 508 mm Outlet size 457 mm	2	each	596.8	472.0	Warman AH 20/18, Horizontal centrifugal R.L.C.S. VFD 1 operating, 1 standby.
260	CY-001 to CY-008 CY-101 to CY-104	Tailings Cyclones Feed capacity 3975 m³/h Number of operating cyclones 8 Cyclone Diameter 762 mm	1	each			8 operating / 4 standby Skid mounted RLCS
		Area total connected power Area total operating power			**1,194** **378**		
		Total Plant Connected Power (derated) **Total Plant Operating Power**			**130,909** **60,613**		

002674

WATER & UTILITIES MECHANICAL EQUIPMENT LIST

Aker Kvaerner

Company: PERU COPPER INC. **Project No.** 1806
Project: Toromocho Copper Project **Date:** 14-Dec-06
Case: 92000 tpd **Rev.** A

REV.	WBS CODE	CLIENT EQUIP NO. AND SEQUENCE NO.	EQUIPMENT NAME AND DESCRIPTION	QTY	UNIT	kW (derated)	kW	Remarks
		270	**Plant Reagents**					
A	270	HS-001	Reagent Area Monorail Hoist Capacity 2 t	1	each	3.7	2.2	
A	270	ZM-001	Reagent Area Forklift Capacity 2 t	1	each			
A	270	FN-001 to FN-004	Reagent Area Exhaust Fans Capacity 1000 m3/h	4	each	29.8	25.0	
A	270	WE-001	Weigh Scale Capacity 2 t	1	each			
A	270	CV-001	Pneumatic Conveying System, Lime Transfer capacity 200 t/h Length 50 m Line diameter 6 in. Air blower capacity 2210 Am3/h pressure 100 kPag	1	each	44.8	37.3	
A	270	LM-001	Lime Slaking Package Design Capacity 18.6 t/h Package Includes:	1	each			c/w slurry valves / piping, instruments
			Lime Silo Capacity 3200 t Diameter 12.0 m Height (straight side) 22.8 m	1	each			Mass-flow type c/w inside wall coating (plasite paint) 7 days capacity, with discharge chute
			Lime Bin Vent	1	each			Bag type, FRP
			Lime Dust Collector Exhaust Fan	1	each	3.7	2.2	
			Bin discharge gate	1	each	11.2	7.5	
			Weigh Feeder, Lime Width mm	1	each	1.1	0.7	variable speed drive, with discharge chute
			Lime Slaking Tower Mill Feed Conveyor Length 10 m	1	each	11.2	7.5	
			Lime Slaking Tower Mill Capacity (dry) 18.6 t/h Size VTM-400 LS	1	each	298.4	298.0	c/w separating tank, reducer, motor Temp Probe, Orebed Magnetic R.L. mill slaker screw transporter
			Wet Scrubber	1				wet scrubber and vent system, c/w fan and motor.
			Cyclopack	1	set			
			Cyclone Feed Pumpbox	1	each			R.L.C.S., 2 compartments
			Cyclone Feed Pump	2	each	29.8	27.7	1 operating/ 1 standby R.L.
			Recycle Pumpbox	1	each			R.L.C.S., 2 compartments
			Recycle Pumps	2	each	11.2	7.5	1 operating/ 1 standby R.L.

A	270	ZM-002	Lime Slaking Ball Charge Quantity Size (dia)	5 t 25 mm (50%) 32 mm (50%)	1	lot			forged steel based on vendor quote
A	270	TK-001	Milk of Lime Holding tank Capacity Diameter Height	232 m3 6.7 m 6.7 m	1	each			C.S., c/w baffles, covered and vented 24 hours capacity
A	270	AG-001	Milk of Lime Holding Tank Agitator Diameter	2.2 m	1	each	37.3	29.8	R.L.C.S.
A	270	PP-001 PP-101	Milk of Lime Loop Pumps Capacity Head Size	540.0 m3/h 30 m 102 x 76 mm	2	each	111.9	93.3	R.L., horizontal centrifugal 1 operating / 1 standby
A	270	TK-004	Xanthate Mixing Tank Capacity Diameter Height	43.6 m3 3.8 m 3.8 m	1	each			FRP, c/w baffles, covered and vented
A	270	AG-004	Xanthate Mix Tank Agitator Diameter	1.3 m	1	each	7.5	5.6	Stainless Steel
A	270	PP-004	Xanthate Transfer Pump Capacity Head Size	46.0 m3/h 15 m 102 x 76 mm	1	each	7.5	5.6	FRP, horizontal centrifugal
A	270	TK-005	Xanthate Holding Tank Capacity Diameter Height	43.6 m3 3.8 m 3.8 m	1	each			FRP
A	270	PP-005 PP-105	Xanthate Holding Tank Pumps Capacity Head Size	46.0 m3/h 20 m 102 x 76 mm	2	each	11.2	7.5	1 operating/1 standby FRP, horizontal centrifugal
A	270	TK-006	Xanthate Day Tank Capacity Diameter Height	15.1 m3 2.7 m 2.7 m	1	each			FRP 4 hours capacity
A	270	PP-201 to PP-204	Xanthate Metering Pumps Capacity to Ball Mill to Rougher to Ro-Scav to Clnr-Scav Standby (2)	1080 L/h 460 L/h 0 L/h 0 L/h 1080 L/h	4	each	3.7	2.2	polypropylene 2 operating/2 standby uninstalled
A	270	PP-010	MIBC Transfer Pump Capacity Head Size	7.0 m3/h 10.0 m 102 x 76 mm	1	each	5.6	3.7	FRP., horizontal centrifugal isotainer unloading pump
A	270	TK-011	MIBC Holding Tank Capacity Diameter Height	11.5 m3 2.4 m 2.4 m	1	each			FRP
A	270	PP-011 PP-111	MIBC Holding Tank Pumps Capacity Head Size	7.0 m3/h 20.0 m 38 x 25 mm	2	each	5.6	3.7	FRP, horizontal centrifugal 1 operating/1 standby

A	270	TK-012	MIBC Day Tank Capacity Diameter Height	 5.4 m3 1.9 m 1.9 m	1	each			FRP 12 hours capacity
A	270	PP-210 to PP-213	MIBC Metering Pumps Capacity to Rougher to Ro-Scav to 1st Clnr to Clnr-Scav to 2nd Clnr Standby (2)	 780 L/h 0 L/h 0 L/h 0 L/h 0 L/h 780 L/h	4	each	3.7	2.2	polypropylene 2 operating / 2 standby uninstalled
A	270	PP-018	AF-238 Transfer Pump Capacity Head Size	 7.0 m3/h 10.0 m 38 x 25 mm	1	each	5.6	3.7	FRP, horizontal centrifugal
A	270	TK-019	AF-238 Holding Tank Capacity Diameter Height	 10.8 m3 2.4 m 2.4 m	1	each			FRP
A	270	PP-019 PP-119	AF-238 Holding Tank Pumps Capacity Head Size	 7.0 m3/h 20 m 38 x 25 mm	2	each	5.6	3.7	FRP, horizontal centrifugal 1 operating/1 standby
A	270	TK-020	AF-238 Day Tank Capacity Diameter Height	 1.3 m3 1.2 m 1.2 m	1	each			FRP 4 hours capacity
A	270	PP-220 to PP-224	AF-238 Metering Pumps Capacity to Ball Mill to Rougher to Ro-Scav to Regrind to Clnr-Scav Standby (2)	 40 L/h 20 L/h 0 L/h 0 L/h 0 L/h 40 L/h	5	each	3.7	2.2	polypropylene 3 operating/2 standby uninstalled
A	270	TK-025	CMC Mixing Tank Capacity Diameter Height	 48.0 m3 3.9 m 3.9 m	1	each			FRP, c/w baffles, covered and vented
A	270	AG-025	CMC Mixing Tank Agitator Diameter	 1.3 m	1	each	7.5	5.6	Stainless Steel
A	270	PP-025	CMC Transfer Pump Capacity Head Size	 50.0 m3/h 10 m 102 x 76 mm	1	each	5.6	3.7	FRP, horizontal centrifugal
A	270	TK-026	CMC Holding Tank Capacity Diameter Height	 144.0 m3 5.7 m 5.7 m	1	each			FRP
A	270	PP-026 PP-126	CMC Holding Tank Pumps Capacity Head Size	 50.0 m3/h 20 m 102 x 76 mm	2	each	11.2	7.5	FRP., horizontal centrifugal 1 operating/1 standby
A	270	TK-027	CMC Day Tank Capacity Diameter Height	 9.8 m3 2.3 m 2.3 m	1	each			FRP

A	270	PP-227 to PP-229	CMC Metering Pumps Capacity to 1st Clnr L/h to 2nd & 3rd C 3650 L/h Standby (2) L/h	3	each	3.7	2.2	Polypropylene 2 operating/1 standby
A	270	FT-001	Flocculant Mixing System No. 1 Capacity Required 60 kg/h Capacity of system 53.0 kg/h Makedown Strength 0.5 %	4	each	11.2	7.5	Vendor's Package including: powder wetting system hopper c/w screw feeder, mixing tank w/ mixer, transfer pump, storage tank, metering pumps and blower
A	270	FT-002	Flocculant Mixing System No. 2 Capacity 25 kg/h	1	each	5.6	3.7	powder wetting system hopper c/w screw feeder, mixing tank w/ mixer, transfer pump, storage tank, metering pumps and blower
A	270	PP-042	Lime Area Sump Pump Capacity 25.0 m3/h Head 20 m Size 51 mm	1	each	5.6	3.7	Vertical Centrifugal, R.L.C.I.
A	270	PP-043 PP-044	Reagent Area Sump Pump Capacity 25.0 m3/h Head 20 m Size 51 mm	2	each	5.6	3.7	Vertical Centrifugal, R.L.C.I.
A	270	ES-001/101 ES-002/102	Reagent Area Safety Shower and Eyewash stations	2	each			various locations
			Area total connected power Area total operating power			**1028.7** **408.8**		
		280	**Water Management**					
A	280	TK-001	Fresh Water Reservoir Capacity 4400 m^3 Height 10.0 m Length 27.5 m Width 16.0 m	1	each			Concrete Resevoir
A	280	PP-001 PP-101	Fresh Water Pumps Capacity 1500 m^3/h Head 30 m Fluid S.G. 1.0 Inlet size 305 mm Outlet size 254 mm	2	each	186.5	154.2	Warman AH 12/10, 1 op./1 standby C.I., horizontal centrifugal
A	280	PP-002 PP-102	Gland Water Pumps Capacity 125 m^3/h Head 60 m Fluid S.G. 1.0 Inlet size 102 mm Outlet size 76 mm	2	each	37.3	31.1	Warman AH 4/3, 1 op./1 standby C.I., horizontal centrifugal
A	280	TK-004	Process Water Reservoir Capacity 24200 m^3 Height 10.0 m Length 53.8 m Width 45.0 m	1	each			Concrete Resevoir
A	280	PP-004 PP-104	Process Water Pumps Capacity 13698 m^3/h Head 30 m Fluid S.G. 1.0 Inlet size 1200 mm Outlet size 1000 mm	2	each	1305.5	1257.0	Warman GSL 1000, 1 op./1 standby C.I., horizontal centrifugal

A	280	PP-006 PP-106	Hose Station Pumps Capacity 625 m^3/h Head 40 m Fluid S.G. 1.0 Inlet size 203 mm Outlet size 152 mm	2	each	111.9	97.3	Warman AH 8/6, 1 op./1 standby C.I., horizontal centrifugal
A	280	WT-001	Portable Water Treatment System Capacity 20 m^3/h	1	each	111.9	93.3	
A	280	TK-010	Potable Water Tank Capacity 35 m3 Diameter 3.0 m Hight 5.0 m	1	each			C.I.
A	280	PP-010 PP-110	Potable Water Pumps Capacity 20 m^3/h Head 50 m Fluid S.G. 1.0 Inlet size 38 mm Outlet size 25 mm	2	each	7.5	5.8	Warman AH 1.5/1, 1 op./1 standby C.I., horizontal centrifugal
A	280	TE-001	Sewage Treatment System Capacity 30 m^3/h	1	each	111.9	93.3	assumed 125 kW
A	280	FP-001	Fire Water Pump Package System Capacity					
			Area total connected power Area total operating power			**3521** **1463**		
		290	**Air System**					
A	290	GC-001	HP Plant Air Compressor Package Capacity 1600 m^3/h* Delivery Pressure 690 kPa	1	each	186.5	149.2	1 operating, 1 stage, air cooled oil-free rotary screw type *@ 20 ℃ and 101.3 kPa package including air filter and air receiver
A	290	GC-002 to GC-005	Column Flotation Air Compressors Packages Capacity 1600 m^3/h* Delivery Pressure 690 kPa	4	each	186.5	149.2	4 operating, 1 stage, air cooled oil-free rotary screw type *@ 20 ℃ and 101.3 kPa package including air filters and air receiver
A	290	GC-006 to GC-009	Cu Conc. Press Filter Air Compressors Packages Capacity 1600 m^3/h* Delivery Pressure 690 kPa	4	each	186.5	149.2	4 operating, 1 stage, air cooled oil-free rotary screw type *@ 20 ℃ and 101.3 kPa package including air filters and air receiver
A	290	GC-010	Instrument Air Compressor Package Capacity 1600 m^3/h* Delivery pressure 690 kPa	1	each	186.5	149.2	1 operating, 1 stage, air cooled oil-free rotary screw type *@ 20 ℃ and 101.3 kPa package including air filter and air receiver
A	290	DR-001	Instrument Air Dryer	1	each			Blower purge twin tower desiccant air dryer c/w alarms, digital dew point demand, filter mounted w/ bypass
			Area total connected power Area total operating power			**1865** **1194**		

		295	**Fuels Area**					
A	295	TK-001	Diesel Fuel Storage Tank Capacity (excl. F/B) 288 m^3 Diameter 7.2 m Height 7.2 m	1	each			C.S.
A	295	PP-001 PP-101	Diesel Fuel Pumps Capacity 13.0 m^3/h Head 30 m Fluid S.G. 0.90 Size 76 x 51 mm	2	each	5.6	3.7	1 operating/1 standby horizontal centrifugal
A	295	ZM-001 ZM-002	Diesel Fuel Distribution Station	2	each			
A	295	TK-002	Gasoline Storage Tank Capacity (excl. F/B) 288 m^3 Diameter 7.2 m Height 7.2 m	1	each			C.S.
A	295	PP-002 PP-102	Gasoline Pumps Capacity 13.0 m^3/h Head 30 m Fluid S.G. 0.72 Size 76 x 51 mm	2	each	5.6	3.7	1 operating/1 standby horizontal centrifugal
A	295	ZM-003	Gasoline Distribution Station	1	each			
			Area total connected power Area total operating power			**22.4** **6.0**		
			Total Plant Connected Power (derated) **Total Plant Operating Power**			**6,437** **3,072**		

Appendix D
Design Criteria

Aker Kvaerner **DESIGN CRITERIA** PROJECT NO. 180600
DATE 26/01/2007
Client: **Peru Copper Inc.** REVISION A
Project: **Toromocho Copper-Moly**

SOURCE CODE CATEGORIES

	CODE		CODE
Criteria Provided by the Client	CC	Engineering Handbook Data	EH
Aker Kvaerner Recommendation	AK	Assumed Data	AD
Standard Industry Practice	SI	Regulations	R
Vendor-Oriented Criteria	V	World Bank Environmental Regulatior	WR
Criteria From Process Calculations	PC	Peruvian Environmental Regulations	CR
Test Report	TR	Technical Report from the Client	TEC

Summary

Total Ore Processed		**30,222,000**	tonnes/yr		A
Average Ore Processed -	**Ore Grade : Cu**	**0.60**	g/t	CC	A
	Ore Grade : Mo	**0.027**	%	CC	A
Overall Copper Recovery		**89.0**	%		A
Overall Molybdenium Recovery		**60.0**	%		A
Copper Conc. Production			g/h		A
Copper Conc. Grade			g/t		A

DESIGN BASIS				**Source**	**Rev.**
Ore to Plant		92,000	dt/d	CC	A
		30,222,000	dt/y		
Operations					
Days per year		365	dpy	CC	A
Primary Crushing - hours per day		24	hrs/d	AK	A
Mill - hours per day		24	hrs/d	AK	A
Availability					
Crushing		75	%	AK	A
Conveying		80	%	AK	A
Concentrator		90	%	AK	A
Crushing Feed Rate		4600.0	dt/h	PC	A
Concentrator Feed Rate		3833.3	dt/h	PC	A
Ore Specification					
Ore Grade	Cu	0.60	%	CC	A
Ore Grade	Mo	0.027	%	CC	A
Ore Moisture Content		3.0		AK	A
Ore Max Rock Size		1,000	mm, max. 40 inch	AK	A
Ore Bulk SG		2.70	t/m3	CC	A
Ore Bulk Density		1.60	t/m3	CC	
Angle of repose					
crushed		38	deg.	AK	A

PLANT SITE DATA

Location	Morococha, Peru		CC	A
Elevation, nominal	5,000	m above sea level	CC	A
Average Atmospheric pressure	57.6 - 65.5	kPa	CC	A

Ambient Air Temperature (dry bulb)					
Mean Maximum		20.0	℃	CC	A
Mean Minimum		-4.0	℃	CC	A
Mean Average		4.9 – 7.1	℃	CC	A
Design Minimum			℃		
Design Maximum			℃		
Rainfall					
Annual Rainfall		265.3 - 451.5	mm	CC	A
Design Precipitation (max)		680.9	mm	CC	A
Monthly Precipitation					
Wet Season (Jul - Sept)			mm		
Dry Season (Feb - April)			mm		
Evaporation Net per Year		2115 – 2473	mm	CC	A
Site Wet Bulb Temperature			℃		
Relative Humidity		43.4 – 45.7	%	CC	A
Mean January			%		
Mean July			%		
Snowfall					
Average Snowfall		9.5	mm	CC	A
			m drifts poss.		
Design Building Snow Load		0.15	kN/m²	CC	A
Frost Depth			m		
Frost free days		110 - 120	days	CC	A
Wind Conditions					
Average Wind Velocity		1.6 – 3.3	m/s	CC	A
Maximum Wind Velocity		25	m/s	CC	A
Structural Design			m/s		
Predominant Wind Directions		SE - NW		CC	A
Design Basic Wind Load		0.3	kN/m²	CC	A
Seismicity					
Building Design Codes					
Design Seismic Aceleration Value		0.15	g	CC	A
Anti-Seismic Intensity		7	degrees	CC	A

METALLURGICAL DESIGN CRITERIA

Ore haulage					
Truck Size		350	tonnes	AK	A
Stockpile and reclaim					
Size of Stockpile		24	hours	AK	A
Stockpile Shape		Conical with reclaim belt		AK	A
Reclaim					
Method		Belt feeder		AK	A
Primary Crusher					
Crusher Type		Gyratory		AK	A
Hopper capacity		700.0	tonnes	Designed for two trucks capacity	
Hopper volume		438.0	m3	One hopper per each crusher	
Product Size (P80)		115	mm	CC	A
Crusher liner consumption		1	liners/year	AK	A
Liner weight	1 of	100.0	t	AK	A
SAG Stockpile		100,000	t		
Stockpile Shape		Conical with reclaim belt		AK	A

SAG Mill

Minnovex SPI value		69	Minutes	TR	
Transfer size (Screen undersize, 80 % passing)		5500	microns	TR	
Power requirement		5.05	kWh/t	TR	
SAG Mill Discharge Density		70	w/w	TR	
Ball Consumption		500	g/t	SI	
Liner Consumption		25	g/t	SI	

Pebble Crusher

Pebble production		20	%	TR	
Crusher Discharge Density		20	%	AK	A
Product size		25	mm	TR	
Pebbles Bond Index		1.1 + Wi mineral			
No.of Crushers		2		AK	A

Ball Mill

Bond Work Index		12.0	kWh/mt	TR	A
No. of Mills		2		AK	A
Circuiting Load		300	%	AK	A
Feed Size for calcs		2500	microns		A
Product Size (P80)		125	microns	AK	A
Mill Moisture		30	%	SI	A
Ball consumption		800.0	g/t	SI	A
Liner consumption		25.0	g/t	SI	A

Cyclones

Cyclone Underflow Solids		70	%	SI	A
Cyclone Overflow Solids		30	%	SI	A
Cyclone Overflow P80		125	microns	SI	A

Copper Flotation

Copper Rougher Flotation

Flotation time		20	min	TR	
Feed		30.0	% solids	SI	A
Slurry pH		10.5		TR	
Feed particle size, P80		135	microns	TR	
Feed Grade	Cu	0.60	%	TR	
	Mo	0.027	%	TR	
Stage Recovery	Cu	94.6	%	TR	A
	Mo	82.8	%	TR	
Rougher Flot Conc. Density		30.0	% solids	AD	A
Conc. Grade	Cu	4.50	%	TR	
	Mo	0.179	%	TR	
Conc. Destination		Regrind Cyclone			A
Tails Destination		Tailings Thickener		AK	A

Regrind Cyclone

Cyclone U/F		65.0	% solids	SI	A
U/F Destination		Regrind Tower Mill			A
Cyclone O/F		21.0	% solids	TEC	A
O/F Destination		1st Cleaner Flotation			A

Regrind

Type		Tower Mill	VTM - 1500		A
Mill Feed Density		60.0	% solids		A
Circulating Load		150.0	% wt		A

1st Copper Cleaner Flotation

Flotation time		8	min	TR	A
Feed		20.0	% solids	TR	A
Slurry pH		11.5		TR	
Feed particle size, P80		45	microns	TR	
Feed Grade	Cu	4.5	%	PC	
	Mo	0.19	%	PC	
Stage Recovery	Cu	96.9	%	TR	A
	Mo	90.7	%	TR	
1st Cleaner Flot Conc Density		25.0	% solids	TR	A
Conc. Grade	Cu	13.90		TR	
	Mo	0.455		TR	
Conc. Destination		2nd Cleaner Flotation			A
Tails Destination		Tailings Thickener		AK	A

2nd Copper Cleaner Flotation					
Flotation time		7	min	TR	TR
Feed		20.0	% solids	TR	A
Slurry pH		11.8		TR	
Feed particle size, P80		45	microns	TR	
Feed Grade	Cu	15.43		PC	
	Mo	0.395		PC	
Stage Recovery	Cu	97.3	% Cu	TR	A
	Mo	25.5		TR	
Concentrate Density		25.0	% solids	AD	A
Conc. Grade	Cu	20.11		PC	
	Mo	0.220		PC	
Wash Water Ratio		1.00		TR	A
Conc. Destination		3rd Cleaner Flotation or Concentrate Thickener			A
Tails Destination		Regrinding Cyclone or 1st Cleaner Flotation		AK	A
3rd Copper Cleaner Flotation (Column Flotation)					
Flotation time		7	min	TR	A
Feed		19	% solids	TR	A
Slurry pH		11.8		TR	A
Feed particle size, P80		45	microns	TR	A
Feed Grade	Cu	20.11		PC	A
	Mo	0.220		PC	A
Stage Recovery	Cu	70.0	% Cu	TR	A
	Mo	15.0		TR	A
Final Concentrate Density		18.5	% solids	PC	A
Conc. Grade	Cu	26.3		TR	A
	Mo	0.043		PC	A
Wash Water Ratio		1.07			A
Conc. Destination		Concentrate Thickener			A
Tails Destination		Cleaner Scavenger Flotation			A
Copper Cleaner Scavenger Flotation					
Flotation time		5	min	TR	A
Feed		14.59	% solids	PC	A
Slurry pH		11.8		TR	A
Feed particle size, P80		45.0	microns	TR	A
Feed Grade	Cu	12.9	%	PC	A
	Mo	0.426	%	PC	A
Stage Recovery	Cu	89.0	%	TR	A
	Mo	16.2	%	TR	A
Cleaner Scav. Flot Conc. Density		25.0	% solids	AD	A
Conc. Grade	Cu	22.00		TR	A
	Mo	0.085		TR	A
Conc. Destination		2nd Cleaner Flotation			A
Tails Destination		Copper Flotation Tails Thickening			A
Recovery into Cu Concentrate:	**Cu**	89.0	%	TR	A
	Mo	3.2	%	TR	
Copper Concentrate Thickener					
Unit Capacity		0.08	m2/t/d	SI	
Underflow Density		65	%	AD	A
Feed density		20	% solids	PC	A
Overflow Destination		Process Water		AK	A
Concentrate Filtering					
Filtercake Moisture		9.0	%	TR	
Pump Gland Water		1.0	% solids		
Cloth Wash Water		6.7	% solids		
Availabilty		90.0	%		
Final Tailings Thickener					
Unit Capacity		0.125	m2/t/d		
Underflow Density		55	% solids	AD	A
Feed Density		28.2	% solids		
Overflow Destination		Tailings Pond Cyclones		AK	A
Final Tailings Pond Cyclones					
Feed density		54	% solids	PC	A
Underflow Density		55	%	AD	A
Overflow/Underflow Destination		Tailings Pond		AK	A
Solids Recovery to U/F		60	%		
Moly Concentrate					
Recovery	**Mo**	60.0	%		A
Conc. Grade	Mo	50.0	%		
	Cu	0.70	%		

5.-Talc-Moly Flotation

Copper Flotation Tails Thickening

Unit Capacity		0.125	m2/t/d	AD	A
Underflow Density		55.0	% solids	TEC	A
Feed Density		11.2	% solids	PC	
Pump Gland Water		1.0	% solids	AD	A

Conditioning

Agitated Tank				AK	
Temperature		65-80	oC	TEC	A
Residence Time		30.0	min	AK	A

Moly-Talc Rougher Flotation

Feed		25.0	% Solids	AK	A
Concentrate Grade	Mo	1.0	%	AK	A
	Cu	1.3	%	AK	A
Recovery	Mo	68.2	%	AK	A
	Cu	3.9	%	AK	A
Froth at Lip of Cell		25.0	% Solids	TEC	A
Froth at Launder End		22.0	% Solids	TEC	A
Flotation Time		10.0	min	AK	A

Moly-Talc Rougher Scav Flotation

Feed		20.0	% solids	PC	A
Feed Grade	Mo	0.3	%	PC	A
Concentrate Grade	Mo	1.4	%	PC	A
Recovery		1.0	%	PC	A
Flotation Time		10.0	min	AD	A

Moly-Talc Rougher Conc Thickening

Unit Capacity		0.150	m2/t/d		
Underflow Density		60.0	% solids	TEC	A
Feed Density		19.2	% solids		A
Pump Gland Water		1.0	% solids	AK	A

Moly-Talc Rougher Conc Filtering

Filtercake Moisture		9.0	%	TEC	A
Pump Gland Water		1.0	% solids		A
Cloth Wash Water		6.7	% solids		A
Availabilty		90.0	%		A

Roasting

Temperature		232-260	oC	TR	A
Residence Time		20.0	min	AK	A

Talc Flotation

Talc Rougher Flotation

Feed		22.0	% solids	PC	A
Feed Grade	Mo	1.03	%	PC	A
	Cu	1.3	%	PC	A
	Talc	45.0	%	TEC	A
Concentrate Grade	Mo	0.022	%	PC	A
	Cu	0.34	%	PC	A
	Talc	85.0	%	TEC	A
Tails Grade	Mo	3.2	%	PC	A
	Cu	3.4	%	PC	A
	Talc	8.6	%	TEC	A
Recovery	Talc	90.0	%	TEC	A
Froth at Lip of Cell		24.0	% solids	AD	A
Froth at Launder End		24.0	% solids	AD	A

Moly Flotation

Moly Rougher Flotation

Feed		20.0	% solids	AD	A
Feed Grade		3.1	%	PC	A
Concentrate Grade	Mo	15.3	%	PC	A
Recovery		68.0	%	AD	A
Flotation Time		10.0	min	AD	A

Moly 1st Cleaner Flotation					
Feed		14.4	% solids	PC	A
Feed Grade		11.5	%	PC	A
Concentrate Grade	Mo	20.3	%	PC	A
Recovery		67.5	%	AD	A
Flotation Time		20.0	min	TEC	A
Moly 2nd Cleaner Flotation					
Feed		15.2	% solids	PC	A
Feed Grade		15.6	%	PC	A
Concentrate Grade	Mo	25.6	%	PC	A
Recovery		66.4	%	AD	A
Flotation Time		20.0	min	TEC	A
Moly 3rd Cleaner Flotation					
Feed		18.4	% solids	PC	A
Feed Grade		19.8	%	PC	A
Concentrate Grade	Mo	29.4	%	PC	A
Recovery		65.3	%	AD	A
Flotation Time		18.0	min	TEC	A
Moly 4th Cleaner Flotation					
Feed		18.0	% solids	PC	A
Feed Grade		24.9	%	PC	A
Concentrate Grade	Mo	36.3	%	PC	A
Recovery		64.5	%	AD	A
Flotation Time		18.0	min	TEC	A
Moly 4th Cleaner Tail Thickening					
Unit Area		0.10	m2/t/d	AD	A
Underflow density		60.0	% solids	AD	A
Feed		13.1	% solids	PC	A
Moly 5th Cleaner Flotation					
Feed		13.0	% solids	PC	A
Feed Grade		33.0	%	PC	A
Concentrate Grade	Mo	42.9	%	PC	A
Recovery		63.5	%	AD	A
Flotation Time		10.0	min	TEC	A
Moly 5th Cleaner Tail Thickening					
Unit Area		0.1	m2/t/d	AD	A
Underflow density		60.0	% solids	AD	A
Feed density		6.3	% solids	PC	A
Moly 6th Cleaner Flotation					
Feed		14.2	% solids	PC	A
Feed Grade		42.9	%	PC	A
Concentrate Grade	Mo	50.0	%	PC	A
Recovery		60.0	%	CC	A
Flotation Time		10.0	min	TEC	A
Moly Concentrate Thickening					
Unit Area		0.1	m2/t/d	AD	A
Underflow density		60.0	% solids	TEC	A
Feed		16.1	% solids	PC	A
Pump Gland Water		1.0	% solids	TEC	A
Moly Concentrate Filtering					
Filtercake Moisture		9.0	%	TEC	A
Pump Gland Water		1.0	% solids	TEC	A
Cloth Wash Water		6.7	% solids	TEC	A
Availabilty		90.0	%	TR	A

Appendix E
Detailed Capital Cost Estimate

Aker Kvaerner E&C
Toromocho Project
Project No 180600

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21Dec06
Rev 6

Summary Capital Cost Estimate - by Area

Description				150,000 tpd Total Installed Cost	92,000 tpd TIC	38 ft SAG + 3 Ball Mills 100,000 tpd TIC	77,000 tpd TIC	65,000 tpd TIC	130,000 tpd TIC
Process Mechanical Equipment									
Area 000	GENERAL			126,533	126,533	126,533	126,533	126,533	126,533
Area 100	PRIMARY CRUSHING,COARSE ORE HANDLING & STOCKPILE			29,668,173	17,533,944	17,533,944	17,268,233	15,832,391	23,042,465
Area 200	GRINDING PLANT			156,811,483	107,927,465	125,700,121	98,701,903	77,735,607	149,257,157
Area 300	FLOTATION & REGRINDING PLANT			32,869,190	30,601,846	30,601,846	26,430,167	21,610,406	42,951,006
Area 400	MOLY PLANT			4,149,661	4,149,661	4,149,661	4,149,661	4,149,661	4,149,661
Area 500	CONCENTRATE THICKENING, FILTRATION & STORAGE			7,069,871	6,931,048	6,931,048	6,734,892	6,060,665	9,502,715
Area 600	TAILINGS THICKENING & WATER RECOVERY			6,044,592	5,282,427	5,282,427	5,074,091	4,891,797	5,777,224
Area 720	SERVICES			9,512,477	9,512,477	9,512,477	9,512,477	9,512,477	9,512,477
Subtotal Process Plant Mechanical Equipment				**246,251,980**	**182,065,401**	**199,838,057**	**167,997,957**	**139,919,538**	**244,319,238**
Earthworks and Civil		20.8%	of Process Mechanical Equipment	51,123,725	37,799,000	41,488,000	34,878,000	29,049,000	50,723,000
Concrete		35.7%	of Process Mechanical Equipment	87,982,550	65,050,000	71,400,000	60,024,000	49,992,000	87,293,000
Structural Steel		24.7%	of Process Mechanical Equipment	60,783,857	44,941,000	49,328,000	41,468,000	34,538,000	60,307,000
Buildings, Architectural		1.3%	of Process Mechanical Equipment	3,247,936	2,402,000	2,636,000	2,216,000	1,846,000	3,223,000
Building Services		0.0%	of Process Mechanical Equipment	-	-	-	-	-	-
Electrical		22.5%	of Process Mechanical Equipment	55,315,682	40,898,000	44,890,000	37,738,000	31,431,000	54,882,000
Instrumentation		7.2%	of Process Mechanical Equipment	17,701,938	13,088,000	14,366,000	12,077,000	10,059,000	17,564,000
Piping		17.4%	of Process Mechanical Equipment	42,764,968	31,619,000	34,705,000	29,176,000	24,299,000	42,430,000
Insulation and Protection		0.0%	of Process Mechanical Equipment						
Subtotal Process Plant Factored Commodities				**318,920,656**	**235,797,000**	**258,813,000**	**217,577,000**	**181,214,000**	**316,422,000**
Subtotal Process Plant				**565,172,636**	**417,862,401**	**458,651,057**	**385,574,957**	**321,133,538**	**560,741,238**
Infrastructure									
Area 710	Plant Infrastructure	4.6%	of Process Plant	25,793,805	19,070,733	19,070,733	19,070,733	19,070,733	19,070,733
Area 730	Transportation & Port Facilities								
Area 740	Mine Infrastructure	5.3%	of Process Plant	30,047,444	22,215,675	22,215,675	22,215,675	22,215,675	22,215,675
Area 750	Mine								
Area 760	Tailings Transport & Reclaim System								
Area 800	Dump Leach,SXEW								
Subtotal Infrastructure				**55,841,249**	**41,286,407**	**41,286,407**	**41,286,407**	**41,286,407**	**41,286,407**
Total Direct Cost				**621,013,885**	**459,148,808**	**499,937,464**	**426,861,364**	**362,419,946**	**602,027,645**
Indirect Costs									
920	EPCM Services	13.0%	of Direct Cost	87,105,000	59,689,345	64,991,870	55,491,977	47,114,593	78,263,594
920	Construction Field Indirects	7.0%	of Direct Cost	46,903,000	32,140,417	34,995,623	29,880,295	25,369,396	42,141,935
920	Capital Spare Parts	1.8%	of Direct Cost	12,382,000	8,264,679	8,998,874	7,683,505	6,523,559	10,836,498
920	Vendor Supervision	0.7%	of Direct Cost	4,651,000	3,214,042	3,499,562	2,988,030	2,536,940	4,214,194
920	Ocean Freight (All Equipments FOB)	3.0%	of Direct Cost	20,279,000	13,774,464	14,998,124	12,805,841	10,872,598	18,060,829
920	Import Duties,Taxes & Transport	1.7%	of Direct Cost	11,633,000	7,805,530	8,498,937	7,256,643	6,161,139	10,234,470
920	Inland Freight to Site	1.0%	of Direct Cost	6,974,000	4,591,488	4,999,375	4,268,614	3,624,199	6,020,276
920	Oversize & Special Freight to Site	0.2%	of Direct Cost	1,238,000	918,298	999,875	853,723	724,840	1,204,055
920	First Fills and Inventory	0.7%	of Direct Cost	4,375,000	3,214,042	3,499,562	2,988,030	2,536,940	4,214,194
920	Third Party Engineering	0.3%	of Direct Cost	2,000,000	1,377,446	1,499,812	1,280,584	1,087,260	1,806,083
920	Start-up/Commissioning Support	0.7%	of Direct Cost	5,000,000	3,214,042	3,499,562	2,988,030	2,536,940	4,214,194
920	Environmental		Fixed Cost	4,951,000	4,951,000	4,951,000	4,951,000	4,951,000	4,951,000
Subtotal Indirect Cost				**207,491,000**	**143,154,791**	**155,432,177**	**133,436,271**	**114,039,404**	**186,161,321**
Subtotal Direct & Indirect Costs				**828,504,885**	**602,303,599**	**655,369,641**	**560,297,635**	**476,459,349**	**788,188,966**
910	Contingency	25.0%	of Direct & Indirect Cost	149,500,000	150,575,900	163,842,410	140,074,409	119,114,837	197,047,242
910	Owner's Cost		Fixed Cost	87,918,000	66,511,000	68,432,000	62,232,000	58,559,000	76,254,000
910	Mine		Fixed Cost	244,030,000	229,903,000	232,509,000	215,979,000	194,204,000	250,790,000
910	Owner's Cost & Mine Contingency	8.5%	of Owner's & Mine	30,930,000	25,195,190	25,579,985	23,647,935	21,484,855	27,798,740
910	Tailings Dam(Contingency Included)			106,377,000	76,666,289	76,666,289	68,048,002	60,746,120	96,651,509
910	ROM Leaching & SXEW (15,000 tpy,contingency included)		Fixed Cost	61,800,000	315,225,000	315,225,000	315,225,000	315,225,000	315,225,000
Project Total				**1,509,060,863**	**1,466,379,978**	**1,537,625,182**	**1,385,503,981**	**1,245,793,162**	**1,751,955,457**

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Mechanical Equipment Capital Cost Estimate

		SNC						38 ft SAG + 3 Ball Mills											
		150,000 tpd			92,000 tpd			100,000 tpd			77,000 tpd			65,000 tpd			130,000 tpd		
Tag / Drawing No	ESTIMATE ITEM	Qty	Unit	Total Cost	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total
	AREA 000-GENERAL																		
OOO-PP-001	Fire System Centrifugal Pump -Electric Drive 200HP-Horizontal	1	c/u	53,101	100%		53,101	100%		53,101	100%		53,101	100%		53,101	100%		53,101
OOO-PP-002	Fire System Centrifugal Pump -Diesel Drive 250HP-Horizontal	1	c/u	69,525	100%		69,525	100%		69,525	100%		69,525	100%		69,525	100%		69,525
OOO-PP-003	Fire Water Jockey Pump 10 HP	1	c/u	3,907	100%		3,907	100%		3,907	100%		3,907	100%		3,907	100%		3,907
Subtotal Area 000				**126,533**			**126,533**			**126,533**			**126,533**			**126,533**			**126,533**
	AREA 100-PRIMARY CRUSHING,COARSE ORE HANDLING & STOCKPILE																		
100-CN-001	Primary Crusher Bridge Crane ,12m Span,75 m Longitudinal travel ,double hook ,30 m lift	1	ea	366,540	100%		366,540	100%		366,540	75%		274,905	60%		219,924	100%		366,540
100-GC-001 / 002	Primary Crushing Service Air Compressor ,Screw Type,Oil free,Air cooled , 825kPa Operating Pressure,2 operating	2	ea	164,488	50%		82,244	50%		82,244	50%		82,244	50%		82,244	100%		164,488
100-AR-001	Primary Crushing Service Air Receiver ,Vertical ,Carbon Steel.	1	ea	6,175	100%		6,175	100%		6,175	100%		6,175	100%		6,175	100%		6,175
100-DY-001	Primary Crushing Instrument Air dryer	1	ea	5,002	100%		5,002	100%		5,002	100%		5,002	100%		5,002	100%		5,002
100-DN-001	Primary Crusher Feed Hopper Dust Suppressor System ,Complete with Water Spray System,spraying Nozzles	1	ea	93,772	100%		93,772	100%		93,772	100%		93,772	100%		93,772	100%		93,772
	Spraying Nozzles and Piping ,Control System																		-
100-DC-001-002	Crusher Discharge Dust Collection System,Complet with Bag Filter Ducting ,centrifugal fan,	2	ea	130,219	50%		65,110	50%		65,110	50%		65,110	50%		65,110	100%		130,219
	stack,rotary valve ,controls,5 capture hoods.																		-
100-RB-001/002	Rock Breaker,Hydraulically powered .with air cooled hydraulic unit,remotely operated,impact energy:	2	ea	754,076	50%		377,038	50%		377,038	50%		377,038	50%		377,038	100%		754,076
	4000 Joules,430-600 bpm,working Pressure;118-167 bar																		-
100-CR-001/002	Primary Crusher ,Gyratory,62" x 75' size ,DSC=6-7",complete with hydraulic Unit and oil-air	2	ea	6,707,447		4,550,000	4,550,000		4,550,000	4,550,000		4,550,000	4,550,000	50%		3,353,724	100%		6,707,447
	oil cooling system.																		-
100-BN-001/002	Crushed Ore bin,Concrete	2	ea																-
100-CH-001/002	Crushed Ore bin Discharge Chute,with lances and its supports,variable thickness plates,300 and	2	ea																-
	500HBN 12,14 and 25 mm thick wearing plates,included in platework Estimate.																		-
100-CH-003/004	Sacrifice Belt Conveyor skirtboard ,comprises 12 mm structural plates and 20 mm thick antiabraison	2	ea																-
	500 BHN plates.included in platework Estimate.																		-
100-TA-001/002	Eccentric Maintenance System ,complete with cart ,hydaulic unit,etc.	2	ea	20,110	50%		10,055	50%		10,055	50%		10,055	50%		10,055	100%		20,110
100-GA-001/002	Gate for Eccentric Maintenance cart ,on concrete wall.	2	ea	11,120	50%		5,560	50%		5,560	50%		5,560	50%		5,560	100%		11,120
100-WI-001/002	Gate Winch for Eccentric maintenance cart	2	ea	10,912	50%		5,456	50%		5,456	50%		5,456	50%		5,456	100%		10,912
100-LF-001	Crushing building Elevator ,for personnel and tools,30 m travel,5 stops	1	ea	221,906	100%		221,906	100%		221,906	100%		221,906	100%		221,906	100%		221,906
100-CN-002/003	Crushed Ore Feeder belt Maintenance hoist,lifting height:5 m	2	ea	39,120	50%		19,560	50%		19,560	50%		19,560	50%		19,560	100%		39,120
100-CN-004/005	Sacrifice Belt maintenance Hoist,lifting height : 14 m	2	ea	39,120	50%		19,560	50%		19,560	50%		19,560	50%		19,560	100%		39,120
100-CN-006	Primary Crusher Motor Maintenance Hoist:lifting height: 5 m	1	ea	19,560	100%		19,560	100%		19,560	100%		19,560	100%		19,560	100%		19,560
																			-
	Crushing Control Room																		-
100-AC-001	Primary Crusher Control Room,7.5 x 9.5 m	71	m2	536,621	60%		321,973	60%		321,973	60%		321,973	60%		321,973	75%		402,466
100-AC-001	Control Room Air conditioner,minisplit type,heat pump type,220v,60hz	1	ea	6,988	100%		6,988	100%		6,988	100%		6,988	100%		6,988	100%		6,988
																			-
	Crusher Electric Room 100-ER-001																		-
100-AC-002	Air conditioner for Crushing Electric Room 100-ER-001 heavy duty split type ,precision A/C unit, Air	1	ea	6,956	100%		6,956	100%		6,956	100%		6,956	100%		6,956	100%		6,956
	Cooled condenser,for room cooling purposes,to keep temperature between 10and 30C.																		-
100-FE-001/002	Crushed Ore belt Feeder,96" wide x 9,5 m long ,horizontal,SS head pulley,Variable Speed with VFD	2	ea	1,442,762	40%		577,105	40%		577,105	40%		577,105	35%		504,967	70%		1,009,933
100-CV-001	Crushed Ore Sacrifice Belt Conveyor,120" wide x 79 m long ,horizontal,indoors	1	ea	696,306	100%		696,306	100%		696,306	75%		522,230	60%		417,784	90%		626,675
100-CV-002	Crushed Ore belt Conveyor 72" wide x 2,080 m long ,6o inclination,in Tunnel	1	ea	13,518,431		8,898,000	8,898,000		8,898,000	8,898,000		8,898,000	8,898,000		8,890,000	8,890,000		10,668,000	10,668,000
100-CV-003	Crushed Ore Belt Conveyor and Tripper,120" wide x 209 m long , inclination = 15o,with one side walkway	1	ea	3,083,766	0%		-	0%		-	0%		-	0%		-	0%		-
100-MA-001/002	Belt Feeder Magnetic Seperator ,96" wide belt feeder ,manual cleaning	2	ea	822,720	50%		411,360	50%		411,360	50%		411,360	50%		411,360	100%		822,720
100-MD-001/002	Sacrifice Belt Conveyor Metal Detector.	1	ea	8,648	100%		8,648	100%		8,648	100%		8,648	100%		8,648	200%		17,296
100-WE-001	Belt Scale for Sacrifice Belt Conveyor.	1	ea	5,016		30,000	30,000		30,000	30,000		30,000	30,000		30,000	30,000		30,000	30,000
100-DC-003	Stock Pile Dust Collection System ,complete with bag filter, dusting,centrifugal fan,stack,rotary valve,controls	1	ea	65,110	100%		65,110	100%		65,110	100%		65,110	100%		65,110	100%		65,110
	LINERS & MISCELLANEOUS MECHANICAL																		-
100-ZM-001	Platework A36(chutes,boxes,tanks,etc)	87765	kg	463,399	75%		347,549	75%		347,549	75%		347,549	75%		347,549	90%		417,059
100-ZM-002	Steel Liners 500HB (chutes)	64670	kg	347,925	75%		260,944	75%		260,944	75%		260,944	75%		260,944	90%		313,133
100-ZM-003	Platework in Stainless Steel (chutes)	4280	kg	73,958	75%		55,469	75%		55,469	75%		55,469	75%		55,469	90%		66,562
Subtotal Area 100				**29,668,173**			**17,533,944**			**17,533,944**			**17,268,233**			**15,832,391**			**23,042,465**

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Mechanical Equipment Capital Cost Estimate

		SNC						38 ft SAG + 3 Ball Mills											
		150,000 tpd			92,000 tpd			100,000 tpd			77,000 tpd			65,000 tpd			130,000 tpd		
Tag / Drawing No	ESTIMATE ITEM	Qty	Unit	Total Cost	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total
	AREA 200-GRINDING PLANT																		
	SAG GRINDING																		
200-FE-001 to 016	Stockpile Crushed Ore Belt Feeder,36" wide x 9,5 m ling, horizontal, indoors, variable speed with VFD,	16	ea	4,472,456		2,100,000	2,100,000		2,100,000	2,100,000		1,800,000	1,800,000		1,600,000	1,600,000		3,200,000	3,200,000
	8 operating , 4 stand by.																		-
200-CH-001 to 016	Crushed Ore Stockpile Discharge Chute, with lances and its supports, variable thickness plates, 300 and 500 HBN 12, 14 and 25 mm thick wearing plates, inlcuded in Platework Estimate																		-
200-CV-001 / 002	SAG Mill Ore Feed Belt Conveyor, 72" wide x 83 m long, 4 m lift, 53 m underground, 30 m overground, indoors, fixed speed, with belt scale	2	ea	1,237,528		906,000	906,000		906,000	906,000		820,000	820,000		715,000	715,000		1,430,000	1,430,000
200-ML-001/002	Semiautogenous Mill, gearless, 40' diam x 24.5' lenght	2	ea	46,185,800		28,800,000	28,800,000		24,600,000	24,600,000		24,600,000	24,600,000		21,900,000	21,900,000		43,800,000	43,800,000
200-ML-001A / 002A	Semiautogenous Mill Electric Motor, included with Mill	2	ea	957,600			-			-	0%		-	0%		-	0%		-
200-SN-001 to 004	Vibratory Screen, 12' x 24'	4	ea	1,776,689	50%		888,345	50%		888,345	45%		799,510	40%		710,676	80%		1,421,351
200-SN-005	Vibratory Screen, 12' x 24' (spare screen at warehouse), same characteristics of installed screen	1	ea	416,812	0%		-	0%		-	0%		-	0%		-	0%		-
200-CN-001	SAG Mill Bridge Crane, 36,35 m span x 180 m bridge travel, double hook, 11 m lift, 110/15 t	1	ea	1,073,286	100%		1,073,286	100%		1,073,286	100%		1,073,286	100%		1,073,286	100%		1,073,286
200-CN-002	Ball Mill Bridge Crane, 36,35 m span x 180 m bridge travel, double hood, 11 m lift, 65/15 t	1	ea	935,248	100%		935,248	100%		935,248	100%		935,248	100%		935,248	100%		935,248
200-WE-001 / 002	SAG Mill Ore Feed Belt Scale	2	ea	10,032		35,000	35,000		35,000	35,000		35,000	35,000		35,000	35,000		70,000	70,000
200-LH-001	SAG Mill Liner Machine	1	ea	493,904	100%		493,904	100%		493,904	100%		493,904	100%		493,904	100%		493,904
200-AR-001	SAG Milling Service Air Receiver, vertical, carbon steel	1	ea	7,202	100%		7,202	100%		7,202	100%		7,202	100%		7,202	100%		7,202
200-DY-001	SAG Mill Instrument Air Dryer, dessicant type, regenerative	1	ea	9,209	100%		9,209	100%		9,209	100%		9,209	100%		9,209	100%		9,209
200-AC-004	SAG Mill Control Room Air Conditioner, split type, heat pump type, 220 V 60 HZ	1	ea	15,300	100%		15,300	100%		15,300	100%		15,300	100%		15,300	100%		15,300
200-BN-001	SAG Mill Ball Bin, concrete																		-
200-DO-001	SAG Mill Ball Dosing System, complete with balls hopper load cells, ball discharge device, belt conveyor, ball deviators, etc.	1	ea	94,200	100%		94,200	100%		94,200	100%		94,200	100%		94,200	100%		94,200
																			-
	PEBBLES CRUSHING																		-
200-CV-006/007	Pebbles Belt Conveyor, 36" wide x 80.4 m long, 3°inclination, 4.2 m lift, indoors, SS head pulley	2	ea	415,316	65%		269,955	65%		269,955	60%		249,190	55%		228,424	110%		456,848
200-CV-008/009	Pebbles Belt Conveyor to bin, 36" wide x 114 m long, inclination 9.5°, with walkway, with belt scale, outdoors	2	ea	905,662	65%		588,680	65%		588,680	60%		543,397	55%		498,114	110%		996,228
200-CV-024/025	Pebbles Bin Feed Conveyor, horizontal, 36" wide x 10 m long	2	ea	168,484	65%		109,515	65%		109,515	60%		101,090	55%		92,666	110%		185,332
200-BN-003/004	Pebbles Feed Bin, structural carbon steel, included in Platework Estimate																		-
200-CH-017 to 020	Pebbles Bin Discharge Chute, with lances and its supports, variable thickness plates, 300 and 500 HBN 12, 14 and 25 mm thick wearing plates, included in Platework Estimate																		-
200-FE-017 to 020	Pebbles Belt Feeder, 36" wide x 10.6 m long, horizontal, variable speed with VFD	4	ea	1,092,260	65%		709,969	65%	1,064,954	1,774,923	60%		655,356	55%		600,743	110%		1,201,486
200-CR-001 to 004	Pebbles Crushers, hydrocone type, short head, complete with hydraulic unit and oil-air oil cooling system	4	ea	12,279,304		6,440,000	6,440,000		6,440,000	6,440,000		6,440,000	6,440,000		4,200,000	4,200,000		8,400,000	8,400,000
200-CV-010/011	Crusher Discharge Belt Conveyor, 36' wide x 32.8 m long, horizontal, indoors	2	ea	296,579	50%		148,290	50%		148,290	50%		148,290	50%		148,290	100%		296,579
200-DC-001/004	Crusher Discharge Belt Conveyor Dust Collection System	4	ea	118,240	100%		118,240	100%		118,240	100%		118,240	100%		118,240	100%		118,240
200-DN-001	Pebbles Belt Conveyors Dust Suppression System, 20 dust suppression points	1	ea	62,194	50%		31,097	50%		31,097	100%		62,194	100%		62,194	100%		62,194
200-CV-012/013	Crushed Pebbles to SAG Mill Belt Conveyor No. 1, 36" wide x 146.4 m long, 15°inclination, outdoors, with belt scale	2	ea	956,687	50%		478,344	50%		478,344	50%		478,344	45%		430,509	90%		861,018
200-CV-014/015	Crushed Pebbles to Ball mill Belt Conveyor No. 2, 36" wide x 48.2 m long, 7°inclination, indoors	2	ea	444,141	0%		-	0%		-	0%		-	0%		-	0%		-
200-CV-016/017	Crushed Pebbles Distributor Belt Conveyor, 36" wide x 84 m long, horizontal, outdoors	2	ea	528,579	0%		-	0%		-	0%		-	0%		-	0%		-
200-CV-018/019	Pebbles Plant By Pass Belt Conveyor, 36" wide x 30 m long, 13° inclination, outdoors, with belt scale	2	ea	337,549	50%		168,775	50%		168,775	50%		168,775	50%		168,775	100%		337,549
200-WE-005/006	Belt Scale for Pebbles to SAG Mill Belt Conveyor	2	ea	10,032		25,000	25,000		25,000	25,000		25,000	25,000		25,000	25,000		50,000	50,000
200-CV-020 to 023	Ball Mill Pebbles Feed Belt Conveyor, 36" wide x 20.3 m long, 3° inclination, indoors, with belt scale	4	ea	518,489	0%		-	0%		-	0%		-	0%		-	0%		-
200-WE-007/010	Belt Scale for Pebbles Feed Belt Conveyor	4	ea	20,064	0%		-	0%		-	0%		-	0%		-	0%		-
200-MA-001/002	Pebbles Belt Conveyor Magnetic Separator, over CV-008/009, 36" wide belt, self cleaning	2	ea	93,680	100%		93,680	100%		93,680	100%		93,680	100%		93,680	100%		93,680
200-MA-003/004	Pebbles Belt Conveyor Magnetic Separator, over CV-006/007, 36" wide belt, self cleaning	2	ea	93,680	0%		-	0%		-	100%		93,680	100%		93,680	100%		93,680
200-WE-003/004	Belt Scale for Pebbles Belt Conveyor to Bin	2	ea	10,032		25,000	25,000		25,000	25,000		25,000	25,000		25,000	25,000		50,000	50,000
200-CN-003/004	Secondary Crushers Bridge Crane, 40/15 t, 12.65 m span x 40 m bridge travel, 17 m lifting height, double hook	2	ea	532,386	50%		266,193	50%		266,193	50%		266,193	40%		212,954	100%		532,386
200-AR-002/003	Pebbles Crushing Service Air Receiver, vertical, carbon steel	2	ea	11,667	50%		5,834	50%		5,834	50%		5,834	50%		5,834	100%		11,667
200-DY-002	Pebbles Crushing Air Dryer	1	ea	9,209	100%		9,209	100%		9,209	100%		9,209	100%		9,209	100%		9,209
																			-

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Mechanical Equipment Capital Cost Estimate

		SNC						38 ft SAG + 3 Ball Mills											
		150,000 tpd			92,000 tpd			100,000 tpd			77,000 tpd			65,000 tpd			130,000 tpd		
Tag / Drawing No	ESTIMATE ITEM	Qty	Unit	Total Cost	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total
	BALL MILL GRINDING																		-
200-CY-001 to 004	Cyclone Cluster, with 10 cyclones, 33" diameter	4	ea	2,037,500	125%		2,546,875	145%		2,954,375	110%		2,241,250	95%		1,935,625	150%		3,056,250
200-ML-003 to 006	Ball Mill, gear less, 24.5' diam x 37.5' length	4	ea	58,449,400		49,000,000	49,000,000		69,390,000	69,390,000		46,260,000	46,260,000		32,120,000	32,120,000		64,240,000	64,240,000
200-ML-003A to 006a	Ball Mill Electric Motor, included with mill	4	ea	1,915,200	0%		-	0%		-	0%		-	0%		-	0%		-
200-SU-001/002	SAG Mill Discharge Sump, concrete																		-
200-SU-003/006	Ball Mill Discharge Sump, concrete																		-
200-TK-001/002	Cyclone Cluster Overflow Tank, carbon steel, included in Platework Estimate																		-
200-LH-002	Ball Mill Liner Machine	1	ea	404,518	100%		404,518	100%		404,518	100%		404,518	100%		404,518	100%		404,518
200-CN-005 to 008	Crushed Ore Feeders Maintenance Hoist, 8 m lift	4	ea	49,120	0%		-	0%		-	0%		-	0%		-	0%		-
200-CN-009/010	SAG Feed Belt Conveyor Maintenance Hoist 8 m lift	2	ea	24,560	50%		12,280	50%		12,280	50%		12,280	50%		12,280	100%		24,560
200CN-011/012	Pebbles Magnetic Separator Maintenance Hoist, 8 m lift	2	ea	65,080	100%		65,080	100%		65,080	100%		65,080	100%		65,080	100%		65,080
200-CN-013/014	Pebbles Bin Feed Conveyor Maintenance Hoist, 3 m lift	2	ea	24,560	0%		-	0%		-	0%		-	0%		-	0%		-
200-CN-015/016	Pebbles to Bin Belt Conveyor Maintenance Hoist, 8 m lift	2	ea	65,080	0%		-	0%		-	0%		-	0%		-	0%		-
200-CN-017/020	Pebbles Return Belt conveyor Maintenance Hoist, 6 m lift	4	ea	49,120	0%		-	0%		-	0%		-	0%		-	0%		-
200-CN-021/022	Pebbles To SAG Belt Conveyor Maintenance Hoist, 8 m lift	2	ea	24,560	0%		-	0%		-	0%		-	0%		-	0%		-
200-BN-002	Ball Mill Bin, concrete																		-
200-PP-001 to 004	Ball Mill Feed Pump, 4 operating, horizontal, max. tdh 20,1 mlc, slurry density, 1,6 tm3, variable speed with VFD	4	ea	476,707	0%		-	0%		-	0%		-	0%		-	0%		-
200-PP-005	Ball Mill Feed Pump (Spare Pump at Warehouse), same characteristics of installed pumps	1	ea	106,388	0%		-	0%		-	0%		-	0%		-	0%		-
200-PP-009 to 012	Ball Mill Cyclone Cluster Feed Pump, 4 operating, horizontal, max. tdh 37,5 mlc, slurry density 1,64 t/m3, variable speed with VFD	4	ea	2,204,052	100%		2,204,052		2,314,255	2,314,255	70%		1,542,836	60%		1,322,431	100%		2,204,052
200-PP-013	Ball Mill Cyclone Cluster Feed Pump (Spare Pump at Warehouse), same characteristics of installed pumps	1	ea	516,529	100%		516,529	100%		516,529	70%		361,570	60%		309,917	100%		516,529
200-PP-017 to 019	Grinding area Sump Pump, 2 per SAG line, 1 operating, 1 stand by	3	ea	87,006	100%		87,006	100%		87,006	100%		87,006	100%		87,006	100%		87,006
	Grinding/Flotation control and Eng. Rooms																		-
200-AC-001	Electricla Room No. 1 Air Conditioner, split type, cold only	1	ea	7,344	100%		7,344	100%		7,344	100%		7,344	100%		7,344	100%		7,344
200-AC-002	Electrical Room No. 2 Air Conditioner, split type, cold only	1	ea	7,581	100%		7,581	100%		7,581	100%		7,581	100%		7,581	100%		7,581
200-AC-003	Electrical Toom No. 3 Air Conditioner, split type, cold only	1	ea	15,300	100%		15,300	100%		15,300	100%		15,300	100%		15,300	100%		15,300
																			-
	Liners & Miscellaneous Mechanical																		-
200-ZM-001	Platework A36 Steel (chutes, boxes, lauders, tanks, etc.)	1481514	kg	7,822,394	60%		4,693,436	60%		4,693,436	55%		4,302,317	50%		3,911,197	90%		7,040,155
200-ZM-002	Steel Liners 500 HB (chutes, boxes, etc.)	894483	kg	4,812,319	60%		2,887,391	60%		2,887,391	55%		2,646,775	50%		2,406,160	90%		4,331,087
200-ZM-003	Rubber Liners (chutes, boxes, launders) Thickness 8 mm	1130	m2	90,400	60%		54,240	60%		54,240	55%		49,720	50%		45,200	90%		81,360
200-ZM-004	Stainless Steel Platework (chutes)	55976	kg	967,265	60%		580,359	60%		580,359	55%		531,996	50%		483,633	90%		870,539
Subtotal Area 200				**156,811,483**			**107,927,465**			**125,700,121**			**98,701,903**			**77,735,607**			**149,257,157**
	AREA 300- FLOTATION & REGRINDING PLANT																		
	COLLECTIVE FLOTATION																		
300-CN-001/002	Flotation Bridge Crane,26 m span x 168 m Bridge travel, double hook,30 m lift	2	ea	260,320	0%		-	0%		-	0%		-	0%		-	0%		-
	Rougher Flotation															-			-
300-SA-001/002	Flotation Feed Automatic Sampler, 3 stages	2	ea	51,400	100%		51,400	100%		51,400	100%		51,400	100%		51,400	100%		51,400
300-BX-001 / 002	Distributor Box with Dart Valves, rubber lined carbon steel																		-
300-SU-001/002	Floor Sump, concrete																		-
300-PP-001 to 003	Rougher Floor Sump Pump	3	ea	144,483	40%		57,793	40%		57,793	40%		57,793	40%		57,793	40%		57,793
300-FC-001 to 024	Rougher Flotation Cell, cylindrical, vertical, self-aspired, 8900 cu.ft.	24	ea	13,086,329		10,260,000	10,260,000		10,260,000	10,260,000		8,794,286	8,794,286		7,328,571	7,328,571		14,657,143	14,657,143
300-BX-005	Rougher Tailings Collector Box, concrete																		-
300-SA-003	Rougher Tailings Automatic Sampler, 3 stages	1	ea	25,700	100%		25,700	100%		25,700	100%		25,700	100%		25,700	100%		25,700
																			-
	REGRINDING																		-
300-BX-006	Tailings from Circuit B Distributor Box, rubber lined carbon steel, included in Platework Estimate																		-
300-BX-007 / 008	Regrinding Feed Distributor Box, rubber lined carbon steel, included in Platework Estimate																		-
300-PP-009 to 012	Regrinding hydrocyclone Feed Pump, 4 operating, variable speed with VFD	4	ea	486,944	100%		486,944	100%		486,944	90%		438,250	80%		389,555	160%		779,110
300-PP-013	Regrinding Hydrocyclone Feed Pump, spare pump at warehouse	1	ea	121,736	0%		-	0%		-	0%		-	0%		-	0%		-
300-BX-009/010	Regriding Mill Discharge Box, rubber lined carbon steel, inlcuded in Platework Estimate																		-
300-CY-001 to 004	Hydrocyclone Cluster	4	ea	743,464	75%		557,598	75%		557,598	63%		468,382	50%		371,732	100%		743,464
300-SU-003/004	Regrinding Sump, concrete																		-
300-PP-017 to 019	Regrinding Sump Pump, 2 operating, 1 stand by, max. tdh hold	3	ea	50,103	66%		33,068	66%		33,068	66%		33,068	66%		33,068	66%		33,068
300-ML-001 to 004	Regrinding Vertical Mill	4	ea	9,172,300	150%		13,758,450	150%		13,758,450	0%	12,000,000	12,000,000	0%	9,172,300	9,172,300	0%	18,344,600	18,344,600
300-PP-063 to 066	Vertical Mill Recycle Pump (incl. in Vertimill Supply)	4	ea	3,648	150%		5,472	150%		5,472	150%		5,472	100%		3,648	200%		7,296
300-BN-001	Regrinding Ball mill Bin, concrete																		-

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		SNC						38 ft SAG + 3 Ball Mills											
		150,000 tpd			92,000 tpd			100,000 tpd			77,000 tpd			65,000 tpd			130,000 tpd		
Tag / Drawing No	ESTIMATE ITEM	Qty	Unit	Total Cost	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total
																			-
	FIRST CLEANER FLOTATION																		-
300-BX-011	Distributor Box, rubber lined carbon steel, inlcuded in Platework Estimate																		-
300-FC-025 to 034	First Cleaner Cell, self-aspirated, 4500 cu.ft.	10	ea	2,830,346		950,000	950,000		950,000	950,000	0%	760,000	760,000	0%	760,000	760,000	0%	1,520,000	1,520,000
300-BX-012	First Cleaner Concentrate Box, rubber lined carbon steel																		-
300-PP-021/022/037/038	First Cleaner Concentrate Pump, 3 operating, 1 stand by, variable speed with VFD	4	ea	158,636	50%		79,318	50%		79,318	45%		71,386	40%		63,454	80%		126,909
	SECOND CLEANER FLOTATION																		-
300-FC-035 to 039	Second Cleaner Cell, self-aspirated, 4500 cu.ft.	5	ea	1,421,308		1,540,000	1,540,000		1,540,000	1,540,000		1,320,000	1,320,000	0%	1,100,000	1,100,000	0%	2,200,000	2,200,000
300-BX-013	Second Cleaner Tail Box, rubber lined carbon steel, included in Platework Estimate																		-
300-BX-014	Second Cleaner Concentrate Box, rubber lined carbon steel, included in Platework Estimate																		-
300-PP-023/024	Second Cleaner Tailing Pump, 1 operating, 1 stand by, max. tdh hold, variable speed with VFD, variable speed with VFD	2	ea	30,470	150%		45,705	150%		45,705	130%		39,611	120%		36,564	240%		73,128
300-PP-025/026	Second Cleaner Concentrate Pump, 1 operating, 1 stand by, max tdh hold, variable speed with VFD	2	ea	226,660	50%		113,330	50%		113,330	45%		101,997	40%		90,664	80%		181,328
300-PP-027/028	2nd Cleaner Sump Pump	2	ea	6,330	150%		9,495	150%		9,495	150%		9,495	150%		9,495	150%		9,495
																			-
	THIRD CLEANER FLOTATION																		-
300-BX-015	Third Cleaner Distributor Box, rubber lined carbon steel, included in Platework Estimate																		-
300-CC-001 to 003	Third Cleaner Column Cell, self-aspirated	3	ea	1,002,531		1,100,000	1,100,000		1,100,000	1,100,000		880,000	880,000		880,000	880,000		1,760,000	1,760,000
300-AR-001	Column Cell Air Compressed Receiver, vertical, carbon steel	1	ea	8,570	100%		8,570	100%		8,570	100%		8,570	100%		8,570	100%		8,570
300-SU-006	Third Cleaner Sump, concrete																		-
300-PP-041/042	Third Cleaner Sump Pump	1	ea	10,891	100%		10,891	100%		10,891	100%		10,891	100%		10,891	100%		10,891
300-SA-004	Third Cleaner Concentrate Sampler, 2 stages	1	ea	22,560	100%		22,560	100%		22,560	100%		22,560	100%		22,560	100%		22,560
																			-
	SCAVANGER FLOTATION																		-
300-FC-041/042	Scavanger Flotation Cell, self-aspirated, 3000 cu.ft.	2	ea	503,593		425,000	425,000		425,000	425,000	0%	350,000	350,000	0%	291,667	291,667	0%	583,333	583,333
300-BX-016	Scavenger Flotation Concentrate Box, rubber lined carbon steel, included in Platework Estimate																		-
300-BX-017	Tailing Pumping Box, rubber lined carbon steel, included in Platework Estimate																		-
300-PP-029/030	Scavenger Tailings Pumps, 1 operating, 1 stand by, variable speed with VFD	2	ea	71,342	63%		44,945	63%		44,945	56%		39,952	50%		35,671	100%		71,342
300-PP-031/032	Scavenger Tailings Pumps, 1 operating, 1 stand by, variable speed with VFD	2	ea	226,316	0%		-	0%		-	0%		-	0%		-	0%		-
																			-
	COLLECTIVE CONCENTRATE THICKENER																		-
300-SA-005	Concentrate Automatic Sampler, 2 stages	1	ea	22,560	100%		22,560	100%		22,560	100%		22,560	100%		22,560	100%		22,560
300-TM-001	Collective Concentrate Thickener,Conventional ,65 ft diameter ,complete with carbon steel tank.	1	ea	614,143	0%		-	0%		-	0%		-	0%		-	0%		-
300-PP-039/040	Thickener Discharge Pump,variable speed with VFD	2	ea	42,356	0%		-	0%		-	0%		-	0%		-	0%		-
300-AC-001	Flotation Electrical Room air Conditioner,split type,cold only(SE 300 ER 001)	1	ea	27,770	100%		27,770	100%		27,770	100%		27,770	100%		27,770	100%		27,770
300-FL-001	Electrical Room Presurization Unit ,with fan,dust filters.																		-
																			-
	LINERS & MISCELLANEOUS MECHANICAL																		-
300-ZM-001	Plate work and Liners (chutes,boxes,launders.tanks.etc)	246665	kg	1,302,391	65%		846,554	65%		846,554	60%		781,435	55%		716,315	110%		1,432,630
300-ZM-020	Rubber Liners(chutes,boxes,launders) thickness 8 mm	1517	m2	121,360	65%		78,884	65%		78,884	60%		72,816	55%		66,748	110%		133,496
300-ZM-021	Rubber Liners(chutes,boxes,launders) thickness 12 mm	581	m2	61,290	65%		39,839	65%		39,839	60%		36,774	55%		33,710	110%		67,419
300-ZM-022	Dart Valv ,Diameter 700 mm	8	ea	6,048	0%		-	0%		-	0%		-	0%		-	0%		-
300-ZM-023	Dart Valv ,Diameter 500 mm	7	ea	5,292	0%		-	0%		-	0%		-	0%		-	0%		-
Subtotal Area 300				**32,869,190**			**30,601,846**			**30,601,846**			**26,430,167**			**21,610,406**			**42,951,006**
	AREA 400- MOLY PLANT																		
	ROUGHER FLOTATION																		
400-BX-001	Cu-Mo Concentrate Conditioning Box with H2SO4, polyurethane lined carbon steel, included in Platework Estimate																		-
400-AG-001	Cu-Mo Concentrate Conditioning Box With H2SO4 Agitator	1	ea	10,170	100%		10,170	100%		10,170	100%		10,170	100%		10,170	100%		10,170
400-BX-009	Cu-Mo Concentrate Conditioning Box with NASH, polyurethane lined carbon steel, included in Platework Estimate																		-
400-AG-002	Cu-Mo Concentrate Conditioning Box with NASH Agitator	1	ea	6,780	100%		6,780	100%		6,780	100%		6,780	100%		6,780	100%		6,780
400-PP-001/002	Rougher Flotation Feed Pump, variable speed with VFD	2	ea	43,242	100%		43,242	100%		43,242	100%		43,242	100%		43,242	100%		43,242
400-BX-003	Distribution Box, polyurethane lined carbon steel, with dart-valves																		-
400-FC-001 TO 012	Rougher Flotation Cell, self-aspirated, 500 cu.ft.	12	ea	1,021,440	100%		1,021,440	100%		1,021,440	100%		1,021,440	100%		1,021,440	100%		1,021,440
400-BX-004	Rougher Tailing Pumping Box, polyurethane lined carbon steel																		-
400-PP-026/029	Rougher Tailling Pump, variable speed with VFD	2	ea	60,740	100%		60,740	100%		60,740	100%		60,740	100%		60,740	100%		60,740
400-BX-005	Rougher Concentrate Box, polyurethane lined carbon steel																		-

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		SNC						38 ft SAG + 3 Ball Mills											
		150,000 tpd			92,000 tpd			100,000 tpd			77,000 tpd			65,000 tpd			130,000 tpd		
Tag / Drawing No	ESTIMATE ITEM	Qty	Unit	Total Cost	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total
400-PP-006/007	Rougher Concentrate Pump	2	ea	30,470	100%		30,470	100%		30,470	100%		30,470	100%		30,470	100%		30,470
400-SA-001 to 003	Automatic Sampler, 1 stage	3	ea	34,260	100%		34,260	100%		34,260	100%		34,260	100%		34,260	100%		34,260
400-CN-001	Selective Flotation Bridge Crane, 18 m span, 58 m longitudinal travel, single hook 14 m lift	1	ea	71,271	100%		71,271	100%		71,271	100%		71,271	100%		71,271	100%		71,271
400-SU-001	Rougher Flotation Area Sump, concrete																		-
400-PP-003	Rougher Flotation Area Sump Pump	1	ea	3,165	100%		3,165	100%		3,165	100%		3,165	100%		3,165	100%		3,165
																			-
	FIRST CLEANER FLOTATION																		-
400-FC-013 to 017	First Cleaner Flotation Cell, self-aspirated, 500 cu.ft.	5	ea	447,983	100%		447,983	100%		447,983	100%		447,983	100%		447,983	100%		447,983
400-BX-006	First Cleaner Tailings Box, polyurethane lined carbon steel																		-
400-PP-004/005	Moly Plant: Rougher Tailing Pumps - Horizontal Centrifugal - 25 hp - Slurry Pump	2	c/u	25,298	100%		25,298	100%		25,298	100%		25,298	100%		25,298	100%		25,298
400-PP-009/010	First Cleaner Tailings Pump, variable speed with VFD	2	ea	25,298	100%		25,298	100%		25,298	100%		25,298	100%		25,298	100%		25,298
400-BX-007	First Cleaner Concentrate Box, polyurethane lined carbon steel																		-
400-PP-011/012	First Cleaner Concentrate Pumps, variable speed with VFD	2	ea	25,298	100%		25,298	100%		25,298	100%		25,298	100%		25,298	100%		25,298
400-SU-002	First Cleaner Flotation Area Sump, concrete																		-
400-PP-008	First Cleaner Flotation Area Sump Pump	1	ea	3,165	100%		3,165	100%		3,165	100%		3,165	100%		3,165	100%		3,165
																			-
	SECOND AND THIRD CLEANER FLOTATION																		-
400-FC-018 to 022	Second Cleaner Flotation Cell, self-aspirated, 300 cu.ft.	5	ea	268,969	100%		268,969	100%		268,969	100%		268,969	100%		268,969	100%		268,969
400-FC--023/024	Third Cleaner Flotation Cell, self-aspirated, 300 cu.ft.	2	ea	52,439	100%		52,439	100%		52,439	100%		52,439	100%		52,439	100%		52,439
400-BX-008	Third Cleaner Concentrate Box, polyurethane lined carbon steel																		-
400-PP-021/022	Third Cleaner Concentrate Pump, variable speed with VFD	2	ea	11,748	100%		11,748	100%		11,748	100%		11,748	100%		11,748	100%		11,748
																			-
	FOURTH, FIFTH AND SIXTH CLEANER FLOTATION																		-
400-FC-025 to 036	Fourth Cleaner Flotation Cell, self-aspirated, 50 cu.ft.	12	ea	289,930	100%		289,930	100%		289,930	100%		289,930	100%		289,930	100%		289,930
400-BX-010	Fourth Cleaner Concentrate Box, polyurethane lined carbon steel																		-
400-PP-025/026	Fourth Concentrate Pump, variable speed with VFD	2	ea	9,038	100%		9,038	100%		9,038	100%		9,038	100%		9,038	100%		9,038
400-FC-037 to 042	Fifth Cleaner Flotation Cell, self-aspirated, 50 cu.ft.	6	ea	144,960	100%		144,960	100%		144,960	100%		144,960	100%		144,960	100%		144,960
400-BX-011	Fifth Concentrate Flotation Box, polyurthane lined carbon steel																		-
400-PP-023/024	Fifth concentrate Pump, variable speed with VFD	2	ea	9,038	100%		9,038	100%		9,038	100%		9,038	100%		9,038	100%		9,038
400-FC-043 to 046	Sixth Cleaner Flotation Cell, self-aspirated, 50 cu.ft.	4	ea	96,640	100%		96,640	100%		96,640	100%		96,640	100%		96,640	100%		96,640
400-SU-003	Fourth, Fifth and Sixth Cleaner Flotation Area Sump, concrete																		-
400-PP-027	Fourth, Fifth and Sixth Cleaner Flotation Area Sump Pump	1	ea	3,165	100%		3,165	100%		3,165	100%		3,165	100%		3,165	100%		3,165
400-BX-012 to 014	Fourth, Fifth and Sixth Distribution box, polyurethane lined carbon steel, with dart valves																		-
																			-
	GENERAL																		-
400-DY-001	Instrument Air Dryer	1	ea	5,025	100%		5,025	100%		5,025	100%		5,025	100%		5,025	100%		5,025
																			-
	INTERMEDIATE CONCENTRATE THICKENING																		-
400-TM-001	Intermediate Concentrate Thickener, conventional, 20 ft. diameter, complete with carbon steel tank	1	ea	172,114	100%		172,114	100%		172,114	100%		172,114	100%		172,114	100%		172,114
400-PP-013/014	intermediate Thickener Discharge Pump, variable speed with VFD	2	ea	17,164	100%		17,164	100%		17,164	100%		17,164	100%		17,164	100%		17,164
400-SU-004	Intermediate Thickener Area Sump, concrete																		-
400-PP-015	Intermediate Thickener Area Sump Pump	1	ea	3,165	100%		3,165	100%		3,165	100%		3,165	100%		3,165	100%		3,165
																			-
	Mo CONCENTRATE THICKENING																		-
400-TM-002	Mo Concentrate Thickener, conventional, 20 ft. diameter, complete with carbon steel tank	1	ea	172,114	100%		172,114	100%		172,114	100%		172,114	100%		172,114	100%		172,114
400-PP-016/017	Mo Concentrate Thickener Discharge Pump, variable speed with VFD	2	ea	5,512	100%		5,512	100%		5,512	100%		5,512	100%		5,512	100%		5,512
400-SU-005	Mo Concentrate Thickerner Area Sump, concrete																		-
400-PP-020	Mo Concentrate Thickener Area Sump Pump	1	ea	3,165	100%		3,165	100%		3,165	100%		3,165	100%		3,165	100%		3,165
																			-
	FILTERING AND DRYING																		-
400-TK-001	Mo Concentrate Holding Tank, polyurethane lined carbon steel, included in Platework Estimate	1	ea	41,400	100%		41,400	100%		41,400	100%		41,400	100%		41,400	100%		41,400
400-AG-003	Mo Concentrate Holding Tank Agitator	1	ea	10,170	100%		10,170	100%		10,170	100%		10,170	100%		10,170	100%		10,170
400-PP-018/019	Filter Press Feed Pump, variable speed with VFD, 1 operating, 1 stand by (included in Filter Press Supply)	2	ea	17,164	100%		17,164	100%		17,164	100%		17,164	100%		17,164	100%		17,164
400-PP-030	Filter Press Wash Water Pump, piston type, 40 bar (included in Filter Press Supply)	1	ea	16,701	100%		16,701	100%		16,701	100%		16,701	100%		16,701	100%		16,701
400-ZM-002	Filter Press Cleaning Device (included in Filter Press Supply)																		-
400-FL-001	Moly Concentrate Filter Press 25 m2 area	1	ea	277,403	100%		277,403	100%		277,403	100%		277,403	100%		277,403	100%		277,403
400-FE-001	Moly Concentrate Dryer Feeder, screw type	1	ea	24,104	100%		24,104	100%		24,104	100%		24,104	100%		24,104	100%		24,104
400-DY-002	Moly Concentrate Dryer, multidisc	1	ea	261,486	100%		261,486	100%		261,486	100%		261,486	100%		261,486	100%		261,486
400-HE-001	Thermal Fluid Heater, associated to multidisc dryer	1	ea	44,003	100%		44,003	100%		44,003	100%		44,003	100%		44,003	100%		44,003
400-FE-002	Molybdenum Concentrate Bin Feeder	1	ea	24,104	100%		24,104	100%		24,104	100%		24,104	100%		24,104	100%		24,104
400-BN-001/002	Final Mo Concentrate Bin, included in Platework Estimate																		-
400-PK-001	Mo Concentrate Packing System, 1 t maxibags	1	ea	68,240	100%		68,240	100%		68,240	100%		68,240	100%		68,240	100%		68,240

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Mechanical Equipment Capital Cost Estimate

		SNC			38 ft SAG + 3 Ball Mills														
		150,000 tpd			92,000 tpd			100,000 tpd			77,000 tpd			65,000 tpd			130,000 tpd		
Tag / Drawing No	ESTIMATE ITEM	Qty	Unit	Total Cost	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total
400-WE-001	Mo Concentrate Packing System Scale	1	ea	5,016	100%		5,016	100%		5,016	100%		5,016	100%		5,016	100%		5,016
400-SA-004	Automatic Sampler, 1 stage	1	ea	11,420	100%		11,420	100%		11,420	100%		11,420	100%		11,420	100%		11,420
400-AB-001	Wet Scrubber	1	ea	1,140	100%		1,140	100%		1,140	100%		1,140	100%		1,140	100%		1,140
400-AR-001	Filter Press Air Receiver, vertical, carbon steel	1	ea	5,834	100%		5,834	100%		5,834	100%		5,834	100%		5,834	100%		5,834
400-MH-001	Mo Concentrate Maxibags Forklift	1	ea	30,000	100%		30,000	100%		30,000	100%		30,000	100%		30,000	100%		30,000
400-AC-001	Selective Flotation Electrical Room Air Conditioner, split type, cold only, 220 C, 60 HZ, (SE 400 ER 001)	1	ea	6,988	100%		6,988	100%		6,988	100%		6,988	100%		6,988	100%		6,988
400-AC-002	Control Room Air Conditioner, split type	1	ea	17,438	100%		17,438	100%		17,438	100%		17,438	100%		17,438	100%		17,438
							-			-									-
	LINERS & MISCELLANEOUS MECHANICAL																		-
400-ZM-001	Platework and Liners (chutes, boxes, launders, tanks, etc.)	39,734	kg	209,796	100%		209,796	100%		209,796	100%		209,796	100%		209,796	100%		209,796
400-ZM-002	Rubber Liners (chutes, boxes, launders) thickness 6 mm	12	m2	840	100%		840	100%		840	100%		840	100%		840	100%		840
400-ZM-003	Dart Valv, diameter 200 m	8	ea	3,648	100%		3,648	100%		3,648	100%		3,648	100%		3,648	100%		3,648
Subtotal Area 400				**4,149,661**			**4,149,661**			**4,149,661**			**4,149,661**			**4,149,661**			**4,149,661**
	AREA 500 - CONCENTRATE THICKENING, FILTRATION & STORAGE																		
	THICKENING																		
500-TM-001	CU Concentrate Thickener, conventional type, 20 m diam., complete with carbon steel tank	1	ea	662,678	90%		596,410	90%		596,410	80%		530,142	70%		463,875	100%		662,678
500-BX-001	Distributor Box, with dart valves, rubber lined carbon steel, included in Platework Estimate																		-
500-TK-002/003	CU Concentrate Holding Tank, concrete	2	ea	369,000		215,000	215,000		215,000	215,000		190,000	190,000		170,000	170,000		170,000	170,000
500-AG-002/003	CU Concentrate Holding Tank Agitator	2	ea	54,240		80,000	80,000		80,000	80,000		70,000	70,000		64,000	64,000		64,000	64,000
500-PP-001/002	Thickener Discharge CU Concentrate Pump, horizontal, 1 operating, 1 stand by	2	ea	39,156	100%		39,156	100%		39,156	90%		35,240	80%		31,325	100%		39,156
500-SU-001	Sump, concrete																		-
500-PP-005/006	Thickening Area Sump Pump	2	ea	28,910	50%		14,455	50%		14,455	50%		14,455	50%		14,455	50%		14,455
																			-
	FILTERING																		-
500-TK-001	CU Concentrate Holding Tank, included in Platework Estimate	1	ea	81,000			-			-	0%		-	0%		-	0%		-
500-AG-001	CU Concentrate Holding Tank Agitator	1	ea	40,680			-			-	0%		-	0%		-	0%		-
500-FL-001/002	CU Concentrate Filter Press, 340 m2 area	2	ea	2,375,500		4,000,000	4,000,000		4,000,000	4,000,000		3,960,000	3,960,000		3,550,000	3,550,000		6,000,000	6,000,000
500-PP-003/004	Filter Press Feed Pump, variable speed with VFD, 1 operating, 1 stand by (included in Filter Press Supply)	2	ea	78,345	100%		78,345	100%		78,345	100%		78,345	90%		70,511	140%		109,683
500-PP-013/014	Cloth Filter Wash Pump, 1 operating, 1 stand by, 14 bar	2	ea	81,539	100%		81,539	100%		81,539	100%		81,539	90%		73,385	140%		114,155
500-TK-006	Cloth Filter Water Tank + H181, included in Platework Estimate	1	ea	84,600	100%		84,600	100%		84,600	100%		84,600	90%		76,140	140%		118,440
500-GC-001/003	Filter Press Air Compressor, oil injected, integrated oil filter, integrated air dryer, 2 operating, 1 stand by	3	ea	822,079	70%		575,455	70%		575,455	70%		575,455	60%		493,247	100%		822,079
500-AR-001	Filter Press Air Receiver, 110 psi, vertical, carbon steel	1	ea	7,052	100%		7,052	100%		7,052	100%		7,052	100%		7,052	100%		7,052
500-DY-001/003	Filter Air Dryer (Integrated with Air Compressors Package)																		-
500-CV-001/002	Filter Press Concentrate Belt Conveyor, 48" wide x 16,1 long, horizontal, indoors	2	ea	274,055	50%		137,028	50%		137,028	50%		137,028	40%		109,622	100%		274,055
500-CV-005	Concentrate Belt Conveyor to Stock pile, 24" wide x 71,8 m long, inclination = 15.1°, with belt scale	1	ea	318,216	100%		318,216	100%		318,216	100%		318,216	100%		318,216	100%		318,216
500-SU-002	Sump, concrete															-			-
500-PP-007	Sump Pump	1	ea	8,582	100%		8,582	100%		8,582	100%		8,582	100%		8,582	100%		8,582
500-CV-007	Stock pile Feed Distribution Belt Conveyor	1	ea	337,080	0%		-	0%		-	0%		-	0%		-	0%		-
500-CN-001	Concentrate Filtering Bridge Crane, single beam, 5 t capacity, 12 m span, 20 m longitudinal travel, lifting height	1	ea	71,271	100%		71,271	100%		71,271	100%		71,271	100%		71,271	100%		71,271
500-CV-008/009	Copper Concentrate Stacker Belt Conveyor, 30" wide x 30 m long, inclination = 16.3°, with belt scale	2	ea	330,240	0%		-	0%		-	0%		-	0%		-	0%		-
500-WE-001	Railcars Scale, with concrete pit	1	ea	55,016	100%		55,016	100%		55,016	100%		55,016	100%		55,016	100%		55,016
500-WE-002/003	Stacker Belt Scale	2	ea	10,032	0%		-	0%		-	0%		-	0%		-	0%		-
500-WE-004	Concentrate Belt Conveyor to Stock pile Belt Scale	1	ea	5,016		25,000	25,000		25,000	25,000		25,000	25,000		25,000	25,000		25,000	25,000
500-DC-001	Stockpile Dust Collector	1	ea	65,110	100%		65,110	100%		65,110	100%		65,110	100%		65,110	100%		65,110
500-MG-001/002	Concentrate Front End Loader	2	ea	200,000	100%		200,000	100%		200,000	100%		200,000	100%		200,000	100%		200,000
500-AC-001	Concentrate Thickening Electrical Room Air Conditioner, split type, cold only, 220 V, 60 Hz	1	ea	6,988	100%		6,988	100%		6,988	100%		6,988	100%		6,988	100%		6,988
500-AC-002	Control Room Air conditioner,minisplit type,heat pump type,220v,60hz	1	ea	16,963	100%		16,963	100%		16,963	100%		16,963	100%		16,963	100%		16,963
																			-
	WATER RECOVERY																		-
500-TM-002	Clarifier, complete with carbon steel tank	1	ea	128,400	0%		-	0%		-	0%		-	0%		-	0%		-
500-PP-009/010	Clarifier underflow Pump, horizontal, centrifugal	2	ea	16,274	0%		-	0%		-	0%		-	0%		-	0%		-
500-TK-004/005	Clarifier Water Tank, carbon steel, included in Platework Estimate	2	ea	99,000	0%		-	0%		-	0%		-	0%		-	0%		-
500-PP-011/012	Clarified Water Pump, horizontal, centrifugal	2	ea	62,121	0%		-	0%		-	0%		-	0%		-	0%		-
																			-
	LINERS & MISCELLANEOUS MECHANICAL																		-
500-ZM-001	Platework and Liners (chutes, boxes, launders, tanks, etc.)	64359	kg	339,816	75%		254,862	75%		254,862	60%		203,890	50%		169,908	100%		339,816
500-ZM-002	Dart Valv, Diameter 200 mm	2	ea	912	0%		-	0%		-	0%		-	0%		-	0%		-

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Mechanical Equipment Capital Cost Estimate

		SNC						38 ft SAG + 3 Ball Mills											
		150,000 tpd			92,000 tpd			100,000 tpd			77,000 tpd			65,000 tpd			130,000 tpd		
Tag / Drawing No	ESTIMATE ITEM	Qty	Unit	Total Cost	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total
Subtotal Area 500				**7,069,871**			**6,931,048**			**6,931,048**			**6,734,892**			**6,060,665**			**9,502,715**
	AREA 600 - TAILINGS THICKENING & WATER RECOVERY																		
	TAILINGS THICKENING																		
600-BX-001	Distributor Box, concrete, with dart valves, concrete																		-
600-TM-001 to 002	High Rate Thickener, diam: 100 m	2	ea	2,604,198	72%		1,875,023	72%		1,875,023	64%		1,666,687	57%		1,484,393	91%		2,369,820
600-TK-001/002	Thickener Tank, concrete																		-
600-BX-002	Thickener Tailings Discharge Collector Box, concrete																		-
600-SU-001	Tailing Thickener Area sump, concrete																		-
600-PP-001/002	Tailing Thickener Area Sump Pump, one operating, one stand by	2	ea	65,980	50%		32,990	50%		32,990	50%		32,990	50%		32,990	50%		32,990
																			-
	WATER RECOVERY																		-
600-PD-001	RECOVERED PROCESS WATER POND, EARTH, LINED, Incl. Civil Estimate.																		-
600-PP-008 to 013	Recovery Water Pumps - Vertical Centrifugal - 1750 hp	6	c/u	1,910,700	100%		1,910,700	100%		1,910,700	100%		1,910,700	100%		1,910,700	100%		1,910,700
600-AC-001	ELECTRICAL ROOM AIR CONDITIONER, minisplit type, heat pump type, cold only, 220V, 60HZ	1	ea	16,963	100%		16,963	100%		16,963	100%		16,963	100%		16,963	100%		16,963
600-PK-001	FLOCULANT PLANT (COMPACT TYPE-SUPPLIED AS A PACKAGE INCLUDING POWER PANEL)	1	ea	810,205	100%		810,205	100%		810,205	100%		810,205	100%		810,205	100%		810,205
600-BN-001	FLOCULANT BIN, carbon steel, Included in package																		-
600-FE-001	FLOCULANT SCREW FEEDER, Included in package																		-
600-RE-001	CONTACT REACTOR, Included in package																		-
600-TK-003	FLOCULANT DILUTION TANK, Included in package																		-
600-AG-001	FLOCULANT DILUTION TANK AGITATOR, Included in package																		-
600-PP-015/016	Floculant Transfer Pumps - Positive Displacement - 7.5 hp, Included in package																		-
																			-
	FLOCULANT DISTRIBUTION																		-
600-TK-005	FLOCULANT DISTRIBUTION TANK, carbon steel, Included in Platework Estimate	1	ea	184,500	100%		184,500	100%		184,500	100%		184,500	100%		184,500	100%		184,500
600-PP-017/018	Floculant Distribution Pumps - Positive Displacement - 20 hp	2	ea	21,688	100%		21,688	100%		21,688	100%		21,688	100%		21,688	100%		21,688
600-MX-001/002	FLOCULANT DILUTION MIXER	2	ea	11,003	100%		11,003	100%		11,003	100%		11,003	100%		11,003	100%		11,003
600-CN-001	FLOCULANT PREPARATION CRANE HOIST	1	c/u	7,280	100%		7,280	100%		7,280	100%		7,280	100%		7,280	100%		7,280
																			-
	LINERS & MISCELANEOUS MECHANICAL																		-
600-ZM-001	PLATEWORK AND LINERS (chutes, boxes,launders, tanks, etc)	76099	kg	406,027	100%		406,027	100%		406,027	100%		406,027	100%		406,027	100%		406,027
600-ZM-	DART VALV, DIAMETER 700 mm	8	ea	6,048	100%		6,048	100%		6,048	100%		6,048	100%		6,048	100%		6,048
Subtotal Area 600				**6,044,592**			**5,282,427**			**5,282,427**			**5,074,091**			**4,891,797**			**5,777,224**
	AREA 720- SERVICES																		
	LINERS & MISCELLANEOUS MECHANICAL																		
700-ZM-001	PLATEWORK AND LINERS (chutes, boxes, launders, tanks, etc)	290634	kg	1,534,548	100%		1,534,548	100%		1,534,548	100%		1,534,548	100%		1,534,548	100%		1,534,548
700-ZM-	DART VALV, DIAMETER 700 mm	2	ea	1,512	100%		1,512	100%		1,512	100%		1,512	100%		1,512	100%		1,512
																			-
	LIME STORAGE																		-
700-BN-001/003	CAUSTIC LIME STORAGE BIN, wit dust collector system, Included in Platework Estimate																		-
700-AT-001/003	CAUSTIC LIME STORAGE BIN ACTIVATOR	3	ea	66,840	100%		66,840	100%		66,840	100%		66,840	100%		66,840	100%		66,840
700-PN-001	LIME PNEUMATIC TRANSPORT SYSTEM	1	ea	9,560	100%		9,560	100%		9,560	100%		9,560	100%		9,560	100%		9,560
700-AR-001	DUST COLLECTION SYSTEM AIR RECIEVER, vertical, carbon steel	1	ea	5,834	100%		5,834	100%		5,834	100%		5,834	100%		5,834	100%		5,834
700-DY-001	DUST COLLECTION SYSTEM AIR DRYER	1	ea	5,025	100%		5,025	100%		5,025	100%		5,025	100%		5,025	100%		5,025
700-PK-001	MILK OF LIME PLANT (COMPACT TYPE-SUPPLIED AS A PACKAGE WITHOUT POWER PANEL)	1	ea	1,325,750	100%		1,325,750	100%		1,325,750	100%		1,325,750	100%		1,325,750	100%		1,325,750
700-BN-004-005	CAUSTIC LIME BIN, with dust collector system, Included in package																		-
700-DC-001/002	SILO DUST COLLECTION LOADING SYSYTEM, Included in package																		-
700-AT-004/005	CAUSTIC LIME BIN ACTIVATOR, Included in package																		-
700-FE-001/002	LIME FEEDER, screw type, with VFD, Included in package																		-
700-FE-003/004	LIME FEEDER, rotary valve type, included in package																		-
700-TK-001/002	SLAKER, Included in package																		-
700-HE-001 to 004	SLAKER HEATER, 2 per slaker, Included in package																		-
700-AG-001/002	SLAKER TANK AGITATOR, Included in package																		-
700-DC-003/004	GAS CLEANING SYSTEM, Included in package																		-
700-TK-003/004	DILUTION CONTROL TANK, Included in package																		-
700-AG-003/004	MILK OF LIME AGITATOR, Included in package																		-
700-PP-025 @ 028	Milk Of Lime Plant: Recirculating Pumps, Included in package																		-
700-PP-029 @ 032	Milk Of Lime Plant: Transfer Pumps, Included in package																		-
																			-
	MILK OF LIME DISTRIBUTION																		-
700-BX-001	Distribution Box ,carbon steel,with dart valves.																		-

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Toromocho Project
Project No 180600

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Rev 6

Mechanical Equipment Capital Cost Estimate

		SNC						38 ft SAG + 3 Ball Mills											
		150,000 tpd			92,000 tpd			100,000 tpd			77,000 tpd			65,000 tpd			130,000 tpd		
Tag / Drawing No	ESTIMATE ITEM	Qty	Unit	Total Cost	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total
700-TK-005/008	Distribution Tank, carbon steel, included in Platework Estimate																		-
700-AG-005/008	Distribution Tank Agitator	4	ea	162,720	100%		162,720	100%		162,720	100%		162,720	100%		162,720	100%		162,720
700-PP-033 @ 036	Milk of Lime Plant: Loop Feed Pumps	4	c/u	86,484	100%		86,484	100%		86,484	100%		86,484	100%		86,484	100%		86,484
700-SU-001/002	Sump, concrete																		-
700-PP-037-038	Milk of Lime Plant: Sump Pumps - Verticla Centrifugal	2	c/u	6,330	100%		6,330	100%		6,330	100%		6,330	100%		6,330	100%		6,330
700-CN-001	Hoist (portable)	1	ea	13,192	100%		13,192	100%		13,192	100%		13,192	100%		13,192	100%		13,192
																			-
	REAGENT PLANT																		-
	Copper Principal Collector (PAX)																		-
700-BN-001	PAX Collector Bin, carbon steel, inlcuded in Platework Estimate																		-
700-TK-010	PAX Reagent Preparation Tank, carbon steel, included in Platework Estimate	1	ea	13,500	100%		13,500	100%		13,500	100%		13,500	100%		13,500	100%		13,500
700-AG-009	PAX Reagent Preparation Tank Agitator	1	ea	2,034	100%		2,034	100%		2,034	100%		2,034	100%		2,034	100%		2,034
700-PP-039-040	Reagent Plant: Reagent Transfer Pumps - Copper Principal Collector	2	c/u	5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670
700-TK-011	PAX Reagent Distribution Tank, carbon steel, included in Platework Estimate	1	ea	36,000	100%		36,000	100%		36,000	100%		36,000	100%		36,000	100%		36,000
700-PP-041 @ 043	Reagent Plant: Metering Pumps - Copper Principal Collector	3	c/u	27,585	100%		27,585	100%		27,585	100%		27,585	100%		27,585	100%		27,585
																			-
	Copper Secondary Collector (AF-238)																		-
700-TK-012	AF-238 Reagent Storage Tank, carbon steel, included in Platework Estimate	1	ea	40,500	100%		40,500	100%		40,500	100%		40,500	100%		40,500	100%		40,500
700-PP-044 -045	Reagent Plant: Reagent Transfer Pumps - Copper Secondary Collector	2	c/u	5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670
700-TK-013	AF-238 Reagent Distribution Tank, carbon steel, inlcuded in Platework Estimate	1	ea	9,000	100%		9,000	100%		9,000	100%		9,000	100%		9,000	100%		9,000
700-PP-046 @ 048	Reagent Plant: Metering pumps - Copper Secondary Collector	3	c/u	27,585	100%		27,585	100%		27,585	100%		27,585	100%		27,585	100%		27,585
	Copper auxiliar collector (SEX)																		-
700-BN-002	SEX Collector Bin, carbon steel, included in Platework Estimate																		-
700-TK-014	SEX Reagent Preparation Tank, carbon steel, included in Platework Estimate	1	ea	13,500	100%		13,500	100%		13,500	100%		13,500	100%		13,500	100%		13,500
700-AG-010	SEX Reagent Preparation Tank Agitator	1	ea	2,034	100%		2,034	100%		2,034	100%		2,034	100%		2,034	100%		2,034
700-PP-049 050	Reagent Plan: Reagent Transfer Pumps - Copper Auxiliary Collector	2	c/u	5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670
700-TK-015	SEX Reagent Distribution Tank, carbon steel, included in Platework Estimate	1	ea	36,000	100%		36,000	100%		36,000	100%		36,000	100%		36,000	100%		36,000
700-P-051 @ 053	Reagent Plant: Metering Pumps - Copper Auxiliary Collector	3	c/u	27,585	100%		27,585	100%		27,585	100%		27,585	100%		27,585	100%		27,585
																			-
	Frother (MIBC)																		-
700-PP-016	Frother Reagent Storage Tank, carbon steel, included in Platework Estimate	1	ea	40,500	100%		40,500	100%		40,500	100%		40,500	100%		40,500	100%		40,500
700-PP-054 -055	Reagent Plant: Reagent Transfer Pumps - Flocculant	2	c/u	6,856	100%		6,856	100%		6,856	100%		6,856	100%		6,856	100%		6,856
700-TK-017	Frother Reagent Distribution Tank to SAG Plant, carbon steel, included in Platework Estimate	1	ea	22,500	100%		22,500	100%		22,500	100%		22,500	100%		22,500	100%		22,500
700-PP-058 @ 058	Reagent Plant: Metering Pumps - Flocculant	3	ea	27,585	100%		27,585	100%		27,585	100%		27,585	100%		27,585	100%		27,585
700-TK-018	Frother Reagent Distribution Tank to Circuit B, carbon steel, included in Platework Estimate	1	ea	4,500	100%		4,500	100%		4,500	100%		4,500	100%		4,500	100%		4,500
700-PP-059 @ 061	Reagent Plant: Metering Pumps - Flocculant	3	c/u	8,505	100%		8,505	100%		8,505	100%		8,505	100%		8,505	100%		8,505
																			-
	Molybdenum Collector (Diesel Oil No. 1)																		-
700-TK-019	Diesel Oil No. 1 Reagent Storage Tank, carbon steel, included in Platework Estimate	1	ea	31,500	100%		31,500	100%		31,500	100%		31,500	100%		31,500	100%		31,500
700-PP-062-063	Reagent Plant: Reagent Transfer Pumps - Diesel No. 1	2	c/u	5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670
700-TK-020	Diesel Oil No. 1 Reagent Distribution Tank to SAG Plant, carbon steel, included in Platework Estimate	1	ea	9,000	100%		9,000	100%		9,000	100%		9,000	100%		9,000	100%		9,000
700-PP-054 @ 066	Reagent Plant: Metering Pumps - Diesel No. 1	3	c/u	27,585	100%		27,585	100%		27,585	100%		27,585	100%		27,585	100%		27,585
700-TK-021	Diesel Oil No. 1 Reagent Distribution Tank to Circuit A, carbon steel, include din Platework Estimate	1	ea	4,500	100%		4,500	100%		4,500	100%		4,500	100%		4,500	100%		4,500
700-PP-067 @ 069	Reagent Plant: Metering Pumps - Diesel no. 1	3	ea	27,585	100%		27,585	100%		27,585	100%		27,585	100%		27,585	100%		27,585
																			-
	Molybdenum Collector (Diesel Oil No. 2)																		-
700-TK-022	Diesel Oil No. 2 Reagent Storage Tank, carbon steel, included in Platework Estimate	1	ea	45,000	100%		45,000	100%		45,000	100%		45,000	100%		45,000	100%		45,000
700-PP-070-071	Reagent Plant: Reagent Transfer Pumps - Diesel no. 2	2	ea	5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670
700-TK-023	Diesel Oil No. 2 Reagent Distribution Tank to Circuit B, carbon steel, included in Platework Estimate	1	ea	18,000	100%		18,000	100%		18,000	100%		18,000	100%		18,000	100%		18,000
700-PP-072-073	Reagent plant: Metering Pumps - Diesel No. 2	2	ea	18,390	100%		18,390	100%		18,390	100%		18,390	100%		18,390	100%		18,390
700-TK-024	Diesel Oil No. 2 Reagent Distribution Tank to Circuit C, carbon steel, included in Platework Estimate	1	ea	18,000	100%		18,000	100%		18,000	100%		18,000	100%		18,000	100%		18,000
700-PP-074-075	Reagent Plant: Metering Pumps - Diesel No. 2	2	c/u	18,390	100%		18,390	100%		18,390	100%		18,390	100%		18,390	100%		18,390
																			-
	Molybdenum and Talc Depressor (CMC)																		-
700-BN-003	CMC Collector Bin, carbon steel, included in Platework Estimate		ea																-

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		SNC						38 ft SAG + 3 Ball Mills											
		150,000 tpd			92,000 tpd			100,000 tpd			77,000 tpd			65,000 tpd			130,000 tpd		
Tag / Drawing No	ESTIMATE ITEM	Qty	Unit	Total Cost	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total
700-TK-025	CMC Reagent Preparation Tank, carbon steel, included in Platework Estimate	1	ea	20,250	100%		20,250	100%		20,250	100%		20,250	100%		20,250	100%		20,250
700-AG-011	CMC Reagent Preparation Tank Agitator	1	ea	2,034	100%		2,034	100%		2,034	100%		2,034	100%		2,034	100%		2,034
700-PP-076 to 077	Reagent Plant: Reagent Transfer Pumps - Moly and Talc Depressor	2	c/u	6,330	100%		6,330	100%		6,330	100%		6,330	100%		6,330	100%		6,330
700-TK-026	CMC Reagent Distribution Tank, carbon steel, included in Platework Estimate	1	ea	40,500	100%		40,500	100%		40,500	100%		40,500	100%		40,500	100%		40,500
700-PP-078 to 080	Reagent Plant: Metering Pumps - Moly and Talc Depressor	3	c/u	27,585	100%		27,585	100%		27,585	100%		27,585	100%		27,585	100%		27,585
																			-
	Copper Depressor (NaHs)																		-
700-TK-027	NaHS Reagent Storage Tank, carbon steel, insulated, included in Platework Estimate	1	ea	63,000	100%		63,000	100%		63,000	100%		63,000	100%		63,000	100%		63,000
700-PP-081-082	Reagent Plant: Loop Feed Pumps - Sulphuric Acid	2	c/u	5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670
700-TK-028	NaHS Reagent Preparation Tank, carbon steel, included in Platework Estimate	1	ea	20,250	100%		20,250	100%		20,250	100%		20,250	100%		20,250	100%		20,250
700-AG-012	NaHS Reagent Preparation Tank Agitator	1	ea	2,034	100%		2,034	100%		2,034	100%		2,034	100%		2,034	100%		2,034
700-PP-083-084	Reagent Plant: Reagent Transfer Pumps - Sulphuric Acid	2	c/u	5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670
700-TK-029	NaHS Reagent Distribution Tank, carbon steel, included in Platework Estimate	1	ea	42,750	100%		42,750	100%		42,750	100%		42,750	100%		42,750	100%		42,750
700-PP-085-088	Reagent Plant: Reagent Transfer Pumps - Sulphuric Acid	2	c/u	5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670
																			-
	Sulphuric Acid																		-
700-TK-030	Sulphuric Acid Storage and Distribution Tank, carbon steel, included in Platework Estimate	1	ea	36,000	100%		36,000	100%		36,000	100%		36,000	100%		36,000	100%		36,000
700-PP-087-088	Reagent Plant: Loop feed Pumps - Sulphuric Acid	2	c/u	5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670	100%		5,670
																			-
	Concentrate Flocculant *HYCHEM 650)																		-
700-BN-004	HHYCHEM Collector Bin, carbon steel, included in Platework Estimate		ea																-
700-FE-006	HYCHEM Screw Feeder	1	ea	24,104	100%		24,104	100%		24,104	100%		24,104	100%		24,104	100%		24,104
700-MX-001	Circuit B Static Mixer for Flocculant/Water	1	ea	5,502	100%		5,502	100%		5,502	100%		5,502	100%		5,502	100%		5,502
700-TK-031	HYCHEM Reagent Preparation Tank, carbon steel, included in Platework Estimate	1	ea	49,500	100%		49,500	100%		49,500	100%		49,500	100%		49,500	100%		49,500
700-AG-013	HYCHEM Reagent Preparation Tank Agitator	1	ea	10,170	100%		10,170	100%		10,170	100%		10,170	100%		10,170	100%		10,170
700-PP-089-090	Reagent Plant: Reagent Transfer Pumps - Concentrate Flocculant	2	c/u	912	100%		912	100%		912	100%		912	100%		912	100%		912
700-TK-032	HYCHEM Reagent Circuit a-C Distribution Tank, carbon steel, included in Platework Estimate	1	ea	42,750	100%		42,750	100%		42,750	100%		42,750	100%		42,750	100%		42,750
700-PP-091 to 094	Reagent Plant: Metering Pumps - concentrate Flocculant	4	c/u	1,824	100%		1,824	100%		1,824	100%		1,824	100%		1,824	100%		1,824
700-TK-033	HYCHEM Reagent Circuit B Distribution Tank, carbon steel, included in Platework Estimate	1	ea	36,000	100%		36,000	100%		36,000	100%		36,000	100%		36,000	100%		36,000
700-PP-095 -096	Reagent Plant: Metering Pumps - Concentrate Flocculant	2	c/u	18,390	100%		18,390	100%		18,390	100%		18,390	100%		18,390	100%		18,390
700-MX-002	HYCHEN Static Mixer	4	ea	22,006	100%		22,006	100%		22,006	100%		22,006	100%		22,006	100%		22,006
700-MX-003	HYCHEN Static Mixer	4	ea	22,006	100%		22,006	100%		22,006	100%		22,006	100%		22,006	100%		22,006
700-MX-004	HYCHEN Static Mixer	4	ea	22,006	100%		22,006	100%		22,006	100%		22,006	100%		22,006	100%		22,006
700-MX-005	HYCHEN Static Mixer	4	ea	22,006	100%		22,006	100%		22,006	100%		22,006	100%		22,006	100%		22,006
700-MH-001	General Service Forklift	1	ea	30,000	100%		30,000	100%		30,000	100%		30,000	100%		30,000	100%		30,000
																			-
	Others																		-
700-GC-001 TO 005	Plant Service and Instrument Air Compressor, oil free, screw type, water cooled, 825 kPa operating pressure, 4 operating, 1 as stand by	5	ea	1,370,132	100%		1,370,132	100%		1,370,132	100%		1,370,132	100%		1,370,132	100%		1,370,132
700-AR-001	Service Air Receiver	1	ea	6,026	100%		6,026	100%		6,026	100%		6,026	100%		6,026	100%		6,026
700-DY-001	Instrument Air Dryer	1	ea	5,025	100%		5,025	100%		5,025	100%		5,025	100%		5,025	100%		5,025
	Water Supply and Distribution																		-
	Kings Mill																		-
700-PP-001 to 012	Kingsmill Tunnel Pumps of Water System - Vertical Centrifugal - 800 hp	12	c/u	1,983,096	100%		1,983,096	100%		1,983,096	100%		1,983,096	100%		1,983,096	100%		1,983,096
700-PP-013	Kingsmill Tunnel Pumps of Water System - Vertical Centrifugal - 800 hp - Spare	1	c/u	157,962	100%		157,962	100%		157,962	100%		157,962	100%		157,962	100%		157,962
700-PP-019 @ 022/097 @	Huacracocha Lake Pumps of Water System - Vertical Centrifugal - 700 hp	8	c/u	1,212,312	100%		1,212,312	100%		1,212,312	100%		1,212,312	100%		1,212,312	100%		1,212,312
																			-
	Huacracocha																		-
700-PP-023	Huacracocha Lake Water Pump, spare at warehouse, same characteristics of installed pumps	1	ea	145,155	100%		145,155	100%		145,155	100%		145,155	100%		145,155	100%		145,155
700-AC-001	Main Substation Electrical Room Air Conditioner, split type, cold only	1	ea	7,106	100%		7,106	100%		7,106	100%		7,106	100%		7,106	100%		7,106
700-FL-001	Main Substation Electrical Room Pressurization Unit, with fan, dust filters																		-
700-AC-002	Electrical Room Air Conditioner	1	ea	28,957	100%		28,957	100%		28,957	100%		28,957	100%		28,957	100%		28,957
700-AC-003	Electrical Room Air Conditioner	1	ea	16,963	100%		16,963	100%		16,963	100%		16,963	100%		16,963	100%		16,963
700-AC-004/009	Electrical Room Air Conditioner	6	ea	72,564	100%		72,564	100%		72,564	100%		72,564	100%		72,564	100%		72,564
700-AC-010/011	Electrical Room Air Conditioner	2	ea	33,926	100%		33,926	100%		33,926	100%		33,926	100%		33,926	100%		33,926
	Allowance HVAC other Buildings 700	1	lot	72,800	100%		72,800	100%		72,800	100%		72,800	100%		72,800	100%		72,800

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		SNC						38 ft SAG + 3 Ball Mills											
		150,000 tpd			92,000 tpd			100,000 tpd			77,000 tpd			65,000 tpd			130,000 tpd		
Tag / Drawing No	ESTIMATE ITEM	Qty	Unit	Total Cost	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total
Subtotal Area 720				**9,512,477**			**9,512,477**			**9,512,477**			**9,512,477**			**9,512,477**			**9,512,477**
	AREA 740-MINE INFRASTRUCTURE																		
	TRUCK WASHING SYSTEM																		
700-ZM-	High Pressure Water Cannon, 100 gpm @ 125 psi	2	ea	31,368	100%		31,368	100%		31,368	100%		31,368	100%		31,368	100%		31,368
700-ZM-	High Pressure Water Hose, 23 m reel, pedestal mounted	2	ea	4,456	100%		4,456	100%		4,456	100%		4,456	100%		4,456	100%		4,456
700-PP-	High Pressure Wash Water Pumps	6	ea	31,824	100%		31,824	100%		31,824	100%		31,824	100%		31,824	100%		31,824
700-SK-	Oil Skimmer	1	ea	5,000	100%		5,000	100%		5,000	100%		5,000	100%		5,000	100%		5,000
700-TK-	Cold Wash Water Tank, included in Platework Estimate	1	ea	58,500	100%		58,500	100%		58,500	100%		58,500	100%		58,500	100%		58,500
700-TK-	Hot Wash Water Tank, included in Platework Estimate	1	ea	31,500	100%		31,500	100%		31,500	100%		31,500	100%		31,500	100%		31,500
700-MI-	Steam Washing Machine	1	ea	10,000	100%		10,000	100%		10,000	100%		10,000	100%		10,000	100%		10,000
700-SU-	Mud Settling Basin, concrete															-			-
700-GC-	Air Compressor with Air Receiver	1	ea	19,560	100%		19,560	100%		19,560	100%		19,560	100%		19,560	100%		19,560
																			-
	FUEL STORAGE																		-
700-TK-	Diesel Oil Tank, included in Platework Estimate	1	ea	31,500	100%		31,500	100%		31,500	100%		31,500	100%		31,500	100%		31,500
700-TK-	Gasoline Tank, included in Platework Estimate	1	ea	31,500	100%		31,500	100%		31,500	100%		31,500	100%		31,500	100%		31,500
700-PP-	Diesel Oil Station Pump	1	ea	15,912	100%		15,912	100%		15,912	100%		15,912	100%		15,912	100%		15,912
700-PP-	Gasoline Station Pump	1	ea	15,912	100%		15,912	100%		15,912	100%		15,912	100%		15,912	100%		15,912
																			-
	TRUCK WORKSHOP AND SERVICE																		-
700-CN	Truck Workshop Bridge Crane, 22 m span	2	ea	300,320	100%		300,320	100%		300,320	100%		300,320	100%		300,320	100%		300,320
700-CN-	Highway Truck Bay Overhead Crane, 15 m span	1	ea	92,540	100%		92,540	100%		92,540	100%		92,540	100%		92,540	100%		92,540
700-RV-	Roof Ventilator	6	ea	20,736	100%		20,736	100%		20,736	100%		20,736	100%		20,736	100%		20,736
700-MI-	Welding Machines	1	ea	50,000	100%		50,000	100%		50,000	100%		50,000	100%		50,000	100%		50,000
700-ZM-	Truck Lube and Service Station, complete with oil pumping modules, oil evacuation modules, fluid hose reels, waste collection tank, nitrogen gas storage, etc.	12	ea	253,680	100%		253,680	100%		253,680	100%		253,680	100%		253,680	100%		253,680
700-ZM-	Portable Hot Water Pressure Washer	2	ea	20,000	100%		20,000	100%		20,000	100%		20,000	100%		20,000	100%		20,000
700-MG-	Warehouse Forklift	1	ea	30,000	100%		30,000	100%		30,000	100%		30,000	100%		30,000	100%		30,000
700-GC-	Air Compressor with Air Receiver	1	ea	19,560	100%		19,560	100%		19,560	100%		19,560	100%		19,560	100%		19,560
																			-
	MINOR EQUIPMENT WORKSHOP																		-
700-CN-	Truck Workshop Bridge Crane, 15 m span	2	ea	92,540	100%		92,540	100%		92,540	100%		92,540	100%		92,540	100%		92,540
700-RV-	Roof Ventilator	2	ea	6,912	100%		6,912	100%		6,912	100%		6,912	100%		6,912	100%		6,912
700-MI-	Welding Machines	1	ea	25,000	100%		25,000	100%		25,000	100%		25,000	100%		25,000	100%		25,000
700-MI-	Lube and Service Station, complete with oil pumping modules, oil evacuation modules, fluid hose reels, waste collection tanks, etc.	2	ea	952,000	100%		952,000	100%		952,000	100%		952,000	100%		952,000	100%		952,000
700-MI-	Portable Hot water Pressure Washer	2	ea	20,000	100%		20,000	100%		20,000	100%		20,000	100%		20,000	100%		20,000
700-ZM-	Electrical Extension Cord/Lamp, 15 m cord on retractable reel	2	ea	1,000	100%		1,000	100%		1,000	100%		1,000	100%		1,000	100%		1,000
700-MI-	Tire Mounting and Dismounting Machine	1	ea	11,140	100%		11,140	100%		11,140	100%		11,140	100%		11,140	100%		11,140
700-GC-	Air Compressor with Air Receiver	1	ea	19,560	100%		19,560	100%		19,560	100%		19,560	100%		19,560	100%		19,560
																			-
	PLATEWORK SHOP																		-
700-CN-	Platework Workshop Bridge Crane, 31 m span	1	ea	112,540	100%		112,540	100%		112,540	100%		112,540	100%		112,540	100%		112,540
700-RV-	Roof Ventilator	6	ea	20,736	100%		20,736	100%		20,736	100%		20,736	100%		20,736	100%		20,736
700-MG-	Platework Shop Forklift	1	ea	30,000	100%		30,000	100%		30,000	100%		30,000	100%		30,000	100%		30,000
																			-
	Tire Changer Area																		-
700-MG-	Tire Handler, mounted on truck	1	ea	250,456	100%		250,456	100%		250,456	100%		250,456	100%		250,456	100%		250,456
700-MG-	Tire Handler, mounted on wheel loader	1	ea	600,456	100%		600,456	100%		600,456	100%		600,456	100%		600,456	100%		600,456
700-PS-	Tire Press	1	ea	60,456	100%		60,456	100%		60,456	100%		60,456	100%		60,456	100%		60,456
700-GC-001 TO 005	Air Compressor with Air Receiver	1	ea	34,560	100%		34,560	100%		34,560	100%		34,560	100%		34,560	100%		34,560
700-TK-	Nitrogen Tank	1	ea	31,500	100%		31,500	100%		31,500	100%		31,500	100%		31,500	100%		31,500
700-MG-	Forklift	1	ea	30,000	100%		30,000	100%		30,000	100%		30,000	100%		30,000	100%		30,000
700-MI-	Tire Mounting and Dismounting Machines	1	ea	71,140	100%		71,140	100%		71,140	100%		71,140	100%		71,140	100%		71,140
700-MQ-	Wheel Balancing Machine	1	ea	71,140	100%		71,140	100%		71,140	100%		71,140	100%		71,140	100%		71,140
700-MQ-	Work Bench	2	ea	8,560	100%		8,560	100%		8,560	100%		8,560	100%		8,560	100%		8,560
700-ZM-	Tool Box	2	ea	2,000	100%		2,000	100%		2,000	100%		2,000	100%		2,000	100%		2,000
700-CN-001	Tire Repair Bay Overhead Crane	1	ea	92,540	100%		92,540	100%		92,540	100%		92,540	100%		92,540	100%		92,540
																			-
	Sampling Building																		-
700-MG-	Forklift	1	ea	30,000	100%		30,000	100%		30,000	100%		30,000	100%		30,000	100%		30,000
																			-
	General Storage Building																		-
700-MG-	Forklift	1	ea	30,000	100%		30,000	100%		30,000	100%		30,000	100%		30,000	100%		30,000
																			-
	General For All Shops																		-
700-ZM-	Allowance, Hand Tools for All Shops	1	set	200,000	100%		200,000	100%		200,000	100%		200,000	100%		200,000	100%		200,000
700-ZM-	Allowance, Machine Tools for All Shops	1	ea	200,000	100%		200,000	100%		200,000	100%		200,000	100%		200,000	100%		200,000
700-ZM-	Miscellaneous Equipment for All Shops	1	ea	200,000	100%		200,000	100%		200,000	100%		200,000	100%		200,000	100%		200,000

Aker Kvaerner E&C
Minera Peru Copper S.A
Toromocho Project
Project No 180600

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21Dec06
Rev 6

Mechanical Equipment Capital Cost Estimate

		SNC						38 ft SAG + 3 Ball Mills											
		150,000 tpd			92,000 tpd			100,000 tpd			77,000 tpd			65,000 tpd			130,000 tpd		
Tag / Drawing No	ESTIMATE ITEM	Qty	Unit	Total Cost	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total	%	Amount	Total
Subtotal Area 740				4,278,104			4,278,104			4,278,104			4,278,104			4,278,104			4,278,104

Appendix F
Quotations

Summary of Budgetary Quotations

Company: Peru Copper Inc

Project: Toromocho Copper Project

Aker Kvaerner

Project No. 180600
Date: 26-Jan-07
Rev. A

Equipment Number	Equipment Size	Equipment Description	Unit Cost, USD
220 ML-001	40ft * 24ft	**EGL SAG Mill (28MW)**	
		SAG Mill and sub system (incl. brake system)	$ 10,277,000
		28 MW wrap-around motor	$ 13,750,000
		SAG mill liners & hardware (772,900kg)	$ 1,765,000
		TOTAL	**$ 25,792,000**
220 ML-001	38ft * 23ft	**EGL SAG Mill (23MW)**	
		SAG Mill and sub system (incl. brake system)	$ 8,772,000
		23 MW wrap-around motor	$ 11,660,000
		SAG mill liners & hardware (740,000kg)	$ 1,630,000
		TOTAL	**$ 22,062,000**
220 ML-001	36ft * 22ft	**EGL SAG Mill (20MW)**	
		SAG Mill and sub system (incl. brake system)	$ 7,575,000
		20 MW wrap-around motor	$ 10,863,000
		SAG mill liners & hardware (574,100kg)	$ 1,243,000
		TOTAL	**$ 19,681,000**
220 ML-002/003	28ft * 40ft	**Ball Mill (20MW)**	
		Ball Mill and sub system (incl. brake system)	$ 8,951,000
		20 MW wrap-around motor	$ 12,119,000
		Ball mill liners & hardware (376,900kg)	$ 974,000
		TOTAL	**$ 22,044,000**
220 ML-002/003	26ft * 40ft	**Ball Mill (17MW)**	
		Ball Mill and sub system (incl. brake system)	$ 7,978,000
		17 MW wrap-around motor	$ 11,988,000
		Ball mill liners & hardware (330,100kg)	$ 852,000
		TOTAL	**$ 20,818,000**
220 ML-002/003	24ft * 40ft	**Ball Mill (2*7MW, Gear Driven)**	
		Ball Mill and sub system (incl. inching drive)	$ 8,488,000
		2*7 MW wrap-around motor	$ 5,126,000
		Ball mill liners & hardware (328,000kg)	$ 802,000
		TOTAL	**$ 14,416,000**
230 ML-001-006	1500Hp	**VTM-1500-WB**	
		Mill body complete with access door	
		Grinding media agitator (screw)	
		Cast metal screw liners	
		Separating tank	
		Mill lining-orebed magnetic lining	
		Bearings and drive shaft	
		Vertical speed reducer	
		High speed and low speed couplings	
		Feed chute	
		Mill motor	
		Slurry pump with pump moto	
		TOTAL	**$ 9,672,000**

Aker Kvaerner

PERU COPPER INC.

Toromocho Project Feasibility Study

Concentrator Location Study

March 2007

Prepared for
Peru Copper, Inc.

Project No. R0521300
Report No. RP-07

AKER KVÆRNER™

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5-1 Concentrator Location Trade-off Study Evaluation Matrix –Capital Cost
5-2 Concentrator Location Trade-off Study Evaluation Matrix – Operating Cost

1.0 INTRODUCTION

Peru Copper Inc. (PCI) has retained the services of Aker Kvaerner Metals, Inc. (Aker Kvaerner) to carry out a Definitive Feasibility Study (DFS) for the Toromocho Project in Peru. The project involves an open-pit mine, sulfide concentrator, heap leach/SX/EW facility and related infrastructure.

PCI has identified three potential locations for the sulfide concentrator and Aker Kvaerner has carried out a trade-off study to compare these options as follows:

(a) 4875-m elevation above the Site 3 tailings storage facility

(b) 4600-m elevation in Morococha Southeast area

(c) 4520-m elevation south of Sites 3 and 4 along the railroad and near the filtration plant and concentrate load out facilities location.

This report presents the findings of the study including the comparison methodology, description of alternatives, comparison of alternatives and recommendation.

2.0 COMPARISON METHODOLOGY

The factors that have been considered in the evaluation of the different alternative locations are as follows:

2.1 Capital Cost

- Overland ore conveying
- Concentrate pipeline/pumping
- Concentrate filtrate pipeline/pumping
- Tailings disposal pipeline/pumping costs
- Tailings reclaim water pipeline/pumping costs
- Freshwater pipeline/pumping costs
- Cut and fill costs
- Electrical power connection costs
- Construction labour productivity
- De-rating of electrical motors
- Laydown areas.

2.2 Operating Cost

- Overland ore conveying
- Concentrate pumping
- Concentrate filtrate pumping
- Tailings disposal pumping
- Tailings reclaim water pumping
- Freshwater pipeline/pumping
- Operating labour productivity
- Operating supplies transportation

- Operating labour productivity.

2.3 Other

- Freshwater storage and supply
- Power supply
- Ease of access.

Option 1 at the 4875-m elevation will be used as the Base Case for this evaluation. Capital cost and operating cost differences compared to the Base Case will be developed for the other cases where there are identifiable quantities. The other factors will be evaluated on a qualitative basis.

3.0 DESCRIPTION OF ALTERNATIVES

Figure 3.1 shows the location of the three alternative locations for the concentrator that are under consideration.

The concentrator design is basically identical for all of the alternatives and includes tailings high capacity thickeners at the concentrator with the underflow being pumped to paste thickeners close to the tailings storage facility. The freshwater supply is provided from the east end of the Kingsmill Tunnel and is pumped initially south-west and then north-east to Option 3 and finally north to Options 1 and 2. The electrical power line follows the same routing as the freshwater line.

3.1 Option 1

Option 1 is located at an elevation of 4875-m south of the mine and above the Site 3 tailings storage facility. The location is based on the prefeasibility study work and has been the basis for development of the location thus far for the concentrator. This is at the highest elevation of the three cases under evaluation. It is the most rugged location and access is difficult. The overland ore conveyor is moderately long and has a rise of approximately 200 m. Horizontal centrifugal pumps can be used to transfer the tailings thickener underflow to the paste thickeners. Concrete tanks have been provided for storage of fresh and process water. The freshwater and electrical supply lines are the longest for this option.

3.2 Option 2

Option 2 is located at 4600-m elevation in the Morococha Southeast area. This location is close to the mine and to the main highway from Lima. The area for the facilities is rather limited. Access is very easy for people and supplies. The length of the overland conveyor is relatively short and it is virtually flat. Positive displacement pumps are required to transfer the tailings thickener underflow to the paste thickeners and the concentrate to the filter plant. Concrete tanks have been provided for storage of fresh and process water. The freshwater and electrical supply lines are medium for this option.

3.3 Option 3

Option 3 is located at 4520-m elevation south of Sites 3 and 4 along the railroad tracks and near the filtration plant and loadout facilities locations (south side of the ridge). This location is the most remote from the mine and therefore requires the longest overland ore conveyor which will have to rise to an elevation of approximately 4900 m before descending to the 4520-m elevation. Road access is the longest for this Option but access by rail is very close and would be used for the supply of operating consumables. Ponds will be used for storage of freshwater. The freshwater and electrical supply lines are the shortest for this option.

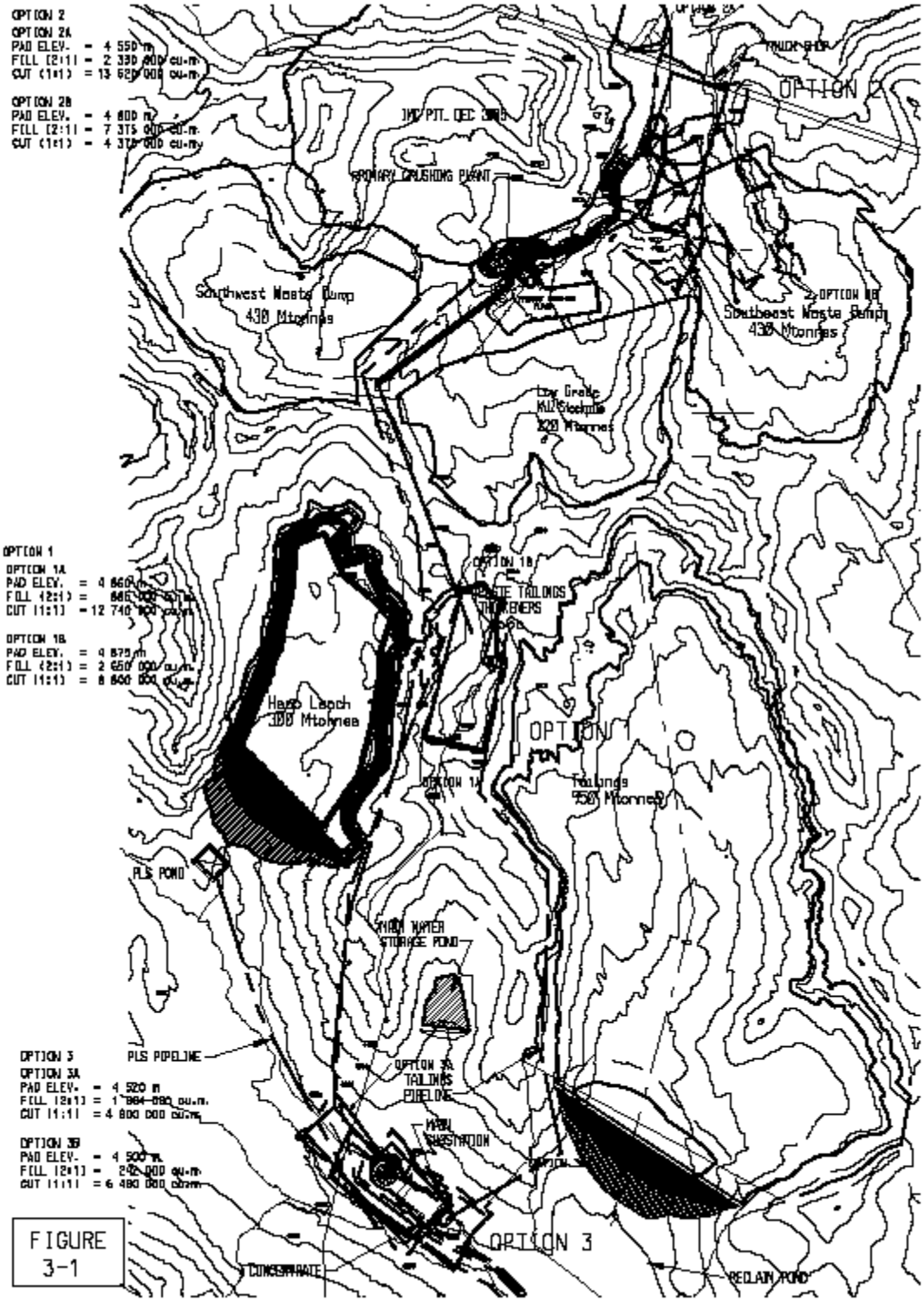
OPTION 2
OPTION 2A
PAD ELEV. = 4 550 m
FILL (2:1) = 2 330 000 cu.m.
CUT (1:1) = 13 620 000 cu.m.
OPTION 2B
PAD ELEV. = 4 800 m
FILL (2:1) = 7 375 000 cu.m.
CUT (1:1) = 4 370 000 cu.m.
PRIMARY CRUSHING PLANT
Southwest Waste Dump
430 Mtonnes
OPTION 2
OPTION 2B
Southeast Waste Dump
430 Mtonnes
Low Grade
Mill Stockpile
220 Mtonnes
OPTION 1
OPTION 1A
PAD ELEV. = 4 660 m
FILL (2:1) = 665 000 cu.m.
CUT (1:1) = 12 740 000 cu.m.
OPTION 1B
PAD ELEV. = 4 875 m
FILL (2:1) = 2 650 000 cu.m.
CUT (1:1) = 8 600 000 cu.m.
OPTION 1B
FINE TAILINGS
THICKENERS
Hard Leach
100 Mtonnes
OPTION 1
OPTION 1A
Tailings
530 Mtonnes
PLS POND
MAIN WATER
STORAGE POND
OPTION 3
PLS PIPELINE
OPTION 3A
PAD ELEV. = 4 520 m
FILL (2:1) = 1 864 000 cu.m.
CUT (1:1) = 4 800 000 cu.m.
OPTION 3A
TAILINGS
PIPELINE
MAIN
SUBSTATION
OPTION 3B
PAD ELEV. = 4 500 m
FILL (2:1) = 242 000 cu.m.
CUT (1:1) = 6 480 000 cu.m.
OPTION 3
CONCENTRATE
RECLAIM POND

FIGURE
3-1

4.0 COSTING METHODOLOGY

4.1 CAPITAL COST

The capital cost estimates produced for the plant location study are based on the following assumptions and qualifications:

- Option 1 capital cost is used as the base and the comparative cost to each of the other locations is a +/- relative amount.
- Direct capital costs were developed for each of the items and then factors were applied for indirect costs and contingency. The factor for indirect costs was applied to all the items other than cut and fill. Escalation is excluded.
- Access and site roads are excluded.
- The overland conveyor cost is for the mechanical equipment cost only. Localized costs for excavations, concrete, etc associated with conveyor supports are excluded. It is assumed the cost for earthworks associated with the conveyor right of way is included with the roads.
- No cost has been included for earthworks associated with pipeline right of ways. It is assumed pipelines will follow site road routings and/or are common to all options.
- With plant Option 2, the cost for demolition of existing facilities is excluded.
- For Options 2 and 3, the labour productivity factor has been reduced by 5% to account for the lower elevations.
- For Options 2 and 3, the cost of motors (de-rating) has been reduced by 5%.

4.2 OPERATING COST

The operating cost estimates produced for the plant location study are based on the following assumptions and qualifications:

- Option 1 operating cost is used as the base and the comparative cost to each of the other locations is a +/- relative amount.
- It has been assumed that the overland conveyor would have power generation capability where appropriate.
- The operating labour productivity is assumed to be 5% better for Options 2 and 3 due to the lower altitude.

- For the costs for transporting operating supplies, it is assumed that they will be delivered by rail to a location close to Option 3. Then, the costs are based on estimating the annual consumption of supplies, the distances from Option 3 to Options 1 and 2.

5.0 COMPARISON OF ALTERNATIVES

Tables 5-1 and 5-2 show a summary of the comparison of the alternatives. The advantages and disadvantages of each option are discussed below.

5.1 Option 1

At 4875-m elevation above the Site 3 tailings storage facility.

Advantages

The advantages for Option 1 are:

- Lower tailings and paste tailings reclaim water pumping costs
- Medium primary conveyor belt length.

Disadvantages

The disadvantages for Option 1 are:

- Highest cut and fill requirements
- All mill supplies must be delivered by truck
- Higher costs for water delivery
- All water storage must be held in tanks
- Lower construction and operating labour productivity at higher elevation
- Difficult access road
- Medium concentrate pumping distance
- Medium electrical power line transmission length.

5.2 Option 2

At 4600-m elevation in Morococha Southeast area or where originally the SX/EW plant was going to be located (north side of the ridge).

Advantages

The advantages for Option 2 are:

- Higher construction and operating labour productivity at lower elevation
- Shorter and easier access road
- Closer to Lake Huascacocha
- Shorter primary conveyor belt length
- If Lake Huascacocha can be used as a tsf in the future then pumping costs would be lower.

Disadvantages

The disadvantages for Option 2 are:

- All mill supplies must be delivered by truck from the rail unloading facility close to Option 3
- Higher cost for water delivery
- All water storage must be held in tanks
- Limited area for other facilities including mine truck shop
- Higher tailings and reclaim water pumping costs
- Longer concentrate pumping distance
- Longer electrical power line transmission length.

5.3 Option 3

At 4520-m elevation south of Sites 3 and 4 along the railroad tracks and near the filtration plant and loadout facilities locations (south side of the ridge).

Advantages

The advantages for Option 3 are:

- Higher construction and operating labour productivity at lower elevation
- Easier access for both construction and operating personnel
- Most of the mill supplies can be delivered by rail so this results in the lowest cost. This advantage also applies to the delivery by rail of construction materials but this has not been considered in this analysis.
- Fewer trucks on the national highway
- Water storage can be in ponds
- All process facilities are in one area
- All mining facilities are in one area
- Lower cost for water delivery
- Shorter power line at lower elevations
- Shorter concentrate pumping.

Disadvantages

The disadvantages for Option 3 are:

- Higher tailings pumping costs to Site 3. In the event that Lake Huascacocha is used as a tailings site in the future then the length of the tailings pipeline would be considerably greater, but the pumping costs would only be marginally increased as once the tailings line reaches approximately 4900 m elevation then the slurry can flow by gravity to Lake Huascacocha.
- Longer primary conveyor belt length.
- Longer access road

Table 5-1
Concentrator Location Trade-off Study Evaluation Matrix - Capital Cost

Factor	Option 1 Original Location	Option 2 Former SX/EW Location	Option 3 Near Filtration Plant
Site Elevation, m	4875	4600	4520
Direct Capital Cost Differences, USD			
Overland conveyor cost, Mechanical only	$0	(-$3,635,521)	$12,293,307
Concentrate pipeline/pumping cost	$0	$1,056,800	(-$778,000)
Filtrate Return pipeline/pumping cost	$0	$284,000	(-$520,400)
Tailings disposal pipeline/pumping cost	$0	$26,504,000	$25,544,000
Reclaim water pipeline/pumping cost	$0	$7,752,000	$6,140,000
Fresh water pipeline/pumping cost	$0	$2,430,000	(-$1,728,000)
Cut and fill cost	$0	(-$59,025,089)	(-$147,954,092)
Electrical power 230 kV Powerline	$0	$405,000	(-$288,000)
Construction labour productivity	$0	(-$12,732,050)	(-$12,732,050)
Derating of electrical motors	$0	(-$980,500)	(-$980,500)
Total Direct Capital Cost Difference	$0	(-$37,941,360)	(-$121,003,735)
Indirect Costs	$0	$6,346,203	$8,112,057
Total Direct & Indirect Cost	$0	(-$31,595,157)	(-$112,891,678)
Contingency @ 25%	$0	(-$7,898,789)	(-$28,222,919)
Project Total (Difference)	**$0**	**(-$39,493,947)**	**(-$141,114,597)**
Laydown areas	**Limited**	**Moderate**	**Easiest**

Table 5-2
Concentrator Location Trade-off Study Evaluation Matrix - Operating Cost

Factor	Option 1 Original Location	Option 2 Former SX/EW Location	Option 3 Near Filtration Plant
Operating Cost Difference, USD/a			
- Tailings Pumping	$0	$1,922,216	$2,691,102
- Reclaim Water Pumping	$0	$108,797	(-$326,391)
- Concentrate Pumping	$0	$36,198	(-$2,413)
- Concentrate Filtrate Pumping	$0	$1,554	(-$22,071)
- Fresh Water Pumping	$0	$38,530	(-$547,127)
- Ore Conveying	$0	(-$1,626,310)	(-$765,876)
- Operating labour productivity	$0	(-$200,000)	(-$200,000)
- Operating supplies transportation	0	$75,668	(-$53,808)
Total Operating Cost Difference	$0	$356,654	$773,416
Qualitative factors			
- Fresh water storage	concrete tanks	concrete tanks	ponds
- Ease of access	most difficult	easiest	moderate

6.0 RECOMMENDATIONS

Based on the results of the comparison of the three options discussed in Section 5.0, it is recommended that Option **3** be chosen as the concentrator location to be used for the execution of the DFS. The primary reason is that the capital cost is the lowest while the operating cost is only marginally higher than for the other options. This site is at the lowest elevation and is also close to the other processing facilities so these are significant advantages.

Toromocho Project Feasibility Study

Concentrate Leach Evaluation Process

Prepared for

Peru Copper Inc.

AKER KVÆRNER™

April, 2007
Project No. R0521300
Report No. RP-08

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CONCENTRATE LEACH PROCESS DESIGN CRITERIA
EQUIPMENT LIST
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MATERIAL BALANCE WITH METSIM FLOWSHEETS

1.0 INTRODUCTION

Peru Copper, Inc. (PCI) requested that Aker Kvaerner conduct a more in-depth study to further evaluate the possible use of the concentrate leach process technology, based on a previously completed order-of-magnitude study on the Toromocho Copper Project. The previous scoping study indicated that the economics improve with increased capacity. PCI requested that this study be based on the maximum concentrate that could be processed within the limits of the heap leach acid consumption and water balance. The water balance restriction is based on the typical three month wet period using the latest precipitation and evaporation data available.

Both capital and operating costs were determined so that PCI could evaluate a Concentrate Leach Plant (CLP) in the existing financial model for the project. If results were favorable, PCI would investigate further the legal aspect of using CLP technology on the Toromocho feasibility study.

2.0 EXECUTIVE SUMMARY

The concentrate leach facility was evaluated based on satisfying the sulfuric acid demand of the heap leach and on controlling the water balance of the heap leach. See Section 3.0 for the method used to determine the CLP capacity.

The major conclusions of this analysis are as follows:

Concentrate Feed	33.7 t/h 809 t/d (24 hrs) 265,700 t/y
CLP Availability	90%
Copper Recovery to Cathode	97.5%
Cathode Production	219.5 72,100 t/y
Acid to Heap Leach	750 t/d 246,000 t/y
Capital Costs	$ 214.4 M
Operating Costs	$ 36.3 M/yr

Additional advantages of the concentrate leaching facility are itemized in Section 8.0 of this report. Additional opportunities for improving the economics of the concentrate leach can be found in Section 10.0.

3.0 CLP SIZING BASIS

Aker Kvaerner has developed a METSIM computer simulation model for the 50,000 tpd heap leach facility using data from column testwork performed at Plenge Laboratories in Lima, Peru. This simulation predicted that the acid consumption would be about 20 kg/t of the heap leach ore, or an acid requirement of about 1000 mt of acid per day. A two train plant was therefore selected as the basis for this evaluation.

The water balance restriction was identified as the limiting factor for determining throughput. New meteorological data was obtained in late January. Analysis of the information demonstrated that the heap leach would only need an average of 50m^3/h of water to maintain the heap leach solution volume during the three month wet season of January through March (both average rain fall and evaporation being considered in the analysis).

Flowsheet changes from the order of a magnitude study were required so that the volume of solution could be reduced. These changes included:

- Using recycle product solution as coolant to increase copper solution grade and reduce volume
- Using a residue filter in lieu of a CCD circuit to reduce water consumption
- Using Plate and Frame heat exchanger to condense scrubber discharge steam with Heap Leach Pregnant Leach Solution (HLPLS) followed by an atmosphere cooling tower for the HLPLS, thus reducing volume by evaporation.

A METSIM model was constructed to incorporate these changes as well as including new rainfall and evaporation data. Most, but not all of the CLP heat output, was used to remove water from the process system.

4.0 PROCESS DESCRIPTION

4.1 Concentrate Leach Plant (CLP)

Concentrate for pressure leaching feed will normally be pumped directly from the copper filter feed tank to a storage tank at the CLP. A facility will be provided so that filter cake can be repulped to provide CLP feed during time when the concentrator is down.

The two pressure leach vessels will be operated at 225°C, with 700 kPa of oxygen overpressure. The vessels will be fed by high pressure diaphragm pumps. A mixture of product solution and water will be used to control temperature in each of the five compartments. Each compartment will be supplied with an agitator to maintain the solids in suspension and to disperse oxygen throughout the slurry. Both oxygen and coolant will be injected from the bottom of the vessel into the eye of the impeller for each compartment. The oxidized slurry will be depressurized through a choke system to a flash tank. The flashed steam will be cleaned in a series of two venturi scrubbers. The cleaned steam will be condensed using HL PLS in a plate and frame heat exchanger. Non-condensable gases are discharged to the atmosphere.

Slurry from the flash tank will be cooled in an evaporative cooler. Again HL PLS will be used for removing heat from the overhead condenser. The cooled slurry will be pumped to a decant thickener from which the product solution, SPLS, will be advanced to the heap leach pregnant leach solution pond. A portion of the solution will be recycled back to the pressure leach vessels to be used as coolant. The amount of recycle solution will be the control parameter for the product solution copper tenor.

The acid concentrations in the pressure leach vessels will significantly increase due to the recycle of solution as coolant. The high acid concentration is expected to significantly increase the formation of an unstable compound commonly referred to as basic ferric sulfate ($FeOHSO_4$). This material settles poorly and will slowly decompose into hematite and sulfuric acid over time. To prevent the settling and acid generation problems, the slurry will be maintained at about 80°C for two hours so that the decomposition of basic ferric sulfate into soluble ferric sulfate and water will proceed more rapidly. Both the magnitude of the problem caused by this material as well as the rate of decomposition will have to be determined in subsequent testwork.

Residue from the decant thickener will be filtered on an automatic plate and frame filter, and washed in series by HL PLS and water to remove soluble values. The filter cake will be hauled by end-dump trucks to the heap leach crusher facility where it will be added to the heap feed.

4.2 Solvent Extraction

The incorporation of a CLP into the heap leach flowsheet will require that the SX mixer-settlers be increased in area by 30%. The flow to the heaps will have to be increased so that the SX feed copper and acid concentrations are reduced to acceptable levels to achieve high extraction rates. Additional raffinate pumps to the heaps will be required, but expansion of the ponds will not be required.

4.3 Electrowinning

The electrowinning tankhouse will have to be expanded by 145% to plate the additional copper from the CLP solutions. The number of cells increases from 126 to 308. Two rectifier circuits will be required, each of equal size. Circulation tanks and pumps will increase proportionally. However, many items which would be supplied for the heap leach EW circuit only will not require duplication.

One cathode stripping machine will be sufficient for the new capacity, but the machine will have to be significantly upgraded from 300 cathodes per hours to 500 cathodes per hour. The stripping cycle will be adjusted from one 10-hour shift, five days per week to two 8-hour shifts, 7 days per week. Stripping machine maintenance will be conducted on the day shift.

5.0 PROJECT DESCRIPTION

5.1 Concentrate Leaching

The CLP will be sited between the SX/EW facilities and the concentrate filter plant. This site has numerous advantages including the following:

- Short slurry pipeline for concentrate feed
- Short pipelines for exchanging large volume flows of solution to and from the solvent extraction facility.
- Adjacent to the railroad allowing easy access delivery of materials and equipment and shipment of the cathode.

The repulping facility will be located within the concentrate filter plant facility. A single pipeline will be used for transfer of slurry from either the filter feed tank or the repulping tank.

The two pressure leach vessels, 4.5m internal dia. by 19m long tan-tan, will be housed in a single steel framed building. Siding of the building will extend only to the operating floor level. Flash tanks and the vapor scrubbing circuits will be located on the discharge end of the pressure leach vessels. The building framing will extend over the flash tanks but roofing and siding will not be required for the extension. A single overhead bridge crane spanning both vessels will be supplied for maintenance.

The two leach vessels will be equipped with a corrosion barrier and three layers of brick, each about 75 mm thick, making the inside brick diameter about 4.0m. Vessel agitators have “small” mounting nozzles which are sized based on passing the coupling and the agitator hub only. Maintenance access into the vessel will be through two large manholes in compartments two and four. The vessels will be founded on two concrete piers at an elevation suitable for maintenance of piping and values below the vessel.

Three 6m dia. by 6m high tanks in series will be used to reduce the sulfate content of the residue. An evaporative slurry cooling system will be supplied to reduce slurry temperatures so that 316 SS can be used for down-stream equipment.

A 12 m dia. high capacity thickener made of 316 SS will be supplied for initial liquid-solid-separation. An automatic plate and frame filter will be used for final residue dewatering. The filter will be housed in a steel-framed building equipped with an overhead maintenance crane.

The entire wet area of the CLP will have a curbed concrete floor and it will be covered with an acid resistant lining. Sump pumps throughout the area will deliver floor washing and spill clean-up to a second thickener, 9 m diameter, which will also serve the dewatering of the scrubber effluent.

5.2 Solvent Extraction

The solvent extraction pump mixers will be twice the capacity for the heap leach alone, but the settlers will only have to be 30% larger in area. Raffinate pumps to the heap will have to be duplicated from the heap leach design.

5.3 Electrowinning

The EW facility will require expansion from 126 cells to 308 cells to provide plating capacity for the leach solution from the CLP. The tankhouse will be divided into two identical sections, each having 154 cells with individual rectifiers and electrolyte circulating systems.

6.0 CAPITAL COSTS

6.1 Basis of Estimate

6.1.1 Concentrate Leach Facility

A detailed equipment list was developed from a similar pressure oxidation circuit currently under construction. A METSIM heat and material balance was developed for Toromocho concentrates using high temperature criteria. This material balance was used to size major equipment and pumps. Factors were developed for individual items in comparison to the known costs of the base case project. In general, pumps, tanks and other volumetric sensitive equipment were adjusted based on a 0.6 factor on the ratio to the modified Morenci estimate which served as the base case. Items which are area sensitive, heat exchangers, thickeners, etc. were adjusted based on a 0.8 factor on the ratio to the base case.

Many items such as repulping equipment, buildings, control room, DCS, utility equipment, etc. were used for the estimate without further adjustment.

The pressure leach vessels were of similar volume to the base case project, but at a much higher pressure. The proposed vessel for Toromocho will have a thicker wall, a slightly larger diameter, but will be shorter, having only 5 compartments, compared to 6 compartments for the base case. Also manholes for maintenance have been reduced from 6 for the base case to 2 for Toromocho. Cleanout activities are expected to be significantly less for the high temperature Toromocho design versus the medium temperature design for the base case. Using these differences, an estimate for the Toromocho vessel was developed as compared to the base case project. An estimate for brick lining of the vessels was more straightforward as the Toromocho vessels will use three layers of brick versus two layers for the base project. As the areas of the vessels were similar a 1.5 factor was applied to the base case brickwork costs.

6.1.2 Solvent Extraction

The direct cost of expansion of the SX mixer-settlers was taken from a recently completed project in Chile, and was based on comparative settler areas.

6.1.3 Electrowinning

The electrowinning facility was factored in total from a recent project in Peru having a similar size tankhouse. The ratio of EW cells to a 0.8 factor was used to adjust the facility cost. A further 5% deduction in facility costs was taken as many minor items will already be required for the heap leach EW whether or not the CLP facility is included in the Toromocho scope.

6.1.4 Indirect Costs

Indirect costs were based on the same ratio to direct costs as developed from a recent similar project in Peru. Appropriate escalation was applied individually to the CLP and EW, as each of the estimates were based on a different time frame, the CLP of first quarter 2006 and the EW on 2nd quarter of 2006.

Capital Cost Summary

	$Million	$Million
CLP Direct Costs	50.6	
Indirect Costs	36.6	
CLP Subtotal		87.2
EW Direct Costs	50.8	
Indirect Costs	26.4	
EW Subtotal		72.2
SX Direct Costs	3.6	
Indirect Costs	1.8	
SX Subtotal		5.4
HL Duplicate Pump Station for Raffinate (Allowance)		2.0
Direct and Indirect Cost Totals		171.9
Contingency at 20%		34.5
Escalation at 5% (15mo. on CLP, 9mo. on EW)		7.9
Total Capital Costs (all in)		$214.4

7.0 OPERATING COST ESTIMATE

7.1 Labor Costs

Labor rates were factored from a recent project in Peru. The staffing level is based on a similar facility taking into account the high altitude of the Toromocho plant site. The following is a listing of the number of personnel, position and rate.

Position	Unit Cost	CLP	
	$/yr	Qty	$/yr
Superintendent	45,000	1	45,000
Metallurgists	40,000	2	80,000
POX Operators	23,000	16	368,000
EW Operators	19,000	15	285,000
Lab Technician	18,000	1	18,000
Mechanical / Pipefitters	22,000	10	222,000
Electrical / Instrumentation	22,000	5	111,000
Clerk	18,000	1	18,000
Maintenance Superintendent	30,000	1	30,000
Maintenance Planner	22,000	1	22,000
EW Mechanical / Pipefitters	22,000	8	176,000
Cell Cleaning Labor	15,000	3	45,000
Total		**64**	**$1,420,000**

7.2 Power Costs

An estimated electrical load was based on recently completed projects of a similar nature. The oxygen plant power requirement was increased by a factor of 15% to account for the altitude.

The unit power cost of $0.041/kWh was provided by PCI.

7.3 Oxygen Costs

The cost of oxygen is based on an “Over-the-Fence” operation in which the vendor retains ownership of the Air Separation Unit (ASU) and the user pays the vendor a monthly fee. The oxygen rental factor used was from a recent project having identical oxygen capacity. Power costs for oxygen production are paid by the user. These costs were based on power consumption from the referenced project, but corrected for elevation difference.

7.4 Cost of Consumables (Excluding Maintenance Spares)

The costs of consumables were factored from a recent similar project. Consumption rates were taken from heat and material balance developed for the project.

7.5 Maintenance Spares

The costs for maintenance spares (10%) were factored from the direct installed cost of equipment and bulk materials.

7.6 SX and EW Costs

Copper sent to the "expanded" SX-EW facility will be incurred at the following rates based on current operating costs:

SX	$44.10/mt Cu
EW	$88.20/mt Cu

These costs include reagents, spare parts and electrical power for pumping systems. Electrical power for plating copper is identified separately. Cost of cathode packing and shipping is not included in this operating cost estimate.

7.7 Operating Cost Summary

The following table summarizes the operating cost for the pressure leach options considered. The operating cost accuracy is ± 25%.

The approximate annual copper production for each leach option is based on an assumed availability of 90% for HT.

Category	**CLP 72500 t/y Cathode**
	Average Annual Cost ($1000's)
Labor	1420
Electrical Power (Less O_2 Plant)	6960
Reagents	496
Maintenance	2500
Oxygen Plant Rental	5400
Oxygen Plant Power	4211
Subtotal	**20987**
Miscellaneous SX / EW ($0.06/16)	9592
EW Power (17829 kW)	5763
Total Annual Cost	**$36342**

8.0 ADVANTAGES OF CONCENTRATE LEACHING

The use of pressure leaching has several advantages which can be used to justify the capital costs of the facility.

- Produces a value added product which can be sold directly to customers with improved payment terms for product.
- Eliminates smelting and refining charges.
- Eliminates transportation costs of concentrate to the smelter.
- Increases overall copper recovery from concentrate by 1.5%.
- Enables treatment of high arsenic ores to concentrate instead of diverting these ores to heap leaching.
    - Increase copper recovery by about 30%.
    - Allows recovery of molybdenum at about 50% from these ores that is lost by heap leaching.
- Allows treatment of high zinc ores with similar benefits as with high arsenic ores.
- Acid requirements for the heap leach will be reduced by 750 t/d.
- Produces ferric ions which is integral to the heap leach chemistry.
- Provides additional heat to the heap leach fluids which should enhance bio-oxidation of sulfide minerals, possibly leading to higher copper recoveries in the heap leach.

All of the above, with the exception of the last item, can be calculated to determine values of each benefit.

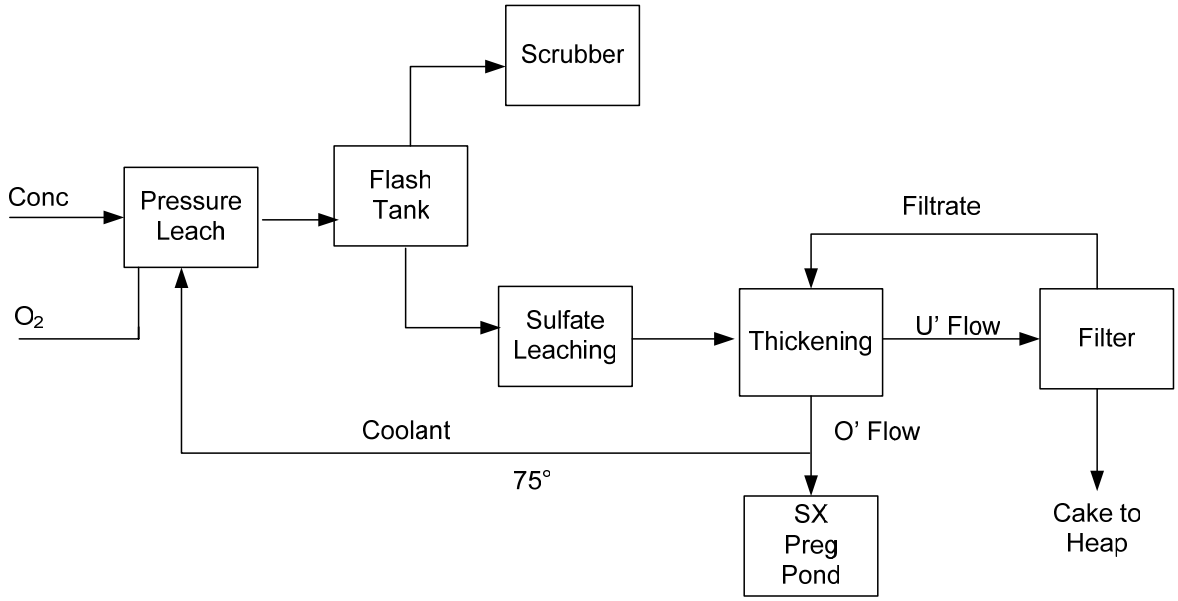
9.0 CLP TESTWORK PROGRAM

AK strongly recommends that a testwork program be conducted to establish basic criteria needed for verifying process parameters and for sizing of equipment using Toromocho concentrates. The information to be determined includes, but is not limited to, the following:

1. Retention time
2. Operating temperature
3. Oxidation profile by compartment
4. Soluble iron concentrations by compartment
5. Sulfate analysis of PLV residue
6. Determination of temperature and duration of conditioning step to reduce residue sulfate to acceptable levels
7. Residue settling characteristics with regard to thickener sizing and flocculant selection
8. Residue under flow pulp density
9. Pressure filtration sizing criteria.

Copper Concentrate Leach

Testwork Program



OBJECTIVES:

Pressure Leaching

1. Retention Time – Copper in Residue vs. Time (55 to 70 min)
2. Iron in solution by compartment
3. Sulfate in residue by compartment
4. Temperature effects on leaching and residue sulfate (215° to 225°)
5. Recycle product to achieve ≈ 100g/L Cu^{++}

Residue Leaching

Temperature 75° → 85°
Duration to achieve max 5% $SO_4^{=}$ in residue

Thickening

Settling testwork to establish thickener sizing parameters

Filtration

Pressure Filtration Data at 60°-70°

Test Duration

8hr Equipment operation run on water
8hr test run to establish base parameter on concentrate- collect coolant for recycle
48hr run to establish base criteria
Temp Variation
Feed Rate Variation (residence time)

Proposed Operation Sequence

8hr @ 225° & 70min
8hr @ 225° & 62.5 min
8hr @ 225° & 55 min
8hr @ 215° & 55 min
8hr @ 215° & 62.5 min
8hr @ 215° & 20 min

10.0 OPPORTUNITIES

There are several possibilities for flowsheet changes in design criteria which may result in substantial savings in either capital or operating costs.

1. Use of Crystallization of Copper Sulfate

   A preliminary flowsheet has been developed to take advantage of the high copper concentrations from the autoclave. By removing a large portion of copper sulfate as crystals and re-leaching these crystals with lean electrolyte, this copper will bypass solvent extraction, lower the copper concentration to the SX feed and eliminate the need to increase heap leach circulation. A mass balance using METSIM is being developed currently.

2. Serious consideration should be given to the possibility of increase EW current density and thus reduce the number of cells and EW building volume. This is currently being done in other new EW facilities.

AKER KVÆRNER™

Aker Kvaerner Project No. R0521300

PERU COPPER INC.

Toromocho Project Feasibility Study

General Specification GD-01a

Concentrate Leach Process Design Criteria

Aker Kvaerner Metals, Inc.
2550 N. Dragoon St., Ste. 150
Tucson, Arizona 85745

Owner Approval: _____

Date: _____

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APPENDIX

1.0 PROCESS SUMMARY

The Toromocho Concentrate Leach plant (CLP) consists of new facilities that will treat a portion of the Toromocho concentrate and produce high tenor copper solution which will be fed together with the heap leach PLS to a slightly expanded SX facility and sufficient EW capacity to recover the copper as cathode.

The CLP is designed to operate at 225°C using the Phelps Dodge High Temperature (HT) process in which all sulfides are converted to sulfates. The residual solids slurry will be neutralized with milk-of-lime and discharged to the concentrator tailings line.

The basic parameters for the concentrate leaching project are as follows:

Copper in concentrate, % Cu	28.0
Recovery of copper to strong PLS, %	98
Concentrate leaching plant availability, %	90
Concentrate feed rate, stph	31.0
Copper production, t/d	220
Copper production, t/y	72500
Oxygen purity, %	98
Leaching temperature, °C	225
Pressure leach vessel (design), kPa	3600
Acid credits to heap leach, t/d	750
Acid credits to heap leach, t/y	247000

2.0 UNITS, STANDARD CONDITIONS, TERMS AND ABBREVIATIONS

2.1 The units of measurement used throughout the project shall be in the metric system. See Appendix A of this document for a list of standard abbreviations.

2.2 The standard conditions for gas volumes shall be 0°C and 101.325 kPa.

2.3 The terms and abbreviations used throughout the specification are

PD	Phelps Dodge
AK	Aker Kvaerner
HR	Hazen Research
Bag	Bagdad Data
PCI	Peru Copper, Inc.
TBD	To Be Determined
TBC	To Be Confirmed

3.0 GENERAL

3.1 Environmental Restrictions and Regulations TBD

3.2 Site Details

Location & access: 145 km east of Lima off of National Highway at Morochocha

	CRITERIA	REFERENCE
Altitude, m	4900	PCI
Barometric pressure, kPa	55.0	Handbook
Temperature (design), °C		PCI
Minimum	-10	
Maximum (dry bulb)	20	
Maximum (wet bulb)	10	
Annual precipitation (average) mm	830	
Seismic zone	4	
Wind load (design)	75 km/h (UBC)	
Wind direction (prevailing)		
Ambient temperature for process feed streams, °C	15	

1

3.3 Plant Capacity and Availability

Production capacity, t/y copper		
Concentrate leaching	72,500	
Heap leaching	50,400	
Plant availability, %		
Concentrate leaching plant	90	
Heap leaching	98	
SX/EW	98	

3.4 Schedule

Plant operating schedule, hr/d	24	AK
d/wk	7	AK

3.5 Feed Characteristics

Concentrate chemical analysis, dry basis	
Cu, %	28.0
Fe, %	30.0
Sulfide sulfur, %	31.0
Zn, %	0.132
Moisture, Filter Cake %	9.0
Copper Thickener U'F, % Sol	65
Specific gravity of dry concentrate	4.2

Mineralogy (basis for METSIM model)	
$CuFeS_2$ (Chalcopyrite)	Balance of Cu
Cu_3AsS_4 (Enargite)	All of As
$Cu_{12}Sb_4S_{13}$ (Tetrahedrite)	All of Sb
FeS_2 (Pyrite)	Balance of Fe
ZnS (Sphalerite)	All of Zn
$CaAl_2Si_2O_8$	All of Ca
Al_2O_3 (Alumina)	Balance of Al
PbS (Galena)	All of Pb
MoS_2 (Molybdenite)	All of Mo
SiO_2(Silica)	Balance of Mass

4.0 CONCENTRATE PREPARATION

4.1 Concentrate Repulping

Front end loader model	TBD
FEL bucket capacity, m^3	10
Concentrate bin capacity, m^3	20
Repulp slurry density, wt % solids	65
Repulp sump capacity, min.	20

4.2 Slurry Storage

Repulped concentrate capacity, hr-live	12

5.0 PRESSURE LEACH

5.1 Pressure Leach Vessel

No. of pressure leaching vessels	2	
Pressure leach retention time, min.	60	
No. of compartments	6	
Operating temperature (design), °C	225	
Operating temperature (max), °C	230	
Volume utilization, %	75	
Mixer Type (Comp. 1 & 2)	Up-pumping hydrofoil	
Mixer type (Comp. 3 → 5)	Rushton turbine	
Mixer tip speed (max), m/s	6.4	
% Sulfide oxidation profile (cumulative)		Estimate
Compartment 1	69	
Compartment 2	90	
Compartment 3	96	
Compartment 4	97	
Compartment 5	98	

Pressure leach reactions

$CuFeS_2 + 4O_2 = CuSO_4 + FeSO_4$

$2FeS_2 + 7O_2 + 2H_2O = 2Fe_{SO4} + 2H_2SO_4$

$ZnS + 2O_2 = ZnSO_4$

$4Cu_3AsS_4 + 35O_2 + 10H_2O = 4H_3AsO_4 + 12CuSO_4 + 4H_2SO_4$

$MoS_2 + 9O_2 + 4H_2O = MoO_3 + 4H_2SO_4$

$PbS + 2O_2 = PbSO_4$

$2Cu_{12}Sb_4S_{13} + 61O_2 + 2H_2O = 4Sb_2O_5 + 24CuSO_4 + 2H_2SO_4$

$4FeSO_4 + O_2 + 2H_2SO_4 = 2Fe_2(SO_4)_3 + 2H_2O$

$2H_3AsO_4 + Fe_2(SO_4)_3 = 2FeAsO_4 + 3H_2SO_4$

$Fe_2(SO_4)_3 + 3H_2O = Fe_2O_3 + 3H_2SO_4$

$Fe_2O_3 + 2H_2SO_4 = 2FeOHSO_4 + H_2O$

$3Fe_2O_3 + 4H_2SO_4 + 5H_2O = 2H_3OFe_3(SO_4)_2 (OH)_6$

Copper extraction, %	98	
Solids weight loss, % (after flash)	52	
Quench water source	Fresh Water & Recycled HL PLS	
Oxygen utilization efficiency, %	85	
Oxygen partial pressure, kPa	690	
Total pressure (vessel design), kPa	3600	
Final residue solids SG	4.2	
Solution concentration profile, g/L Fe	TBD	
Final residue $SO_4^=$ analysis, wt %	TBD	
Vessel lining thickness, mm	240	Vendor
Corrosion barrier	Pyroflex	Vendor

5.2 Pressure Let-down and Gas Cleaning

Flash vessel		
No. of stages	1	AK
Operating pressure, kPa	20	AK
Design pressure, Pa	200	AK
Exhaust gas rise velocity, m/s	1.0	AK
Slurry entrainment to vent gas, wt % in overheads	18	Bagdad
Venturi scrubber		
First stage pressure drop, kPa	6	Mikropul
Maximum solids concentration, wt %	1	AK
Blowdown solution destination	Scrubber Thickener	AK
Second stage pressure drop, in. kPa	10	Mikropul

5.3 Slurry Conditioning Tank

Retention time, min.	120 (Est)
Temperature, °C	80
Sulfate in Residue	TBD

5.4 Pressure Leach Evaporative Cooling

Type	Evaporation	AK
New Feed to evaporator, °C	80	AK
Recirculated Feed to evaporator, °C	54	AK
Temperature from coolers, °C	52	AK
Heat removal heat exchanger	Plate & Frame	
Non-condensable inerts removal	Liq. Ring Vacuum Pump	Vendor

6.0 AUTOCLAVE RESIDUE WASHING AND DISPOSAL

6.1 Decant Thickener

Unit settling area, m^2/tpd solids	0.246	Bagdad
Underflow density, wt % solids	65	Bagdad
Flocculant addition, lb/st of solids	60	TBC
Flocculant type, 1st stage	Non-ionic	Bagdad
Solution overflow turbidity, ppm		
Design	200	
Nominal	100	

6.2 Residue Filtration TBD

Filter type	Automatic Plate & Frame
Filter feed tank retention, hr	4
Filter feed pressure, kPa	560
Filter cake moisture, %	12
Filter cake wash, no.	2
First cake wash fluid	HL PLS
First stage wash water, displacements	3
Second cake wash fluid	Water
Second stage wash water, displacements	3
Cake wash efficiency, each stage, %	75
Filtrate solids, ppm	2000
Filtrate destination	Decant Thickener Feed Tank
Wash water filtrate destination	Product Tank
Filter Cake destination	Heap Leach Pile
Filter Cake Transportation	End-dump truck

UNITS OF MEASUREMENT AND STANDARD ABBREVIATIONS

Terms	Units
actual cubic meters per hour	am^3/h
Amp	A
celsius	C
centipoise	cp
centistokes	cs
countercurrent decantation	CCD
cubic meter	m^3
cubic meter per hour	m^3/h
cubic centimeter	cc
days per week	d/wk
days per year	d/y
dew point temperature	dpt
diameter	dia
dry bulb temperature	dbt
electrowinning	EW
giga joules	GJ
gram	g
grams/liter	g/L
high density polyethylene	HDPE
hour	hr
hours per day	hr/d
inside diameter	ID
kilojoules	kJ
kilogram	kg
kilo pascal	kPa
Kilo pascal gauge	kPa
Kilometers	kg/y
kilometer per hour	km/h
kilovolt	kV
kilowatt	kW
kilowatt-hour	kWh
mega joules	MJ
meters per minute	m/min
meters per second	m/sec
metric tons per day	mt/d
metric tons per hour	mt/h
metric tons per year	mtpy
millimeters mercury	mm Hg
millimeters water column	in. wc
maximum	max
mean sea level (elevation)	MSL
megawatt (watts x 1,000,000)	MW
megawatt-hour	MWhr
metric ton	mt
microns (micrometers=10^{-6} meters)	μm
milk-of-lime	MOL
milliampere	mA
millimeter	mm
milligrams/liter	mg/L
minimum	min
minute(s)	min.
normal cubic meter	n m^3
normal cubic feet per minute	ncfm
number	no.
outside diameter	OD
overflow	o/f
parts per million by weight	ppm
parts per million by volume	ppmv

Terms	Units
pregnant leach solution	PLS
revolutions per minute	rpm
second	sec
solvent extraction	SX
specific gravity	SG
square meter	m^2
square centimeter	cm^2
stainless steel	SS
standard	std
normal cubic meters per hour	nm^3/h
total dissolved solids	tds
total dynamic head	tdh
temperature	temp
underflow	u/f
variable frequency drive	VFD
variable speed drive	VSD
volt	V
volume	vol
volume percent	vol %
watt	W
water column	wc
water gauge	wg
weight percent	wt %
wet bulb temperature	wbt

Use weight percent on solid and liquid flows and volume percent on gas flows, unless noted.

Use the term "normal" in reference to gas conditions of 101.3 kPa at 0°C. Use the term "standard" in reference to gas conditions of 101.3 kPa at 20°C.

AKER KVÆRNER™

PERU COPPER INC.

EQUIPMENT LIST

TOROMOCHO COPPER CLP FACILITY

PROJECT No. R0521300

Rev	Description	By	Approved By	Date
A	Issued for Information			

Distribution	
Aker Kvaerner	**Peru Copper**

PLANT AREAS			
700	Engineering Studies	706	Solution Handling
701	General & Overland Pipelines	707	Oxygen Plant
702	Concentrate Handling & Storage	708	Electrowinning Modifications
703	Superfine Grinding	709	Construction Distributals
704	Pressure Leaching		
705	Thickening and Residue Neutralization		

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Equipment Number	Equipment Description	REV	REV DATE	QTY	POWER RATING Hp	Status P=Prelim C=Certified	SPEC	DRAWING NO.	P.O.	REMARKS
650-BA-001	125 VDC BATTERY (10) ALCAD Sealed Lead Battery Cell			1			E-007		E-007	
650-BC-001	125 VDC BATTERY CHARGER Complete with (1) ALCAD Battery Rack, (1) C&D Battery Charger and portable remote control			1			E-007		E-007	
650-CP-001	INSTRUMENT AIR COMPRESSOR 670 m^3/h SCFM capacity, rated at 800 kPa rotary screw air cooled, sullair LS 2005 125 HWC			1			P-013		P-013	
650-CP-002	PLANT AIR COMPRESSOR 670 m^3/h SCFM capacity, rated at 800 kPa rotary screw air cooled, sullair LS 2005 125 HWC			1			P-013		P-013	
650-CP-003	PLANT AIR COMPRESSOR 670 m^3/h SCFM capacity, rated at 800 kPa rotary screw air cooled, sullair LS 2005 125 HWC			1			P-013		P-013	
650-CT-001	PLV COOLING TOWER 2.8 MM Btu/h, 70m^3/h capacity, induced draft counter flow type. fixed speed fan motor. Cooling Fan			1			P-018		P-018	
650-DR-001	INSTRUMENT AIR DRYER 670 m^3/h capacity. Dessicant Type - 40°C			1			P-013		P-013	
650-DR-002	PLANT AIR DRYER 670 m^3/h capacity. Dessicant Type - 40°C			1			P-013		P-013	
650-DR-003	PLANT AIR DRYER 670 m^3/h capacity. Dessicant Type - 40°C			1			P-013		P-013	
650-DU-001	PLANT AIR DRYER From Flash tanks to primary venturis, 1.2 m inch diameter Material shall be Duplex stainless 2205.			Lot			M-297		M-297	
650-EP-001	DISTRIBUTION PANEL 125VDC			1			AKIC			
650-EZ-001	LV CABLE 600V power and control cables			LOT			E-016		E-016	
650-EZ-002	LV CABLE Instrument Cables			lot			E-017		E-017	

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650-EZ-003	ELECTRICAL Bulk Material			LOT			AKIC			
650-EZ-004	LIGHTING AND GROUNDING			LOT			AKIC			
650-EZ-005	ELECTRICAL UNDERGROUND WORK			LOT			AKIC			
650-EZ-006	Lighting Panel 208Y/120V, 200A, 3 Phase, 42 ckt			1			AKIC			
650-EZ-007	Lighting Panel 208Y/120V, 100A, 42CKT's			1			AKIC			
650-EZ-008	Circuit Breaker Panel 200A, 42CKI,480V			1			AKIC			
650-EZ-009	UPS 15kVA, 3 phase 480V with battery for PLV Agitator seal pumps			1			I-004		I-004	
650-JZ-001	INSTRUMENTATION			Lot						
650-LB-001	LABORATORY EQUIPMENT HIgh sulfur determinator package Leco			1			M-302B		M -302B	
650-LB-002	LABORATORY EQUIPMENT Atomic Abasorption Package Perkin and Elmer			1			M-302C		M-302C	
650-LB-003	LABORATORY EQUIPMENT General Supplies VWR International			1			M-302D		M-302D	
650-MC-001	480V MCC 480 V MCC, 60Hz, 65 kA, 9 vertical section			1			E-010		E-010	
650-MC-002	480V MCC 480 V MCC, 60Hz, 65 kA, 8 vertical section			1			E-010		E-010	
650-MC-003	480V MCC 480 V MCC, 60Hz, 65 kA, 8 vertical section			1			E-010		E-010	
650-MC-004	480V MCC 480 V MCC, 60Hz, 65 kA, 13 vertical section			1			E-010		E-010	
650-PL-001	PRODUCT PLS OVERLAND PIPELINE 700 mm HDPE, SDR 11, 500 m			LOT					PD	
650-PL-002	ROM PLS OVERLAND PIPELINE 700 mm HDPE SDR 11, 500 m			LOT					PD	

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650-PL-003	CONCENTRATE OVERLAND PIPELINE 4" Dia. HDPE SDR 11 From filter feed storage tank. 400 m			LOT					PD	
650-PP-001	CONCENTRATE OVERLAND PUMP Capacity: 52 m^3/h nominal, 65 m^3/h design, 180 ft TDH. 1.98 Spgr Type:Horizontal Centrifugal V-Belt, overhead drive,high chrome (HC 600) casing			1			P-002		P-002	
650-PP-002	ROM PLS Delivery Pump Horizontal Centrifugal ANSI pump, 316SS, 1850 m^3/h design @ 58m TDH, 1.136 sp.gr.			1			P-003		P-003	
650-PP-003	ROM PLS Delivery Pump Horizontal Centrifugal ANSI Pump, 316SS, 1850 m^3/h design @ 58m TDH, 1.136 sp.gr.			1			P-003		P-003	
650-PP-004	ROM PLS AREA SUMP PUMP Vertical Centrifugal, 35m^3/h at 15m tdh, CD4MCu Toyo DEC 61-50-4E-72			1			P-004		P-004	
650-PP-005	Acid Metering Pump For Cooling Tower PH Control Milton Roy MRoy PRP151748SRSESEE1NN, simplex, alloy 20, electronic capacity control, 115V						P-075		P-075	
650-PP-006	Biocide Metering Pump For Cooling Tower PH Control MIlton Roy MRoy DD41X8PM4NNN, PVDF/ceramic/PTFE, manual cap control, 115V						P-075		P-075	
650-PP-007	Corrosion Inhibitor Metering Pump For Cooling Tower PH Control MIlton Roy MRoy DD21X7PM4NNN, 316SS, manual cap control, 115V						P-075		P-075	
650-PP-011	COOLING WATER PUMP 70 m^3/h gpm at 45m tdh (design), vertical turbine type , Cast Iron and 416SS operating			1			P-006		P-006	
650-PP-012	COOLING WATER PUMP 70 m^3/h gpm at 45m tdh (design), vertical turbine type , Cast Iron and 416SS operating			1			P-006		P-006	
650-PP-014	BOILER FEED PUMP 12 m^3/h, 4800 kPa, DI Material, with VFD w/704-BLR-401, two (2) pumps driven by one motor. Clayton model J4			1			P-023		P-023	
650-PR-001	PIPERACK			LOT			S-001		S-001	

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650-PR-002	PIPERACK			LOT			S-001		S-001	
650-PZ-001	PIPING			LOT						
650-PZ-002	FIREWATER LOOPS 8" diameters, underground + hydrants as defined on the P & ID			LOT						
650-PZ-003	EXTENSION OF SEWAGE LINE 150 m. of 4 in. dia, buried.			LOT						
650-SG-001	5kV MEDIUM VOLTAGE CONTROLLER Switchgear with 2000 A bus, 3 phase, 3W, 60 Hz, 50 kAIC.One (1) primary 2000A incoming main breaker, and three (3) motor starters (Type FVNR-350Hp)			1			E-007		E-007	
650-SG-002	5kV MEDIUM VOLTAGE Controller Switchgear with 2000A bus, 3 phase, 3W, 60 Hz, 50 kAIC.One (1) primary 2000A incoming main breaker switch, and five (5) motor controllers, three (3) motor controller (type feeder with latched contactor) and two (2) fully equipped spaces.			1			E-007		E-007	
650-SG-003	5kV MV CONTROLLER Complete with (1) 1200A Incoming Breaker, (2) Motor Startes, (1) Transformer Feeder (1) Future Space			1			E-007		E-007	
650-SP-001	ROM PLS AREA SUMP 4ft dia x 4ft high, concrete with 316SS liner, 350 gal cap			1			P-010		P-010	
650-TK-001	Acid Storage Tank 1.5m dia x 2.4m high 4.5m^3, 316LSS, covered						P-010	705-6-256	P-010	
650-TK-002	Biocide Storage Tank 2m^3, HDPE, covered 1.2m dia x 2.0m high						P-110		P-110	
650-TK-003	Biocide Containment Tank HDPE, open top, to contain 705-TNK-529, 2.4m dia x 1.0m high						P-110		P-110	
650-TK-102	CONCENTRATE STORAGE TANK 10 m dia.X 10 m high, CS Urethane Lined, Open Top, baffled, 700 m^3 cap			1			P-011	703-6-211	P-011	
650-TV-001	CCTV MONITORING SYSTEM 3 System includes CCTV Control unit, MOnitor and four (4) cameras, PLV-scrubber, PLV-Valves Grinding area Filter building.			4			I-005		I-005	
650-TX-001	Power Transformer 46KV - 4160V, 15/25 MVA, OA/FA/FA, Z=7.0% 3 phase, 60Hz, (see PO 511600-E-002, eq no. 017-TXF-02, Z=7.0%			1			PD		PD	

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650-TX-002	Power Transformer 46Kv - 4160V, 15/25 MVA, OA/FA/FA, 3 phase, 60Hz, (see PO 511600-E-002, eq no. 017-TXF-02, Z=7.0%			1			PD		PD	
650-TX-003	Transformer 75KVA Transformer, 480-208Y/120V, 3 phase, 60 Hz			1			AKIC		AKIC	
650-TX-004	Distribution Transformer 4.16 Kv- 480v, 1MVA, 3 phase, 60Hz, OA , Z=5.5%			1			E-008		E-008	
650-TX-005	Distribution Transformer 4.16 Kv- 480v, 1MVA, 3 phase, 60Hz, OA , Z=5.5%			1			E-008		E-008	
650-TX-006	Distribution Transformer 4.16 Kv- 480v, 1MVA, 3 phase, 60Hz, OA , Z=5.5%			1			E-008		E-008	
650-TX-007	Distribution Transformer 4.16 Kv- 480v, 1MVA, 3 phase, 60Hz, OA , Z=5.5%			1			E-008		E-008	
650-TX-008	Distribution Transformer 4.16 Kv- 480v, 1MVA, 3 phase, 60Hz, OA , Z=5.5%			1			E-008		E-008	
650-TX-009	Transformer 500kvA, 13.8-4.16kV (for ROM PLS Booster pumps)			1			E-008		E-008	
650-TX-010	Transformer 30kvA 480-208Y/120			1			AKIC		AKIC	
650-VS-001	INSTRUMENT AIR RECEIVER 1.2m dia x 4m, rated for 1100 kPa, includes oil and water filter, CS			1			P-013		P-013	
650-VS-002	PLANT AIR RECEIVER 1.2m diam x 4m, rated for 1100 kPa, includes oil and water filter, CS			1			P-013		P-013	

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Equipment Number	Equipment Description	REV	REV DATE	QTY	POWER RATING Hp	Status P=Prelim C=Certified	SPEC	DRAWING NO.	P.O.	REMARKS
651-AG-101	CONCENTRATE REPULP TANK AGITATOR Carbon steel rubber covered blades, hub and shaft, 3m dia x 3m high tank			1			M-100		M-100	
651-AG-102	CONCENTRATE STORAGE TANK AGITATOR Vertical, axial flow impellers, rubber coated CS ,for 10 m dia X 10 m high tank			1			M-100		M-100	
651-EZ-101	ELECTRICAL Bulk materials.			LOT			AKIC			
651-EZ-102	LIGHTING AND GROUNDING			LOT			AKIC			
651-FE-101	CONCENTRATE BELT FEEDER Duty: To transfer concentrate from hopper to repulping sump. Capacity: 34 tph nominal capacity, 40 tph design, 1070 mm x 20 m center to center, pulleys. Drive: VFD (E-011)			1			M-020		M-020	
651-HP-101	CONCENTRATE RECEIVING HOPPER Duty: To receive concentrate from FEL. Size: 3 m w x 2.75 high x 9 m long with 60 degree inclination and backstop. 45 cu yd capacity Slope bottom lined with 12 mm. UHMW HDPE liner.			1			M-020		M-020	
651-JZ-101	INSTRUMENTATION			LOT						
651-PP-101	REPULPED SLURRY PUMP Capacity: 52 m^3/h gpm nominal, 65 m^3/h design, 50m TDH.1.98 Spgr Type: Horiz Centrifugal, V-Belt overhead drive, high chrome(HC 600) casing & impeller.			1			P-002		P-002	
651-PP-102	REPULPED SLURRY PUMP Capacity: 52 m^3/h nominal, 65 m^3/h design, 50m TDH.1.98 Spgr Type: Horiz Centrifugal, V-Belt, Overhead drive, high chrome casing & impeller. Goulds Model 5500S 1.5x2-12, 1-stage, VFD(E-011) , installed standby			1			P-002		P-002	
651-PP-103	REPULP AREA SUMP PUMP 34 m3/h at 6 m tdh, CD4MCu wetted parts vertical centrifugal			1			P-004		P-004	
651-PP-104	PRESSURE LEACH VESSEL FEED PUMP Duty: To feed high pressure leach vessel. Capacity: 34 m^3/h nom; 42 m^3/h design @ 550 psig 1.41 sp grType:positive displacement VFD motor (VFD by E-011)			1			P-028		P-028	

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651-PP-105	PRESSURE LEACH VESSEL FEED PUMP Duty: To feed high pressure leach vessel. Capacity: 34 m^3/h nom; 42 m^3/h design @ 550 psig 1.41 sp grType:positive displacement VFD motor (VFD by E-011)			1			P-028		P-028	
651-PP-106	PRESSURE LEACH VESSEL FEED PUMP Duty: To feed high pressure leach vessel. Capacity: 34 m^3/h nom; 42 m^3/h design @ 550 psig 1.41 sp grType:positive displacement VFD motor (VFD by E-011)			1			P-028		P-028	
651-PZ-101	PIPING			LOT						
651-SC-101	Weight Scale 50 tph capacity, 1070 mm wide			1			M-020		M-020	
651-SN-101	SLURRY SCREEN BOX			1			M-296		M-296	
651-SN-102	SLURRY SCREEN BOX			1			M-296		M-296	
651-SN-103	CONCENTRATE SCREEN For ground concentrate storage tank feed, 1000 mm diameter, 1.19 mm screen cloth, 316SS			1			M-088		M-088	
651-SP-101	PRIMARY CONCENTRATE SAMPLER In-line pipe sampler, 100 mm size, 40 mm Thief Pipe H.R. Cooper Model PSA-8004			1			M-301		M-301	
651-SP-102	SECONDARY CONCENTRATE SAMPLER Rotating Cutter type complete with sampling timer control, H.R. Cooper Model PRV-200-SLH			1			M-301		M-301	
651-ST-101	STRUCTURAL STEEL			LOT			S-001		S-001	
651-SU-101	CONCENTRATE REPULP AREA SUMP 1.2 m dia x1.2 m deep, 316L SS lined, 1.3 m^3 cap			1			P-010	701-6-126	P-010	
651-TK-101	CONCENTRATE REPULP TANK Carbon steel 3 m X 3 m Urethane lined, baffled,22 m^3 cap			1			P-010	702-6-201	P-010	
651-VB-101	RECEIVING HOPPER VIBRATOR Electric type Grantham Invicta			1			M-020		M-020	
651-VB-102	RECEIVING HOPPER VIBRATOR Electric type Grantham Invicta			1			M-020		M-020	

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Equipment Number	Equipment Description	REV	REV DATE	QTY	POWER RATING Hp	Status P=Prelim C=Certified	SPEC	DRAWING NO.	P.O.	REMARKS
652-AC-201	CONTROL ROOM HVAC 10 tons cooling capacity, 7600m^3/h, Trane Model No. THC120			LOT			GC-14			
652-AC-202	IT ROOM HVAC 7.5 Tons Cooling capacity, 6200m^3/h, Trane Model No. THC092 1 x 2 HP indoor motor 1 x 9kW heater						GC-14			
652-AC-203	ELECTRICAL ROOM HVAC 25 Tons cooling capacity, 16500m^3/h, Trane model No. TFD301 1 x 7.5hp indoor motor 2 x 1 hp outdoor motor 1 x 36kW Heater						GC-14			
652-AG-211	PRESSURE LEACH VESSEL AGITATOR Duty: To disperse oxygen and cooling water in slurry Size:1.85m dia impeller, A340, (TYP) ALL AGITATORS Material: Ti2 -shaft, Disc & Blades (PLV compartment No.1)Lighting 782-S-200			1			M-101		M-101	
652-AG-212	PRESSURE LEACH VESSEL AGITATOR Duty: To disperse oxygen and cooling water in slurry Size:1.85m dia impeller, flowserve MW200 (typ) Material: Ti2 -shaft, Disc & Blades (PLV compartment No.2) Lighting 782-S-200			1			M-101		M-101	
652-AG-213	PRESSURE LEACH VESSEL AGITATOR Duty: To disperse oxygen and cooling water in slurry Size: 1.8m dia impeller, Material: Ti2 -shaft, Disc & Blades (PLV Agitator Compartment No.3) Rushton Turbine			1			M-101		M-101	
652-AG-214	PRESSURE LEACH VESSEL AGITATOR Duty: To disperse oxygen and cooling water in slurry Size: 1.8m dia impeller, Material: Ti2 -shaft, Disc & Blades (PLV Agitator Compartment No.4) Rushton turbine			1			M-101		M-101	
652-AG-215	PRESSURE LEACH VESSEL AGITATOR Duty: To disperse oxygen and cooling water in slurry Size:1.8m dia impeller, Material: Ti2 -shaft, Disc & Blades (PLV Agitator Compartment No.5) Rushton turbine			1			M-101		M-101	
652-AG-216	PRESSURE LEACH VESSEL AGITATOR Duty: To disperse oxygen and cooling water in slurry Size: 1.85m dia impeller, Material: Ti2 -shaft, Disc & Blades (Un-installed spare for PLV Agitator Compartment No.1 thru 2) Lighting 780-S-75			1			M-101		M-101	

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652-AG-217	PRESSURE LEACH VESSEL AGITATOR Duty: To disperse oxygen and cooling water in slurry Size: 1.8m dia impeller, Material: Ti2 -shaft, Disc & Blades (Un-installed spare for PLV Agitator Compartment No.3 & 6) Rushton turbine			1			M-101		M-101	
652-AG-221	PRESSURE LEACH VESSEL AGITATOR Duty: To disperse oxygen and cooling water in slurry Size: 1.85 dia impeller, A340, (TYP) ALL AGITATORS Material: Ti2 -shaft, Disc & Blades (PLV compartment No.1)Lighting 782-S-200			1			M-101		M-101	
652-AG-222	PRESSURE LEACH VESSEL AGITATOR Duty: To disperse oxygen and cooling water in slurry Size: 1.85 dia impeller, flowserve MW200 (typ) Material: Ti2 -shaft, Disc & Blades (PLV compartment No.2) Lighting 782-S-200			1			M-101		M-101	
652-AG-223	PRESSURE LEACH VESSEL AGITATOR Duty: To disperse oxygen and cooling water in slurry Size: 1.8m dia impeller, Material: Ti2 -shaft, Disc & Blades (PLV Agitator Compartment No.3) Rushton Turbine			1			M-101		M-101	
652-AG-224	PRESSURE LEACH VESSEL AGITATOR Duty: To disperse oxygen and cooling water in slurry Size: 1.8m dia impeller, Material: Ti2 -shaft, Disc & Blades (PLV Agitator Compartment No.4) Rushton Turbine			1			M-101		M-101	
652-AG-225	PRESSURE LEACH VESSEL AGITATOR Duty: To disperse oxygen and cooling water in slurry Size:1.8m dia impeller, Material: Ti2 -shaft, Disc & Blades (PLV Agitator Compartment No.5) Rushton Turbine			1			M-101		M-101	
652-AG-226	SLURRY CONDITIONING TANK AGITATOR Vertical, axial flow impellers, 2205 duplex SS wetted parts, blades & shaft for 6m x 6m tank Linghtnin 506Q15			1			M-100		M-100	
652-AG-227	SLURRY CONDITIONING TANK AGITATOR Vertical, axial flow impellers, 2205 duplex SS wetted parts, blades & shaft for 6m x 6m tank			1			M-100		M-100	
652-AG-228	SLURRY CONDITIONING TANK AGITATOR Vertical, axial flow impellers, 2205 duplex SS wetted parts, blades & shaft for 6m x 6m tank			1			M-100		M-100	
652-AG-229	PLV Coolant In Line Mixer			1			P-301			
652-BD-201	CONTROL ROOM / MCC BUILDING 10m x 11.5m (inside) x 9.5m height, concrete block construction with Q-deck for the second floor, insulated panels			LOT			S-001		S-001	

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652-BD-202	PROCESS BUILDING, PLV 39m L x 21m W x 20m H steel construction			LOT			S-001		S-001	
652-BO-203	STEAM GENERATOR PACKAGE Forced circulation boiler used for providing steam during initial startup of pressure leach vessel: Cap 9,100/5g/h gross steam @ 3500 KPa. Natural gas fired.Complete w/ low- NOX gas burner with flame monit			1			P-023		P-023	
652-CK-201	FLASH TANK CHOKE ASSEMBLY Tight Shut-off Design, Complete with ceramic lined letdown angle valve, ceramic lined tube, and fixed choke with tapered outlet.			1			I-701A		I-701A	
652-CK-202	FLASH TANK CHOKE ASSEMBLY Tight Shut-off Design, Complete with ceramic lined letdown angle valve, ceramic lined tube, and fixed choke with tapered outlet.			1			I-701A		I-701A	
652-CN-201	PLV OVERHEAD CRANE Bridge type, 20m span, 15 ton capacity radio controlled , 18m utility lift, 50m travel, with audible alarm and strobe light. Hoist (1) 40(25Kw) hp (2 speed): Bridge (2) 2.5 hp (2speed): Trolley (2) 1.5 hp (2 speed)			1			M-130		M-130	
652-CN-202	PLV MANHOLE HOIST 3t Cap, X 8m lift x 25m travel electric hoist with pendent control			1			M-133		M-133	
652-CN-203	PLV MANHOLE HOIST 3t Cap, X 8m lift x 25m travel electric hoist with pendent control			1			M-133		M-133	
652-CN-204	HOIST AND TROLLEY For sump pump 704-PMP-430, manual chain hoist, 1T capacity, 8m lift x 6m travel.			1			M-133		M-133	
652-DU-202	FLASH VESSEL EXHAUST DUCTWORK From Flash tanks to primary venturis, 1.2m diameter Material shall be Duplex stainless 2205.			Lot			M-297		M-297	
652-DU-203	EXPANSION JOINT 1.2m dia, Ti, GR2 incl w/ 704-DWK-401			1			M-297		M-297	
652-DU-204	EXPANSION JOINT 1.2m dia, Ti, GR2 incl w/ 704-DWK-402			1			M-297		M-297	
652-DU-205	EVAPORATIVE COOLER VAPOR DUCTING			1			M-219		M-219	
652-DU-206	EVAPORATIVE COOLER DUCTING From condenser to vacuum pump, 300mm dia. 316 SS			Lot			M-219		M-219	
652-DU-207	FLV U-TUBE RELIEF SEPARATOR			1			M-296		M-296	
652-DU-208	FLV U-TUBE RELIEF SEPARATOR			1			M-296		M-296	

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652-DU-209	BOILER STACK 800mm dia x 5m tall , 304 SS			1			P-023		P-023	
652-DU-210	2nd SCRUBBER DISCHARGE DUCT From scrubber to condenser 1.2m dia by 10m long, 316 SS									
652-EZ-201	ELECTRICAL BULK MATERIAL			LOT					AKIC	
652-EZ-202	Lighting Panel 3 Phase, 480/277, 200A, 125A, 42ckt			1			AKIC		AKIC	
652-EZ-206	LIGHTING TRANSFORMER 75 kVA, 480/277, 3 phase						AKIC		AKIC	
652-FA-201	BOILER, COMBUSTION AIR FAN 12200m^3/h w/ 704-BLR-401, Model 604 LN			1			P-023		P-023	
652-FA-202	BOILER COOLING AIR FAN 3600m^3/h						P-023		P-023	
652-HX-201	RECIRCULATING CONDENSATE COOLER			1			M-219		M-219	
652-HX-202	RECIRCULATING CONDENSATE COOLER (Installed Spare)			1			M-219		M-219	
652-HX-203	SCRUBBER OVERHEADS CONDENSER Plate and Frame type, 316 SS 45 MM kCal/hr									
652-HX-204	SCRUBBER OVERHEADS CONDENSER Plate and Frame type, 316 SS 45 MM kCal/hr (Installed Spare)									
652-HX-205	PLS COOLER Shell and Tube type 4/2 pass, tube/shell SA 240 316 SS tubes and tube sheet, 2.4m kCal/h, Horizontal, 120 m^3/h			1			P-016		P-016	
652-HX-206	GLYCOL HEAT EXCHANGER Plate and Frame, 24000 kCal/h, 1050 kPa, 43 deg. C, 316 SS APV Products Model SRZM10			1			P-019		P-019	
652-HX-211	SEAL WATER SYSTEM Duty: To provide high pressure seal water to pressure leach vessel agitator. Package includes: seal water reservoir with cooling coil, seal water pump, filter.			1			M-145		M-145	
652-HX-212	SEAL WATER SYSTEM Duty: To provide high pressure seal water to pressure leach vessel agitator. Package includes: seal water reservoir with cooling coil, seal water pump, filter.			1			M-145		M-145	

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652-HX-213	SEAL WATER SYSTEM Duty: To provide high pressure seal water to pressure leach vessel agitator. Package includes: seal water reservoir with cooling coil, seal water pump, filter			1			M-145		M-145	
652-HX-214	SEAL WATER SYSTEM Duty: To provide high pressure seal water to pressure leach vessel agitator. Package includes: seal water reservoir with cooling coil, seal water pump, filter			1			M-145		M-145	
652-HX-215	SEAL WATER SYSTEM Duty: To provide high pressure seal water to pressure leach vessel agitator. Package includes: seal water reservoir with cooling coil, seal water pump, filter			1			M-145		M-145	
652-HX-221	SEAL WATER SYSTEM Duty: To provide high pressure seal water to pressure leach vessel agitator. Package includes: seal water reservoir with cooling coil, seal water pump filter			1			M-145		M-145	
652-HX-222	SEAL WATER SYSTEM Duty: To provide high pressure seal water to pressure leach vessel agitator. Package includes: seal water reservoir with cooling coil, seal water pump filter			1			M-145		M-145	
652-HX-223	SEAL WATER SYSTEM Duty: To provide high pressure seal water to pressure leach vessel agitator. Package includes: seal water reservoir with cooling coil, seal water pump filter			1			M-145		M-145	
652-HX-224	SEAL WATER SYSTEM Duty: To provide high pressure seal water to pressure leach vessel agitator. Package includes: seal water reservoir with cooling coil, seal water pump filter, for agitator 704-AMX-424			1			M-145		M-145	
652-HX-225	SEAL WATER SYSTEM Duty: To provide high pressure seal water to pressure leach vessel agitator. Package includes: seal water reservoir with cooling coil, seal water pump filter			1			M-145		M-145	
652-JC-001	PAS (Process Automation System)			1			I-001		I-001	
652-JZ-001	INSTRUMENTATION Field instrumentation and bulk materials.			LOT						
652-MX-202	STEAM CLEANER SYSTEM 8.7 L/m AT 8600 kPa AND 95°C steam cleaner			1			M-303		M-303B	

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652-MZ-201	HYDROBLASTER Complete with 21,000 kPa high pressure pump at 15 L/m and 90°C and lancing wand. Model 413000 EE			1			M-303		M-303A	
652-MZ-203	PLV AGITATOR BOLT TENSIONER Tentec Model 3CTST: 1750 & 1500			1			M-300		M-300	
652-MZ-204	PLV AGITATOR LIFTING FRAME			2			M-296		M-296	
652-MZ-208	WATER SOFTENING PACKAGE 9000kg/h unit complete with resin column, resin & brine saturation tank and eductor, skid mounted, local control panel & PLC			1			P-020		P-020	
652-PP-201	FIRST STAGE SCRUBBER PUMP Horizontal centrifugal ANSI Pump, CD4MCu wetted parts, 210m^3/h nominal, 250m^3/h design at 50'TDH capacity			1			P-003		P-003	
652-PP-202	FIRST STAGE SCRUBBER PUMP Horizontal centrifugal ANSI pump, CD4MCu wetted parts, 210m^3/h nominal, 250m^3/h design at 50' TDH capacity			1			P-003		P-003	
652-PP-203	SECOND STAGE SCRUBBER PUMP Horizontal centrifugal ANSI Pump, 316 SS wetted parts, 65m^3/h design at 14m TDH capacity			1			P-003		P-003	
652-PP-204	SECOND STAGE SCRUBBER PUMP Horizontal centrifugal ANSI Pump, 316 SS wetted parts, 65m^3/h design at 14m TDH capacity			1			P-003		P-003	
652-PP-205	EVAPORATIVE COOLER FEED PUMP 560 m^3/h gpm design at 20m ft TDH. 1.3s.g. CD4MCu pump casing, alloy,s.s. shaft, horizontal centrifugal V-belt overhead "z" drive, VFD (E-011) . Installed standby			1			P-002		P-002	
652-PP-206	EVAPORATIVE COOLER FEED PUMP Duty: 560 m^3/h gpm design at 20m ftTDH. 1.3s.g., CD4MCu pump casing,alloy s.s. shaft, horizontal centrifugal V-belt overhead "z" drive VFD (E-011)			1			P-002		P-002	
652-PP-207	PLV COOLANT PUMP 2 stage Centrufugal axially split, 316 SS, 250m^3/h rated, 3600kPa TDH, 1 operating, Flowserve Model 4LLR-11A, 6x4			1			P-027		P-027	
652-PP-208	PLV COOLANT PUMP 2 stage Centrufugal axially split, 316 SS, 250m^3/h rated, 3600 kPa TDH, 1 operating			1			P-027		P-027	

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652-PP-209	PLV COOLANT PUMP 2 stage Centrufugal axially split, 316 SS, 250m^3/h gpm rated, 3600 kPa TDH, 1 installed standby			1			P-027		P-027	
652-PP-210	TREATED WATER DISTRIBUTION PUMP Horizontal centrifugal ANSI Pump, 20m^3/h design at 35m TDH, type 316 ss			1			P-003		P-003	
652-PP-211	TREATED WATER DISTRIBUTION PUMP Horizontal centrifugal ANSI Pump, 20m^3/h design at 35m tdh, Type 316 ss. Uninstalled spare (warehouse).			1			P-003		P-003	
652-PP-212	GLYCOL TRANSFER PUMP Horizontal Centrifugal ANSI Pump , 316 SS, 12m^3/h gpm design at 6m tdh.			1			P-003		P-003	
652-PP-213	GLYCOL FEED PUMP High pressure 12m^3/h rated at 4200 kPa, 316 SS wetted parts.			1			P-055		P-055	
652-PP-214	GLYCOL FEED PUMP High pressure 12m^3/h gpm rated at 4200 kPa , 316 SS wetted parts.			1			P-055		P-055	
652-PP-215	PRESSURE LEACHING AREA SUMP PUMP Capacity: 35m^3/h design at 15m tdh. Type: Vertical, centrifugal cantilever, CD4MU Drive: V-Belt			1			P-004		P-004	
652-PP-216	PRESSURE LEACHING AREA SUMP PUMP Capacity: 35m^3/h design at 15m tdh. Type: Vertical, centrifugal cantilever, CD4MU Drive: V-Belt			1			P-004		P-004	
652-PP-217	PRESSURE LEACHING AREA SUMP PUMP Capacity: 35m^3/h design at 15m tdh. Type: Vertical, centrifugal cantilever, CD4MU Drive: V-Belt			1			P-004		P-004	
652-PP-218	PRESSURE LEACHING AREA SUMP PUMP Capacity: 35m^3/h design at 15m tdh. Type: Vertical, centrifugal cantilever, CD4MU Drive: V-Belt			1			P-004		P-004	
652-PP-219	EVAPORATIVE COOLER RECIRCULATION PUMP Axial flow pump, 4500m^3/h at 2.4m tdh			1			M-219		M-219	
652-PP-220	COOLED SLURRY RECYCLE PUMP 290 m^3/h design at 10m tdh. 1.3s.g., Type 316ss , horizontal centrifugal V-Belt overhead drive, VFD			1			P-002		P-002	

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652-PP-221	COOLED SLURRY RECYCLE PUMP 290 m^3/h design at 10m tdh. 1.3s.g., Type 316ss , horizontal centrifugal V-Belt overhead drive, VFD			1			P-002		P-002	
652-PP-222	COOLED SLURRY TRANSFER PUMP 225 m^3/h gpm design at 10m tdh. at 1.30s.g., Type 316SS, horizontal centrifugal V- Belt Overhead drive, VFD			1			P-002		P-002	
652-PP-223	COOLED SLURRY TRANSFER PUMP 225 m^3/h gpm design at 10m tdh. at 1.30s.g., Type 316SS, horizontal centrifugal V- Belt Overhead drive, VFD			1			P-002		P-002	
652-PP-224	BOILER FEED WATER BOOSTER PUMP 12m^3/h, 14m tdh, Operating			1			P-023		P-023	
652-PP-225	BOILER FEED WATER BOOSTER PUMP 12m^3/h, 14m tdh, Installed standby			1			P-023		P-023	
652-PZ-201	PIPING			LOT						
652-PZ-202	EVAPORATIVE COOLER RECIRCULATION PIPING			LOT			M-219		M-219	
652-SB-001	FIRST STAGE SCRUBBER Variable Vanturi type, 2205 duplex stainless steel wetted construction, complete with scrubber tower, two variable throat venturis w/ actuators, nozzles/ header, single cyclonic separator and sump			1			M-164		M-164	
652-SB-002	SECOND STAGE SCRUBBER Variable venturi type, 316/316L stainless steel wetted construction; complete wiith scrubber tower, variable throat venturi with actuator, nozzles/header, cyclonic separator, mist eliminator and sump.			1			M-164		M-164	
652-SU-201	PLV AREA SUMP Pressure leaching area sump 1.2m dia by 1.2m deep concrete with 316 L SS liner, 1.3m^3			1			P-010	701-6-126	P-010	
652-SU-202	PLV AREA SUMP Pressure leaching area sump 1.2m dia by 1.2m deep concrete with 316 L SS liner, 1.3m^3			1			P-010	701-6-126	P-010	
652-SU-203	PLV AREA SUMP Pressure leaching area sump 1.2m dia by 1.2m deep concrete with 316 L SS liner, 1.3m^3			1			P-010	701-6-126	P-010	
652-SU-204	PLV AREA SUMP Pressure leaching area sump 1.2m dia by 1.2m deep concrete with 316 L SS liner, 1.3m^3			1			P-010	701-6-126	P-010	

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652-TK-201	PLV COOLANT TANK 5m dia. by 5m high, 316L SS, 90m^3, covered top, 20 min retention.			1			P-011	704-6-223	P-011	
652-TK-202	TREATED WATER STORAGE TANK 38m^3 capacity, 3.6m diameter by 3.6m high, covered, 304LSS			1			P-010	704-6-224	P-010	
652-TK-203	GLYCOL MIX TANK 2.4m dia x 2.4m high, 316L SS, covered top. 11m^3 cap			1			P-010	704-6-225	P-010	
652-TK-205	UPS FOR PAS 15 kVA, 1 phase, 120V with battery						I-004		I-004	
652-TK-207	CHEMICAL INJECTION PACKAGE Oxygen Scavenger Day Tank Oxygen scavenger metering pumps- 0.14 kw (110V) Inhibitor metering pump 0.33 hp/E (115V) (2) LMI Model B121-95S w/704-BLR-401			1			P-023		P-023	
652-TK-226	SLURRY CONDITIONING TANK 6m dia x 6m high, duplex stainless SAF 2205, 180m^3, 40 min retention time covered top with baffles.			1			P-011	704-6-221	P-011	
652-TK-227	SLURRY CONDITIONING TANK 6m dia x 6m high, duplex stainless SAF 2205, 180m^3, 40 min retention time covered top with baffles.			1			P-011	704-6-221	P-011	
652-TK-228	SLURRY CONDITIONING TANK 6m dia x 6m high, duplex stainless SAF 2205, 180m^3, 40 min retention time covered top with baffles.			1			P-011	704-6-221	P-011	
652-VP-201	EVAPORATIVE COOLER VACUUM PUMP Duty: 115kg non-condensable at 80mm. Hg abs, complete with separation tank, 316SS			1			M-219		M-219	
652-VS-201	PRESSURE LEACH VESSEL Duty: High pressure leach vessel, 3800 kPa design at 235 deg.C Size :4.5m dia - 2 in. shell I.D. x 19m. tangent to tangent length with semi-elliptical heads; horizontal configuration with 2 mounting saddles, carbon steels			1			M-262 & M-2		M-262 &	
652-VS-202	PRESSURE LEACH VESSEL Duty: High pressure leach vessel, 3800kPa design at 235 deg.C Size :4.5m shell I.D. x 19m tangent to tangent length with semi-elliptical heads; horizontal configuration with 2 mounting saddles, carbon steels			1			M-262, M-268		M-262, M	
652-VS-203	PRESSURE LEACH FLASH VESSEL Size: 5.5 m dia. (inside steel) x 8m tan-tan, semi elliptical heads. Material: Carbon steel with vinyl ester lining. Brick Lined.			1			M-263 & M-2		M-263 &	

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652-VS-204	PRESSURE LEACH FLASH VESSEL Size: 5.5 dia. (inside steel) x 8m tan-tan, semi elliptical heads. Material: Carbon steel with vinyl ester lining. Brick Lined.			1			M-263 & M-2		M-263 &	
652-VS-205	EVAPORATIVE COOLER 6.1m x 3.7m St. side rated for 100 kPa, full vacuum @ 150°C, 60 degree cone bottom, dished head top, 316 SS.			1			M-219		M-219	
652-VS-206	OXYGEN BLOWBACK VESSEL 1.2m dia by 3m tan-tan 316L SS, design for 4700 kPa			1			P-012	704-6-229	P-012	
652-VS-207	STEAM BLOWBACK VESSEL 1.2m dia by 3m tan-tan 316L SS, design for 4700 kPa, insulated			1			P-012	704-6-230	P-012	
652-VS-208	SEAL WATER ACCUMULATOR 1.2m dia x 2.5m tan-tan, vertical, rated at 4000 kPa 316LSS			1			P-012	704-6-228	P-012	

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Equipment List
Toromocho Concentrate Leach
Facility 653-Thickening, Filtrating, and Solution Handling

Equipment Number	Equipment Description	REV	REV DATE	QTY	POWER RATING Hp	Status P=Prelim C=Certified	SPEC	DRAWING NO.	P.O.	REMARKS
653-AG-301	DECANT THICKENER FEED TANK AGITATOR Vertical, 316L SS wetted parts (tank size:2.0m dia by 2.5m)			1			M-100		M-100	
653-AG-302	SCRUBBER THICKENER FEED TANK AGITATOR 4 Vertical, 316 SS wetted parts (tank size: 1.5 dia x 2.0m)			1			M-100		M-100	
653-AG-306	RESIDUE FILTER FEED TANK AGITATOR Vertical, axial flow impellers, 316 SS wetted parts									
653-AG-307	CLOTH WASHWATER COLLECTION TANK AGITATOR Vertical, axial flow impeller, 316 SS wetted parts									
653-CH-301	RESIDUE FILTER DISCHARGE HOPPER 316 SS with UMHW Liner			1			M-296		M-296	
653-CH-302	CLOTH WASHWATER LAUNDER 316 SS			1			M-083		M-083	
653-CN-301	HOIST AND TROLLEY FOR FILTER BUILDING 5T Capacity, 20m lift x 20m travel Hoist- 5.5hp Trolley- 0.5hp			1			M-133		M-133	
653-CN-302	AGITATOR HOIST AND TROLLEY 1 ton- capacity x 9m lift, x 20m travel manual chain hoist			1			M-133		M-133	
653-CN-303	HOIST AND TROLLEY for flocculant bag handling 2T cap, 6m lift x 3m travel, electric Hoist ___2HP Trolley___0.25HP			1			M-133		M-133	
653-CZ-301	THICKENER AREA CONTAINMENT Concrete floor under thickeners and tanks with curb to hold			Lot						
653-CZ-302	Acid Containment sized to contain 705-TNK-528 plus 10%									
653-EZ-301	Distribution Panel Board 3 Phase, 480/277V, 100A, 42ckt			1			AKIC		AKIC	
653-EZ-302	ELECTRICAL BULK MATERIALS								AKIC	
653-EZ-303	LIGHTING PANEL 480/277,200A,42CKT			1			AKIC			

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653-EZ-304	LIGHTING TRANSFORMER 75 KVA, 480-480Y/277V, 3 phase			1			AKIC		AKIC	
653-EZ-305	Electrical			Lot						
653-FL-301	RESIDUE FILTER Automatic recessed plate and frame type, horizontal plate pack, polyethylene filter cloth, 1200mm x 1200mm polypropylene filter plates, capacity of 21 tph of dry solids. Hydraulic unit-50hp-480V Cooling Fan-0.75hp-480V Heater-2.			1			M-083		M-083	
653-JZ-301	INSTRUMENTATION Field mount instrumentation and bulk materials			Lot						
653-JZ-301	Instrumentation Solution measuring and sampling			Lot						
653-MZ-301	Flocculant Preparation Package Flocculant preparation system, 32lbs polymer at 0.5% concentration per hr. skid mounted complete with: Hopper-14.5 cu ft with level indication screw feeder- 0.5HP, Air blower- 2.5HP, Ciba jetwet mixer- 3.0HP, mix tank-			1			M-252		M-252	
653-PP-301	DECANT THICKENER U/FLOW PUMP Horizontial Centrifugal V-Belt overhead drive, 58m^3/h design, 12m tdh, 1.52s.g. Type Alloy 20 VFD (E-011)			1			P-002		P-002	
653-PP-302	DECANT THICKENER U/FLOW PUMP Horizontial Centrifugal V-Belt overhead drive, 58m^3/h design, 12m tdh, 1.52s.g. Alloy 20 VFD (E-011)			1			P-002		P-002	
653-PP-303	SCRUBBER THICKENER U/FLOW PUMP Horizontal centrifugal, V-belt overhead drive, 10m^3/h, 10m tdh, 1.52 sp.gr Type 316 SS, VFD (E-011)			1			P-002		P-002	
653-PP-304	SCRUBBER THICKENER U/FLOW PUMP Horizontal centrifugal, V-belt overhead drive, 10m^3/h nominal146 gpm design, 10m tdh, 1.52 sp.gr Type 316 SS, VFD (E-011)			1			P-002		P-002	
653-PP-305	SCRUBBER THICKENER 0'FLOW PUMP Horizontal centrifugal ANSI Pump, 53m^3/h gpm nominal, 62m^3/h design, 28m tdh, Type 316SS.			1			P-003		P-003	
653-PP-307	STRONG PLS RECYCLE PUMP 127m^3/h design @ 25m tdh, 1.276s.g. horizontal centrifugal ANSI Pump, Type 316 SS. Flowserve Model 2K6x4-10HRVM3ST			1			P-003		P-003	

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653-PP-308	STRONG PLS RECYCLE PUMP 127 m^3/h design @ 25m tdh, 1.276s.g. horizontal centrifugal ANSI Pump, Type 316 SS. Flowserve Model 2K6x4-10HRVM3ST installed standby			1			P-003		P-003	
653-PP-309	Flocculant Metering Pump For Decant 1.2m^3/h, at 15m tdh VSD(E-011)			1			P-009		P-009	
653-PP-310	Flocculant Metering Pump For Decant 1.2m^3/h, at 15m tdh VSD(E-011)			1			P-009		P-009	
653-PP-311	Flocculant Metering Pump For Scrubber Thickener 1.2m^3/h, at 15m tdh VSD(E-011)			1			P-009		P-009	
653-PP-312	Flocculant Metering Pump For Scrubber Thickener 1.2m^3/h, at 15m tdh VSD(E-011)			1			P-009		P-009	
653-PP-313	CCD AREA SUMP PUMP Capacity: 35m^3/h at 15m tdh., CD4MCu Type: Vertical, centrifugal			1			P-004		P-004	
653-PP-314	CCD AREA SUMP PUMPS Capacity: 35m^3/h at 15m tdh. CD4MCu Type: Vertical, centrifugal			1			P-004		P-004	
653-PP-315	RESIDUE FILTER FEED PUMP Two duties: 230 m^3/h at 26m tdh, 40m^3/h at 56m tdh, horizontal centrifugal, V-belt Overhead drive, CD4MCu casing and impellers construction, 1-stage, VFD(E-011)			1			P-002		P-002	
653-PP-316	RESIDUE FILTER FEED PUMP Two duties: 230m^3/h at 26m tdh, 40m^3/h at 56m tdh, horizontal centrifugal, V-belt Overhead drive, CD4MCu casing and impellers construction, 1-stage, VFD(E-011)			1			P-002		P-002	
653-PP-317	CLOTH WASHWATER PUMP 320m^3/h design at 45m, tdh, 1.0 s.g., Type 316 SS, horizontal centrifugal ANSI pump.			1			P-003		P-003	
653-PP-318	CLOTH WASHWATER RETURN PUMP 22m^3/h design at 10m tdh, 1.00s.g., Type316 SS, horizontal centrifugal ANSI Pump. (VFD by E-011)			1			P-003		P-003	

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653-PP-323	WATER TRANSFER PUMP Horizontal centrifugal ANSI Pump, 55m^3/h gpm nominal, 62m^3/h design, 28m tdh, Type 316SS.			1			P-003		P-003	
653-PP-324	WATER TRANSFER PUMP Horizontal centrifugal ANSI Pump, 55m^3/h gpm nominal, 62m^3/h design, 28m tdh, Type 316SS.									
653-PP-325	PRODUCT TRANSFER PUMPS Horizontal Centrifugal, 1000m^3/h at 35m tdh, 316SS.									
653-PP-326	PRODUCT TRANSFER PUMPS Horizontal Centrifugal, 1000m^3/h at 35m tdh, 316SS.									
653-PP-327	PRODUCT TRANSFER PUMPS Horizontal Centrifugal, 1000m^3/h at 35m tdh, 316SS.									
653-PZ-301	PIPING			Lot						
653-PZ-301	Piping Pipe and Fittings to add strong and weak PLS into Existing tanks and lines			Lot						
653-SU-301	CCD AREA SUMP 1.2m dia by 1.2m deep concrete, lined with 316L SS, 1.3m^3 cap			1			P-010	701-6-126	P-010	
653-SU-302	CCD AREA SUMP 1.2m dia by 1.2m deep concrete, lined with 316L SS, 1.3m^3 cap			1			P-010	701-6-126	P-010	
653-TK-301	DECANT THICKENER FEED TANK 2.0m dia x 2.5 high, 316L SS, with 3 baffles, intern			1			M-084		M-084	
653-TK-302	DECANT THICKENER TANK Size:12m dia x 2.5 side wall height; open top; above ground, 220555			1			M-084		M-084	
653-TK-303	SCRUBBER THICKENER FEED TANK 1.5m dia x 2.0m high, 316L SS,with 3 baffles,			1			M-084		M-084	
653-TK-304	SCRUBBER THICKENER TANK Size: 9m dia x 2.5 side wall height; open top; above grade on support legs, 316L SS			1			M-084		M-084	
653-TK-305	FLOCCULANT STORAGE TANK 3m dia X 3m High, CS, Cone top covered, 20m^3 cap			1			P-010	705-6-246	P-010	
653-TK-306	RESIDUE FILTER FEED TANK 316L SS, 4 Hour Retention, open top 6.7 dia by 6.7m			1			P-011	705-6-247	P-011	

653-TK-307	CLOTH WASHWATER TANK 2.4m dia by 3.0m high, 316L SS, open top			1			P-010	705-6-249	P-010	
653-TK-308	CLOTH WASHWATER COLLECTION TANK 2.4m dia by 2.4m, 316L SS, Baffled, open top			1			P-010	705-6-250	P-010	
653-TK-309	PRODUCT TANK 8m dia x 6m high, 316LSS, open top			1			P-011		P-011	
653-TK-310	SPLS TANK 1.5m dia. x 55 m high, 316 SS									
653-TK-311	RESIDUE FILTER FIRST WASH TANK 2m dia. x 2m high, 316 SS									
653-TM-301	DECANT THICKENER MECHANISM Standard design. Size: 12m dia. mechanism Material: 220555 Rake- 5.0hp Lift- 0.5hp			1			M-084		M-084	
653-TM-302	SCRUBBER THICKENER MECHANISM Standard design. Size: 9m dia. mechanism Material: 316LSS Rake- 5.0 hp lift- 0.5hp			1			M-084		M-084	
653-VS-301	RESIDUE FILTER AIR RECEIVER 2.6m dia by 4m high C.S., 1100 kPa			1			P-012	705-6-253	P-012	
653-VS-302	AIR BLOW SEPARATOR			1			M-083		M-083	

002771

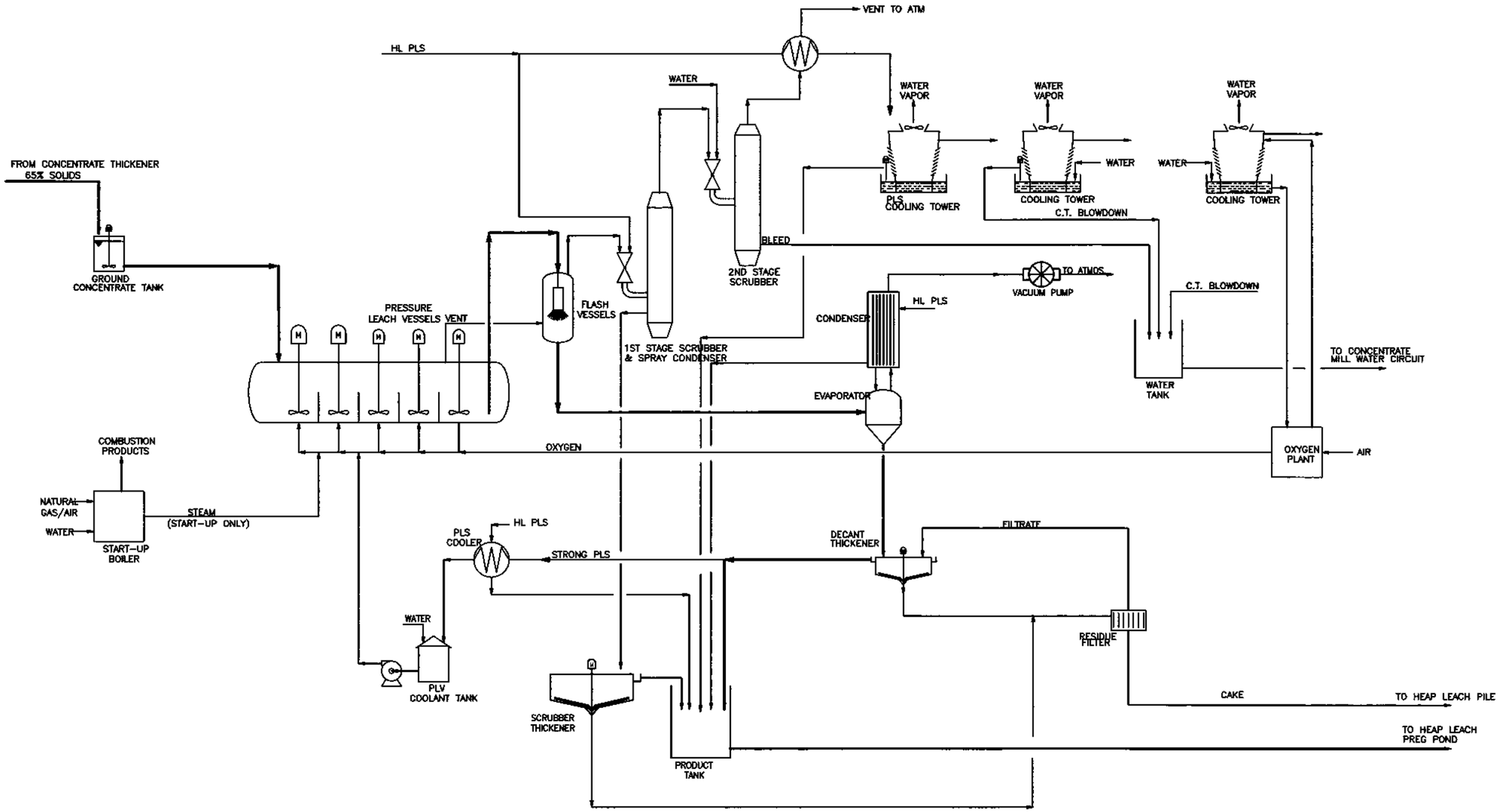
Equipment Number	Equipment Description	REV	REV DATE	QTY	POWER RATING Hp	Status P=Prelim C=Certified	SPEC	DRAWING NO.	P.O.	REMARKS
654-OX-401	OXYGEN PLANT 600 mtpd contained oxygen at 98% purity and 3600 kPa discharge pressure			1			M-278		PD	

002772

Equipment Number	Equipment Description	REV	REV DATE	QTY	POWER RATING Hp	Status P=Prelim C=Certified	SPEC	DRAWING NO.	P.O.	REMARKS
709-ZZZ-900	Welding supplies									
709-ZZZ-910	Safety Indirects									
709-ZZZ-920	Field Indirects									
709-ZZZ-925	Third Party Resting									
709-ZZZ-930	Salaried contractor Labor									
709-ZZZ-940	Non Manual Labor									
709-ZZZ-950	Salaried Per Diem									
709-ZZZ-960	Non Manual Per Diem									
709-ZZZ-970	Computer Support									
709-ZZZ-980	Craft Per Diem									
709-ZZZ-990	General Contractor Tax									
709-ZZZ-995	Temporary Warehouse 10 year life 50' x 150' x 16' eave height						S-002		S-002	

002773

DRAWING No. 650-F-000



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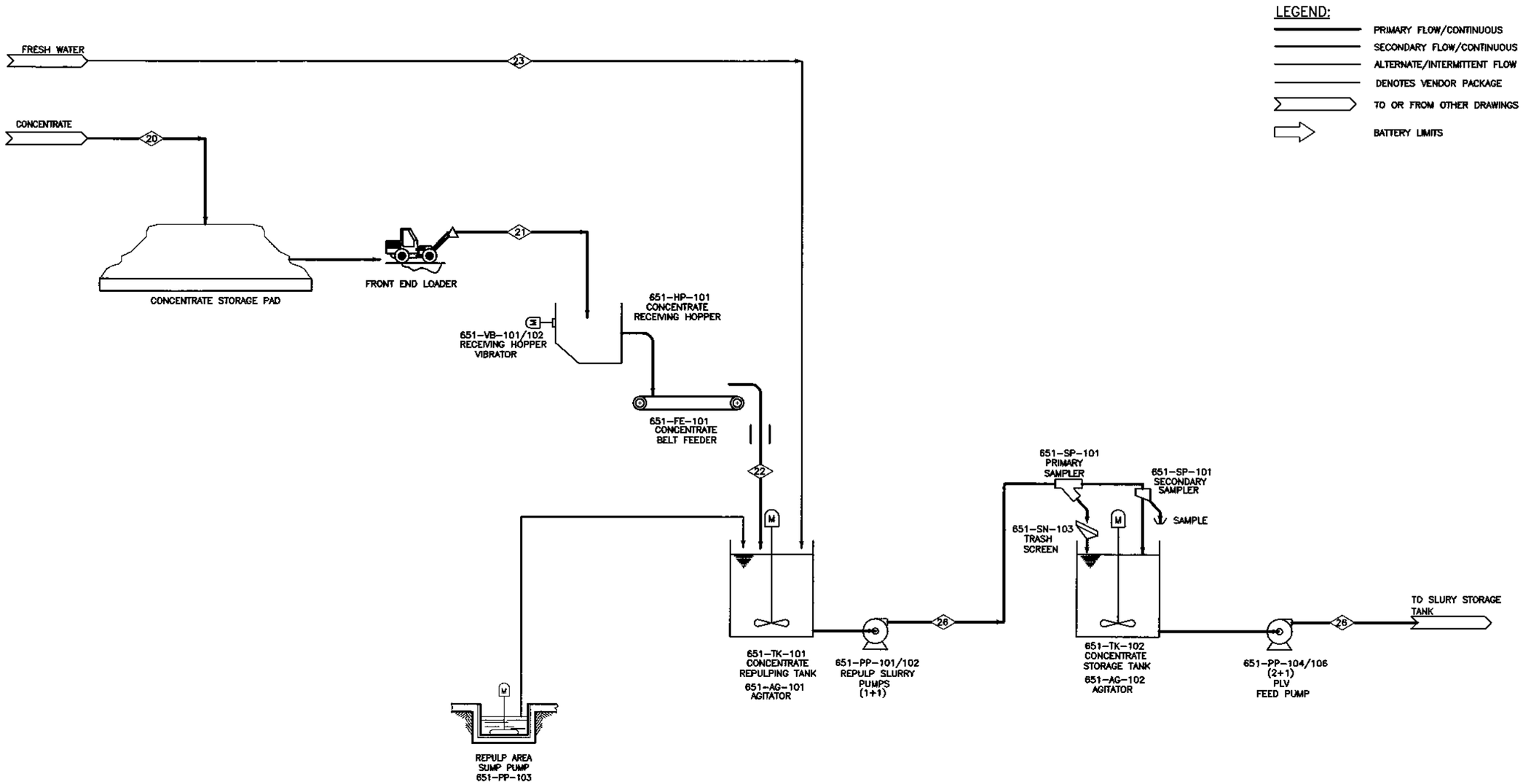
REFERENCES		REVISIONS						REVISIONS					
DWG. NO.	TITLE	NO.	DESCRIPTION	BY	CHK'D	APPROVED	DATE	NO.	DESCRIPTION	BY	CHK'D	APPROVED	DATE
		A	ISSUED FOR INTERNAL REVIEW AND COMMENT	JHL									

TOLERANCES		
FRACTIONS	DECIMALS	ANGLES
±	±	±

SCALE: NONE	SHEET SIZE: A1	PERU COPPER INC.	PROJECT: TOROMOCHO FEASIBILITY STUDY
DRAWN BY: AG	DATE: 03/13/07		AREA:
CHECKED BY: JHL	DATE:		TITLE: TOROMOCHO PROJECT COPPER CONCENTRATE LEACH HIGH TEMPERATURE OPTION PROCESS FLOW DIAGRAM
ENGINEERED BY: JHL	DATE:		JOB NO. R0521300
APPROVED BY:	DATE:		CAD NO. 650F000DWG
			REVISION A
			DWG. NO. 650-F-000

DRAWING No. 350-F-001



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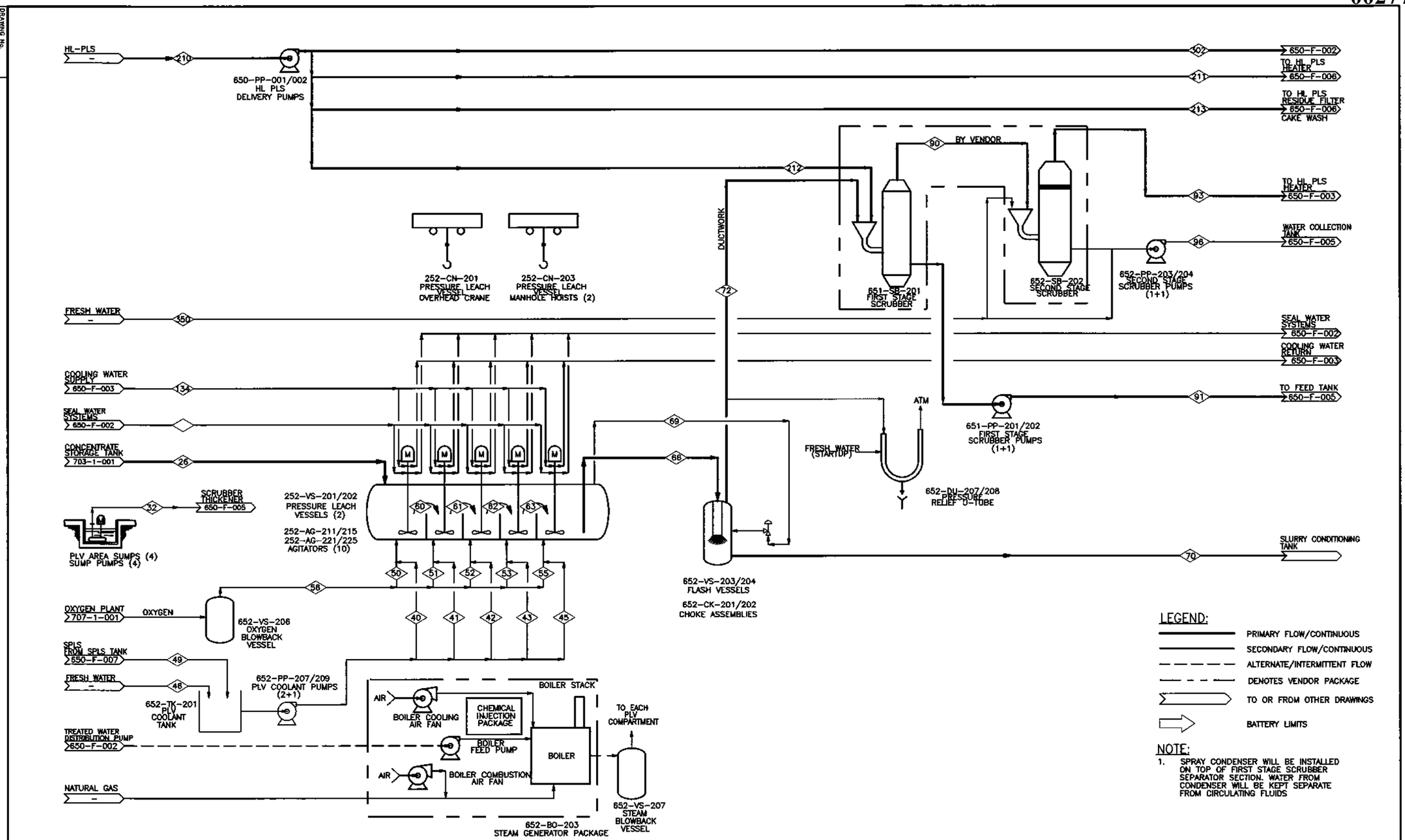
		A	ISSUED FOR INTERNAL REVIEW AND COMMENT	JHL									

TOLERANCES		
FRACTIONS	DECIMALS	ANGLES
±	±	±

SCALE: NONE	SHEET SIZE: A1	PERU COPPER INC.	PROJECT: TOROMOCHO FEASIBILITY STUDY
DRAWN BY: AG	DATE: 03/13/07		AREA:
CHECKED BY: JHL	DATE:		TITLE: TOROMOCHO PROJECT CONCENTRATE RECEIVING PROCESS PROCESS FLOW DIAGRAM
DESIGNED BY: JHL	DATE:		JOB NO. R0521300
APPROVED BY:	DATE:		CAD NO. 350F001.DWG
			REVISION: A
			DWG. NO. 650-F-001



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PERU COPPER INC.

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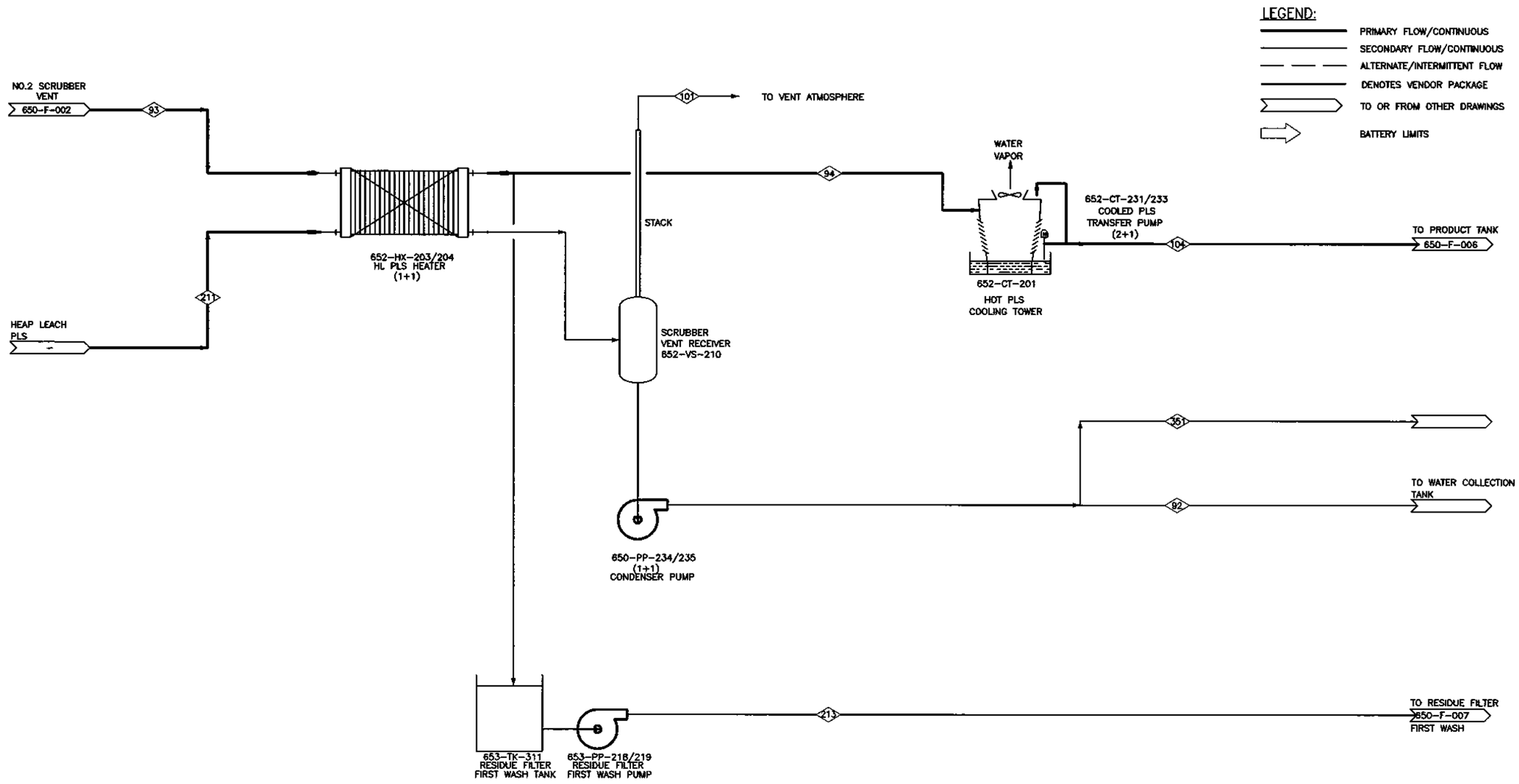
DWG. NO. / TITLE	NO. / DESCRIPTION / BY / CHK'D / APPROVED / DATE	NO. / DESCRIPTION / BY / CHK'D / APPROVED / DATE
	A ISSUED FOR INTERNAL REVIEW AND COMMENT JHL	

SCALE: NONE	SHEET SIZE: A1	PROJECT: TOROMOCHO FEASIBILITY STUDY
DRAWN BY: AG	DATE: 03/13/07	AREA:
CHECKED BY: JHL	DATE:	TITLE: TOROMOCHO PROJECT PRESSURE LEACHING HIGH TEMPERATURE PROCESS FLOW DIAGRAM
ENGINEERING: JHL	DATE:	JOB NO. R0521300
APPROVED BY: JHL	DATE:	CAD NO. 350FD02.DWG
		REVISION A
		DWG. NO. 650-F-002

Size A1 used bdr.dwg Rev. 11/2/06

DRAWING No. 350-F-003



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		A	ISSUED FOR INTERNAL REVIEW AND COMMENT	JHL									

SCALE: NONE	SHEET SIZE: A1	PERU COPPER INC.	PROJECT: TOROMOCHO FEASIBILITY STUDY
DRAWN BY: AG	DATE: 03/13/07		AREA:
CHECKED BY: JHL	DATE:		TITLE: TOROMOCHO PROJECT SCRUBBER HEAT RECOVERY PROCESS FLOW DIAGRAM
ENGINEERED BY: JHL	DATE:		JOB NO. R0521300
APPROVED BY:	DATE:		DWG NO. 350F003.DWG
			REVISION: A
			DWG. NO. 650-F-003

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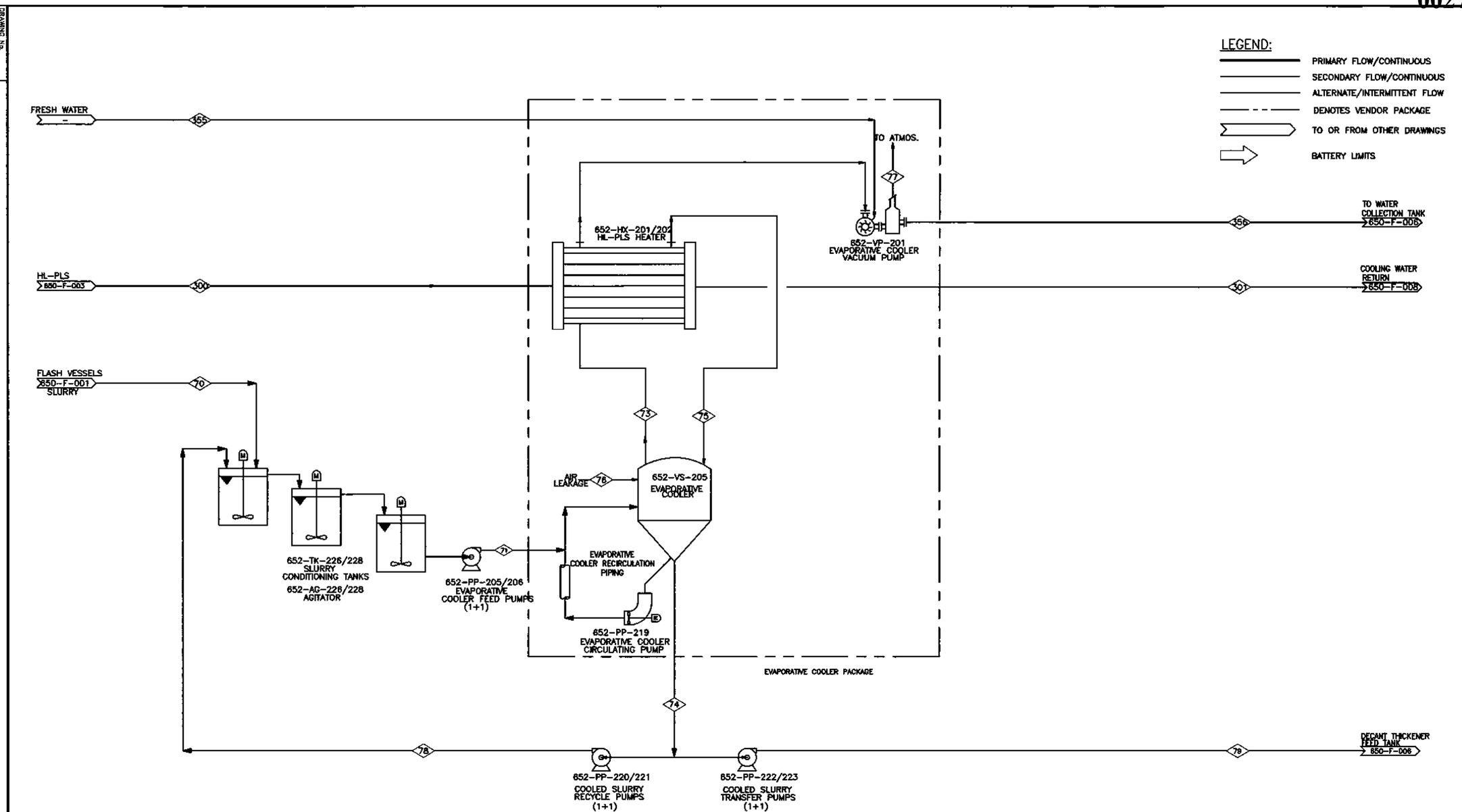
TOLERANCES		
FRACTIONS	DECIMALS	ANGLES
±	±	±

P:\R0521300\06.0 ENGINEERING\06.01 Process Engineering\06.01.03 Drawings\06.01.03.01 Process Flow Diagrams & Heat & Material Balance\PROCESS\LATEST\350F003-A.dwg, 3/13/2007 12:59:27 PM, EL128000

Size A1 excel tab.dwg
Rev. 11/2/06



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		A	ISSUED FOR INTERNAL REVIEW AND COMMENT	JHL									

SCALE: NTS	SHEET SIZE: A1	PERU COPPER INC.	AKER KVÆRNER™ METALS, Inc. Tucson, Arizona
DRAWN BY: AG/JF	DATE: 03/13/2007		PROJECT: TOROMOCHO FEASIBILITY STUDY
CHECKED BY: JHL	DATE:		AREA:
ENGINEERED BY: JHL	DATE:		TITLE: TOROMOCHO PROJECT TANKHOUSE, CATHODE SLURRY COOLING PROCESS FLOW DIAGRAM
APPROVED BY:	DATE:		JOB NO.: R0521300
			CAD NO.: 650F004.DWG
			REVISION: A
			DWG. NO.: 650-F-004

DRAWING No. 350-F-005

LEGEND:
- PRIMARY FLOW/CONTINUOUS
- SECONDARY FLOW/CONTINUOUS
- ALTERNATE/INTERMITTENT FLOW
- DENOTES VENDOR PACKAGE
- TO OR FROM OTHER DRAWINGS
- BATTERY LIMITS

GLYCOL TOTE BIN

336

652-PP-212 TRANSFER PUMP

652-PP-213/214 GLYCOL FEED PUMP

652-TK-203 GLYCOL MIX TANK

COOLING WATER RETURN 650-F003

322

COOLING WATER SUPPLY 650-F003

321

652-HX-208 GLYCOL HEAT EXCHANGER

652-VS-205 SEAL WATER ACCUMULATOR

NITROGEN BOTTLE

336

COOLING WATER SUPPLY 650-F003

323

SEAL WATER SYSTEM PACKAGE

SEAL LEAKAGE TO PRESSURE LEACH VESSEL 650-F003

343

FRESH WATER

DEIONIZING SYSTEM

COOLING WATER RETURN 650-F003

324

TO PACKAGE BOILER 650-F001

652-TK-202 TREATED WATER STORAGE TANK

652-PP-210 TREATED WATER DISTRIBUTION PUMP

652-PP-211 TREATED WATER DISTRIBUTION PUMP (UNINSTALLED)

COOLING WATER SUPPLY 650-F003

325

PLV AGITATOR GEAR BOXES (10)

326

COOLING WATER RETURNED 650-F003

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NO.	DESCRIPTION	BY	CHK'D.	APPROVED	DATE
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DESIGNED BY: AG | DATE: 02/26/07

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APPROVED BY: | DATE:

PERU COPPER INC.

AKER KVÆRNER METALS, Inc. Tucson, Arizona

PROJECT: TOROMOCHO FEASIBILITY STUDY

AREA:

SHEET: TOROMOCHO PROJECT PRESSURE LEACHING AREA PROCESS FLOW DIAGRAM

JOB NO. R0521300

CAD FILE: 350F005.DWG

DWG. NO. 650-F-005

REV. A

DRAWING No. 650-F-006

OVERFLOW FROM SCRUBBER THICKNER 650-F-005 — 97 — GRAVITY FLOW

CONDENSOR 650-F-003 2ND WASH — 45

HL PLS SOLUTION 650-F-001 — 21

SCRUBBER THKR U'FLOW 650-F-105 — 95

DECANT THICKENER U'FLOW 650-F-005 — 81

653-TK-306 RESIDUE FILTER FEED TANK

653-AG-306 AGITATOR

653-PP-315/316 RESIDUE FILTER FEED PUMPS (1+1)

RECYCLE

PLANT AIR 650-F-006

653-VS-301 RESIDUE FILTER AIR RECEIVER

83

653-FL-301 RESIDUE FILTER

653-CN-301/302 FILTER MAINT HOISTS

653-PP-317 CLOTH WASHWATER PUMP

653-TK-307 CLOTH WASHWATER TANK

CORE FLUSH AIR SEPARATOR

FLOOR NEAR SUMP

CORE FLUSH

FILTER CAKE

88 — WASH WATER FILTRATE 650-F-005 TO PRODUCT TANK

85 — MOTHER LIQUOR 650-F-005 TO DECANT THICKENER

84 — TO HEAP LEACH – VIA FEL & TRUCK

CLOTH WASHWATER LAUNDER

RESIDUE FILTER PACKAGE

OXYGEN PLANT BLOWDOWN – 360

COOLING TOWER BLOWDOWN 650-F-003 — 314

2ND SCRUBBER EFFLUENT – 98

VACUUM PUMP SEAL WATER – 356

653-TK-309 WATER COLLECTION TANK

653-PP-323/324 WATER TRANSFER PUMPS (1+1)

653-TK-307 CLOTH WASHWATER COLLECTION TANK

653-AG-307 AGITATOR

653-PP-318 CLOTH WASHWATER RETURN PUMP

CLOTH WASHWATER — 99 — SCRUBBER THICKENER 650-F-005

CONCENTRATOR – TAILINGS

LEGEND:

- PRIMARY FLOW/CONTINUOUS
- SECONDARY FLOW/CONTINUOUS
- ALTERNATE/INTERMITTENT FLOW
- DENOTES VENDOR PACKAGE
- TO OR FROM OTHER DRAWINGS
- BATTERY LIMITS

NOTES:

BATCH FILTER OPERATION–10 MIN CYCLE

1. FILTER PRESS FEED VALVE OPENS, AND RESIDUE FILTER FEED PUMP RECYCLE VALVE CLOSES, ALLOWING FILTER PRESS CHAMBERS TO FILL FOR 4 MINUTES.
2. RESIDUE FILTER FEED PUMP RECYCLE VALVE OPENS AND FILTER PRESS FEED VALVE CLOSES, STOPPING FEED TO THE FILTER PRESS AND SWITCHING THE RESIDUE FILTER FEED PUMP INTO RECYCLE MODE.
3. AIR BLOWS CORE BACK TO RESIDUE FILTER FEED TANK.
4. CAKE IS WASHED WITH HL PLS.
5. CAKE IS WASHED WITH WATER.
6. COMPRESSED AIR BLOWS FOR TWO MINUTES FROM ONE SIDE OF THE FILTRATE LINE THROUGH THE CAKE AND OUT THE OTHER SIDE OF THE FILTRATE LINE.
7. BOMB BAY DOORS OPEN.
8. FILTER PRESS OPENS, ALLOWING CAKE TO FALL.
9. BOMB BAY DOORS CLOSE.
10. CLOTH IS WASHED AT A RATE OF 800 GPM FOR 60 SECONDS.
11. CLOTH WASHWATER IS COLLECTED IN THE CLOTH WASHWATER COLLECTION TANK AND RETURNED AT A UNIFORM RATE.
12. FILTER PRESS CLOSES.

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AKER KVÆRNER™ METALS, Inc. Tucson, Arizona

PERU COPPER INC.

PROJECT: TOROMOCHO FEASIBILITY STUDY

TOROMOCHO PROJECT
RESIDUE FILTER
PROCESS FLOW DIAGRAM

JOB NO. R0521300 | REVISION A | CAD NO. 650F006.DWG | DWG NO. 650-F-006

SCALE: NTS | SHEET SIZE: A1 | DESIGN BY: AG/JF | DRAWN: 03/13/2007 | CHECKED BY: JHL | DATE: | APPROVED BY: JHL | DATE:

REFERENCES

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REVISIONS

NO.	DESCRIPTION	BY	CHK'D.	APPROVED	DATE
A	ISSUED FOR INTERNAL REVIEW AND COMMENT	JHL			

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NO.	DESCRIPTION	BY	CHK'D.	APPROVED	DATE

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Size A1 scale: Inch=Dwg
Rev. 11/2/98

DRAWING No. 350-F-007

LEGEND:
- PRIMARY FLOW/CONTINUOUS
- SECONDARY FLOW/CONTINUOUS
- ALTERNATE/INTERMITTENT FLOW
- DENOTES VENDOR PACKAGE
- TO OR FROM OTHER DRAWINGS
- BATTERY LIMITS

WASHWATER FILTRATE 650-F-008 — 88
SPRAY CONDENSER EFFLUENT 650-F-001 — 83
RESIDUE FILTER FILTRATE 650-F-008 — 85
COOLED SLURRY 650-F-004 — 79

653-TK-301 DECANT THICKENER FEED TANK
653-AG-301 DECANT THICKENER AGITATOR
653-TK-302 DECANT THICKENER TANK
653-TM-301 MECHANISM
82
89
653-TK-310 SPLS TANK
653-TK-309 PRODUCT TANK
653-PP-325/327 PRODUCT TRANSFER PUMPS (2+1)
303
214
TO HEAP LEACH PLS POND
81
TO RESIDUE FILTER FEEDTANK 650-F-006
653-PP-301/302 DECANT THICKNER UNDERFLOW PUMP (1+1)
653-PP-307/308 DECANT THICKNER UNDERFLOW PUMP (1+1)
80
652-HX-205 PLS COOLER
49
TO COOLANT TANK 650-F-002
HP-PLS 650-F-002 — 302
FILTER CLOTH WASH WATER 650-F-006 — 99
FIRST SCRUBBER EFFLUENT 650-F-004 — 91
100
653-TK-304 SCRUBBER THICKNER TANK
653-TM-302 MECHANISM
653-TK-303 SCRUBBER THICKNER FEED TANK
653-AG-303 AGITATOR
98
TO CLOTH WASHWATER TANK 605-F-006
95
TO RESIDUE FILTER FEED TANK 605-F-006
653-PP-303/304 SCRUBBER THICKNER UNDERFLOW PUMP (1+1)

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NUMBER	TITLE

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REVISIONS

NO.	DESCRIPTION	BY	CHK'D	APPROVED	DATE

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SCALE: NONE
SHEET SIZE: A1
DESIGNED BY: AG — DATE: 02/27/07
DRAWN BY: JHL — DATE:
CHECKED BY: JHL — DATE:
APPROVED BY: — DATE:

PERU COPPER INC.

AKER KVÆRNER METALS, Inc. Tucson, Arizona

PROJECT: TOROMOCHO FEASIBILITY STUDY
AREA:
TITLE: TOROMOCHO PROJECT CCD THICKNER CIRCUIT AND NEUTRALIZATION PROCESS FLOW DIAGRAM
JOB NO. R0521300
DWG NO. 350F007.DWG
REVISION A
DRWG NO. 650-F-007

P:\A0521300\06.0 ENGINEERING\06.01 Process Engineering\06.01.03 Drawings\05.01.03.01 Process Flow Diagrams & Heat & Material Balance\PI PROCESS\LATEST\650F007-A.dwg, 3/14/2007 8:31:48 PM, ac1160208

Plot: A1 acad 2dpt.dwg Rev. 11/2/06

DRAWING No. 650-F-008

LEGEND:

- PRIMARY FLOW/CONTINUOUS
- SECONDARY FLOW/CONTINUOUS
- ALTERNATE/INTERMITTENT FLOW
- DENOTES VENDOR PACKAGE
- TO OR FROM OTHER DRAWINGS
- BATTERY LIMITS

NOTES:

1. REFER TO MATERIAL BALANCE FOR ADDITIONAL MASS FLOW DETAILS, TEMPERATURE, ETC.
2. THE COOLING TOWER FLOW TABLES ARE BASED ON OUTFLOW.

PRESSURE LEACH VESSEL AGITATORS >650-F-001 — 326
SEAL WATER SYSTEMS >650-F-002 — 324
GLYCOL HEAT EXCHANGER >650-F-002 — 322

650-VS-002 INSTRUMENT AIR RECEIVER
311
328
330
AIR INLET
AIR INLET
INSTRUMENT AIR TO DISTRIBUTION

650-DR-001 INSTRUMENT AIR DRYER
650-CP-001 INSTRUMENT AIR COMPRESSOR
650-CP-002/003 PLANT AIR COMPRESSORS

FRESH WATER — 317

650-TK-001 ACID STORAGE TANK
650-PP-005 ACID METERING PUMP
ACID CONTAINMENT

650-TK-002 STORAGE TANK
650-TK-003 BIOCIDE CONTAINMENT TANK
650-PP-006 BIOCIDE METERING PUMP

CORROSION INHIBITOR TOTE (BY PDMI)
650-PP-007 CORROSION INHIBITOR METERING PUMP

313
650-CT-001 PLV COOLING TOWER
650-PP-001/002 COOLING WATER PUMPS (1+1)

327
329
316
325 — PRESSURE LEACH VESSEL AGITATORS >650-F-001
323 — SEAL WATER SYSTEMS >650-F-002
321 — GLYCOL HEAT EXCHANGER >650-F-002
314 — BLOWDOWN — WATER COLLECTION TANK >650-F-006

650-DR-001 PLANT AIR DRIER
TO RESIDUE FILTER >650-F-006
PLANT AIR TO DISTRIBUTION

(BACKUP)
650-VS-001 PLANT AIR RECEIVER

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REFERENCES							REVISIONS							REVISIONS						
DWG. NO.	TITLE						NO.	DESCRIPTION	BY	CHK'D	APPROVED	DATE	NO.	DESCRIPTION	BY	CHK'D	APPROVED	DATE		
							A	ISSUED FOR INTERNAL REVIEW AND COMMENT	JHL											

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SCALE: NTS | SHEET SIZE: A1
DRAWN BY: AG/JF | DATE: 03/12/2007
CHECKED BY: J-L | DATE:
ENGINEERED BY: J-L | DATE:
APPROVED BY: | DATE:

PERU COPPER INC.

AKER KVÆRNER METALS, Inc. Tucson, Arizona

PROJECT: TOROMOCHO FEASIBILITY STUDY
AREA:
JOB NO. R0521300
TITLE: TOROMOCHO PROJECT COOLING WATER & UTILITIES PROCESS FLOW DIAGRAM
CAD FILE: 650F008.DWG
REVISION: A
DWG. NO. 650-F-008

P:\R0521300\650 & ENG\650\Eng\R0521300_01 Process Engineering\026.02.03 Drawings\026.02.03.01 Process Flow Diagrams & Heat & Material Balance\UN PROCESS\ATEST\650F008-A.dwg, 3/13/2007 4:47:47 PM, EL135065

Size A1 wood blocking Rev. 11/2/06

3/21/2007

TOROMOCHO - HIGH TEMPERTURE PRESSURE LEACH
Winter Conditions

STREAM NO.	20	21	22	23	25	40	41	42	43	45	48	49	50	51	52
Description	CONC FRM EXIST PILE	CONC TO HOPPER	CONC TO MILL	WATER TO MILL	SLURRY TO PLVS	COOLANT TO #1	COOLANT TO #2	COOLANT TO #3	COOLANT TO #4	COOLANT TO #5	COOLANT TO PLV	COOLED SPLS TO A/C	OXYGEN TO #1	OXYGEN TO #2	OXYGEN TO #3
Solid Flowrate, mt/h	33.70	33.70	33.70		33.70	0.01	0.00	0.00	0.00			0.01			
Liquid Flowrate, mt/h	3.74	3.74	3.74	14.40	18.15	241.94	24.11	19.38	3.17	0.00	164.59	123.99			
Gas Flowrate, mt/h													17.54	5.34	1.53
Organic Flowrate, mt/h															
Total Flowrate, mt/h	37.44	37.44	37.44	14.40	51.85	241.95	24.11	19.38	3.17	0.00	164.59	124.00	17.54	5.34	1.53
Percent solid	90.0	90.0	90.0		65.0	0.0	0.0	0.0	0.0			0.0			
Cu, g/L						28.6	28.8	28.8	28.8	28.6		77.1			
Fe, g/L						7.5	7.5	7.5	7.5	7.6		20.3			
H2SO4, g/l						33.27	33.27	33.27	33.27	33.27		89.76			
Sulfate in solution g/L						95.5	95.5	85.5	95.5	95.5		257.7			
Slurry Flowrate,m3/h	12.1	12.1	12.1	14.4	29.8	218.0	21.7	17.4	2.9	0.0	185.3	86.3			
Gas Flowrate,m3/h													409.7	124.7	35.6
Organic Flowrate, m3/h															
Temperature, C	26.7	26.7	26.7	26.7	26.7	30.0	30.0	30.0	30.0	30.0	30.0	30.0	26.7	26.7	26.7
Cu in solids, mt/h	9.36	9.36	9.36		9.36	0.00	0.00	0.00	0.00			0.00			
Cu in soln, st/h						9.23	0.62	0.50	0.08	0.00		7.43			
H2SO4, st/h						7.25	0.72	0.58	0.10	0.00		8.65			

STREAM NO.	53	56	58	60	61	62	63	68	69	70	71	72	73	74	76
Description	OXYGEN TO #4	OXYGEN TO #5	TOTAL OXYGEN	O/F SLURRY #1	O/F SLURRY #2	O/F SLURRY #3	O/F SLURRY #4	A/C DISCHARGE SLURRY	A/C VENT	FLASH TK SLURRY	SLURRY TO COOLER	FLASH TK VAPOR	EVAP COOLER VAPOR	EVAP COOLER DISCH	EVAP COOLER COND
Solid Flowrate, mt/h				21.39	17.89	15.85	16.68	18.48	0.02	17.94	32.29	0.55		32.29	
Liquid Flowrate, mt/h				286.81	313.84	336.17	338.66	337.13	0.30	259.41	547.42	8.02		532.22	15.20
Gas Flowrate, mt/h	0.25	0.25	24.91	4.18	9.10	9.70	9.80		9.47			79.46	15.40		
Organic Flowrate, mt/h															
Total Flowrate, mt/h	0.25	0.25	24.91	311.38	340.83	361.72	365.14	355.61	9.76	277.36	579.71	88.04	15.40	564.50	15.20
Percent solid				6.9	5.2	4.7	4.6	5.2	0.2	6.5	5.6	0.6		5.7	
Cu, g/L				45.0	48.3	48.4	48.4	48.8	48.8	74.7	75.3	74.7		78.9	
Fe, g/L				10.0	10.0	10.0	10.0	10.3	10.3	16.7	19.8	15.7		20.8	
H2SO4, g/l				59.35	65.80	65.95	65.98	59.11	59.11	90.40	87.66	90.40		91.89	
Sulfate in solution g/L				162.5	163.9	164.1	164.2	158.8	158.8	242.9	251.6	242.9		269.8	
Slurry Flowrate,m3/h				280.6	312.7	333.3	336.7	336.4	0.3	215.4	444.7	6.7		424.5	15.5
Gas Flowrate,m3/h	6.9	6.9	592.6	184.4	485.6	517.8	523.1		499.6			156084.6	127385.6		
Organic Flowrate, m3/h															
Temperature, C	26.7	26.7	26.7	200.0	225.0	225.0	225.0	223.6	223.6	96.6	80.0	99.8	60.2	60.2	60.0
Cu in solids, mt/h				3.22	1.34	0.61	0.72	0.63	0.00	0.61	1.27	0.02		1.27	
Cu in soln, st/h				12.39	14.89	15.92	16.09	16.17	0.01	16.79	32.80	0.49		32.80	
H2SO4, st/h				16.33	20.28	21.79	21.93	19.57	0.02	19.00	38.20	0.59		38.20	

STREAM NO.	75	77	78	79	80	81	82	83	84	85	88	89	90	91	92
Description	AIR-IN-LEAK	NCG	RECYCLE TO COND TK	COOL SLURRY TO DECANT	SPLS TO COOLANT	DECANT THK U/F	DECANT THK O/F	FILTER FEED SLURRY	FILTER CAKE	FILTRATE	WASH FILTRATE	SPLS TO HL POND	1ST SCRUB VAPOR	1ST SCRUB EFF	92.00
Solid Flowrate, mt/h			16.84	15.45	0.01	15.44	0.03	15.99	15.97	0.02		0.01	0.01	0.55	0.00
Liquid Flowrate, mt/h			285.51	281.91	123.99	10.29	269.58	11.12	2.16	8.94	13.07	136.57	0.11	10.44	67.03
Gas Flowrate, mt/h	0.20	0.20											79.39		
Organic Flowrate, mt/h															
Total Flowrate, mt/h	0.20	0.20	302.35	277.36	124.00	25.73	269.58	27.10	18.15	8.95	13.07	136.58	79.50	10.99	67.03
Percent solid			5.6	5.6	0.0	60.0	0.0	59.0	88.0	0.2		0.0	0.0	5.0	0.0
Cu, g/L			76.2	79.2	76.1	78.1	76.1	74.2	3.2	74.2	10.7	76.1	54.5	54.5	0.0
Fe, g/L			20.0	20.0	20.0	20.0	20.0	19.5	3.2	19.6	6.6	20.0	13.7	13.7	0.0
H2SO4, g/l			88.68	88.86	88.61	88.61	88.61	86.55	3.64	86.55	12.47	88.61	65.92	65.92	0.00
Sulfate in solution g/L			254.6	254.6	254.4	254.4	254.4	247.9	14.7	247.9	42.4	254.4	181.1	181.1	0.0
Slurry Flowrate,m3/h			229.3	210.3	97.6	12.9	205.1	13.2	6.5	7.1	12.5	107.5	0.1	9.1	66.9
Gas Flowrate,m3/h	305.4	305.8											170567.4		
Organic Flowrate, m3/h															
Temperature, C	20.0	20.4	60.2	60.2	60.3	60.3	60.3	52.6	52.4	52.6	45.1	60.3	93.4	93.4	62.8
Cu in solids, mt/h			0.66	0.61	0.00	0.61	0.00	0.63	0.63	0.00		0.00	0.00	0.02	0.00
Cu in soln, st/h			17.11	15.70	7.43	0.62	15.69	0.65	0.01	0.53	0.13	8.18	0.00	0.49	0.00
H2SO4, st/h			19.92	18.26	8.55	0.72	18.17	0.76	0.01	0.61	0.16	9.52	0.01	0.59	0.00

STREAM NO.	93	94	95	96	98	99	100	101	102	103	104	131	200	201	210
Description	SCRUBBER VENT	HOT HPLS TO CT	SCRUB THK U/F	2ND SCRUB EFF	SCRUB THK O/F	SCRUB THK O/F TO CLOTHWASH	SCRUB THK TRANSFER LIQ	SCRUBBER VENT TO ATM	AIR TO PLS CT	CT VAPOR	COOLED PLS	ACID TO HPL	HPL ORE	HPL TAILS	HPL-PLS TO CLP
Solid Flowrate, mt/h	0.00		0.55	0.01									2109.96	2137.46	
Liquid Flowrate, mt/h	0.05	1099.88	0.82	4.81	36.25	26.64	9.61			1.03	1026.04	0.00	64.43	264.18	2354.11
Gas Flowrate, mt/h	79.18							5.68	2199.76	2272.57					
Organic Flowrate, mt/h															
Total Flowrate, mt/h	79.22	1099.88	1.37	4.81	36.25	26.64	9.61	5.68	2199.76	2273.60	1026.04	0.00	2174.39	2401.64	2354.11
Percent solid	0.0		40.0	0.1									97.0	89.0	
Cu, g/L	1.0	2.1	51.6	1.0	54.6	54.8	54.8			2.3	2.3			2.1	2.1
Fe, g/L	0.2	8.6	13.4	0.2	13.7	13.7	13.7			8.3	8.3			8.7	8.7
H2SO4, g/l	1.19	2.27	52.47	1.19	66.27	66.27	66.27			2.46	2.46	1704.15		2.31	2.31
Sulfate in solution g/L	3.3	21.0	172.4	3.3	181.9	181.9	181.9			22.8	22.8	1671.4		21.3	21.3
Slurry Flowrate,m3/h	0.1	1085.5	0.9	5.0	30.9	22.7	8.2			1.0	995.2	0.0	859.2	1066.6	2285.4
Gas Flowrate,m3/h	192524.7							10608.2	3263133	1932049					
Organic Flowrate, m3/h															
Temperature, C	87.9	60.0	93.4	87.8	93.4	93.4	93.4	62.8	20.0	20.0	20.0	20.0	20.0	20.5	20.5
Cu in solids, mt/h	0.00		0.02	0.00									7.29	1.46	
Cu in soln, st/h	0.00	2.24	0.04	0.00	1.69	1.24	0.45			0.00	2.24			0.54	4.80
H2SO4, st/h	0.00	2.47	0.04	0.01	2.05	1.51	0.54			0.00	2.46	0.00		0.59	5.28

STREAM NO.	211	212	213	214	219	220	221	222	225	224	226	226	227	228	229
Description	HPL PLS TO CONDENS	HP-PLS TO 1ST SCRUB	HPL PLS TO FILT WASH	LIQ FROM PLV	HP-PLS TO HP POND	WASH WATER	EXCESS RAFFINATE	HPL-PLS	HPL POND O/F	HPL POND SOLIDS	PLS TO SX	SX RAFFINATE	RICH LIQ TO HX	AIR TO HPL	COOLED RICH LIQUOR
Solid Flowrate, mt/h			0.01			0.00				0.01					
Liquid Flowrate, mt/h	1099.88	2.45	8.53	2430.51	1102.34	3646.75	0.00	3456.45	3600.26		3600.51	3585.12	964.74		964.74
Gas Flowrate, mt/h														1.10	
Organic Flowrate, mt/h															
Total Flowrate, mt/h	1099.88	2.45	8.53	2430.52	1102.34	3646.75	0.00	3456.45	3600.26	0.01	3600.51	3585.12	964.74	1.10	964.74
Percent solid				0.0		0.0				100.0					
Cu, g/L	2.1	2.1	2.1	5.8	2.1	0.5		2.1	5.1		5.1	0.5	56.2		57.7
Fe, g/L	8.7	8.7	8.7	9.6	8.7	8.9		8.7	9.1		9.1	9.1	1.7		1.7
H2SO4, g/l	2.31	2.31	2.31	6.63	2.31	13.95		2.31	7.57		7.12	14.21	147.42		148.28
Sulfate in solution g/L	21.3	21.3	21.3	33.3	21.3	31.8		21.3	32.3		32.3	32.2	236.9		235.1
Slurry Flowrate,m3/h	1069.2	2.4	8.4	2334.1	1071.6	3531.2	0.0	3360.9	3459.2	0.0	3459.2	3467.6	801.3		807.5
Gas Flowrate,m3/h														1627.7	
Organic Flowrate, m3/h															
Temperature, C	20.5	20.5	20.5	27.4	20.5	21.0	21.0	20.5	20.0	20.0	20.3	21.2	23.5	20.0	45.9
Cu in solids, mt/h				0.00		0.00				0.00					
Cu in soln, st/h	2.24	0.01	0.01	13.55	2.25	1.76		7.05	17.57		17.67	1.76	46.61		46.61
H2SO4, st/h	2.47	0.01	0.01	16.46	2.47	49.27		7.75	26.18		24.63	49.27	118.12		118.12

3/21/2007

TOROMOCHO - HIGH TEMPERTURE PRESSURE LEACH
Winter Conditions

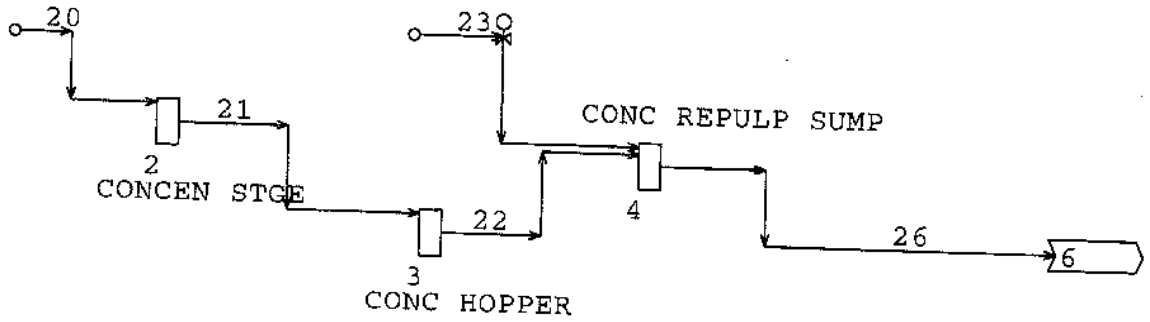
STREAM NO.	230	231	232	240	241	242	243	244	245	246	247	248	250	251	252
Description	BARREN ORGANIC TO SX	LOADED ORGANIC	STRIPPED ORGANIC	HPL RAINFALL	HPL EVAP	RAIN ON HPL POND	HPL POND EVAP	RAIN TO RAFF POND	RAFF POND EVAP	CATCHMENT RAIN	CATCHMENT RAIN TO HPLS	CATCHMENT RAIN TO RAFF	RICH LIQUOR TO EW	LEAN ELECTROLYTE	EW VENT GAS
Solid Flowrate, mt/h															
Liquid Flowrate, mt/h				60.35		3.62		3.62		83.30	41.65	41.65	1030.77	1013.20	
Gas Flowrate, mt/h					25.40		33.71		2.16						3.53
Organic Flowrate, mt/h	3300.78	3316.17	3300.78												
Total Flowrate, mt/h	3300.78	3316.17	3300.78	60.35	25.40	3.62	33.71	3.62	2.16	83.30	41.65	41.65	1030.77	1013.20	3.53
Percent solid															
Cu, g/L	4.0	5.5	4.0										54.5	38.0	
Fe, g/L		0.0											1.8	1.8	
H2SO4, g/l													136.15	153.09	
Sulfate in solution g/L													222.1	221.5	
Slurry Flowrate,m3/h				60.5		3.6		3.6		83.4	41.7	41.7	856.0	857.1	
Gas Flowrate,m3/h					60418.5		80053.3		5195.9						5209.6
Organic Flowrate, m3/h	3459.2	3476.9	3459.2												
Temperature, C	23.5	21.2	23.5	20.0	20.6	20.0	20.0	20.0	21.0	20.0	20.0	20.0	50.0	50.0	50.0
Cu in solids, mt/h															
Cu in soln, st/h	13.84	29.65	13.84										46.61	32.57	
H2SO4, st/h													118.12	139.79	

STREAM NO.	253	254	255	258	259	300	301	302	303	305	306	311	312	313	314
Description	CATHODE	LE TO STRIP	LE BLEED	MAKEUP ACID TO EW	COOL LE TO STRIP	PLS TO EVAP COND	PLS FR EVAP COND	PLS TO LIQ COOLER	CW FR PLS COOLER	CW FR AIR COMP	CT TO AIR COMP	CT RETURN WATER	AIR TO CT	CT EVAP	CT BLOWDOWN
Solid Flowrate, mt/h	14.04														
Liquid Flowrate, mt/h		969.38	55.85	12.03	969.38	928.64	928.64	316.55	316.55	17.02	17.02	71.95		0.07	0.63
Gas Flowrate, mt/h													143.89	145.72	
Organic Flowrate, mt/h															
Total Flowrate, mt/h	14.04	969.38	55.85	12.03	969.38	928.64	928.64	316.55	316.55	17.02	17.02	71.95	143.89	145.79	0.63
Percent solid	100.0														
Cu, g/L		37.8	37.8		38.1	2.1	2.1	2.1	2.1						
Fe, g/L		1.5	1.5		1.6	8.7	8.7	8.7	8.7						
H2SO4, g/l		175.00	175.00	1704.15	176.47	2.31	2.30	2.31	2.30						
Sulfate in solution g/L		232.8	232.8	1671.4	234.7	21.3	21.2	21.3	21.2						
Slurry Flowrate,m3/h	1.6	815.8	47.0	6.6	808.9	902.7	905.0	307.7	308.5	17.1	17.0	72.3		0.1	0.6
Gas Flowrate,m3/h													209612	213977.8	
Organic Flowrate, m3/h															
Temperature, C	60.0	49.8	49.8	20.0	27.5	20.5	30.0	20.5	30.0	30.0	15.0	30.0	15.0	15.0	15.0
Cu in solids, mt/h	14.04														
Cu in soln, st/h		30.80	1.77		30.80	1.90	1.90	0.65	0.65						
H2SO4, st/h		142.76	8.22	11.19	142.76	2.08	2.08	0.71	0.71						

STREAM NO.	315	316	317	321	322	323	324	325	326	327	328	329	330	336	339
Description	WATER TO CONCENT RATOR	CT EXIT WATER	CT MAKEUP WATER	GLYCOL CW OUT	CW TO GLYCOL	SEAL WATER SYSTEM	CW TO SEAL WATER	PLV SEALS	CW TO PLV SEALS	INST AIR CW OUT	CW TO INST AIR	PLANT AIR CW OUT	CW TO PLANT AIR	SEAL WATER	GLYCOL
Solid Flowrate, mt/h	0.00														
Liquid Flowrate, mt/h	71.43	69.42	7.55	9.98	5.00	4.99	14.99	15.00	14.99	9.98	9.99	14.97	14.99	0.02	0.02
Gas Flowrate, mt/h															
Organic Flowrate, mt/h															
Total Flowrate, mt/h	71.44	69.42	7.55	9.98	5.00	4.99	14.99	15.00	14.98	9.98	9.99	14.97	14.99	0.02	0.02
Percent solid	0.0														
Cu, g/L	0.1														
Fe, g/L	0.0														
H2SO4, g/l	0.06														
Sulfate in solution g/L	0.2														
Slurry Flowrate,m3/h	72.5	69.5	7.6	10.0	5.0	5.0	15.0	15.1	15.0	10.0	10.0	15.0	15.0	0.0	0.0
Gas Flowrate,m3/h															
Organic Flowrate, m3/h															
Temperature, C	56.4	15.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	30.0	15.0	26.7	26.7
Cu in solids, mt/h	0.00														
Cu in soln, st/h	0.00														
H2SO4, st/h	0.00														

STREAM NO.	349	350	351	353	354	355	356	360	370	371					
Description	A/C SEAL WATER	WATER TO 2ND SCRUB	FILTER WASH WATER	MAKEUP WATER TO EW	MAKEUP WATER TO RAFFINA	VP SEAL WATER IN	VP SEAL WATER OUT	D2 PLT CT BLOWDO WN	CELL FEED STEAM	CELL FEED CONDEN SATE					
Solid Flowrate, mt/h			0.00		0.00										
Liquid Flowrate, mt/h	0.05	4.53	6.53	46.03	20.54	4.53	4.53	14.97		9.14					
Gas Flowrate, mt/h									9.14						
Organic Flowrate, mt/h															
Total Flowrate, mt/h	0.05	4.53	6.53	46.03	20.55	4.53	4.53	14.97	9.14	9.14					
Percent solid			0.0		0.0										
Cu, g/L			0.0		0.1										
Fe, g/L			0.0		0.0										
H2SO4, g/l			0.00		0.06										
Sulfate in solution g/L			0.0		0.2										
Slurry Flowrate,m3/h	0.0	4.6	6.7	46.1	20.9	4.5	4.5	15.0		9.9					
Gas Flowrate,m3/h									4366.8						
Organic Flowrate, m3/h															
Temperature, C	26.7	20.0	62.8	20.0	56.4	20.0	20.4	30.0	143.3	143.3					
Cu in solids, mt/h			0.00		0.00										
Cu in soln, st/h			0.00		0.00										
H2SO4, st/h			0.00		0.00										

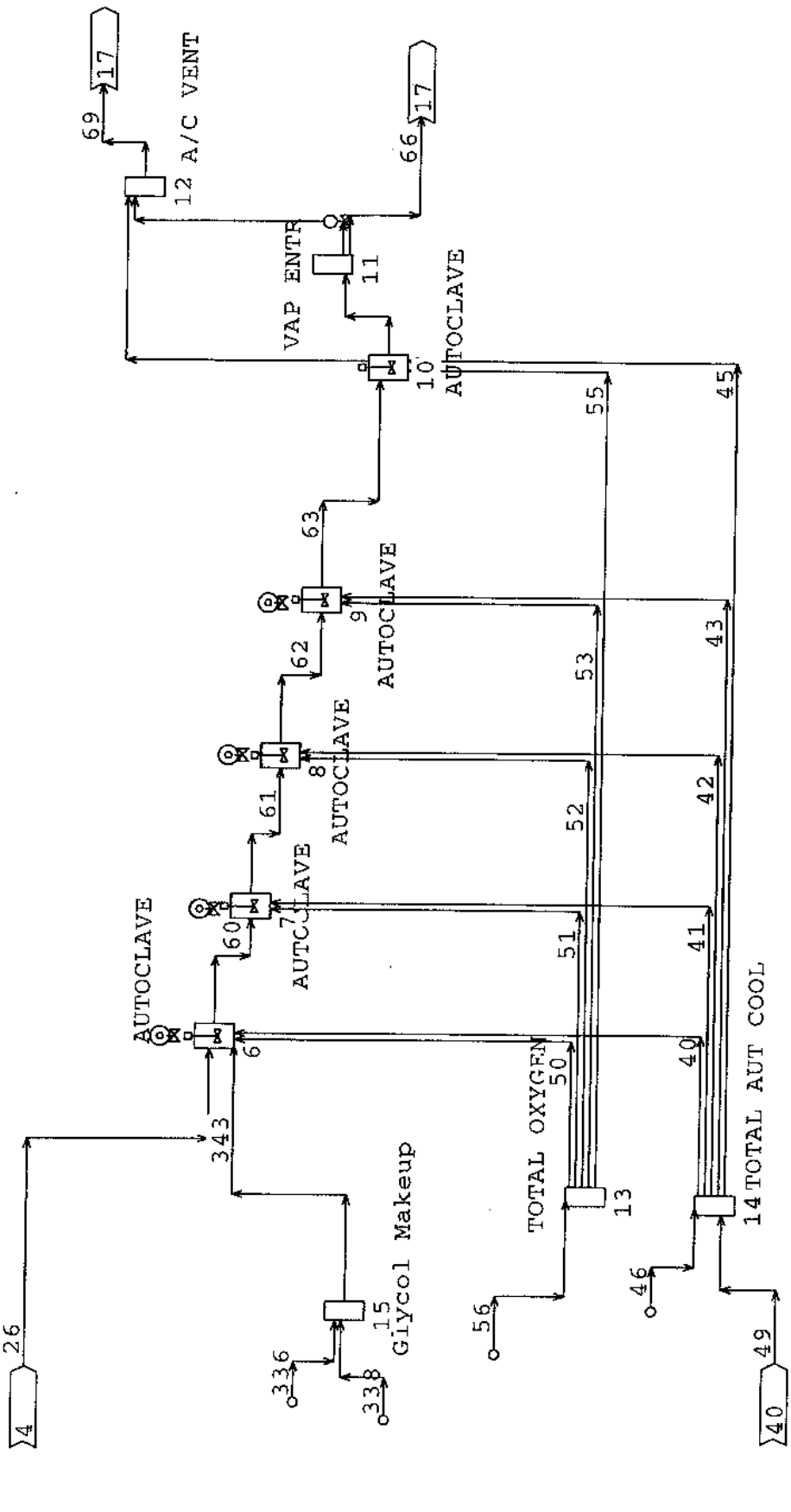
HIGH TEMP PRESSURE LEACH
WINTER CONDITIONS



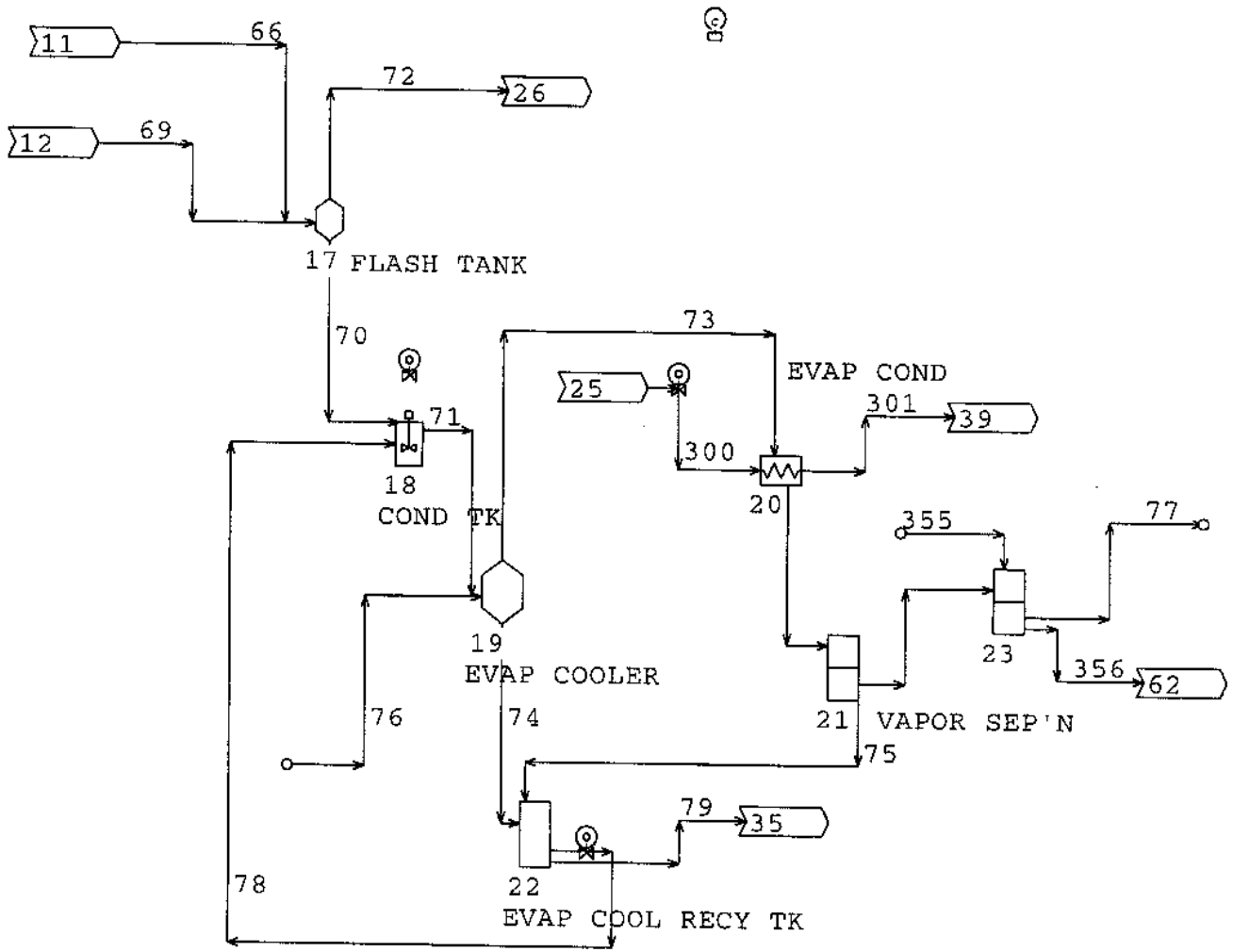
CON HANDLING

002785

HIGH TEMP PRESSURE LEACH
WINTER CONDITIONS



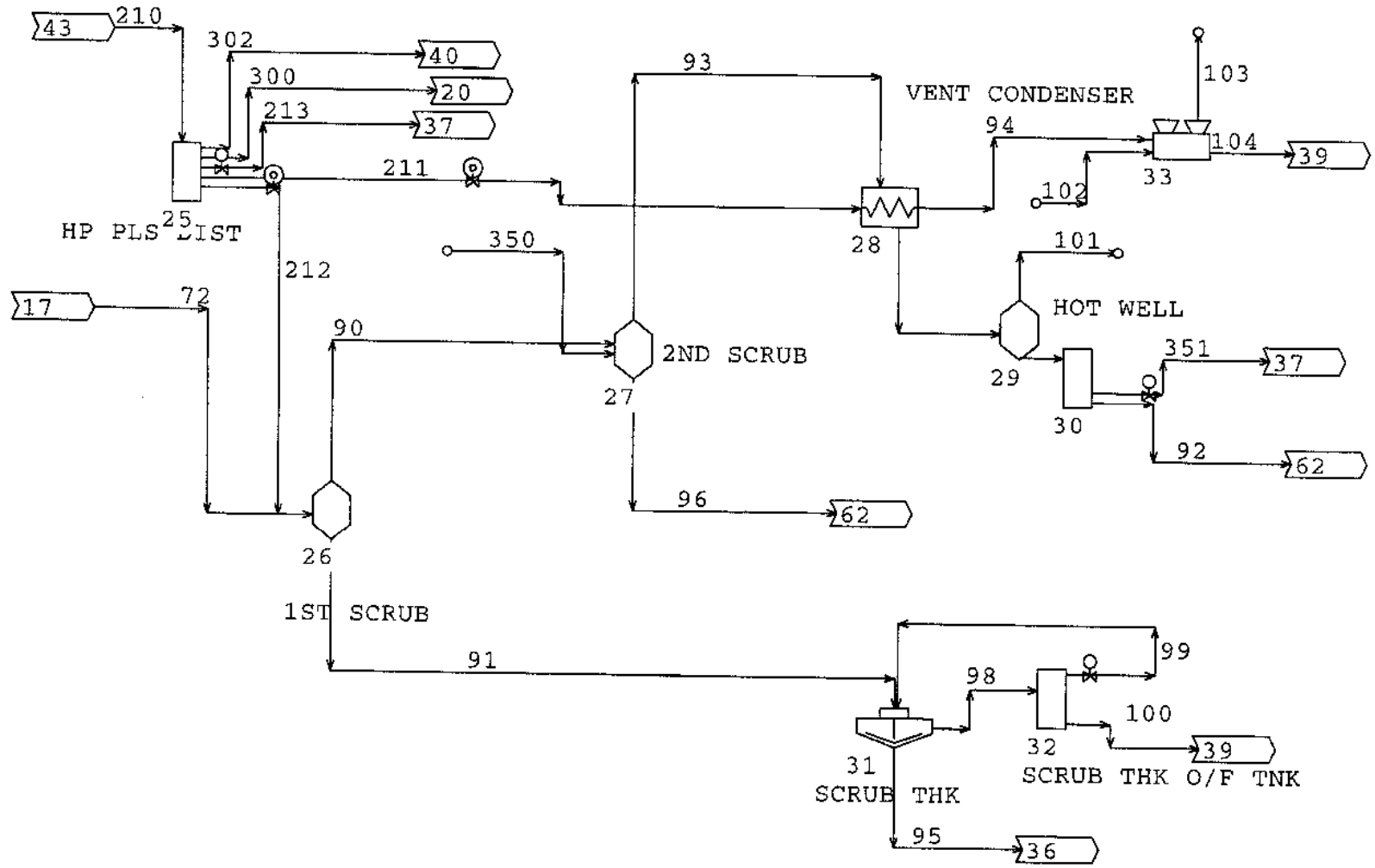
HIGH TEMP PRESSURE LEACH
WINTER CONDITIONS



FLASH

002787

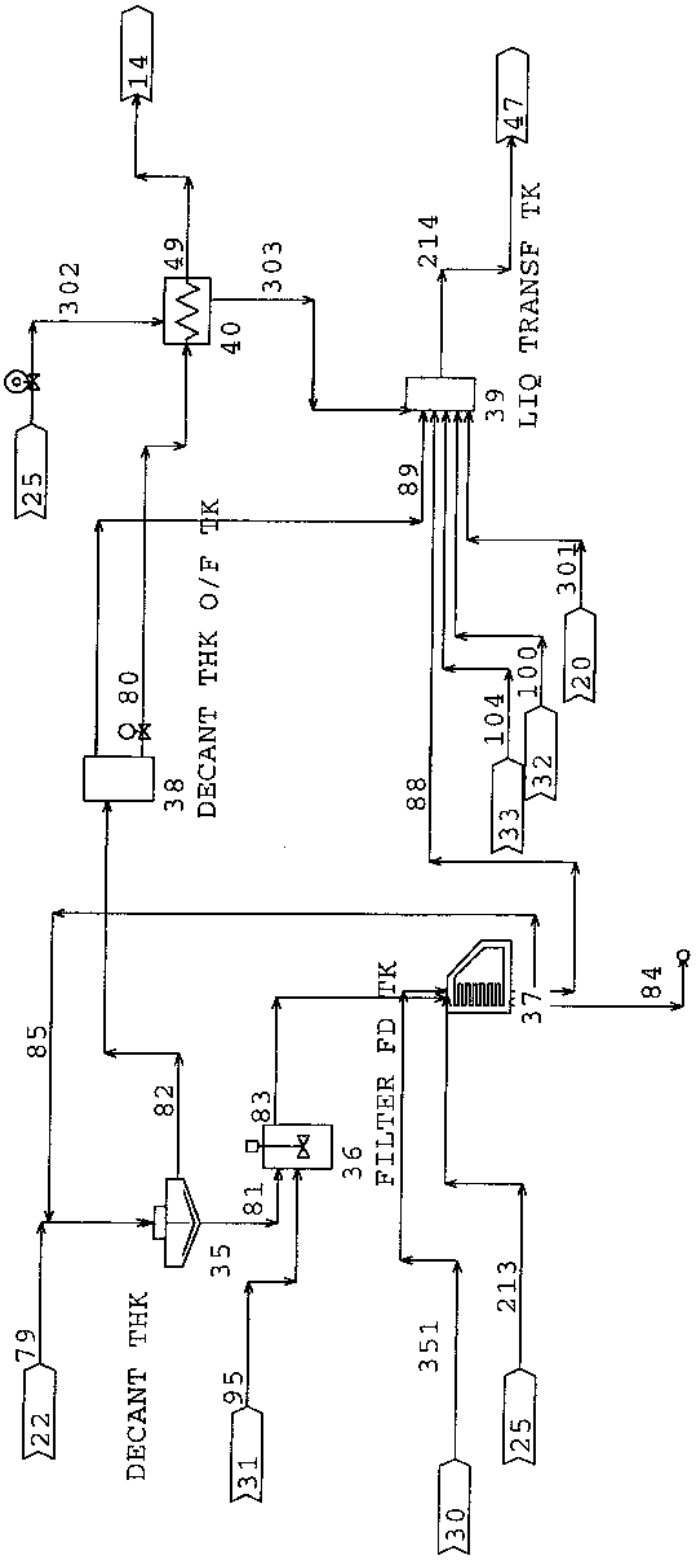
HIGH TEMP PRESSURE LEACH
WINTER CONDITIONS



SCRUBBER

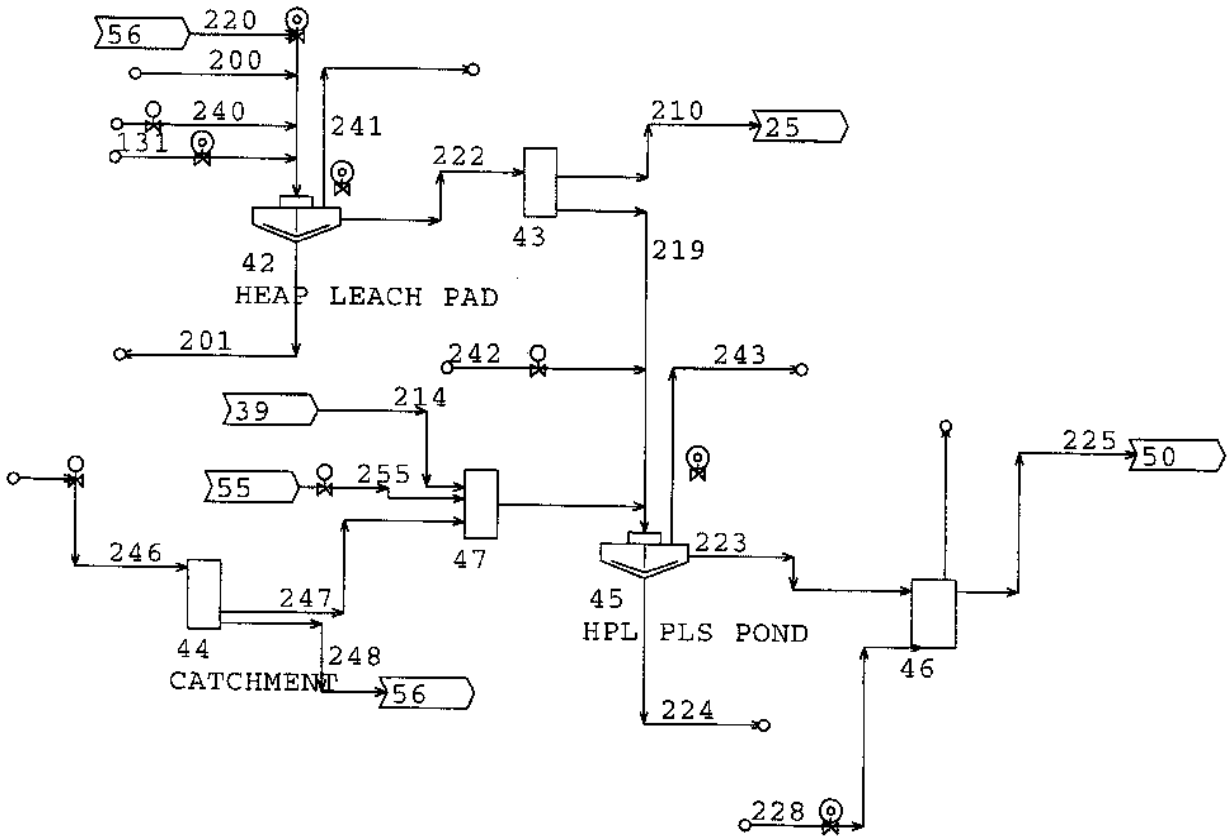
002788

HIGH TEMP PRESSURE LEACH
WINTER CONDITIONS



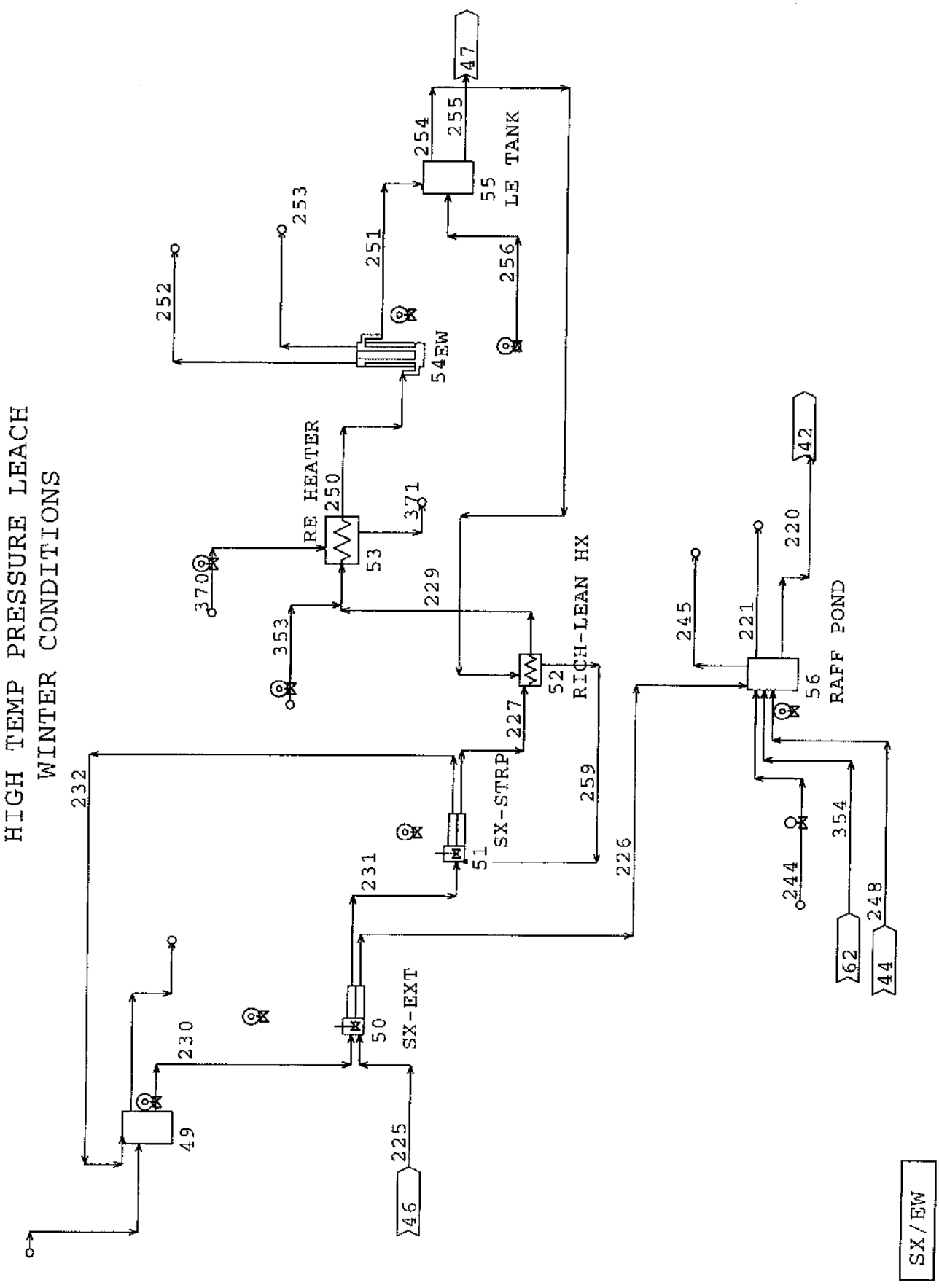
CCD+TAILINGS

HIGH TEMP PRESSURE LEACH
WINTER CONDITIONS

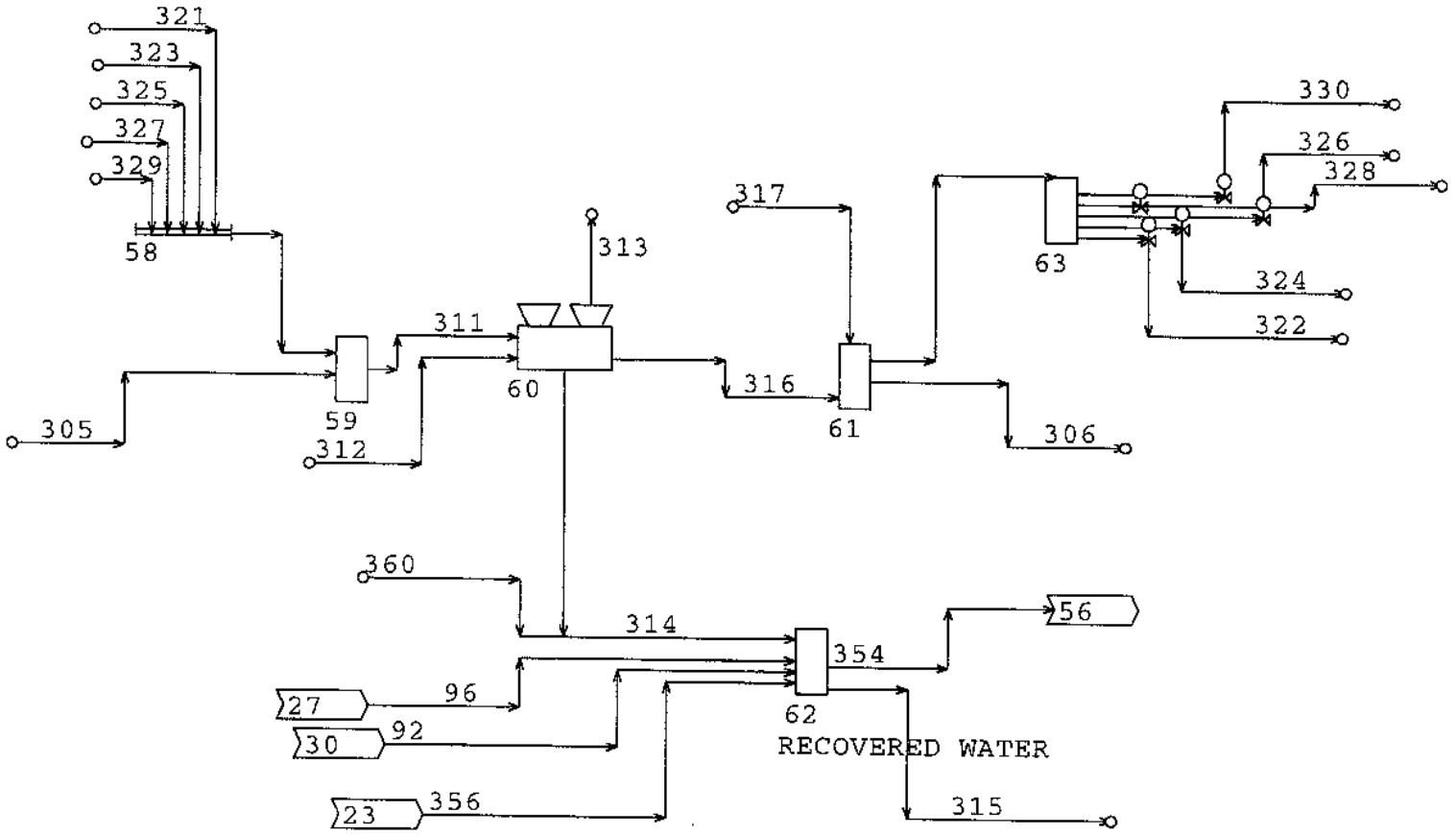


HEAP LEACH

002790


HIGH TEMP PRESSURE LEACH
WINTER CONDITIONS
232
49
230
50
SX-EXT
225
46
231
51
SX-STRP
227
52
RICH-LEAN HX
259
226
370
RE HEATER
250
53
371
353
229
252
253
251
54EW
254
255
55
LE TANK
47
256
245
221
220
42
56
RAFF POND
244
354
62
248
44
SX/EW

HIGH TEMP PRESSURE LEACH
WINTER CONDITIONS



UTILITIES

002792

Toromocho Project Feasibility Study

Molybdenum Hydrometallurgical Facility Status Report

Prepared for

Peru Copper Inc.

AKER KVÆRNER™

July, 2007
Project No. R0521300
Report No. RP-09

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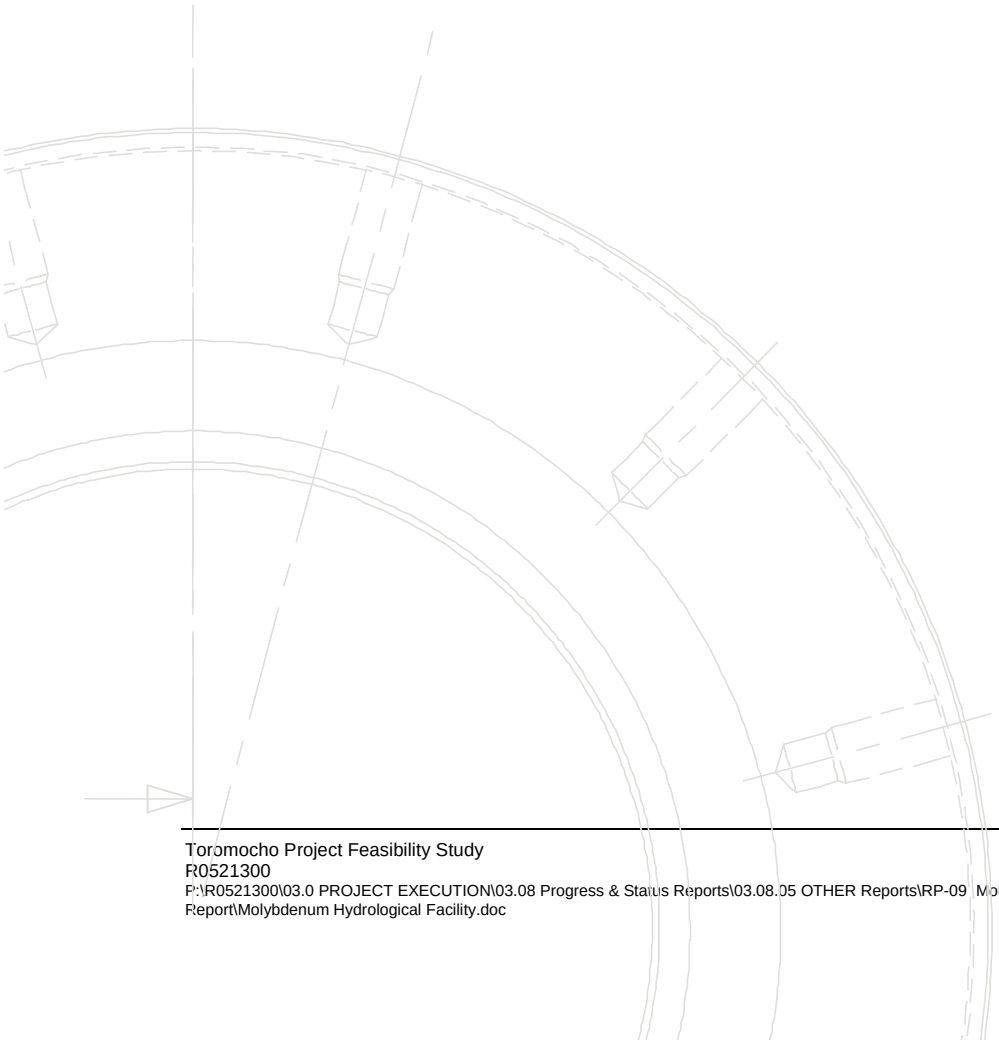

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1.0 INTRODUCTION

Historically, molybdenum recovery into a saleable molybdenum sulphide concentrate (+50% Mo) from Toromocho ore has been difficult due to significant quantities of flotable insolubles which follow the molybdenite in the flotation process. In order to make a saleable product by flotation, the molybdenite recovery would be unacceptable. The relatively low copper grade of the Toromocho ore body and the low Mo grade make it necessary to incorporate greater than 50% Mo recovery into the economics to ensure a robust project.

Two options were considered to achieve the Mo grade and recovery goals, a flotation option using a partial roasting step of the molybdenite to reduce moly floatability and allow removal of insolubles by flotation; and a hydrometallurgical option in which a low-grade moly concentrate is leached under pressure and subsequently recovered as a moly trioxide product. The latter option was selected for several reasons:

- Potential for a higher recovery or about 10% of the Mo in the feed compared to the flotation option.
- Ability to accommodate changes in the ore.
- Production of a high value product which can command a premium price due to the high purity.

Based on discussions with PCI, the hydrometallurgical option was selected as the appropriate choice for the Toromocho Project.

2.0 MOLY CONCENTRATE FEED STOCK

2.1 Introduction

The basis of the study assumes a molybdenum concentrate analysis of 17% molybdenite (10% Mo), 10% chalcopyrite, 5% pyrite, and the balance as insolubles (talc, mica, and other various silicates). The current mass balance is modeled in METSIM.

A testwork program is currently being undertaken by SGS Lakefield on rougher concentrates produced from a bulk flotation pilot plant. Once moly concentrates have been produced the assumptions can be adjusted accordingly.

2.2 Flowsheet Development

The proposed flowsheet consists of a series of unit operations each of which is based on proven technology. The criteria for sizing equipment are not known; however, this will be defined by subsequent testwork. The major unit operations are as follows:

- Pressure Leach
- Autoclave discharge slurry conditioning
- Autoclave discharge liquid-solids separation
- Flotation of insolubles from solids
- Liquid-solids separation of flotation tails
- Ammonia leaching of Mo
- Leach discharge liquid-solids separation
- ADM crystallization
- ADM calcination
- Carbon adsorption of Mo from autoclave liquid phase

The knowledge base for each of these operations is discussed in greater detail below.

3.0 PROCESS DISCUSSION

3.1 Pressure Leach

The basic parameters for the pressure leach of a low grade molybdenum concentrate are based on literature published in the public domain. A continuous autoclave testwork program will be required to establish the detailed criteria for the design of the Toromocho autoclave. The autoclave size will be determined by the degree of oxidation of sulphide sulphur in the design feedstock. The technology is well understood and it is unlikely that significant process problems will develop in this operation.

It is intended to maintain a high acid concentration in the autoclave which will precipitate MoO_3 and minimize soluble Mo. A concern is the materials of construction within the autoclave which need to be confirmed.

3.2 Autoclave Discharge Conditioning

The autoclave is expected to operate in excess of 100g/L sulphuric acid at 225°C. Under these conditions, most if not all of the iron will be precipitated in the form of basic ferric sulphate ($FeOHSO_4$). This compound will re-dissolve in acid to soluble ferric sulphate at atmospheric boiling conditions (about 85°C). The testwork should define the required retention time for this process to occur. Two hours in three tanks in series is the currently assumed criteria. It is not known if some iron will precipitate as hematite. If this occurs then the downstream flotation product (MoO_3) would be contaminated with the hematite and would be fed to the ammonia leach. The impact of such an occurrence is that the filter downstream of the ammonia leach would be significantly larger than currently forecasted. Purity of the ammonia molybdate solution is not expected to change; however, due to filtration washing inefficiency, higher residual solids in the leach will lead to slightly higher moly losses.

3.3 Autoclave Discharge Liquids-Solids Separation

Thickener sizing will be defined by the future testwork. Filtration step is expected to be a belt filter, but the plate-like nature of the insoluble silicates in this slurry could cause problems by increasing filter sizing and reducing wash efficiency. A pressure filter such as made by Pneumapress is a fall back alternative, but this option is more expensive.

3.4 Flotation Of Insolubles

This operation is based on the assumption that the flotable insolubles in the feed to the pressure leach will not be substantially altered in the leach such that they will no longer respond to an oxide flotation. If the material responds as expected, the major objective of the testwork will be to define any moly losses with the flotable insolubles. Elutrition columns or conventional gravity separation can be considered should the low cost flotation route not be viable.

3.5 Liquid Solid Separation Of Flotation Tails

This unit operation is straight-forward and unlikely to create problems. Testwork will determine criteria for thickener and pressure filter sizing (filtration and wash efficiency). Cake moisture is important to minimize possible contamination of the ammonia leach and subsequently, the final product.

3.6 Ammonia Leaching

Ammonia leaching of the impure MoO_3 product from flotation is well understood and is considered conventional technology.

3.7 Filtration Of Ammonia Leach Discharge

Conventional technology is considered with design criteria being based on testwork. A pressure filter is expected to be used in this operation to minimize soluble moly losses to the residue.

3.8 ADM Crystallization

Known proven technology with sizing being based on feed solution concentration.

3.9 ADM Calcination

Known proven technology for recovery of contained ammonia to yield final product.

3.10 Activated Carbon Adsorption

This step is based on published data. An unknown is the carbon loading criteria which in turn is dependent on the feed concentration of Mo. The concept in the pressure leach is to maintain a high acid concentration which favors precipitation of MoO_3 solids to the molybdate anion in solution. The amount of soluble moly in the solution is unknown but will be defined by testwork. The anticipated carbon advance from the CIC columns is quite large in comparison to gold operations. A carbon advance in excess of 100 tpd is anticipated. This solution will be sent to the SX feed stream for recovery of copper.

Stripping parameters are yet to be defined. A continuous carbon stripping process will be used due to the large advance rate. Either acid or ammonia can be used for stripping the carbon. If acid is used the solution will be returned to pressure leach. If sufficient ammonium molybdate concentration can be achieved in the strip solution, this solution would be directed to the ammonia leach operation.

4.0 TESTWORK PROGRAMS

4.1 Batch Testwork

A series of batch autoclave tests is planned on a moly concentrate obtained from the on-going flotation pilot plant program currently underway at SGS Lakefield. See Appendix A for the SGS proposal.

4.2 Continuous Autoclave Testwork

About 15 tonnes of bulk copper-moly concentrate has been prepared in a test run of Toromocho ore through the nearby Austria Duvaz concentrator. Plans are to ship sufficient concentrate to SGS Lakefield and operate a flotation pilot plant for copper-moly separation. This is followed by upgrading of the moly concentrate to meet the requirements of the hydromet process. The product of this flotation work would provide feedstock for a 48 hour continuous autoclave testwork program. See Appendix B for the outline proposed by SGS Lakefield.

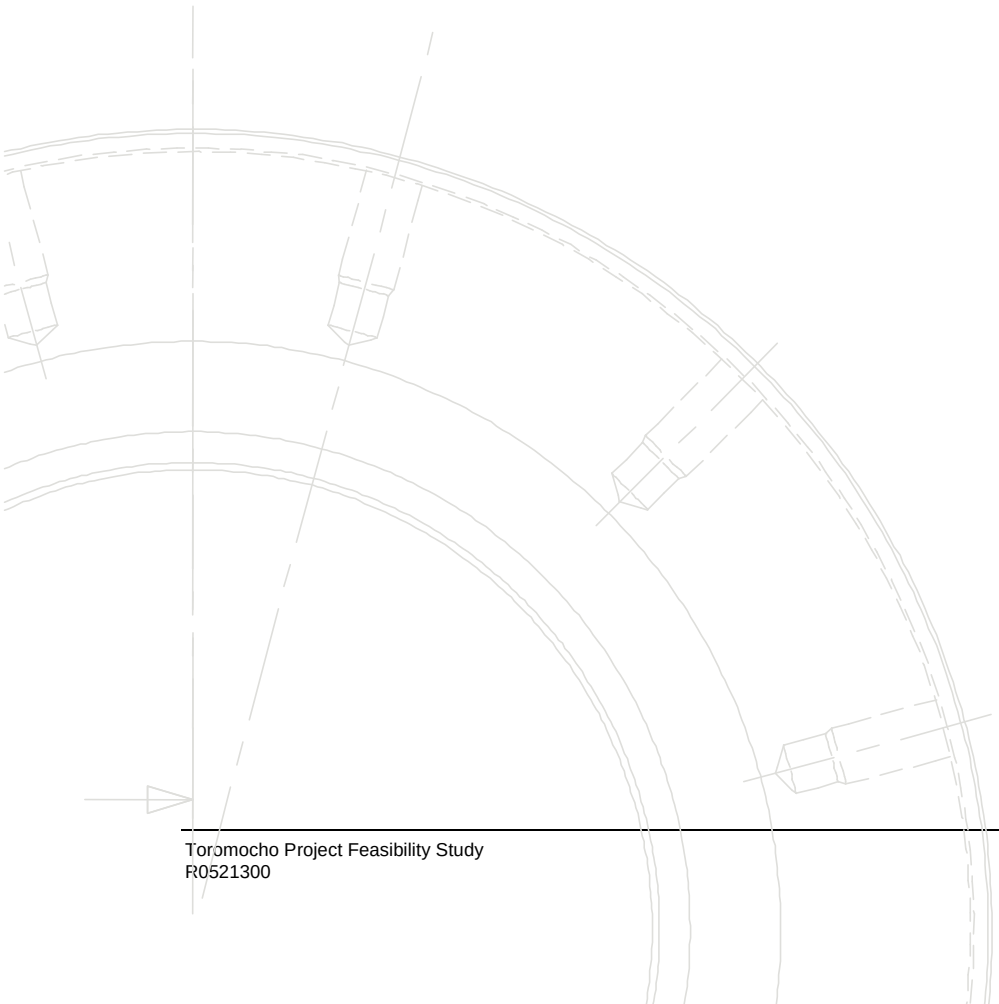
The products from this testwork would provide sufficient material to establish process design criteria for the downstream unit operations through the ammonia leach and subsequent filtration.

Solutions from the thickener following the pressure leach will be used to establish process parameters for the carbon column circuit and carbon stripping.

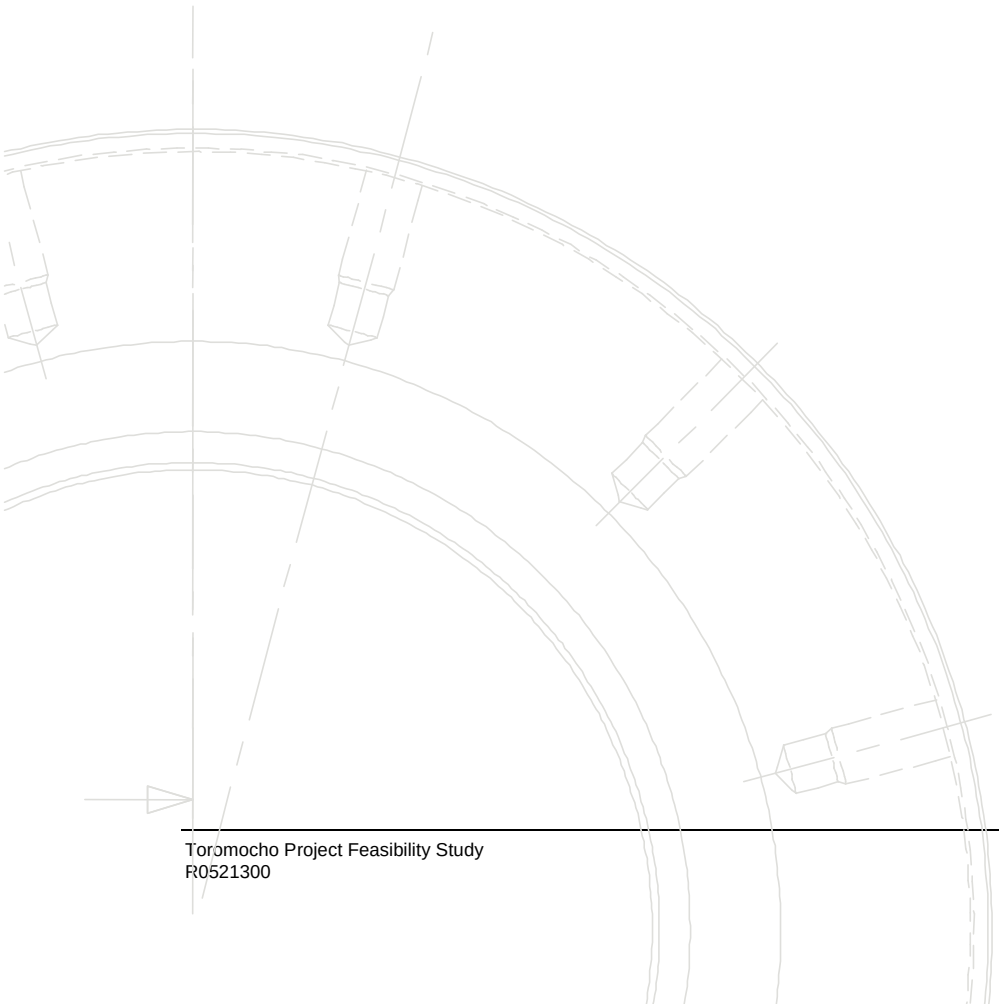
5.0 SUMMARY

Overall the moly hydromet process being proposed by AKM is based on a series of proven unit operations. The testwork programs which will be conducted will provide sufficient data to size equipment and to identify possible processing problems.

It will not be possible to define moly losses from the circuit nor the quality of the final product until the hydrometallurgical testwork is completed.



Appendices



Appendix A:
Batch Autoclave Testwork Program for Toromocho Molybdenum Recovery

APPENDIX A

Batch Autoclave Testwork Program For Toromocho Molybdenum Recovery

1.0 Introduction

The objective of the testwork will be to develop pressure leaching operating parameters for treating a molybdenum sulphide concentrate, to leach the impurities from the concentrate (mainly copper and iron) and leave the molybdenum in the residue as molybdenum oxide. The Toromocho pilot plant at SGS Lakefield was expected to produce a low grade molybdenum concentrate (± 10% Mo by wt), and this concentrate will be the feed to the hydrometallurgical process. The project will develop through on initial phase of batch testing in a 2L Parr autoclave to establish optimum operating conditions (temperature, oxygen partial pressure, acid strength, residence time, pulp density, re-grind particle size). Once the optimum batch conditions have been established, they will be confirmed in the continuous autoclave at SGS's facilities in Lakefield.

The composition of the material is unknown at this point. A METSIM balance has been run based on a 17% MoS2 concentration. Once an analysis of the new concentrate feed is available, another METSIM run can be conducted so that parameters for the batch autoclave test can be determined.

2.0 Anticipated POX Program

The following variables will be considered in a matrix of 20 tests:

2.1 Concentrate Type (one high grade, one low grade)
2.2 Retention Time: 120 min. baseline (plus shorter and longer time)
2.3 Pulp Density at Discharge: 20% Solids (plus 15%, 25%)
2.4 Acidity: 100 gIL H_2SO_4 at discharge (75 gIL, 150 gIL)
2.5 Temperature: 225° C (210, 235C)
2.6 Autoclave Feed Particle Size

3.0 POX Objectives

3.1 Maximize oxidation of sulfides with minimal moly dissolution
3.2 Track deportment of Moly; (% in solids as MoO3, % in solids as MoS2, and % in liquid)
3.3 Determine deportment of Iron: (Basic iron sulfate, hematite, or soluble)
3.4 Nature of contained gangue minerals in discharge
3.5 Feed composition for downstream scoping tests (Mo, Cu, Fe (111), Fe(II), acid, pH, EMF)

4.0 Downstream Scoping Tests

4.1 Solution: Examine Moly removal by adsorption on activated carbon. Optimization of pH for maximum Mo loading on carbon, and minimum Mo in barren. May requires neutralization of acid to a pH of 2.0 or higher. Once optimum pH established, do a loading isotherm at that pH. Determine effect of temperature on Mo loading on carbon (20, 75° C).

4.2 Solids: Examine up-grading of MoO_3 in residue by gangue separation

- 4.2.1 Gravity concentration using spirals
- 4.2.2 Other gravity options
- 4.2.3 Elutriation of fines/slimes/low density gangue
- 4.2.4 Gangue removal by flotation
- 4.2.5 Analysis of upgraded product by mineral speciation (QEMScan)

Budget

Batch POX tests (including assays) 20 at $2,000 each	$40,000
Mo loading on cabon: effect of pH	2,500
: loading isotherm	2,500
: effect of temperature	1,500
: stripping with acid and ammonia	4,000
Up-grading of MoO_3 in residue: 10 tests at $750	7,500
Mineralogy	
Testwork Total	**$63,000**
Project management (15%)	9,500
Communication, meetings (10%)	6,300
Reporting (10%)	6,300
Overall TOTAL	**C$85,100**

Appendix B:
Continuous Autoclave Test Work Program for Toromocho Molybdenum Recovery

APPENDIX B

Continuous Autoclave Testwork Program For Toromocho Molybdenum Recovery

This work will be defined better once the batch test work is complete.

Flotation

Anticipated feed is a once-cleaned, partially reground copper concentrate containing about 15% copper as chalcopyrite, some pyrite (up to 10% by weight), and 0.5% Mo as MoS_2. This material will be upgraded to a MoS_2 concentrate of similar analyses to that being fed to the batch autoclave, M 10% Mo by weight. The flowsheet selected in the current pilot plant run should be used and a detailed metallurgical balance developed for the flotation circuit.

Continuous PDX

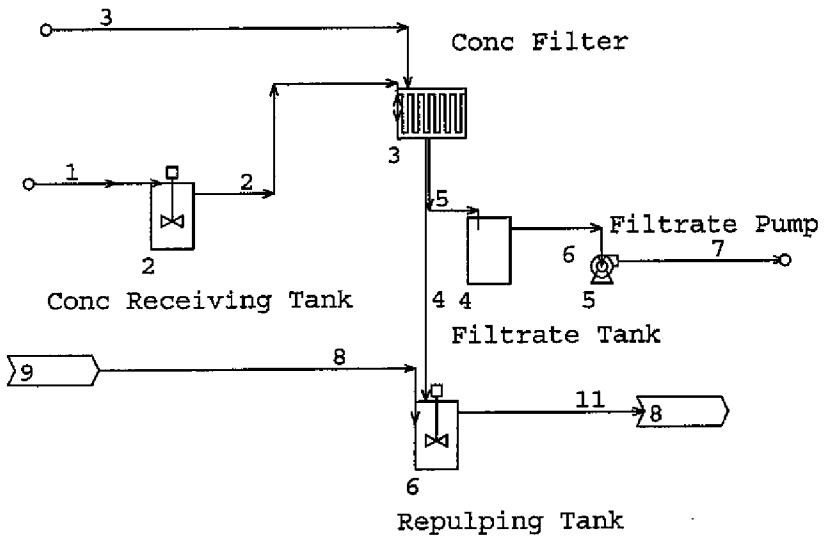
Possible unit processes and operating parameters examined will include:

- PDX retention time – start with 120 minutes to achieve 98% sulfur oxidation adjust retention time base on sulfide sulfur assays.
- Change acid concentrations in vessel to determine affects on soluble moly as well as iron.
- Increase operating temperature from 225° to 230° to determine affects on kinetics.
- Determine time (post autoclave) required to re-dissolve basic ferric sulfate at near boiling conditions 85° C.
- Conduct settling/thickening/filtering tests on PDX slurry at 50° C.
- Conduct flotation, gravity or elutriation tests to remove gangue from MoO_3 in solids.
- Conduct continuous adsorption testing of soluble moly onto activated carbon.
- Examine both acid and ammonium hydroxide stripping of moly from carbon.
- Determine leaching criteria, temperature, leaching time, ammonia overhead pressure, to produce concentrated ammonium molybdenate solutions for crystallizer feed.
- Filtration criteria for ammonia leach discharge.

Appendix C:
Metsim Model Flowsheets

Toromocho Copper-Moly Hydrometallurgical Recovery

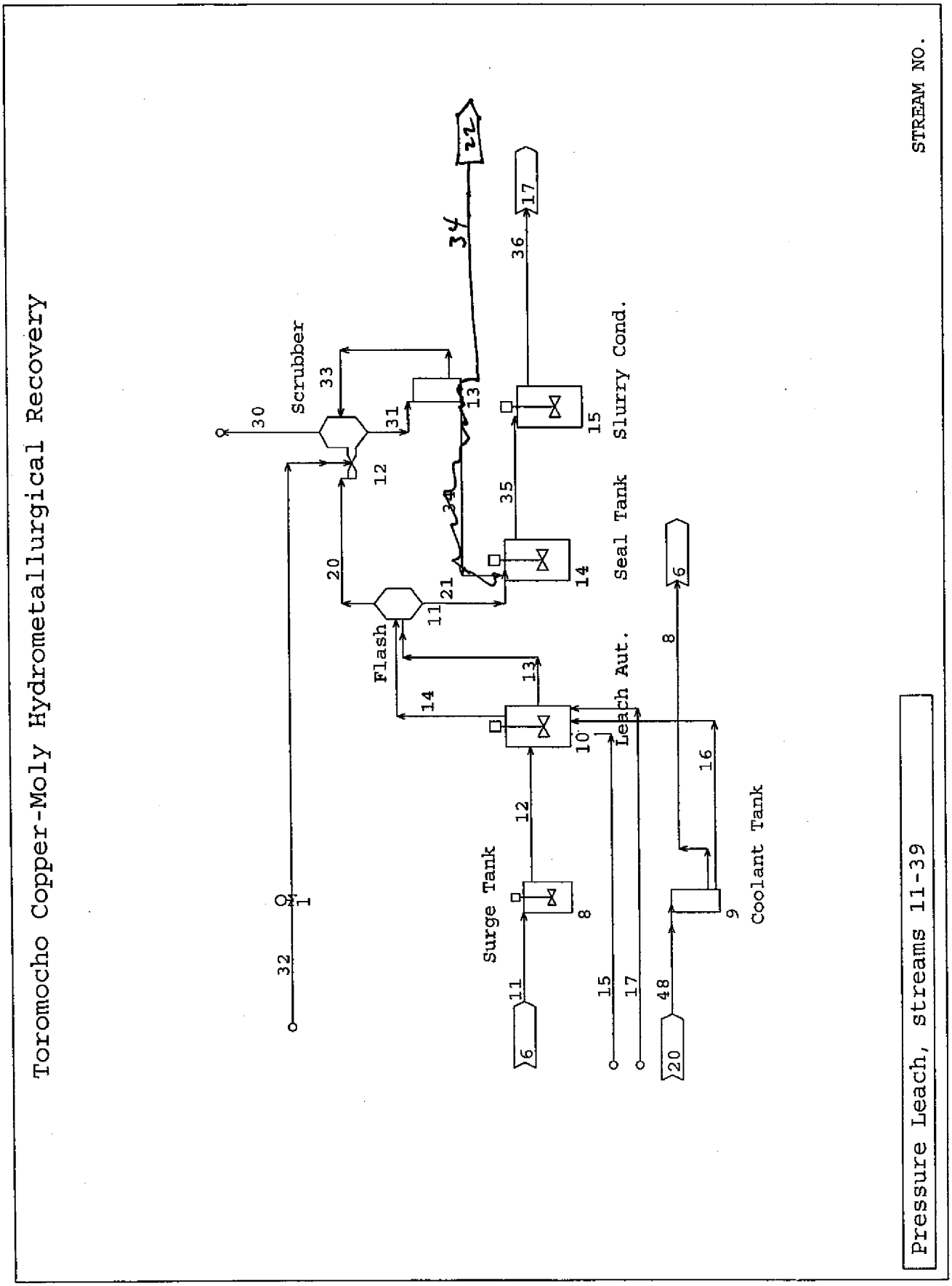
Mets in Flow sheet

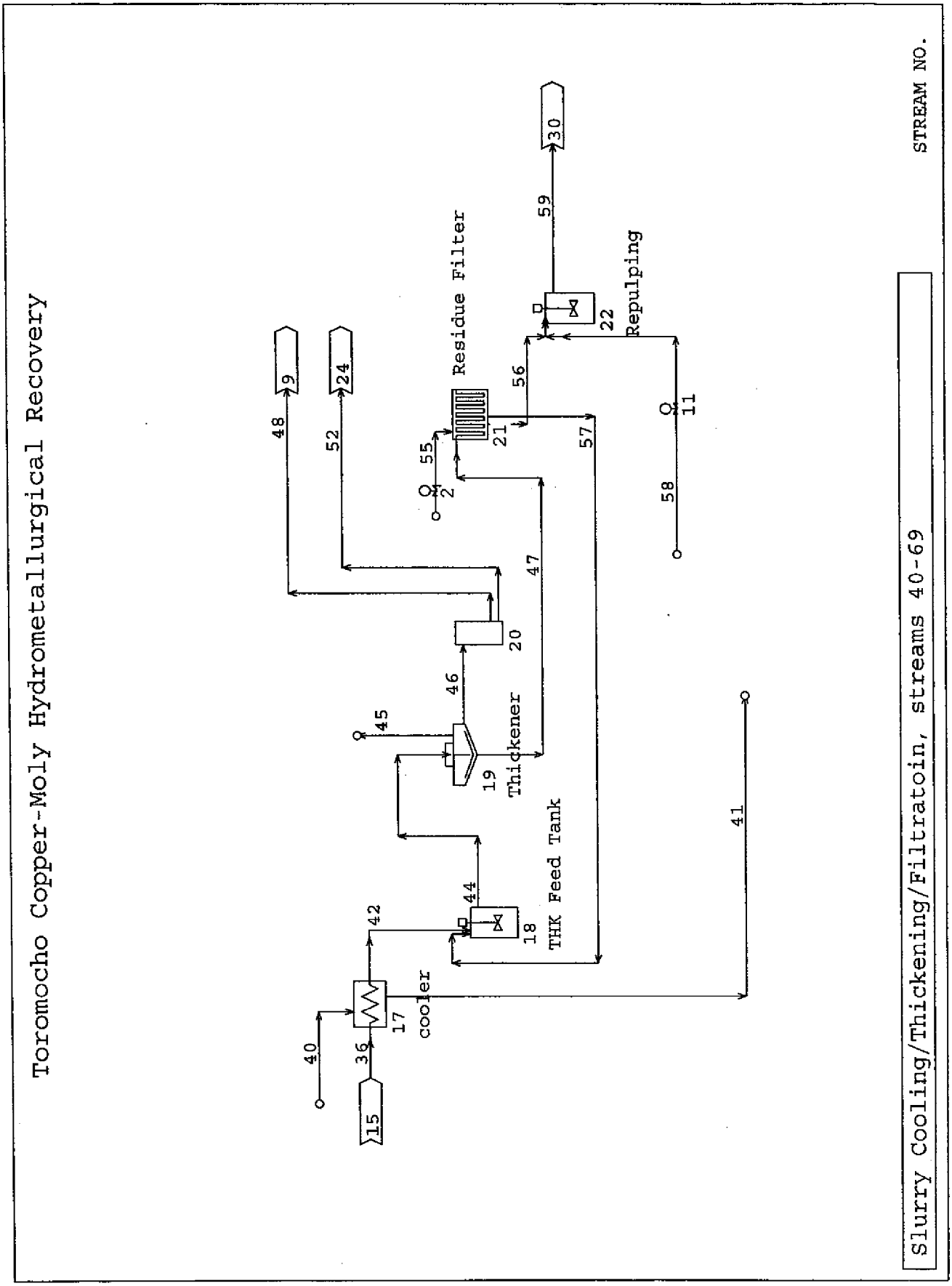


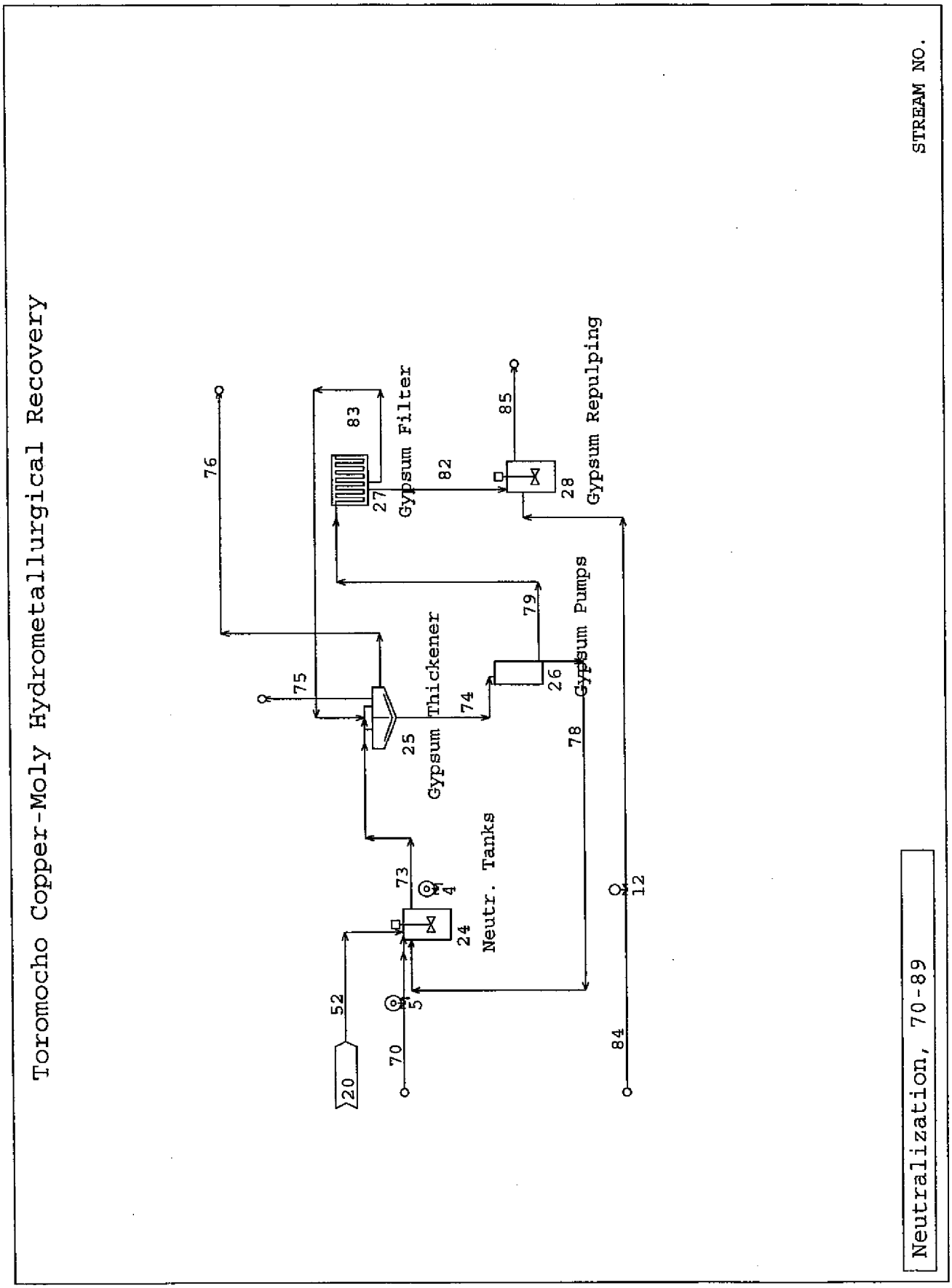
Concentrate Filtration, streams 1-11

STREAM NO.

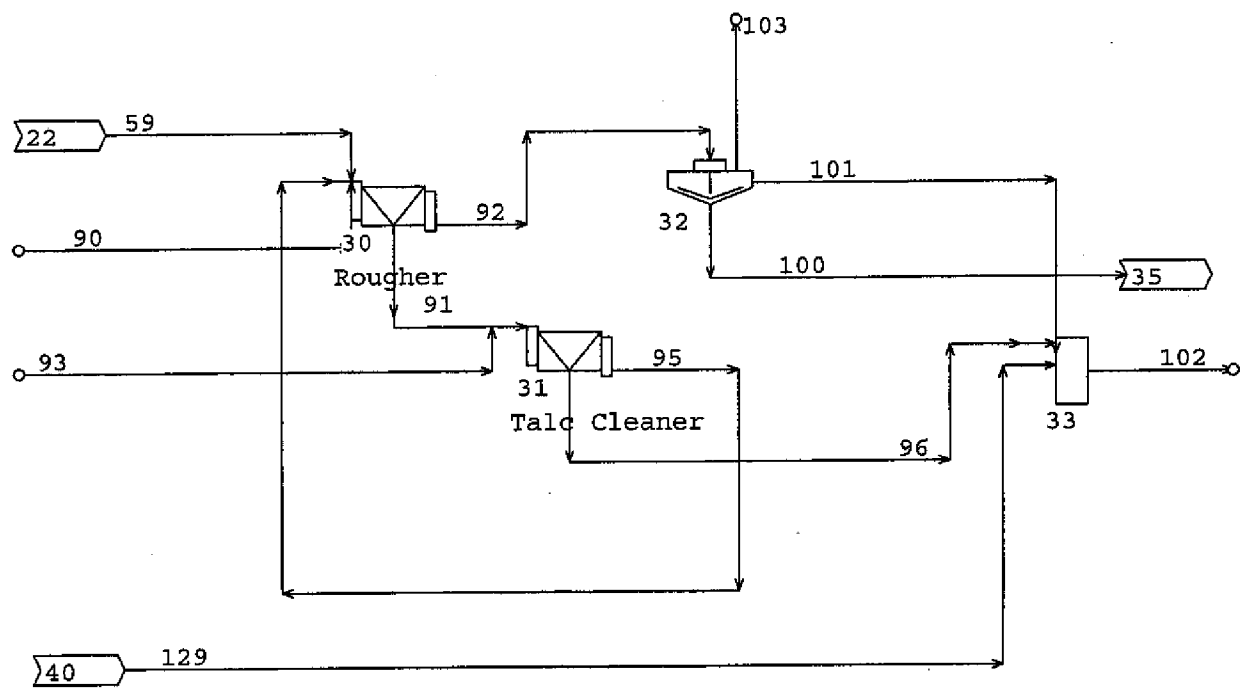
002809


Toromocho Copper-Moly Hydrometallurgical Recovery
STREAM NO.
Pressure Leach, streams 11-39
Scrubber
Flash
Surge Tank
Leach Aut.
Seal Tank
Slurry Cond.
Coolant Tank
21
34


Toromocho Copper-Moly Hydrometallurgical Recovery
Residue Filter
Repulping
Thickener
THK Feed Tank
cooler
STREAM NO.
Slurry Cooling/Thickening/Filtratoin, streams 40-69


Toromocho Copper-Moly Hydrometallurgical Recovery
STREAM NO.
Neutralization, 70-89
Neutr. Tanks
Gypsum Thickener
Gypsum Filter
Gypsum Repulping
Gypsum Pumps
20
24
25
26
27
28
4
5
12
52
70
73
74
75
76
78
79
82
83
84
85

Toromocho Copper-Moly Hydrometallurgical Recovery

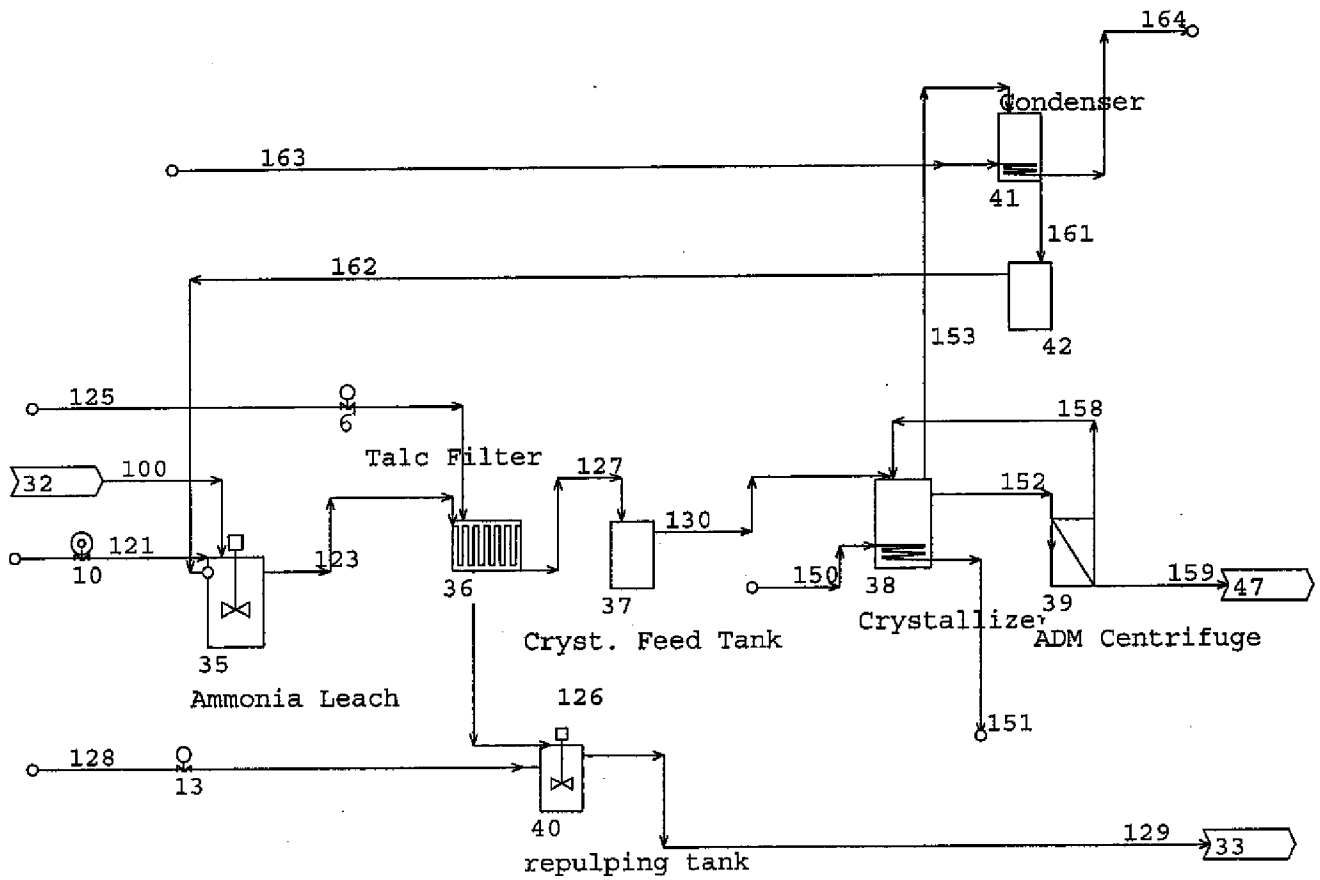


Flotation, 90-120

STREAM NO.

002813

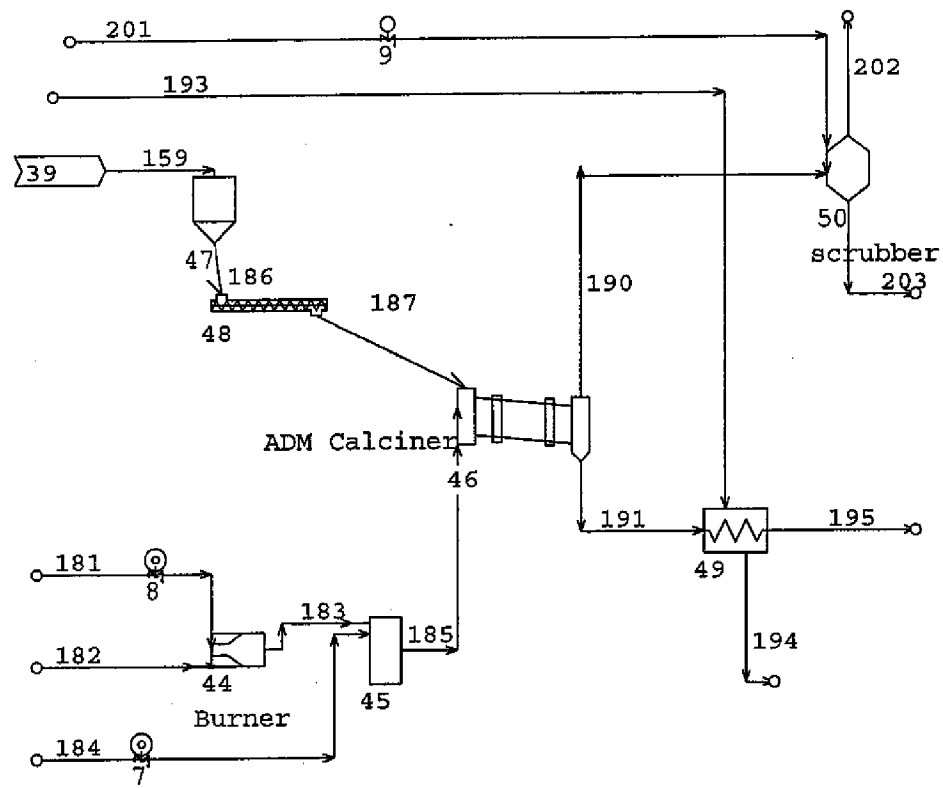
Toromocho Copper-Moly Hydrometallurgical Recovery



Ammonia Leach, 121-140, Crystallizer 150-170

STREAM NO.

Toromocho Copper-Moly Hydrometallurgical Recovery



Calcine, Ammonia Recovery 180 - 210

STREAM NO.

Appendix D:
Mass Bass Balance

DESCRIPTION	Moly Concentrate	Conc to Filter	Water to Conc Filter	Washed Concentrate	Concentrate Filtrate	Concentrate Filtrate	Filtrate to Concentrator	Coolant to Conc Repulping	Conc to Pressure Leach	Autoclave Feed
STREAM NUMBER	1	2	3	4	5	6	7	8	11	12
SOLIDS FLOWRATE (t/h)	5.0	5.0	--	5.0	--	--	--	--	5.0	5.0
LIQUID FLOWRATE (t/h)	6.1	6.1	--	1.7	4.5	4.5	4.5	4.5	6.1	6.1
TOTAL FLOWRATE (t/h)	11.1	11.1	--	6.7	4.5	4.5	4.5	4.5	11.1	11.1
PERCENT SOLIDS (wt%)	45.0	45.0	--	75.0	--	--	--	--	45.0	45.0
SOLID S.G.	3.1	3.1	--	3.1	--	--	--	--	3.1	3.1
LIQUID S.G.	1.0	1.0	--	1.0	1.0	1.0	1.0	1.2	1.1	1.1
STREAM S.G.	1.4	1.4	--	2.0	1.0	1.0	1.0	1.2	1.6	1.6
ACTUAL VOL FLOW (m^3/h)	7.8	7.8	--	3.3	4.5	4.5	4.5	3.8	7.1	7.1
Mo (solid, wt%)	10.0	10.0	--	10.0	--	--	--	--	10.0	10.0
Mo (aq., gpl at 25 °C)	--	--	--	--	--	--	--	65.5	45.7	45.7
H_2SO_4 (aq., gpl at 25 °C)	--	--	--	--	--	--	--	67.2	46.8	46.8
TEMPERATURE (°C)	20	20	15	20	20	20	20	41	33	33
PRESSURE (kPa g)	142	542	342	--	--	--	142	3,342	142	3,342

002817

DESCRIPTION	Autoclave Discharge	Autoclave Vent	O2 to Autoclave	Coolant to Pressure Leach	Steam to Pressure Leach	Flash Overheads	Flash Discharge	Scrubber Vent	Scrubber Bleed	Water to Scrubber
STREAM NUMBER	13	14	15	16	17	20	21	30	31	32
SOLIDS FLOWRATE (t/h)	4.6	--	--	--	--	0.8	3.8	--	3.6	--
LIQUID FLOWRATE (t/h)	16.1	--	--	8.8	--	2.3	10.2	--	61.1	10.5
TOTAL FLOWRATE (t/h)	20.7	0.7	1.5	8.8	0.0	7.4	14.0	3.2	64.8	10.5
PERCENT SOLIDS (wt%)	22.3	--	--	--	--	11.2	27.0	--	5.6	--
SOLID S.G.	2.9	--	--	--	--	2.9	2.9	--	2.9	--
LIQUID S.G.	1.0	--	--	1.2	--	1.3	1.3	--	1.0	1.0
STREAM S.G.	1.2	0.0	0.1	1.2	0.0	0.0	1.5	0.0	1.1	1.0
ACTUAL VOL FLOW (m^3/h)	17.2	--	--	7.6	--	2.1	9.4	--	61.6	10.5
Mo (solid, wt%)	9.5	--	--	--	--	9.5	9.5	--	9.5	--
Mo (aq., gpl at 25 °C)	62.1	--	--	65.5	--	85.3	85.3	--	10.9	--
H2SO4 (aq., gpl at 25 °C)	144.8	--	--	67.2	--	199.0	199.0	--	25.4	--
TEMPERATURE (°C)	225	225	30	41	241	92	92	85	85	20
PRESSURE (kPa g)	3,342	3,342	3,342	3,342	3,350	10	10	--	--	342

002818

DESCRIPTION	Scrubber Recirculation	Scrubber Bleed	Slurry to Conditioning	Conditioing Discharge	CW to Slurry Cooler	Slurry Cooler CWR	Slurry Cooler Discharge	Feed to Decant Thickener	Thickener Vent	Decant Thickener Overflow
STREAM NUMBER	33	34	35	36	40	41	42	44	45	46
SOLIDS FLOWRATE (t/h)	2.8	0.8	4.6	4.3	--	--	4.3	4.3	--	--
LIQUID FLOWRATE (t/h)	47.2	14.0	24.2	24.4	184.1	184.1	24.4	31.2	--	25.8
TOTAL FLOWRATE (t/h)	50.0	14.8	28.8	28.8	184.1	184.1	28.8	35.5	0.1	25.8
PERCENT SOLIDS (wt%)	5.6	5.6	16.0	15.1	--	--	15.1	12.2	--	--
SOLID S.G.	2.9	2.9	2.9	2.9	--	--	2.9	2.9	--	--
LIQUID S.G.	1.0	1.0	1.1	1.1	1.0	1.0	1.2	1.1	--	1.2
STREAM S.G.	1.1	1.1	1.2	1.2	1.0	1.0	1.3	1.2	0.0	1.2
ACTUAL VOL FLOW (m^3/h)	47.6	14.1	23.3	23.3	184.3	184.4	22.8	28.9	--	22.6
Mo (solid, wt%)	9.5	9.5	9.5	10.1	--	--	10.1	10.1	--	--
Mo (aq., gpl at 25 °C)	10.9	10.9	38.5	38.4	--	--	38.4	35.7	--	35.9
H2SO4 (aq., gpl at 25 °C)	25.4	25.4	89.8	85.6	--	--	85.6	79.8	--	80.1
TEMPERATURE (°C)	85	85	87	92	15	20	50	48	46	46
PRESSURE (kPa g)	--	--	142	142	342	292	92	142	--	--

002819

DESCRIPTION	Decant Thickener Underflow	Solution to Coolant Tank	Solution to Neutralization	Wash Water to Pressure Leach Filter	Pressure Leach Filter Cake	Residue Filter Filtrate	Water to Repulp	Repulping Discharge	Milk of Lime to Neutralization	Neutralization Discharge
STREAM NUMBER	47	48	52	55	56	57	58	59	70	73
SOLIDS FLOWRATE (t/h)	4.3	--	--	--	4.3	--	--	4.3	0.9	9.9
LIQUID FLOWRATE (t/h)	5.3	9.5	16.3	2.9	1.5	6.8	5.1	6.5	4.9	31.9
TOTAL FLOWRATE (t/h)	9.6	9.5	16.3	2.9	5.8	6.8	5.1	10.8	5.7	41.8
PERCENT SOLIDS (wt%)	45.0	--	--	--	75.0	--	--	40.0	15.0	23.7
SOLID S.G.	2.9	--	--	--	2.9	--	--	2.9	2.2	2.3
LIQUID S.G.	1.2	1.2	1.2	1.0	1.0	1.1	1.0	1.0	1.0	1.1
STREAM S.G.	1.6	1.2	1.2	1.0	2.0	1.1	1.0	1.4	1.1	1.2
ACTUAL VOL FLOW (m^3/h)	6.2	8.3	14.3	2.9	2.9	6.1	5.1	8.0	5.3	34.5
Mo (solid, wt%)	10.1	--	--	--	10.1	--	--	10.1	--	--
Mo (aq., gpl at 25 °C)	35.9	35.9	35.9	--	2.9	26.6	--	0.7	--	27.5
H2SO4 (aq., gpl at 25 °C)	80.1	80.1	80.1	--	6.4	59.4	--	1.4	--	0.6
TEMPERATURE (°C)	46	46	46	20	31	39	20	23	50	77
PRESSURE (kPa g)	142	--	--	342	--	--	142	142	142	142

002820

DESCRIPTION	Gypsum Thickener Underflow	Gypsum Thickener Vent	Gypsum Thickener Overflow	Gypsum Recycle	Feed to Gypsum Filter	Gypsum Filter Cake	Gypsum Filtrate	Water to Gypsum Repulping	Gypsum to Disposal	Water to Rougher Launder
STREAM NUMBER	74	75	76	78	79	82	83	84	85	90
SOLIDS FLOWRATE (t/h)	9.9	--	--	7.9	2.0	2.0	--	--	2.0	--
LIQUID FLOWRATE (t/h)	14.8	--	19.4	11.9	3.0	0.5	2.5	2.5	3.0	4.0
TOTAL FLOWRATE (t/h)	24.7	0.1	19.4	19.8	4.9	2.5	2.5	2.5	4.9	4.0
PERCENT SOLIDS (wt%)	40.0	--	--	40.0	40.0	80.0	--	--	40.0	--
SOLID S.G.	2.3	--	--	2.3	2.3	2.3	--	--	2.3	--
LIQUID S.G.	1.1	--	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0
STREAM S.G.	1.4	0.0	1.1	1.4	1.4	1.9	1.1	1.0	1.3	1.0
ACTUAL VOL FLOW (m^3/h)	18.3	--	18.4	14.6	3.7	1.3	2.3	2.5	3.8	4.0
Mo (solid, wt%)	--	--	--	--	--	--	--	--	--	--
Mo (aq., gpl at 25 °C)	27.6	--	27.6	27.6	27.6	27.6	27.6	--	4.3	--
H2SO4 (aq., gpl at 25 °C)	0.6	--	0.6	0.6	0.6	0.6	0.6	--	0.1	--
TEMPERATURE (°C)	75	75	75	75	75	75	75	20	36	20
PRESSURE (kPa g)	142	--	--	142	142	--	--	142	142	142

002821

DESCRIPTION	Rougher Conc.	Rougher Tails	Water to Cleaner Launder	Talc Cleaner Tails	Talc Cleaner Conc.	Flotation Thickener Underflow	Flotation Thickener Overflow	Talc to Concentrator Tailings	Flotation Thickener Vent	Ammonia to Leach
STREAM NUMBER	91	92	93	95	96	100	101	102	103	121
SOLIDS FLOWRATE (t/h)	3.4	1.0	--	0.1	3.3	1.0	--	3.7	--	--
LIQUID FLOWRATE (t/h)	10.3	2.6	2.0	2.4	9.9	0.9	1.8	12.3	--	1.1
TOTAL FLOWRATE (t/h)	13.7	3.7	2.0	2.6	13.2	1.9	1.8	16.0	0.0	1.1
PERCENT SOLIDS (wt%)	25.0	28.4	--	5.3	25.0	55.0	--	23.3	--	--
SOLID S.G.	2.7	3.7	--	2.9	2.7	3.7	--	2.7	--	--
LIQUID S.G.	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	--	0.9
STREAM S.G.	1.2	1.3	1.0	1.0	1.2	1.7	1.0	1.2	0.0	0.9
ACTUAL VOL FLOW (m^3/h)	11.6	2.9	2.0	2.5	11.1	1.1	1.8	13.7	--	1.2
Mo (solid, wt%)	0.7	41.3	--	11.4	0.2	41.3	--	0.7	--	--
Mo (aq., gpl at 25 °C)	0.4	0.4	--	0.4	0.4	0.4	0.4	0.4	--	--
H2SO4 (aq., gpl at 25 °C)	0.9	0.9	--	0.7	0.7	0.9	0.9	0.7	--	--
TEMPERATURE (°C)	22	22	20	22	22	21	21	22	21	20
PRESSURE (kPa g)	--	--	142	--	--	142	--	--	--	--

002822

DESCRIPTION	Ammonia Leach Discharge	Wash Water to Ammonia Leach Filter	Ammonia Leach Filte Cake	Ammonia Leach Filtrate	Water to Ammonia Leach Residue Repulping	Ammonia Leach Residue Pulp	Feed to Crystallizer	Steam to Crystallizer	Steam Cond.	Evaporator Discharge
STREAM NUMBER	123	125	126	127	128	129	130	150	151	152
SOLIDS FLOWRATE (t/h)	0.4	--	0.4	--	--	0.4	--	--	--	0.7
LIQUID FLOWRATE (t/h)	2.5	0.1	0.1	2.6	0.6	0.6	2.6	--	2.1	0.2
TOTAL FLOWRATE (t/h)	3.0	0.1	0.5	2.6	0.6	1.1	2.6	2.1	2.1	0.9
PERCENT SOLIDS (wt%)	14.3	--	90.0	--	--	40.0	--	--	--	78.8
SOLID S.G.	2.8	--	2.8	--	--	2.8	--	--	--	2.7
LIQUID S.G.	1.3	1.0	1.0	1.3	1.0	1.0	1.3	--	0.9	1.0
STREAM S.G.	1.4	1.0	2.4	1.3	1.0	1.4	1.3	0.0	0.9	2.0
ACTUAL VOL FLOW (m^3/h)	2.1	0.1	0.2	2.0	0.6	0.8	2.0	--	2.4	0.5
Mo (solid, wt%)	4.4	--	4.4	--	--	4.4	--	--	--	56.5
Mo (aq., gpl at 25 °C)	214.7	--	6.6	209.7	--	0.5	209.7	--	--	8.7
H2SO4 (aq., gpl at 25 °C)	--	--	--	--	--	--	--	--	--	--
TEMPERATURE (°C)	78	20	53	77	20	26	77	180	180	90
PRESSURE (kPa g)	--	--	--	--	--	142	--	945	945	--

002823

DESCRIPTION	Evaporator Overheads	Centrifuge Concentrate	Centrifuge Cake	Recovered Ammonia Solution	Ammonia Solution	CW to Crystallizer Overhead Condenser	Crystallizer Overhead Condenser CWR	NG to Burner	Primary Air	Combustion Gas
STREAM NUMBER	153	158	159	161	162	163	164	181	182	183
SOLIDS FLOWRATE (t/h)	--	0.0	0.7	--	--	--	--	--	--	--
LIQUID FLOWRATE (t/h)	--	0.2	0.0	1.8	1.8	212.1	212.1	--	--	--
TOTAL FLOWRATE (t/h)	1.8	0.2	0.8	1.8	1.8	212.1	212.1	0.0	0.7	0.7
PERCENT SOLIDS (wt%)	--	4.4	95.0	--	--	--	--	--	--	--
SOLID S.G.	--	2.7	2.7	--	--	--	--	--	--	--
LIQUID S.G.	--	1.0	1.0	1.0	1.0	1.0	1.0	--	--	--
STREAM S.G.	0.0	1.1	2.5	1.0	1.0	1.0	1.0	0.0	0.0	0.0
ACTUAL VOL FLOW (m^3/h)	--	0.2	0.3	1.9	1.9	212.3	212.5	--	--	--
Mo (solid, wt%)	--	56.5	56.5	--	--	--	--	--	--	--
Mo (aq., gpl at 25 °C)	--	8.7	8.7	--	--	--	--	--	--	--
H2SO4 (aq., gpl at 25 °C)	--	--	--	--	--	--	--	--	--	--
TEMPERATURE (°C)	90	90	90	50	50	15	20	20	20	1,860
PRESSURE (kPa g)	--	--	--	--	--	--	--	--	--	--

002824

DESCRIPTION	Secondary Air	Hot Gas to Calciner	Wet ADM	ADM to Calcining	Calcine Off-gas	Calcine Product	CW to Calcining Product Cooler	Calcining Product Cooler CWR	ADM Product	Water to Calcine Off-gas Scrubber
STREAM NUMBER	184	185	186	187	190	191	193	194	195	201
SOLIDS FLOWRATE (t/h)	--	--	0.7	0.7	--	0.6	--	--	0.6	--
LIQUID FLOWRATE (t/h)	--	--	0.0	0.0	--	0.0	1.5	1.5	0.0	8.5
TOTAL FLOWRATE (t/h)	2.3	2.9	0.8	0.8	3.1	0.6	1.5	1.5	0.6	8.5
PERCENT SOLIDS (wt%)	--	--	95.0	95.0	--	99.7	--	--	99.7	--
SOLID S.G.	--	--	2.7	2.7	--	4.7	--	--	4.7	--
LIQUID S.G.	--	--	1.0	1.0	--	2.0	1.0	1.0	2.1	1.0
STREAM S.G.	0.0	0.0	2.5	2.5	0.0	4.7	1.0	1.0	4.7	1.0
ACTUAL VOL FLOW (m^3/h)	--	--	0.3	0.3	--	0.1	1.5	1.5	0.1	8.5
Mo (solid, wt%)	--	--	56.5	56.5	--	66.7	--	--	66.7	--
Mo (aq., gpl at 25 °C)	--	--	8.7	8.7	--	329.1	--	--	329.1	--
H2SO4 (aq., gpl at 25 °C)	--	--	--	--	--	--	--	--	--	--
TEMPERATURE (°C)	20	500	90	90	250	150	15	20	60	20
PRESSURE (kPa g)	--	--	--	--	--	--	--	--	--	--

002825

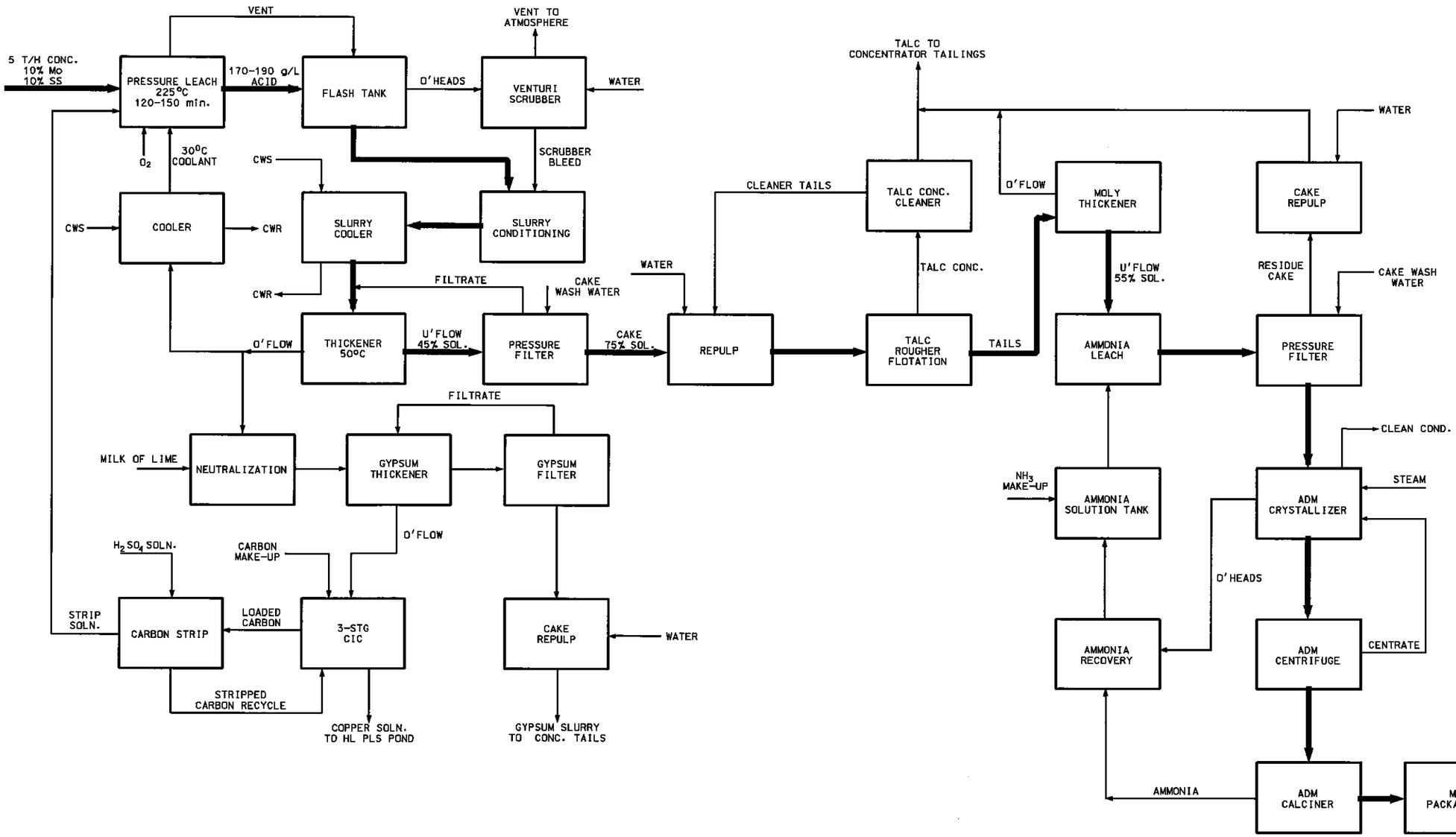
DESCRIPTION	Ammonia Scrubber Off-gas	Ammonia Scrubber Discharge	240	241	242	Stage 3 Carbon Discharge	Barren to Heap Leach PLS Pond	Carbon to Moly Adsorption	Loaded Carbon	251
STREAM NUMBER	202	203	240	241	242	243	244	245	250	251
SOLIDS FLOWRATE (t/h)	--	--	--	--	--	--	--	--	--	--
LIQUID FLOWRATE (t/h)	--	8.5	18.7	--	18.7	--	21.7	3.0	0.8	0.8
TOTAL FLOWRATE (t/h)	3.1	8.5	18.7	1.0	18.7	1.0	21.7	4.0	1.8	1.8
PERCENT SOLIDS (wt%)	--	--	--	100.0	--	100.0	--	25.0	57.1	57.1
SOLID S.G.	--	--	--	--	--	--	--	--	--	--
LIQUID S.G.	--	1.0	1.0	--	1.0	--	1.0	1.0	2.0	2.0
STREAM S.G.	0.0	1.0	1.0	2.3	1.0	2.3	1.0	1.2	2.1	2.1
ACTUAL VOL FLOW (m^3/h)	--	8.6	18.3	0.5	18.3	0.5	21.3	3.5	0.8	0.8
Mo (solid, wt%)	--	--	--	--	--	--	--	--	--	--
Mo (aq., gpl at 25 °C)	--	--	2.8	--	2.8	--	2.4	--	1,181.4	1,181.4
H2SO4 (aq., gpl at 25 °C)	--	--	0.6	--	0.6	--	0.5	--	--	--
TEMPERATURE (°C)	39	39	75	75	75	67	67	20	75	75
PRESSURE (kPa g)	--	--	--	--	--	--	--	--	--	--

002826

DESCRIPTION	Carbon to Eductor	Water to Carbon Eductor	Carbon to Stripping	Acid Solution to Stripping	Strip Solution	Stripped Carbon	Water to Stripped Carbon	Strip Solution Recycle	Strip Solution to Coolant Tank
STREAM NUMBER	252	255	257	258	260	261	265	266	270
SOLIDS FLOWRATE (t/h)	--	--	--	--	--	--	--	--	--
LIQUID FLOWRATE (t/h)	0.8	2.0	2.8	1.0	11.3	--	3.0	7.5	3.8
TOTAL FLOWRATE (t/h)	1.8	2.0	3.8	1.0	11.3	1.0	3.0	7.5	3.8
PERCENT SOLIDS (wt%)	57.1	--	26.7	--	--	100.0	--	--	--
SOLID S.G.	--	--	--	--	--	--	--	--	--
LIQUID S.G.	2.0	1.0	1.3	1.1	1.2	--	1.0	1.2	1.2
STREAM S.G.	2.1	1.0	1.4	1.1	1.2	2.3	1.0	1.2	1.2
ACTUAL VOL FLOW (m^3/h)	0.8	2.0	2.6	0.9	9.3	0.5	3.0	6.2	3.1
Mo (solid, wt%)	--	--	--	--	--	--	--	--	--
Mo (aq., gpl at 25 °C)	1,181.4	--	205.5	--	144.4	--	--	144.4	144.4
H2SO4 (aq., gpl at 25 °C)	--	--	--	106.4	32.4	--	--	32.4	32.4
TEMPERATURE (°C)	75	20	32	20	29	29	20	29	29
PRESSURE (kPa g)	--	--	--	--	--	--	--	--	--

002827

Appendix E:
Block Flow Diagram



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CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: MOLY HYDROMETALLURGICAL RECOVERY BLOCK FLOW DIAGRAM

AKER KVÆRNER™ E&C Division, Toronto, Canada

SCALE | PROJ. NO. 180600 | REVISION

DRAWING NO. DWG- 280-F-000

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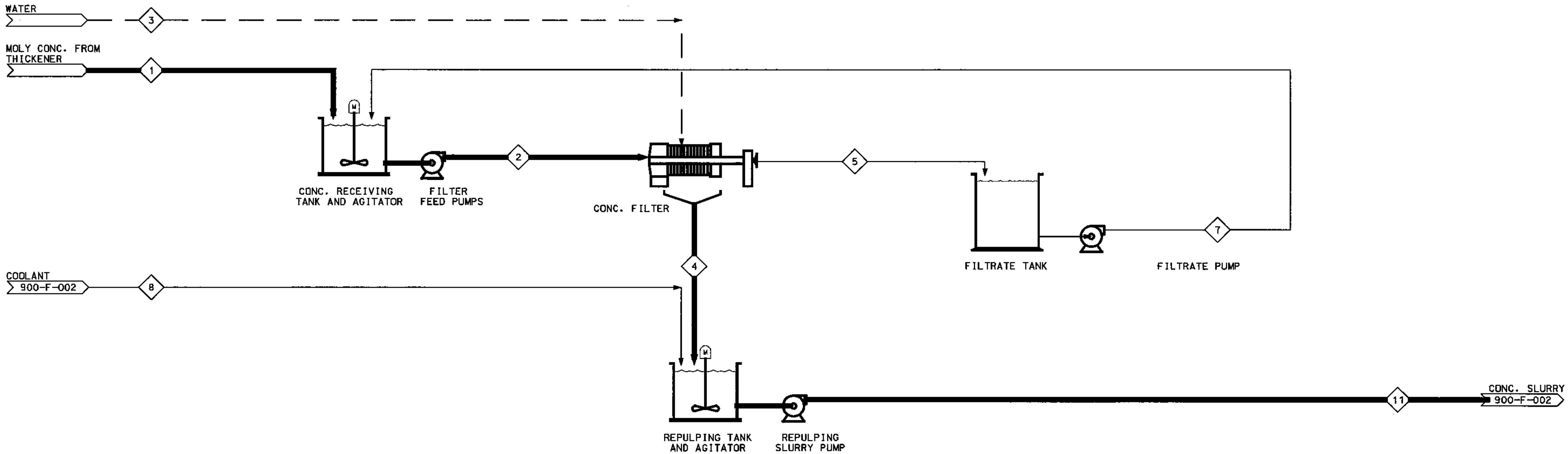

DESCRIPTION	Moly Concentrate	Conc to Filter	Water to Conc Filter	Washed Concentrate	Concentrate Filtrate	Filtrate to Concentrator	Coolant to Conc Repulping	Conc to Pressure Leach
STREAM NUMBER	1	2	3	4	5	7	8	11
SOLIDS FLOWRATE (t/h)	5.0	5.0	–	5.0	–	–	–	5.0
LIQUID FLOWRATE (t/h)	6.1	6.1	–	1.7	4.5	4.5	4.5	6.1
TOTAL FLOWRATE (t/h)	11.1	11.1	–	6.7	4.5	4.5	4.5	11.1
PERCENT SOLIDS (wt%)	45.0	45.0	–	75.0	–	–	–	45.0
SOLID S.G.	3.1	3.1	–	3.1	–	–	–	3.1
LIQUID S.G.	1.0	1.0	–	1.0	1.0	1.0	1.2	1.1
STREAM S.G.	1.4	1.4	–	2.0	1.0	1.0	1.2	1.6
ACTUAL VOL FLOW (m^3/h)	7.8	7.8	–	3.3	4.5	4.5	3.8	7.1
Mo (solid, wt%)	10.0	10.0	–	10.0	–	–	–	10.0
Mo (aq., gpl at 25 °C)	–	–	–	–	–	–	65.5	45.7
H2SO4 (aq., gpl at 25 °C)	–	–	–	–	–	–	67.2	46.8
TEMPERATURE (°C)	20	20	15	20	20	20	41	33
PRESSURE (kPa g)	142	542	342	–	–	142	3,342	142

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AKER KVÆRNER™ E&C Division
Toronto Canada

CLIENT/PROJECT: TOROMOCHO COPPER PROJECT–DFS

TITLE: MOLY CIRCUIT FLOWSHEET

SCALE | PROJ. NO. 190600 | REVISION

DRAWING NO. 900–F–001

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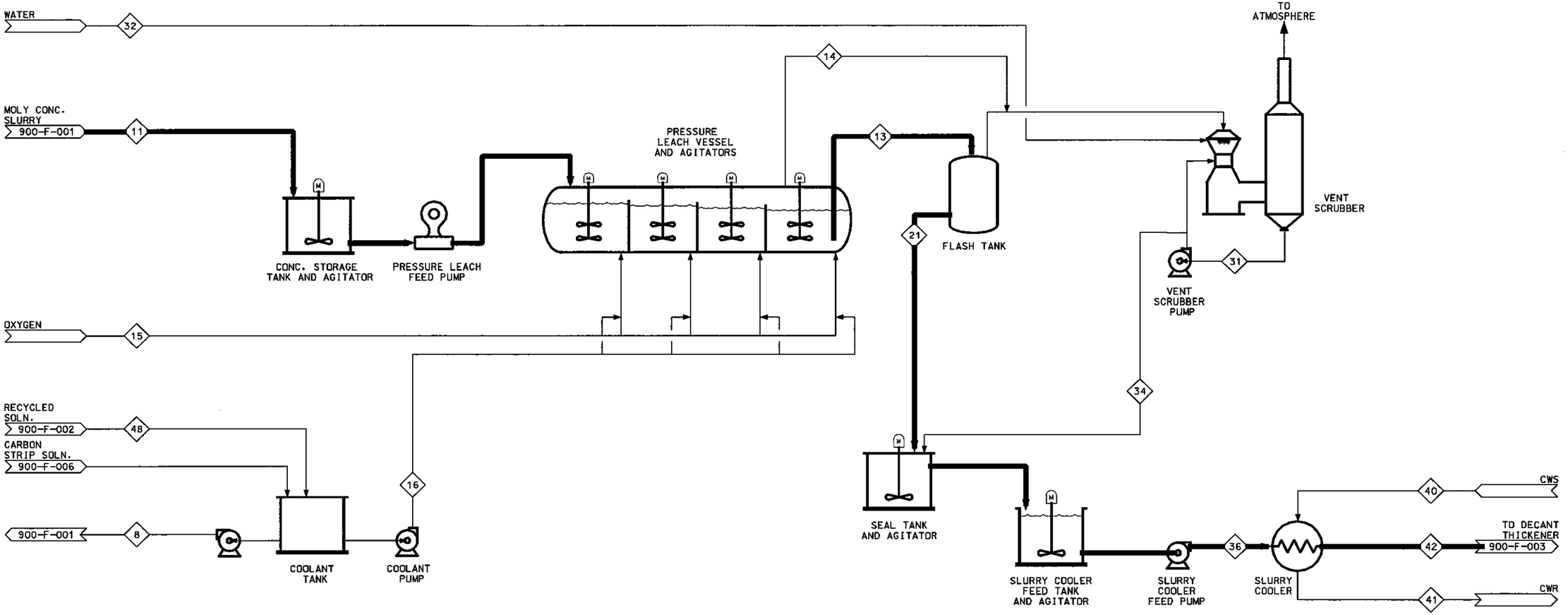

DESCRIPTION	Coolant to Conc Repulping	Conc to Pressure Leach	Autoclave Discharge	Autoclave Vent	O2 to Autoclave	Coolant to Pressure Leach	Flash Discharge	Scrubber Bleed	Water to Scrubber	Scrubber Bleed	Conditning Discharge	CW to Slurry Cooler	Slurry Cooler CWR	Slurry Cooler Discharge	Solution to Coolant Tank
STREAM NUMBER	8	11	13	14	15	16	21	31	32	34	38	40	41	42	48
SOLIDS FLOWRATE (t/h)	--	5.0	4.8	--	--	--	3.8	3.6	--	0.8	4.3	--	--	4.3	--
LIQUID FLOWRATE (t/h)	4.5	6.1	16.1	--	--	8.8	10.2	81.1	10.5	14.0	24.4	184.1	184.1	24.4	9.5
TOTAL FLOWRATE (t/h)	4.5	11.1	20.7	0.7	1.5	8.8	14.0	84.8	10.5	14.8	28.8	184.1	184.1	28.8	9.5
PERCENT SOLIDS (wt%)	--	45.0	22.3	--	--	--	27.0	5.6	--	5.6	15.1	--	--	15.1	--
SOLID S.G.	--	3.1	2.9	--	--	--	2.9	2.9	--	2.9	2.9	--	--	2.9	--
LIQUID S.G.	1.2	1.1	1.0	--	--	1.2	1.3	1.0	1.0	1.0	1.1	1.0	1.0	1.2	1.2
STREAM S.G.	1.2	1.8	1.2	0.0	0.1	1.2	1.5	1.1	1.0	1.1	1.2	1.0	1.0	1.3	1.2
ACTUAL VOL FLOW (m³/h)	3.8	7.1	17.2	--	--	7.6	9.4	61.6	10.5	14.1	23.3	184.3	184.4	22.8	8.3
Mo (solid, wt%)	--	10.0	9.5	--	--	--	9.5	9.5	--	9.5	10.1	--	--	10.1	--
Mo (aq., gpl at 25 °C)	65.5	45.6	62.0	--	--	65.5	85.2	10.9	--	10.9	38.3	--	--	38.3	35.8
H2SO4 (aq., gpl at 25 °C)	67.2	46.8	144.8	--	--	67.2	199.0	25.4	--	25.4	85.8	--	--	85.8	80.0
TEMPERATURE (°C)	41	32	225	225	30	41	91	85	20	85	82	15	20	50	45
PRESSURE (kPa g)	3,342	142	3,342	3,342	3,342	3,342	9	--	342	--	142	342	292	92	--

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Toronto Canada

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TITLE: MOLY CIRCUIT FLOWSHEET

SCALE	PROJ. NO. 180600	REVISION
DRAWING NO. 900-F-002		

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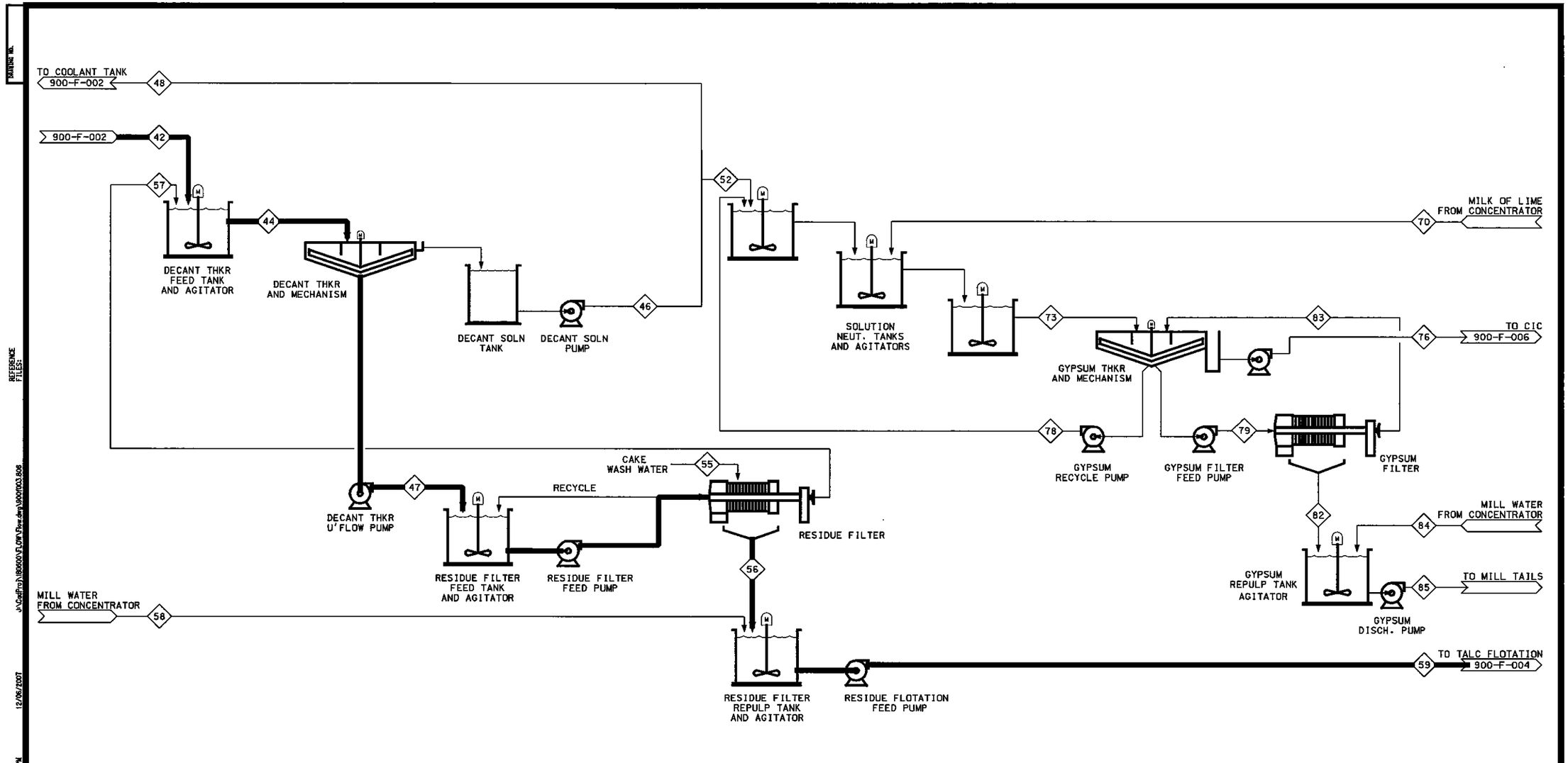

DESCRIPTION	Slurry Cooler Discharge	Feed to Decant Thickener	Decant Thickener Overflow	Decant Thickener Underflow	Solution to Coolant Tank	Solution to Neutralization	Wash Water to Pressure Leach Filter	Pressure Leach Filter Cake	Residue Filter Filtrate	Water to Repulp	Repulping Discharge	Milk of Lime to Neutralization	Neutralization Discharge	Gypsum Thickener Overflow	Gypsum Recycle	Feed to Gypsum Filter	Gypsum Filter Cake	Gypsum Filtrate	Water to Gypsum Repulping	Gypsum to Disposal
STREAM NUMBER	42	44	46	47	48	52	55	56	57	58	59	70	73	76	78	79	82	83	84	85
SOLIDS FLOWRATE (t/h)	4.3	4.3	–	4.3	–	–	–	4.3	–	–	4.3	0.9	9.9	–	7.9	2.0	2.0	–	–	2.0
LIQUID FLOWRATE (t/h)	24.4	31.2	25.8	5.3	9.5	16.3	2.9	1.5	6.8	5.1	6.5	4.9	31.9	19.4	11.9	3.0	0.5	2.5	2.5	3.0
TOTAL FLOWRATE (t/h)	28.8	35.5	25.8	9.6	9.5	16.3	2.9	5.8	6.8	5.1	10.8	5.7	41.8	19.4	19.8	4.9	2.5	2.5	2.5	4.9
PERCENT SOLIDS (wt%)	15.1	12.2	–	45.0	–	–	–	75.0	–	–	40.0	15.0	23.7	–	40.0	40.0	80.0	–	–	40.0
SOLID S.G.	2.9	2.9	–	2.9	–	–	–	2.9	–	–	2.9	2.2	2.3	–	2.3	2.3	2.3	–	–	2.3
LIQUID S.G.	1.2	1.1	1.2	1.2	1.2	1.2	1.0	1.0	1.1	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0
STREAM S.G.	1.3	1.2	1.2	1.6	1.2	1.2	1.0	2.0	1.1	1.0	1.4	1.1	1.2	1.1	1.4	1.4	1.9	1.1	1.0	1.3
ACTUAL VOL FLOW (m³/h)	22.8	28.9	22.6	6.2	8.3	14.3	2.9	2.9	6.1	5.1	8.0	5.3	34.5	18.4	14.6	3.7	1.3	2.3	2.5	3.8
Mo (solid, wt%)	10.1	10.1	–	10.1	–	–	–	10.1	–	–	10.1	–	–	–	–	–	–	–	–	–
Mo (aq., gpl at 25 °C)	38.4	35.7	35.9	35.9	35.9	35.9	–	2.9	26.6	–	0.7	–	27.5	27.6	27.6	27.6	27.6	27.6	–	4.3
H2SO4 (aq., gpl at 25 °C)	85.6	79.8	80.1	80.1	80.1	80.1	–	6.4	59.4	–	1.4	–	0.6	0.6	0.6	0.6	0.6	0.6	–	0.1
TEMPERATURE (°C)	50	48	46	46	46	46	20	31	39	20	23	50	77	75	75	75	75	75	20	36
PRESSURE (kPa g)	92	142	–	142	–	–	342	–	–	142	142	142	142	–	142	142	–	–	142	142

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TITLE: MOLY CIRCUIT FLOWSHEET

AKER KVÆRNER™ E&C Division Toronto Canada

SCALE | PROJ. NO. 180600 | REVISION

DRAWING NO. 900-F-003

REFERENCE FILES:

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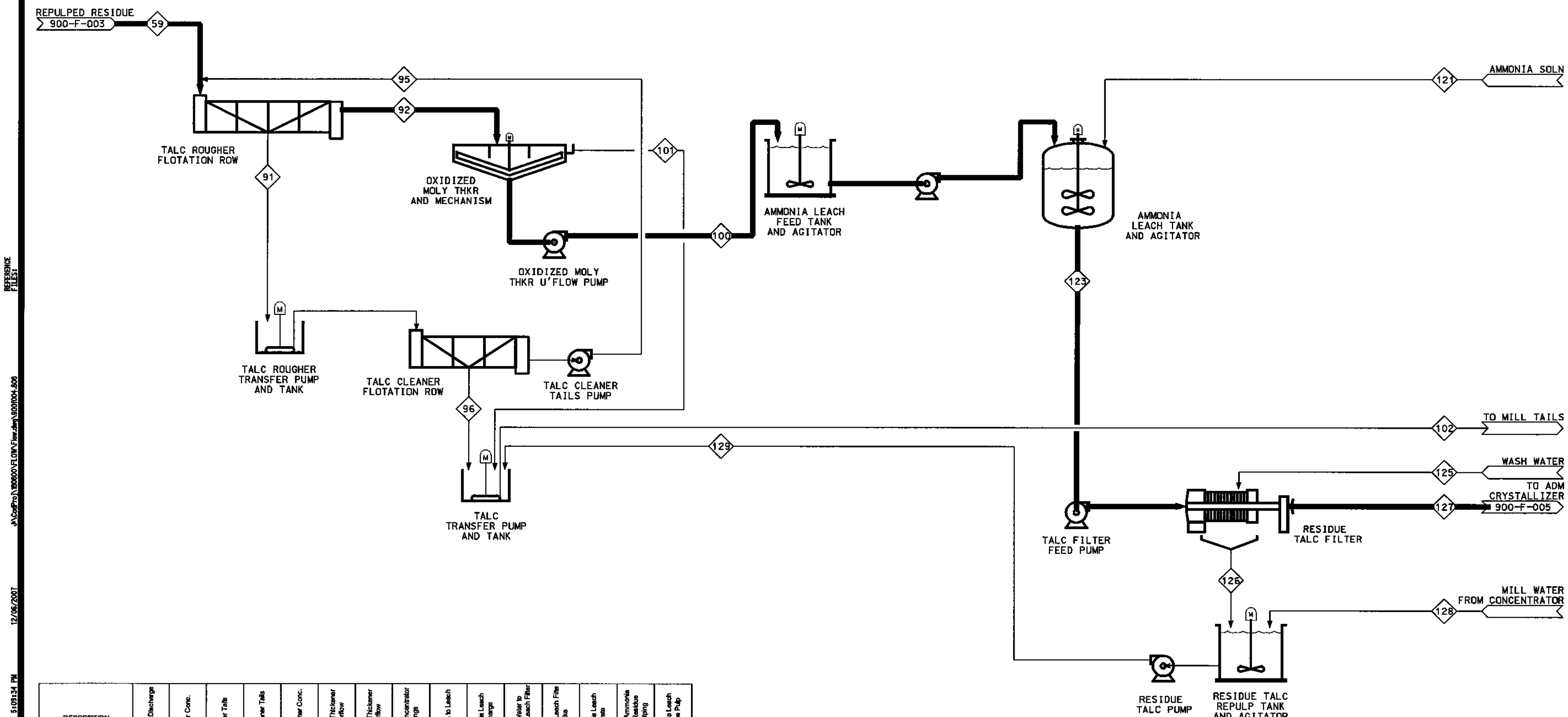

DESCRIPTION	Repulping Discharge	Rougher Conc.	Rougher Tails	Talc Cleaner Tails	Talc Cleaner Conc.	Flotation Thickener Underflow	Flotation Thickener Overflow	Talc to Concentrator Tailings	Ammonia to Leach	Ammonia Leach Discharge	Wash Water to Ammonia Leach Filter	Ammonia Leach Filte Cake	Ammonia Leach Filtrate	Water to Ammonia Leach Residue Repulping	Ammonia Leach Residue Pulp
STREAM NUMBER	59	91	92	95	96	100	101	102	121	123	125	126	127	128	129
SOLIDS FLOWRATE (t/h)	4.3	3.4	1.0	0.1	3.3	1.0	–	3.7	–	0.4	–	0.4	–	–	0.4
LIQUID FLOWRATE (t/h)	6.5	10.3	2.6	2.4	9.9	0.9	1.8	12.3	1.1	2.5	0.1	0.1	2.6	0.6	0.6
TOTAL FLOWRATE (t/h)	10.8	13.7	3.7	2.6	13.2	1.9	1.8	16.0	1.1	3.0	0.1	0.5	2.6	0.6	1.1
PERCENT SOLIDS (wt%)	40.0	25.0	28.4	5.3	25.0	55.0	–	23.3	–	14.3	–	90.0	–	–	40.0
SOLID S.G.	2.9	2.7	3.7	2.9	2.7	3.7	–	2.7	–	2.8	–	2.8	–	–	2.8
LIQUID S.G.	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.3	1.0	1.0	1.3	1.0	1.0
STREAM S.G.	1.4	1.2	1.3	1.0	1.2	1.7	1.0	1.2	0.9	1.4	1.0	2.4	1.3	1.0	1.4
ACTUAL VOL FLOW (m^3/h)	8.0	11.6	2.9	2.5	11.1	1.1	1.8	13.7	1.2	2.1	0.1	0.2	2.0	0.6	0.8
Mo (solid, wt%)	10.1	0.7	41.3	11.4	0.2	41.3	–	0.7	–	4.4	–	4.4	–	–	4.4
Mo (aq., gpl at 25 °C)	0.7	0.4	0.4	0.4	0.4	0.4	0.4	0.4	–	214.7	–	6.6	209.7	–	0.5
H2SO4 (aq., gpl at 25 °C)	1.4	0.9	0.9	0.7	0.7	0.9	0.9	0.7	–	–	–	–	–	–	–
TEMPERATURE (°C)	23	22	22	22	22	21	21	22	20	78	20	53	77	20	26
PRESSURE (kPa g)	142	–	–	–	–	142	–	–	–	–	–	–	–	–	142

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TITLE: MOLY CIRCUIT FLOWSHEET

AKER KVÆRNER™ E&C Division Toronto Canada

SCALE | PROJ. NO. 180600 | REVISION

DRAWING NO. 900-F-004

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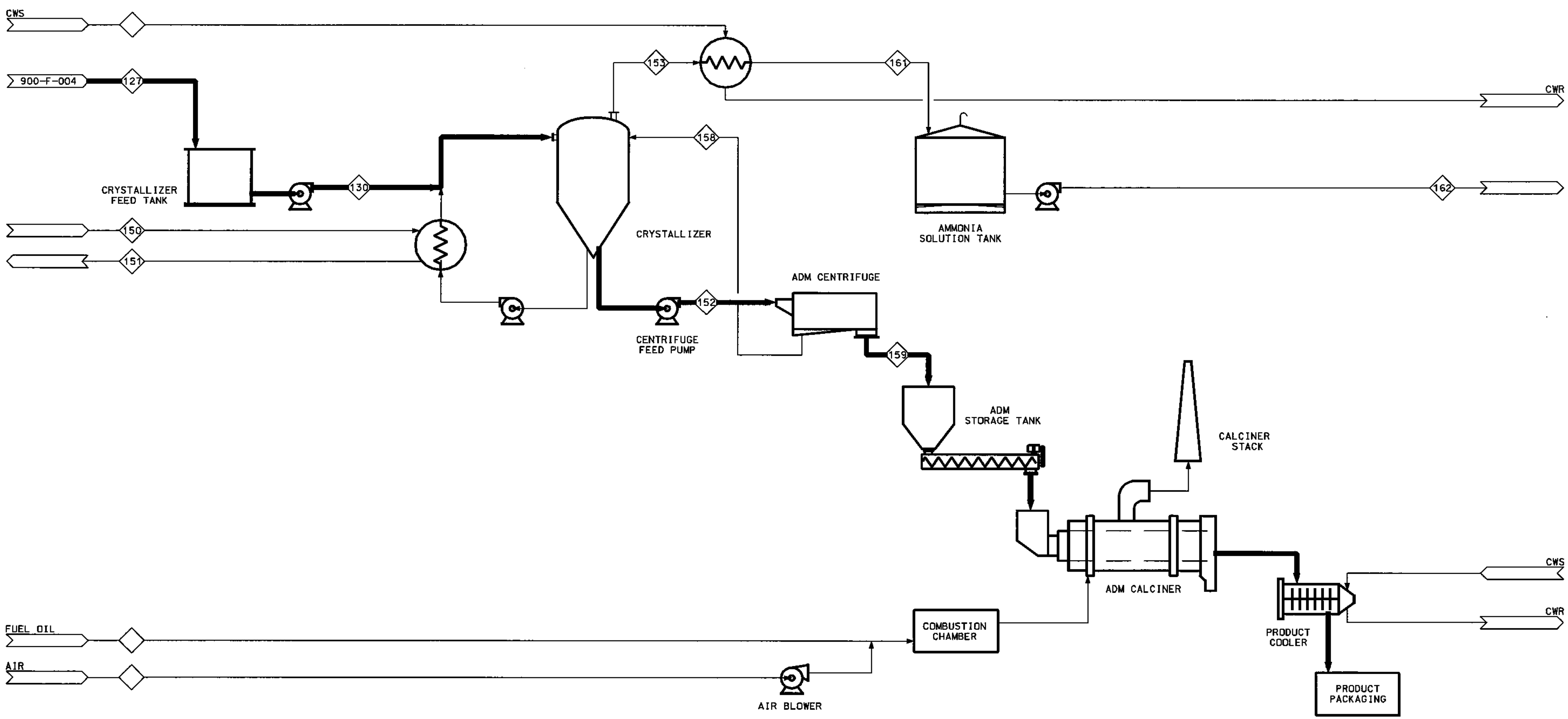

DESCRIPTION	Ammonia Leach Filtrate	Feed to Crystallizer	Steam to Crystallizer	Steam Cond.	Evaporator Discharge	Evaporator Overheads	Centrifuge Concentrate	Centrifuge Cake	Recovered Ammonia Solution	Ammonia Solution
STREAM NUMBER	127	130	150	151	152	153	158	159	161	162
SOLIDS FLOWRATE (t/h)	–	–	–	–	0.7	–	0.0	0.7	–	–
LIQUID FLOWRATE (t/h)	2.6	2.6	–	2.1	0.2	–	0.2	0.0	1.8	1.8
TOTAL FLOWRATE (t/h)	2.6	2.6	2.1	2.1	0.9	1.8	0.2	0.8	1.8	1.8
PERCENT SOLIDS (wt%)	–	–	–	–	78.8	–	4.4	95.0	–	–
SOLID S.G.	–	–	–	–	2.7	–	2.7	2.7	–	–
LIQUID S.G.	1.3	1.3	–	0.9	1.0	–	1.0	1.0	1.0	1.0
STREAM S.G.	1.3	1.3	0.0	0.9	2.0	0.0	1.1	2.5	1.0	1.0
ACTUAL VOL FLOW (m^3/h)	2.0	2.0	–	2.4	0.5	–	0.2	0.3	1.9	1.9
Mo (solid, wt%)	–	–	–	–	56.5	–	56.5	56.5	–	–
Mo (aq., gpl at 25 °C)	209.7	209.7	–	–	8.7	–	8.7	8.7	–	–
H_2SO_4 (aq., gpl at 25 °C)	–	–	–	–	–	–	–	–	–	–
TEMPERATURE (°C)	77	77	180	180	90	90	90	90	50	50
PRESSURE (kPa g)	–	–	945	945	–	–	–	–	–	–

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TITLE: MOLY CIRCUIT FLOWSHEET

KEY PLAN

AKER KVÆRNER™ E&C Division, Toronto Canada

SCALE | PROJ. NO. 160600 | REVISION

DRAWING NO. 900-F-005

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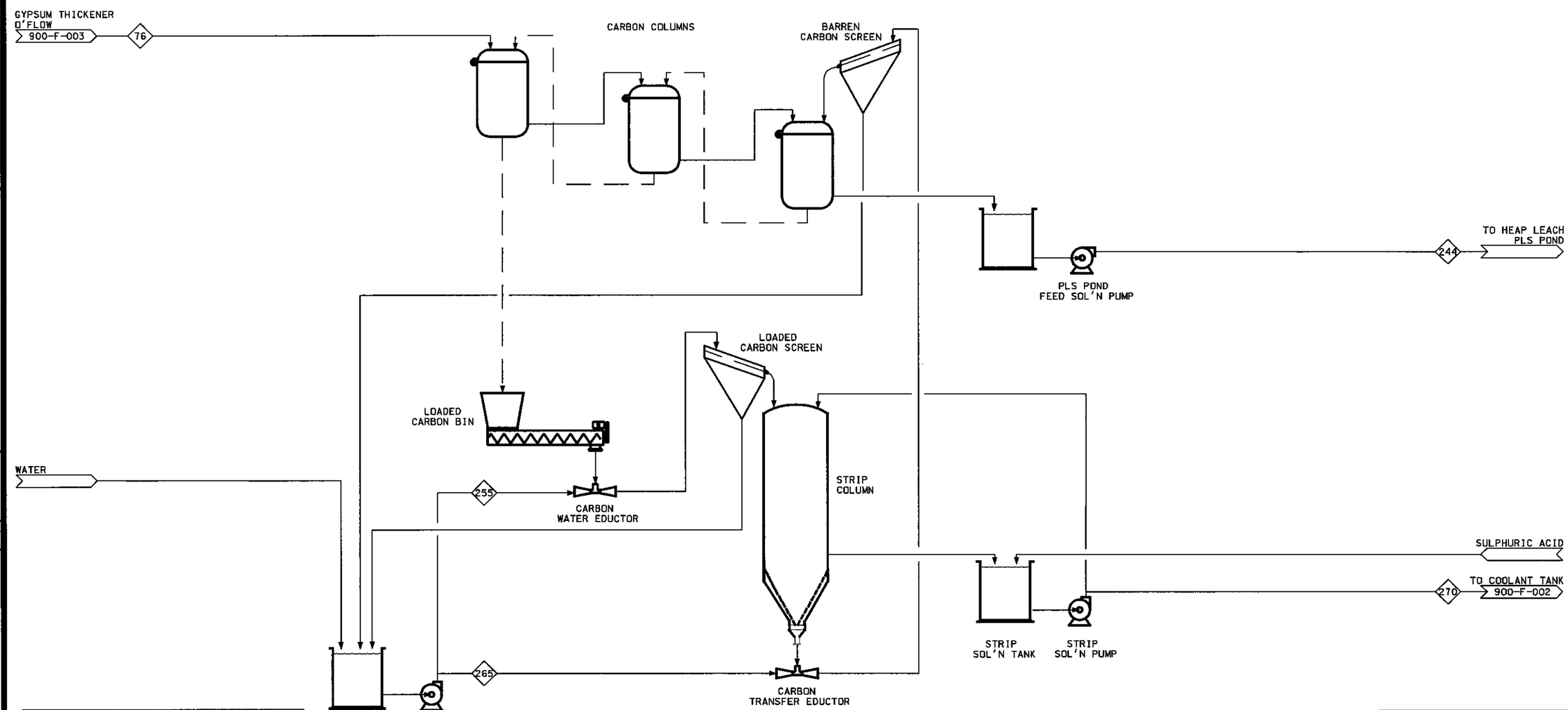

DESCRIPTION	Gypsum Thickener Overflow	Barren to Heap Leach PLS Pond	Water to Carbon Eductor	Water to Stripped Carbon	Strip Solution to Coolant Tank
STREAM NUMBER	76	244	255	265	270
SOLIDS FLOWRATE (t/h)	–	–	–	–	–
LIQUID FLOWRATE (t/h)	19.4	21.7	2.0	3.0	3.8
TOTAL FLOWRATE (t/h)	19.4	21.7	2.0	3.0	3.8
PERCENT SOLIDS (wt%)	–	–	–	–	–
SOLID S.G.	–	–	–	–	–
LIQUID S.G.	1.1	1.0	1.0	1.0	1.2
STREAM S.G.	1.1	1.0	1.0	1.0	1.2
ACTUAL VOL FLOW (m^3/h)	18.4	21.3	2.0	3.0	3.1
Mo (solid, wt%)	–	–	–	–	–
Mo (aq., gpl at 25 °C)	27.6	2.4	–	–	144.4
H2SO4 (aq., gpl at 25 °C)	0.6	0.5	–	–	32.4
TEMPERATURE (°C)	75	67	20	20	29
PRESSURE (kPa g)	–	–	–	–	–

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CLIENT/PROJECT: TOROMOCHO COPPER PROJECT-DFS

TITLE: MOLY CIRCUIT FLOWSHEET

SCALE | PROJ. NO. 180600 | REVISION

DRAWING NO. 900-F-006

DRAWING NO.

REFERENCE FILES:

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Aker Kvaerner

PERU COPPER INC.

Toromocho Project Feasibility Study

Moly Hydromet Testwork Interim Report

November 2007

Prepared for
Peru Copper, Inc.

Project No. R0521300
RP-10

AKER KVÆRNER™

Status:

All of the batch testwork in preparation for the next stage of testwork is complete. A spreadsheet providing the results of the 26 batch tests is attached. A discussion of these results by unit operation follows.

The samples for these tests were the products of the copper-moly separation and moly concentrate cleaning from the original pilot plant test program from the pilot plant run.

Pressure Oxidation:

The desired amount of oxidation of the molybdenate was 98% in approximately two hours. The results indicate that three to four hours may be required to obtain the desired rate of oxidation. It should be noted that unoxidized molybdenate will be lost to tails. The majority of these tests were run at baseline conditions, 225°C and 700 kPa oxygen overpressure. Results from the last three tests indicate that an increase in oxygen overpressure yielded improved results. Additional batch tests are scheduled to determine the affect of higher temperature on the degree of oxidation. Additionally a test has been requested for de-oiled concentrate to determine if removing the oil prior to POX might improve kinetics.

It is likely that a combination of higher temperature and higher oxygen overpressure may be required if oxidation time is to be reduced.

Liquid-Solid Separation:

No significant work has been done in this area due to a lack of material for meaningful tests. Also the continuous autoclave testwork often yields different results than achieved from batch testwork. The preliminary settling test indicates that thickening of the cooled autoclave discharge is achievable. Operating parameters such as settling areas, underflow density and flocculant consumption and selection will be determined by testing product from the continuous autoclave tests.

Flotation as a method of removing gangue material from the MoO_3 precipitate in the autoclave discharge failed.

Similarly, gravity separation as a means of removing gangue material from the MoO_3 also failed to produce beneficial results.

Alkali Leach:

Leaching the autoclave discharge with caustic at 13 pH produced excellent extraction (+98%) of oxidized moly from the solids. Various autoclave operating parameters were used to attempt to achieve high moly solubility in the autoclave to avoid possible losses to the unsoluble residue following the alkali leach step. In lieu of the high recovery of moly to solution with caustic, it would not seem necessary to adjust the autoclave feed to maximize moly solubility. The results will need confirmation with the alkali leach being run with limestone or milk of lime to pH 4 followed by caustic leach to pH 13. The gypsum precipitated with the calcium addition is not expected to change the extraction of the moly using the caustic leach.

It should be noted that when lime only was used as the alkali, extractions dropped significantly. This drop was attributed to reaching solubility limits of calcium molybdenate in the solution. The two stage alkali leach is expected to be the basis of the flowsheet for this unit operation.

Soluble Molybdenum Recovery:

Most of the testwork to date for recovery of moly from solution has been done using activated carbon. Carbon loading has been quite good at +50 kg/tonne. Elution testwork has not yet been done, so solution concentration of eluate is unknown at this time. Also the selectivity of the carbon over other ions is also unknown. Recovery to carbon is anionic with the moly being loaded as $MoO_4^{=}$ ion. Therefore a relatively pure eluate is expected with primary contamination due to physical entrainment rather than adsorption. Carbon loadings seem to be better at about a pH 2. This means that thickening will be necessary to recover sufficient acidic solution to neutralize the alkali leach slurry back to pH 2.0.

A strong base anionic resin was tried in one test with excellent results. Loadings were higher than with activated carbon, and the loading was much faster. The use of ion exchange is very promising and will be a prime consideration for future work as the next program proceeds.

To date, no elution data has been developed because of insufficient quantities of loaded material.

On-going Testwork:

All testwork in the future for the Toromocho Project will be conducted on a single sample of about 250 kg. This sample was obtained from the August 2007 pilot run of about 1000 tonnes of Toromocho ore run through the Austria Duvaz concentrator. The concentrate produced was shipped to SGS Lakefield and used to establish Cu-Mo separation criteria and to produce a suitable moly concentrate for use in this hydrometallurgical testwork program.

Batch Autoclave Tests:

A matrix of five and perhaps more batch autoclave tests are scheduled to establish operating conditions for the first of three continuous autoclave tests which are outlined in the attached proposal from SGS Lakefield.

Flowsheet:

The current flowsheet based on testwork results to date and experience from previous pressure oxidation projects is as follows:

- Pressure oxidation autoclave
- Flash tank, single stage pressure reduction
- Agitated conditioning tank
- Slurry cooling
- Thickener
- Alkali leaching of thickener underflow-two stage, first stage milk-of-lime and second stage caustic

- pH adjustment of alkali leach discharge with thickener overflow with milk-of-lime
- Carbon-in pulp (CIP) or resin-in-pulp (RIP)
- Continuous elution or two stage batch elution
- Eluate to crystallizer
- Crystallizer-solids to calciner
- Product packaging
- Solids slurry to concentrator tails

Design Criteria yet to be Determined:

- Pressure Oxidation
  - Retention time
  - Temperature
  - Oxygen overpressure
  - Decision on adding MgO to feed to increase soluble moly in POX discharge
- Liquid-Solid Separation
- Settling Area – both with and without MgO in POX feed
- Underflow density
- Filtration data
  - Vacuum belt filter (unlikely)
  - Pressure filter
- Alkali leach
  - Recovery with and without MgO in feed
  - Reagent consumptions
  - Evaluate soda-ash as final alkali reagent
- Adsorption
  - Determine loadings with both CIP and RIP
- Stripping
  - Strip times
  - Bed volume required
  - Rinse requirements
  - Analysis of solution to crystallizer
  - Determination of strip method

Areas of Concern:

- Pressure Oxidation – none
- Alkali leach – effects of using lime for initial neutralization
- CIP adsorption – selectivity – acid wash requirements – regeneration?
- RIP adsorption – contamination, salt precipitation in pores
- CIP strip – need confirmation that continuous upflow stripping method will work with minimal back mixing due to variation of S.G of solution in column
- Final selection of stripping reagent
- Crystallizing – need sufficient sample to determine most efficient design parameters of this system
- Capital cost
- Operating cost

Attachments

Attachment I **Testwork Results to Date**

Attachment II **SGS Metallurgical Operations Proposal**

Testwork Results to Date 002841
ATTACHMENT I

Project: 11665-001

Head Sample Analysis

Elements		AC Feed 1	AC Feed 2
S(T)	%	14.0	13.0
S^{2-}	%	8.33	10.9
Mo	%	11.2	15.0
Cu	%	2.33	0.58
Si	%	...	18.4
CO_3	%	2.18	1.36
ICP Scan			
Ag	g/t	70	21
Al	g/t	11000	7400
As	g/t	260	110
Ba	g/t	12	7.5
Be	g/t	0.06	<0.03
Bi	g/t	92	<25
Ca	g/t	2700	2500
Cd	g/t	13	5
Co	g/t	<4	<4
Cr	g/t	34	10
Fe	g/t	30000	15000
K	g/t	1400	900
Li	g/t	<5	<5
Mg	g/t	110000	91000
Mn	g/t	340	220
Na	g/t	3100	810
Ni	g/t	<20	<20
P	g/t	<200	<200
Pb	g/t	200	71
Sb	g/t	92	<10
Se	g/t	<30	<30
Sn	g/t	<40	<20
Sr	g/t	4.2	12
Ti	g/t	500	400
Tl	g/t	<30	<30
U	g/t	<20	<20
V	g/t	24	<2
Y	g/t	5.2	3.5
Zn	g/t	2200	450

Project: 11665-001

Summary of POX Tests on Toromocho Flotation Concentrate AC Feed 1

Test POX	AC Feed 1 Mass[1] g	POX Conditions: Pulp Dens. %	H_2SO_4 Add'n g/L	Temp °C	O_2 psi	Time h	POX PLS: EMF AgCl mV	Free Acid g/L	Assays (mg/L): Mo	Cu	Fe	POX Residue: Mass g	Assays (%): Mo	Cu	Fe	Al	Ca	K	Mg	Si	S(T)	SO_4	S^{2-}	Calculated Head (%): Mo	Cu	Fe	Metal in Solution (%): Mo	Cu	Fe
10	315	21.2	45	225	100	2	550	119	6660	6800	6240	228.8	11.0	0.009	1.12	0.20	0.08	0.038	13.5	25	0.04	<0.4	<0.05	10.3	2.41	3.02	22.7	99.7	73.0
4	315	21.6	20	225	100	2	550	98	11900	6430	5920	223.3	9.02	0.015	1.19	0.28	0.29	0.039	13.8	24.8	0.10	<0.4	<0.05	10.4	2.17	2.83	38.4	99.5	70.2
2	325	24.0	0	225	100	2	560	92	15300	7590	6210	228.3	7.72	0.013	1.24	0.22	0.13	0.031	13.5	25.7	...	<0.4	<0.05	10.1	2.34	2.78	46.5	99.6	68.7
1	315	22.0	0	225	100	2	556	86	15200	6540	6910	210.3	6.80	0.019	1.26	0.25	0.16	0.035	13.6	25.8	...	<0.4	0.08	9.67	2.22	3.18	53.1	99.4	73.5
3	175	14.0	0	225	100	2	553	49	11200	4070	3640	117.4	5.76	0.021	1.28	0.43	0.19	0.051	15.8	25.1	0.38	<0.4	0.26	10.4	2.38	2.97	62.7	99.4	71.1
5	315	21.6	20	225	100	2	545	101	9960	6300	6000	204.7[2]	8.71[2]	Repeat of Test 4 to produce pulp for flotation testing										9.46	...	...	38.2	...	...
8	315	21.6	20	225	100	2	552	98	10400	7020	6300	220.2[2]	9.04[2]	Repeat of Test 4 to produce pulp for flotation testing										10.0	...	...	37.0	...	...
9	315	21.6	20	225	100	2	547	95	11000	6830	6350	191.2[2]	1.83[2]	Repeat of Test 4 to produce pulp for flotation testing										5.18	...	...	78.6	...	...
6	315	21.6	20	200	100	2	495	99	7360	6370	5740	232.6	10.1	0.018	1.24	0.20	0.15	0.036	14.0	26.8	0.21	<0.4	0.09	10.1	2.32	2.99	26.3	99.4	69.4
7	315	21.6	20	225	100	1	515	98	10800	6620	6190	221.0	8.89	0.010	1.20	0.26	0.098	0.045	14.0	25.5	0.48	<0.4	0.33	10.2	2.43	3.11	38.8	99.7	72.9

[1]Used as received [2]Back calculated from flotation test

002842

Project: 11665-001

Summary of POX Tests on Toromocho Flotation Concentrate AC Feed 2

Test POX	AC Feed 2 Mass g	AC Feed 2 K_{80} Size µm	POX Conditions Pulp Dens. %	H_2SO_4 Add'n g/L	Additive Type	Additive Dosage kg/t	Temp °C	O_2 psi	Cumu. Time h	POX PLS EMF AgCl mV	POX PLS Free Acid g/L	POX PLS Assays (mg/L) Mo	Cu	Fe	POX Residue Resi./ Sample g	POX Residue Assays (%) Mo	Cu	Fe	Al	Ca	K	Mg	Si	S(T)	SO_4	S^{2-}	Calculated Head (%) Mo	Cu	Fe	Metal in Solution (%) Mo	Cu	Fe	Cumu. Mo
11	315	64	22.0	45	...	...	200	100	1	447	...	3080	...	...	14.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	8.3	...	...	...
									1.5	482	...	3840	...	...	15.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10.4	...	...	...
									2	510	124	5290	1570	2810	195.3	14.6	0.004	1.17	0.16	0.086	0.025	12.9	20.7	0.37	<0.4	0.17	12.0	0.51	1.74	13.6	99.4	52.0	...
12	175	64	14.0	...	...	...	225	100	2																								
	Added 1075 mL hot DIW								2	515	30	2430	466	853	130.6	14.9	0.008	1.15	0.18	0.081	0.024	13.1	20.5	0.89	<0.4	0.73	14.2	0.59	1.92	21.4	99.1	57.9	...
	Hot Curing of Diluted POX Pulp								2.25	520	...	2440	...	...	122.8	14.5	...	...	...	...	...	...	...	...	...	...	13.9	...	...	22.0	...	...	...
	Adjust/maintain pH 2.0, 95°C, 30 min								2.75	513	4	2530	...	...	191.2	9.66	...	...	...	...	...	...	...	...	...	...	14.6	...	...	20.7	...	...	...
13	87.5	64	7.0	...	...	...	225	100	2	500	23	4230	483	898	62.8	12.1	0.011	1.25	0.21	0.21	0.048	13.4	22.3	2.35	<0.4	2.15	13.9	0.61	2.01	37.7	98.7	55.4	...
15	175	64	14.0	...	...	...	225	100	2	500	54	4990	1020	1940	12.1	14.6	0.008	...	...	...	...	...	...	...	...	0.64	...	0.56	...	22.6	99.9	...	...
	Repulp washed solids in 1 L DIW, heat 60°C, maintain pH 11 for 4 h with NaOH (14.5 g)																																
									4	...	...	13700	...	...	82.0	1.91	...	...	...	...	...	...	...	...	...	...	14.3	...	...	90.1	...	...	91.5
20	125	64	10.4	...	...	...	225	100	1	502	30	2900	...	...	7.04	15.3	...	...	...	...	...	...	...	...	...	4.32	...	...	...	16.2	...	...	...
									2	516	34	3040	...	...	7.60	14.6	...	...	...	...	...	...	...	...	...	2.25	...	...	...	17.0	...	...	...
									3	530	39	3270	...	...	8.01	14.5	...	...	...	...	...	...	...	...	...	1.22	...	...	...	18.3	...	...	...
									4	527	40	4640	757	1470	74.8	14.1	0.010	1.15	0.20	0.53	0.037	13.8	23.7	0.82	<0.4	0.76	14.7	0.63	2.10	26.0	98.8	57.7	...
25	125	64	10.4	...	...	...	225	160	1	502	30	3060	...	...	6.47	14.7	...	...	...	...	...	...	...	...	...	2.42	...	...	...	19.4	...	...	...
									2	521	35	3400	...	...	6.72	14.7	...	...	...	...	...	...	...	...	...	1.14	...	...	...	21.5	...	...	...
									3	525	38	3340	...	...	6.77	14.7	...	...	...	...	...	...	...	...	...	0.60	...	...	...	21.2	...	...	...
									4	528	38	4890	709	1570	67.1	14.0	0.006	1.08	0.20	<0.005	0.032	12.8	...	0.38	<0.4	0.30	12.8	0.62	2.11	34.0	95.3	65.1	...
26	200	44	15.0	...	...	...	225	160	1	505	52	...	...	...	10.4	14.8	...	...	...	...	...	...	...	...	...	2.42	...	...	...	...	...	...	...
									2	525	61	...	...	...	10.7	15.0	...	...	...	...	...	...	...	...	...	1.14	...	...	...	...	...	...	...
									3	537	56	...	...	...	10.7	15.1	...	...	...	...	...	...	...	...	...	0.60	...	...	...	...	...	...	...
									4	548	59	...	...	...	113.5	15.1	0.006	1.14	0.16	0.13	0.037	15.9	3.72	...	...	...	...	...	...	...	...	...	...
21	125	64	10.3	...	MgO	70	225	100	1	495	14	5150	...	...	6.52	12.5	...	...	...	...	...	...	...	...	...	6.05	...	...	...	30.4	...	...	...
									2	514	24	9080	...	...	6.19	8.75	...	...	...	...	...	...	...	...	...	3.23	...	...	...	53.6	...	...	...
									3	522	30	11500	...	...	6.05	6.25	...	...	...	...	...	...	...	...	...	1.82	...	...	...	67.8	...	...	...
									4	530	32	15700	736	1260	56.9	1.79	0.020	1.41	0.70	0.63	0.18	16.4	27.4	1.28	0.8	0.95	14.2	0.63	1.88	92.6	98.1	56.1	...
23	125	64	10.3	...	MgO	70	225	160	1	504	15	5420	...	...	5.39	12.1	...	...	...	...	...	...	...	...	...	5.10	...	...	...	33.3	...	...	...
									2	522	23	8870	...	...	5.86	8.24	...	...	...	...	...	...	...	...	...	2.58	...	...	...	54.4	...	...	...
									3	530	27	10900	...	...	5.52	6.24	...	...	...	...	...	...	...	...	...	1.35	...	...	...	66.9	...	...	...
									4	543	29	15200	731	1240	54.7	1.70	0.041	1.55	0.72	0.12	0.18	17.4	19.7	1.23	0.7	0.58	14.1	0.65	1.93	93.3	96.5	55.3	...
24	125	44	10.3	...	MgO	70	225	160	1	503	21	7900	...	...	5.84	9.88	...	...	...	...	...	...	...	...	...	3.62	...	...	...	50.7	...	...	...
									2	522	28	11200	...	...	5.94	5.89	...	...	...	...	...	...	...	...	...	1.65	...	...	...	71.9	...	...	...
									3	535	33	12900	...	...	5.78	4.07	...	...	...	...	...	...	...	...	...	0.53	...	...	...	77.0	...	...	...
									4	550	32	15300	746	1320	58.5	0.72	0.021	1.42	0.74	<0.005	0.21	16.4	...	0.43	0.8	0.21	12.5	0.63	1.88	96.9	98.2	58.2	...
14	175	64	14.0	0	MgO	69	225	100	2	515	31	21000	1070	1770	120.6	5.04	0.027	1.57	0.69	0.17	0.19	14.7	24.6	2.81	0.8	2.53	15.6	0.64	2.11	77.8	97.1	48.6	...
16	125	64	10.3	0	MgO	71	225	100	1	474	10	5090	...	...	6.24	...	...	...	...	...	...	...	...	...	...	5.72	...	...	...	30.2	...	...	...
									2	506	18	8320	...	...	7.05	...	...	...	...	...	...	...	...	...	...	3.43	...	...	...	49.4	...	...	...
									3	530	24	12800	738	1180	71.1	4.69	0.035	1.51	1.04	0.23	0.19	15.7	24.1	2.48	0.5	2.13	12.8	0.59	1.89	76.0	96.1	47.5	...
17	125	64	10.3	0	MgO	104	225	100	1	484	0	3020	...	...	6.36	...	...	...	...	...	...	...	...	...	...	7.30	...	...	...	18.6	...	...	...
									2	496	13	8530	...	...	6.31	...	...	...	...	...	...	...	...	...	...	3.56	...	...	...	52.4	...	...	...
									3	536	20	12600	730	905	71.1	4.32	0.056	1.85	1.05	0.29	0.16	16.1	25.8	1.92	0.4	1.58	12.8	0.61	1.94	77.5	93.9	36.6	...
18	125	64	10.3	0	MgO	136	225	100	1	366	0	3120	...	...	8.04	...	...	...	...	...	...	...	...	...	...	7.30	...	...	...	19.0	...	...	...
									2	412	0	4710	...	...	6.52	...	...	...	...	...	...	...	...	...	...	3.56	...	...	...	28.7	...	...	...
									3	330	6	8540	458	174	76.6	8.81	0.37	2.48	1.02	0.36	0.095	15.3	23.1	4.87	<0.4	4.71	13.2	0.63	1.91	52.1	58.2	7.3	...
19	125	64	10.2	0	Lime	192	225	100	1	300	0	280	...	...	8.11	...	...	...	...	...	...	...	...	...	...	7.30	...	...	...	1.6	...	...	...
									2	499	11	7700	...	...	8.65	...	...	...	...	...	...	...	...	...	...	3.56	...	...	...	43.9	...	...	...
									3	525	23	13000	720	990	103.6	3.88	0.024	1.29	0.43	9.34	0.015	11.0	18.7	8.32	20	1.60	14.3	0.61	2.03	74.0	96.2	39.5	...
22	125	64	10.3	...	Lime	130	225	100	1	485	8	2710	...	...	8.59	12.6	...	...	...	...	...	...	...	...	...	5.11	...	...	...	16.8	...	...	...
									2	499	17	7310	...	...	7.98	8.69	...	...	...	...	...	...	...	...	...	2.95	...	...	...	45.2	...	...	...
									3	522	20	4020	...	...	8.76	11.3	...	...	...	...	...	...	...	...	...	1.41	...	...	...	24.9	...	...	...
									4	532	20	5080	728	1250	87.9	10.5	0.018	0.98	0.26	6.28	0.058	12.2	18.2	5.77	13	1.06	13.8	0.64	1.96	31.4	97.5	54.7	...

(1) Used as received

002843

Project: 11665-001

Summary of Neutralization/Alkaline Leaching of Pulps from POX on Feed 2

Test POX	AC Feed 2 Mass	AC Feed 2 K_{80} Size	POX															Neutralization/Alkaline Leaching						Calc.	Alkaline Mo Distribution		Mo Extraction	
			POX Conditions							Total	Portion of Pulp to Neut/Alk Leach						Mo in	Sol'n	Time	Temp.	NaOH	Sol'n	Solids	Head				
					Additive		Temp	O_2	Time	Resid.	Solution		Solids Content				POX	Change			kg/t	Mo	Mo	Mo	Sol'n	Solids	POX	Alka.
			Pulp Dens.	H_2SO_4 Add'n	Type	Dosage				Mass	F. Acid	Mo	Mass	Mo	S^{2-}		PLS				POX							Leach
	g	µm	%	g/L		kg/t	°C	psi	h	g	g/L	mg/L	g	%	%		%		h	°C	Feed	mg/L	%	%	%	%	%	%
20	125	64	10.4	...	...	...	225	100	4	96.5	40	4640	32.0	14.1	0.76		26.0	No	1	60	374	16600	...	...	97.0	...	...	...
																			2	60	...	15500	...	...	90.6	...	...	...
																			4	60	...	16000	1.29	13.7	93.5	6.5	26.0	67.5
21	125	64	10.3	...	MgO	70	225	100	4	73.0	32	15700	31.5	1.79	0.95		92.6	No	1	60	308	15000	...	...	85.6	...	...	...
																			2	60	...	14500	...	...	82.8	...	...	...
																			4	60	...	15300	2.35	14.1	87.4	12.6	92.6	-5.2
23	125	64	10.3	...	MgO	70	225	160	4	69.6	29	15200	30.2	1.70	0.58		93.3	No	1	60	263	9570	...	...	56.6	...	...	...
																			2	60	...	13900	...	...	82.2	...	...	...
																			4	60	...	14300	2.34	13.2	84.5	15.5	93.3	-8.8
22	125	64	10.3	...	Lime	130	225	100	4	113.0	20	5080	31.2	10.5	1.06		31.4	No	1	60	295	986	...	...	5.8	...	...	...
																			2	60	...	907	...	...	5.3	...	...	...
																			4	60	...	734	13.7	13.4	4.3	95.7	31.4	-27.1
24	125	44	10.3	...	MgO	70	225	160	4	69.0	32	15100	46.4	0.72	0.21		96.9	Yes	1	60	792	...	...	...	...	...	...	...
																			4	60	...	575	0.33	0.95	67.7	32.3	96.9	2.1
25	125	44	10.4	...	...	...	225	160	4	85.2	38	4890	58.9	14.0	0.30		31.0	Yes	1	60	705	...	...	...	...	...	...	...
																			4	60	...	16900	0.82	14.3	95.8	4.2	31.0	66.1
26	200	44	15.0	...	...	...	225	160	4	143.2	59	...	100.4	15.1	...		?	Yes	1	60	609	...	...	...	...	...	...	...
																			4	60	...	14400	0.038	15.6	99.8	0.2	?	######

(1)Used as received

002844

Project: 11665-001

Carbon Loading Test CL-1

Test Conditions/Products		Test				
		CL-1A	CL-1B	CL-1C	CL-1D	CL-1E
Initial Pulp (POX Tests 4, 6 and 7)						
Solution Volume	mL	452	452	452	452	452
Solids Weight	g	108	108	108	108	108
Feed at pH 1						
Mo in Solution	mg/l	14000	14000	14000	14000	14000
Mo in Solids	%	6.13	6.13	6.13	6.13	6.13
Mo Head Calc.	%	14.0	14.0	14.0	14.0	14.0
Test Conditions						
Carbon Added	g/L sol'n	111	111	111	111	111
Temperature	°C	25	25	25	25	25
pH		1.0	2.0	3.0	4.0	5.0
NaOH Added	g/L sol'n	0	18	26	34	49
Retention Time						
Agitated Vessel	h	6	6	6	6	6
Bottle-on-Rolls	h	18	18	18	18	18
Final Solution sg		1.15	1.15	1.15	1.16	1.16
Loaded Carbon Weight	g	68.4	66.9	63.2	63.7	61.4
Final Solid Weight	g	80.7	85.0	84.7	85.3	91.9
6-Hour Sample						
pH		1.5	2.4	3.2	4.3	5.3
Mo in Solution	mg/L	8170	7170	6830	7210	6840
Carbon Mo Calculated	g/t	38554	46118	51271	48150	52683
24 Hour Samples						
pH		1.6	2.5	3.2	4.0	5.2
Mo in Solution	mg/L	5240	5690	6920	8750	7510
Carbon Mo Assay	g/t	64100	48900	40800	37700	43500
Mo in Residue	%	5.87	7.46	7.29	5.76	5.66
Mo Head Calculated	%	14.8	14.7	14.9	14.3	13.0

Project: 11665-001

Carbon Loading Test CL-2

Test Conditions/Products		Test	
		CL-2A	CL-2B
Initial Pulp (POX Tests 1 and 2)			
Solution Volume	mL	743	743
Solids Weight	g	174	174
Feed at pH 1			
Mo in Solution	mg/l	15251	15251
Mo in Solids	%	7.28	7.28
Mo Head Calc.	%	13.8	13.8
Test Conditions			
Carbon Added	g/L sol'n	102	102
Temperature	°C	25	25
pH		<1	2.0
NaOH Added	g/L sol'n	0	64
Retention Time (Agitated Vessel)	h	48	48
Final Solution sg		1.01	1.14
Loaded Carbon Weight	g	93.1	88.8
Final Solid Weight	g	155.4	169.5
1-Hour Sample			
pH		<1	2.0
Mo in Solution	mg/L	11500	9260
Carbon Mo Calculated	g/t	29939	50156
2-Hour Sample			
pH		<1	2.2
Mo in Solution	mg/L	10000	8610
Carbon Mo Calculated	g/t	41911	55597
4-Hour Sample			
pH		<1	2.2
Mo in Solution	mg/L	9560	7910
Carbon Mo Calculated	g/t	45423	61458
8-Hour Sample			
pH		<1	2.2
Mo in Solution	mg/L	9250	7300
Carbon Mo Calculated	g/t	47897	66564
24-Hour Sample			
pH		<1	2.1
Mo in Solution	mg/L	9940	6050
Carbon Mo Calculated	g/t	42390	77029
48 Hour Samples			
pH		<1	2.1
Mo in Solution	mg/L	10500	5790
Carbon Mo Assay	g/t	96500	74900
Mo in Residue	%	5.02	7.20
Mo Head Calculated	%	14.1	13.7

Project: 11665-001

Carbon Loading Test CL-3

Test Conditions/Products		Test	
		CL-3A	CL-3B
Initial Pulp (POX Tests 14-17)			
Solution Volume	mL	543	543
Solids Weight	g	60.5	60.5
Feed			
Mo in Solution	mg/l	15854	15854
Mo in Solids	%	4.76	4.76
Mo Head Calc.	%	19.0	19.0
Test Conditions			
Carbon Added	g/L sol'n	101	101
Temperature	°C	50	40
pH		2.0	2.0
NaOH Added	g/L sol'n	14	14
Retention Time (Agitated Vessel)	h	8	8
Final Solution sg		1.08	1.08
Loaded Carbon Weight	g	59.0	57.6
Final Solid Weight	g	59.0	55.4
1-Hour Sample			
pH		2.2	2.2
Mo in Solution	mg/L	13600	13100
Carbon Mo Calculated	g/t	20762	25967
2-Hour Sample			
pH		2.2	2.2
Mo in Solution	mg/L	12600	13000
Carbon Mo Calculated	g/t	29973	26910
4-Hour Sample			
pH		2.2	2.2
Mo in Solution	mg/L	11600	12300
Carbon Mo Calculated	g/t	39184	33510
8-Hour Samples			
pH		2.2	2.2
Mo in Solution	mg/L	11300	12000
Carbon Mo Assay	g/t	44600	40900
Mo in Residue	%	4.32	4.40
Mo Head Calculated	%	18.6	18.7

Project: 11665-001

Resin Loading Test RL-1

Test Conditions/Products		Test RL-1
Initial Pulp (POX Tests 14-17)		
Solution Volume	mL	543
Solids Weight	g	60.5
Feed		
Mo in Solution	mg/l	15854
Mo in Solids	%	4.76
Mo Head Calc.	%	19.0
Test Conditions		
Purolite A500 Added	mL/L pulp	175
	mL/L sol'n	184
Temperature	°C	50
pH		10.0
NaOH Added	g/L sol'n	55
Retention Time (Agitated Vessel)	h	8
Final Solution sg		1.07
Loaded Resin Weight	g	36.3
Final Solid Weight	g	53.6
1-Hour Sample		
pH		10.0
Mo in Solution	mg/L	6120
Solution Volume	mL	668
Loaded Resin Mo Calculated	g/t	124533
2-Hour Sample		
pH		10.0
Mo in Solution	mg/L	6550
Loaded Resin Mo Calculated	g/t	116620
4-Hour Sample		
pH		10.0
Mo in Solution	mg/L	6590
Loaded Resin Mo Calculated	g/t	115884
8-Hour Samples		
pH		10.0
Mo in Solution	mg/L	6930
Carbon Mo Assay	g/t	77500
Mo in Residue	%	4.58
Mo Head Calculated	%	16.3
Loaded Resin Mo Calculated	g/t	109628

Project: 11665-001

Settling Characteristics of POX Products

Test POX 20 (10.4% solids, 225°C, 100 psi O_2, 4 hours)

Time	Mudline		Temp.	Remarks
min	mm	mL	°C	
0	150	400	50	slightly cloudy
10		210	50	slightly cloudy
20		110	50	clearing
30		90	50	clear
60		90	50	clear
120		85	50	clear
960		85	25	clear

Test POX 21 (10.3% solids, 70 kg/t MgO, 225°C, 100 psi O_2, 4 hours)

Time	Mudline		Temp.	Remarks
min	mm	mL	°C	
0	160	420	50	very cloudy
10		80	50	very cloudy
20		60	50	very cloudy
30		60	50	very cloudy
60		50	50	cloudy
120		50	50	slightly cloudy
960		50	25	clear

Test POX 22 (10.3% solids, 130 kg/t lime, 225°C, 100 psi O2, 4 h)

Time	Mudline		Temp.	Remarks
min	mm	mL	°C	
0	165	430	50	slightly cloudy
10		350	50	slightly cloudy
20		300	50	clearing
30		270	50	clear
60		150	50	clear
120		130	50	clear
960		120	25	clear

Test POX 23 (10.3% solids, 70 kg/t MgO, 225°C, 160 psi O2, 4 h)

Time	Mudline		Temp.	Remarks
min	mm	mL	°C	
0	168	460	50	very cloudy
10		75	50	very cloudy
20		70	50	very cloudy
30		65	50	cloudy
60		60	50	cloudy
120		55	50	slightly cloudy
960		55	25	clear

All tests conducted in 1-L (6 cm ID) glass graduated cylinders

Project: 11665-001

Budget

Item	Budget		Completed Sept 24/07		Remaining	
	Test	$	Test	$	Test	$
POX tests	20	40000	19	38000	1	2000
Carbon Loading						
Effect of pH	1	2500	1	2500	...	...
Loading Isotherm	1	2500			1	2500
Effect of Temperature	1	1500			1	1500
Kinetics	0	0	1	2500	...	-2500
Stripping with acid and ammonia	1	4000			1	4000
Neutralization Tests (pH 2, 3, ..., 12)	0	0	1	2500	...	-2500
Upgrading of MoO3 in Residue	10	7500			10	7500
Mineralogy	1	5000			1	5000
Testwork Total		63000		45500		17500
Project Management (15%)		9500		6825		2625
Communication Meeting (10%)		6300		4550		1750
Reporting (10%)		6300				6300
Total		**85100**		**56875**		**28225**

Project: 11665-001

Additional Cost for Tests POX 20-23 and Carbon IX Loadings (Email Sept 25, 2007)

Item	No. of Test	Cost Unit	Cost $
1) Effect of POX Conditions on S^{2-} Oxidation and Settling			
POX Tests 20 to 23	4	2000	8000
Neutralization at 60°C, 4 h with samples at 1, 2, 4 h	4	600	2400
Settling tests on POX pulps at 40-50°C	4	600	2400
2) Carbon and Resin Loading			
Tests C-3A and C-3B (repeat of C-2B at 40 and 50°C)	2	1000	2000
8 h, samples at 1, 2, 4 and 8 h Resin Loading at 50°C, 8 h, samples at 1, 2, 4 and 8 h	1	1000	1000
3) Simulation POX,S/L,2nd Leach,Neut,Loading			
Pending			
Testwork Total			15800
Project Management (15%)			2370
Communication Meeting (10%)			1580
Reporting (10%)			1580
Total			**21330**

ATTACHMENT II

002852

SGS

Metallurgical Operations
Proposal

PROPOSAL

for

Development and Optimization of the Hydrometallurgy Flowsheet for Molybdenum Recovery from Toromocho Molybdenum Sulphide Concentrate

prepared for

MINERA PERU COPPER

November 6, 2006

SGS Minerals Services

SGS

Metallurgical Operations Proposal

BACKGROUND

The Toromocho moly concentrate (~20% Mo, ~20% S) is too low grade to be sold directly to a molybdenum refinery, and therefore the Toromocho project feasibility study is examining the technical and economic viability of treating this concentrate on site by a hydrometallurgical process, to produce high grade ammonium molybdate $\{(NH_4)_2MoO_4\}$ for sale.

A conceptual flowsheet has been developed, and key elements of the flowsheet have been tested in small scale bench tests. The first step in the process involves high temperature pressure oxidation (POX) of the concentrate to convert molybdenum sulphide to molybdenum oxide, plus sulphuric acid. This is followed by solid liquid separation, neutralization of the acidic POX liquor, and alkaline leaching of the POX residue to dissolve molybdenum as molybdate anions. Molybdate anions will then be extracted directly from the leach slurry (without slid/liquid separation) by adsorption on activated carbon or anion exchange resin, followed finally by stripping of the loaded adsorbent and crystallization of ammonium molybdate from the strip solution.

The scope of work for this proposal is to:

- run continuous POX campaigns to optimize this part of the flowsheet
- to produce larger quantities of oxidized pulp to further develop the downstream process in small scale bench tests.

TESTWORK DESCRIPTION

1. POX Campaigns

If the optimum pulp density is assumed to be 20% solids, and the optimum residence time 2 hrs, then the feed rate of (dry equivalent) concentrate to the autoclave will be about 3.5 kg/hr. Assuming the availability of 250 kg of feed molybdenum concentrate, this flowrate will allow for about 72 hours autoclave running time in total, or longer if a longer residence time in the autoclave proves to be optimal. On this basis, the following short pilot plant runs are planned:

- An initial 24-hour run to determine the optimum residence time in the autoclave. Pulp residence time will be 4 hrs in the autoclave, allowing for 4 to 6 hours to bring the autoclave to steady operating conditions, and another 18 to 20 hrs running time, allowing for 4 to 5 turnovers to bring the system to steady state process performance. Three sets of 6 compartment samples will be taken during the 18 hrs of steady operation, to determine the kinetic profile of the oxidation reaction. The pulp density of the feed will be set for autothermal operation (~20 to 25% solids), and the autoclave temperature will be maintained at 225°C, based on the results of the bench testing. Oxygen overpressure will be 100 psi.

- A 24 hour production run at the optimum residence time established in the first 24 hour run. It is expected that this will be in the 120 to 180 minutes range. It is planned to run for 8 hrs at the optimum residence time established in the first run, then for another 8 hrs at a higher temperature (235°C), and then for the last 8 hours at a higher oxygen partial pressure of 150 to 200 psi. The objective of increasing temperature and oxygen pressure is to determine their effect on the rate of sulphide oxidation. Two compartment sample profiles will be taken in each 8 hour segment of the run (after ~5 hrs and ~8hrs) to determine the oxidation rate under each set of conditions. The product from the autoclave will be kept for solid/liquid separation testing and downstream flowsheet development work (see section 2)

- A second 24 to 40 hour production run will be carried out to process all of the remaining concentrate. This run will be conducted under constant operating conditions, using the optimum residence time, temperature, pulp density and oxygen partial pressure established in the first 2 runs. The product from the autoclave will be used for thickening and filtration testing (by outside vendors if necessary), and to produce fully representative products for downstream process testing in batch tests and (possibly) small scale continuous tests.

2. Bench-scale Batch Testing

2.1. Further Optimization of the POX Conditions

The main objective of the hydrometallurgical process is to oxidize all the sulphides in the moly concentrate (>99%), and subsequently, to dissolve all of the oxidized Mo into aqueous solution (target >95%). Mo dissolves both in the autoclave under acidic conditions (20 to 90% dissolution) and in the subsequent alkaline leach process (up to 90% dissolution of remaining Mo). It is not clear from the lab work that has been done to date whether it is better to maximize Mo dissolution in the autoclave or in the alkaline leach, in order to achieve the best overall Mo recovery to solution. Both options will be investigated further in a matrix of tests that will be completed before the autoclave pilot plant runs. The following will be examined:

- Fine re-grinding of the Mo concentrate to improve the kinetics.

- Maximize Mo in solution in the autoclave by minimizing acid conc in the autoclave (by adding MgO to the feed), followed by S/L separation and alkaline leaching of the residue.
- Minimize Mo in solution in the autoclave by maximizing acid conc in solution (higher pulp density, no MgO in feed), followed by S/L separation and aggressive alkaline leaching of the residue.
- The above extremes will be tested both with low and high grade Mo concentrates (10% Mo, 20% Mo). The higher grade con will be the pilot plant feed concentrate.

2.2. Optimization of the Alkaline Leach Process

Very little work has been done in this area. A batch of autoclave leach slurry will be collected from the continuous pilot plant (probably the third run, so that the feed is a residue produced under the optimum POX conditions). The slurry will be filtered and washed, and the cake divided into equal proportions to test the following variables in a matrix of 6 tests. Each test will be run for several hours, and kinetic sub-samples will be taken and analyzed for Mo to measure the rate of dissolution.

- The effect of pH (10, 12, 14)
- The effect of temperature (40,60, 80°C)
- The effect of neutralizing agent (NaOH, CaO)

2.3. Development and Optimization of the Process to Recover Mo from the Leach Slurry

Both activated carbon and anion exchange resins work well as extractants of Mo from the final leach slurry. Moreover, both work well as "in-pulp" adsorbents, which means the Mo can be extracted directly from the leach slurry without the need for solid liquid separation and washing. This is a distinct advantage of the process, as a solid liquid separation step is expected to be costly and inefficient, owing to the nature of this Mo concentrate. Further testwork is needed to establish the best method of recovering Mo (resins or carbon), which will be based on considerations such as: (i) the loading capacity of the resin or the carbon for Mo, (ii) the ease of stripping Mo from the resin or carbon and (iii) the ease of integrating the stripping process with the final Mo recovery process (which involves evaporation and crystallization of ammonium molybdate). Leach slurry from the autoclave pilot plant campaigns will be used for this development work. The following tests need to be completed to evaluate and optimize this part of the process:

- Optimization of pH for loading Mo on strong base resin (examine pH 6 to 10).
- Loading isotherms from pilot plant leach slurries at optimum pH onto resin (at pH >6) and carbon (pH 1 to 2)
- Prepare large batches of loaded resin and carbon for elution testwork.
- Development of best elution method for carbon and resin (look at temperature, {RT and 100°C} and eluant type {ammonium hydroxide, ammonium sulphate or possibly acid....for the resin}), as well as eluant volume and flowrate. Elution will be done batch-wise in a column, and the Mo profile in the eluate will be established.

2.4. Recovery of Mo from Resin and/or Carbon Strip Liquors

The method of final molybdenum recovery is expected to involve evaporation of the resin or carbon strip liquor to increase the concentration of ammonium molybdate beyond its saturation limit, followed by freeze-cooling of the liquor and crystallization of $(NH_4)_2MoO_4$. The mother liquor would then be diluted back to its original eluant strength and recycled to elution. The following test work is recommended at this stage:

- Prepare a large batch of synthetic ammonium molybdate solution, and carry out batch tests to determine relationship between Mo in solution and temperature in the range 0 to 100°C.
- Prepare large batches of loaded resin and/or carbon, using autoclave products from the POX pilot plant and commercial resin or carbon. Elute the resin and/or carbon under optimum conditions established in (3) above, to produce large batches of real eluate.
- Evaporate excess water and freeze-crystallize $(NH_4)_2MoO_4$ from real eluates. Analyze crystals to determine product purity for marketing purposes.
- Re-constitute the original eluant by appropriate dilution of the mother liquor, and carry out resin and/or carbon elution testing with the recycled eluant to determine if there is any loss in elution efficiency.

ANEXO 2-7
ESTUDIO DE ALTERNATIVAS SISTEMA DE RELAVES FINAL

Incremento de Capacidad de Presa de Relaves Toromocho
Estudio de Alternativas

002858

002859

PRESENTATION AGENDA

1. Design Drivers
2. Identification of Alternatives
3. Discussion – Basic Engineering Concept
4. Evaluation of Alternatives
5. Evaluation Factors
6. Cost Estimation - Methodology
7. Description of Alternatives
8. Ranking of Alternatives
9. Conclusions
10. Path Forward

002860

1. Parametros de Diseño de la Presa

- Contiene 1.500 Mt de relaves
- Dentro de la huella Toromocho TSF existente
- Maximizar el uso de los equipos existentes.
- Minimice las interrupciones a las operaciones
- Plan de producción actual, incluida la expansión a 170 ktpd
- Se realizaron análisis geotécnicos cualitativos

IDENTIFICACION DE ALTERNATIVAS

3. IDENTIFICATION OF ALTERNATIVES
Tecnologias a Aplicar

002862

- Espesamiento
  - HCT – Relave Baja Densidad (actualmente)
  - HCT – Relave Alta Densidad (diseño original)
  - HCT – Relave en Pasta (70% solidos)
  - Espesamiento por cono profundo – No Factible
- Clasificación (Desague de U/F)
  - Cicloneo
- Filtración
  - Filtro prensa vertical de gran tamaño para relaves.

3. IDENTIFICACION DE ALTERNATIVAS
Otras Tecnologías / Metodos

002863

Otros Métodos considerados en el estudio, pero descartados:

- Pasta cementada
- Floculación en línea / Súper floculantes
- Estructuras de disipación de energía dentro del embalse
- Eliminación de Co con Waste Rock
- Aumento adicional a la presa actual (4730m a 4790m) ** incluido en PPT como "no conforme"
- Geotubos
- "De-lijadoras" (Mantos Blancos, Chile)

4. DISCUSIÓN - CONCEPTO BÁSICO DE INGENIERÍA
Depositación en pendientes pronunciadas de relaves de alta densidad

4. DISCUSION – CONCEPTO DE INGENIERIA BASICA

002865

- Concepto de ingenieria basica = 03 Partes de Proceso

Necesita tensión de rendimiento mínima de 70 Pa (punto de descarga)

(actualmente @60% solidos = 17 to 30 Pa – SLR Consulting, 2015

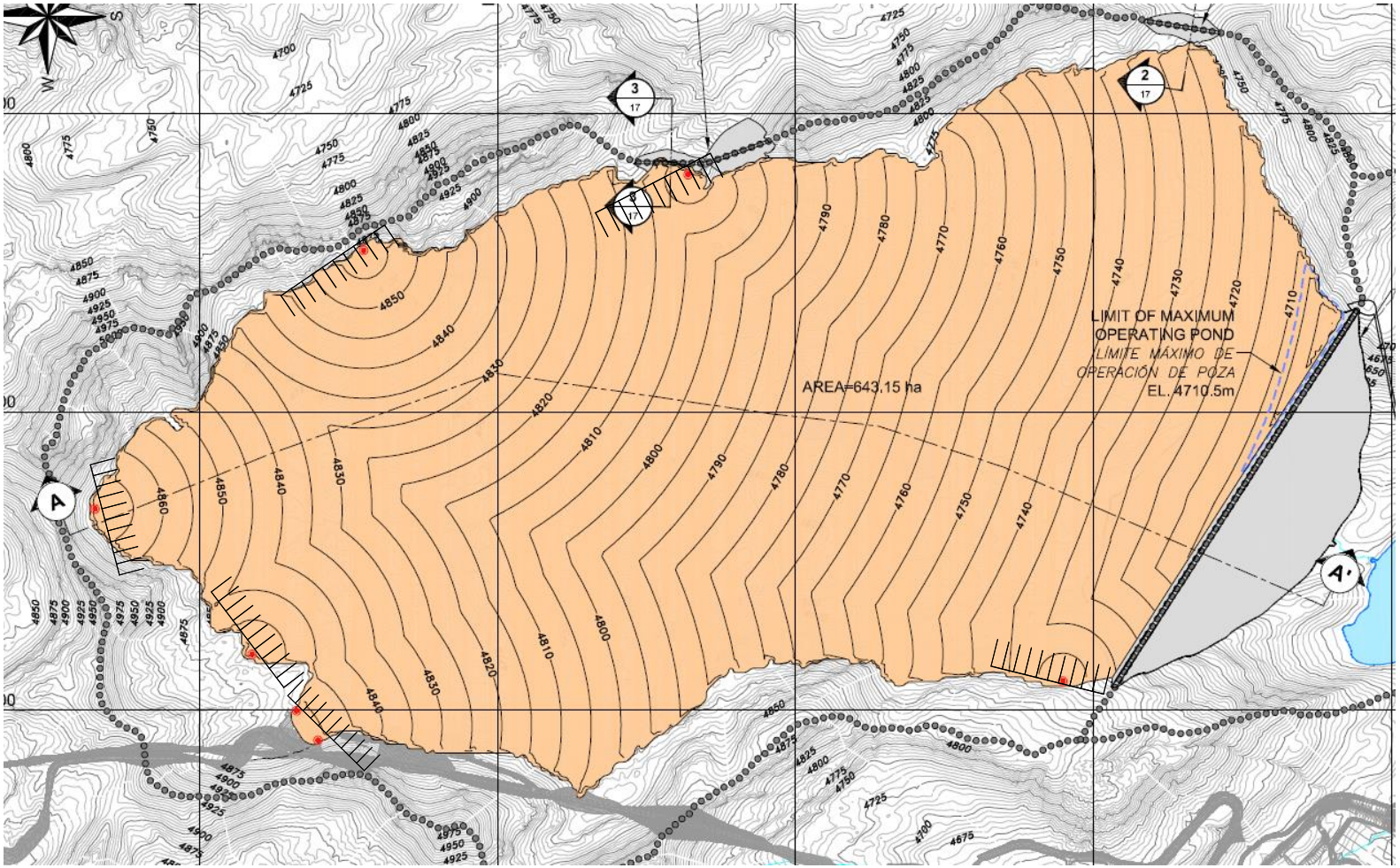
Descarga y flujo de relaves en reducción Estado de energía (lograr pendiente pronunciada)

Densificación e incremento de masa de relaves (estabilidad geotécnica)

4. DISCUSION – CONCEPTO DE INGENIERIA BASICA
Disipación de energía y deposición cíclica

002866

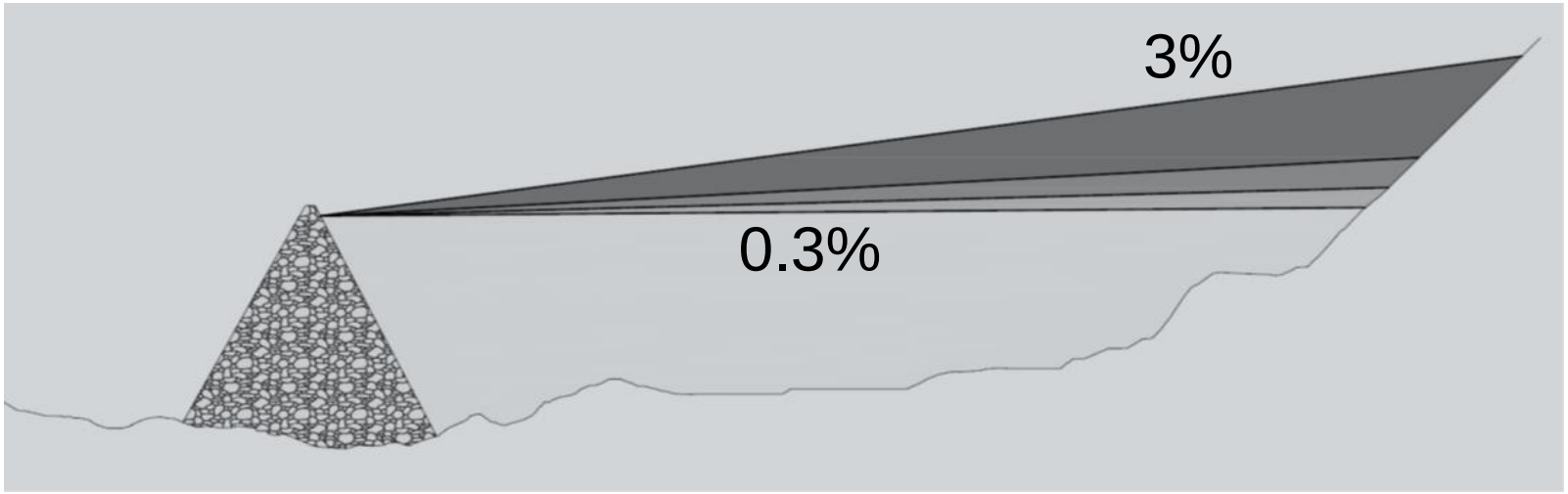
Depositación multiples por Spigot – Year 29



4. DISCUSION – CONCEPTO DE INGENIERIA BASICA

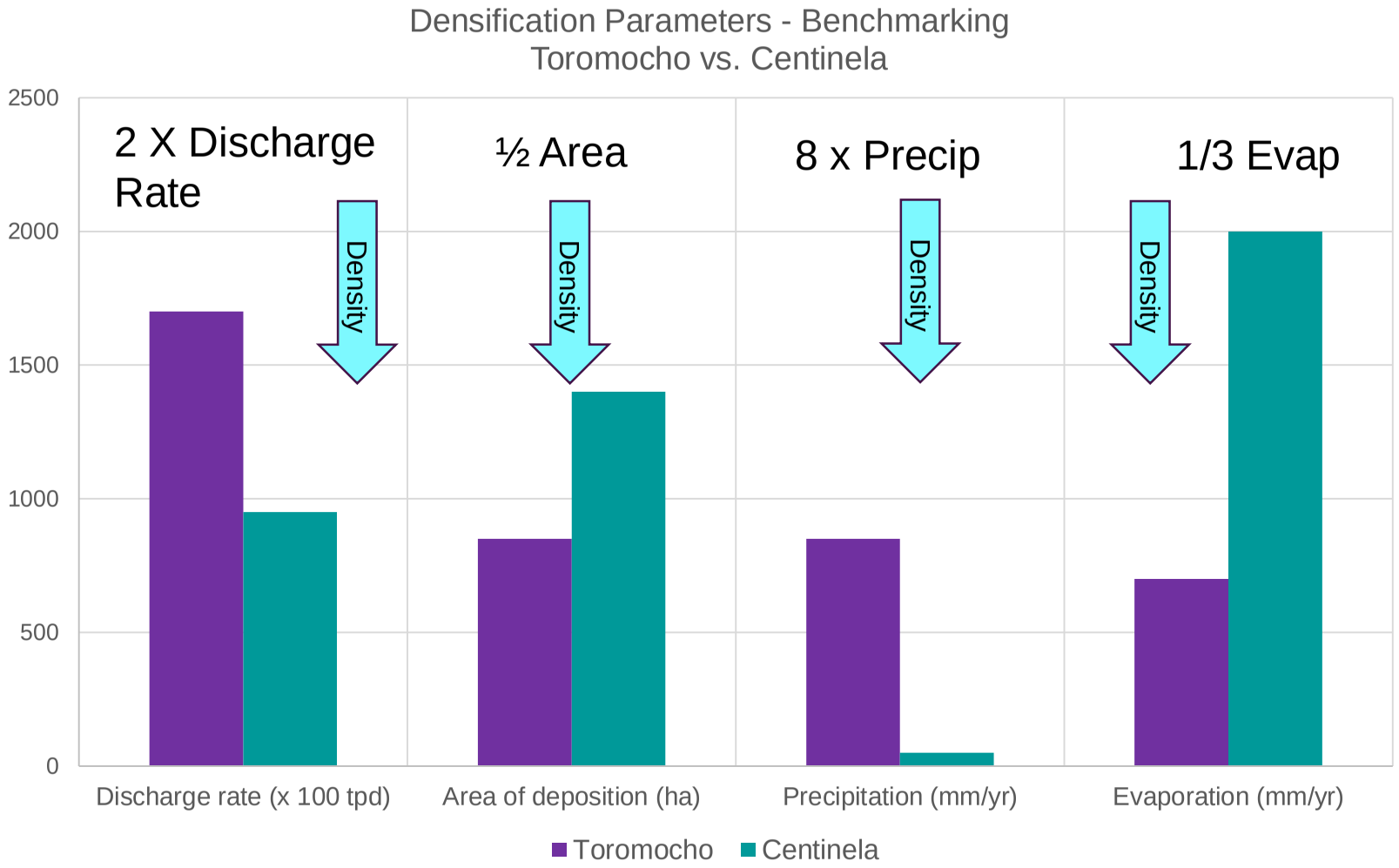
002867

Pendiente (%)	Capacidad (Mt)	Años de depositación @170ktpd	Incremento de capacidad (%)
0.3	550	7.3	--
1	650	9	16
2	750	10.3	35
3	900	13	55



4. DISCUSION – CONCEPTO DE INGENIERIA BASICA
Benchmarking – Centinela

002868

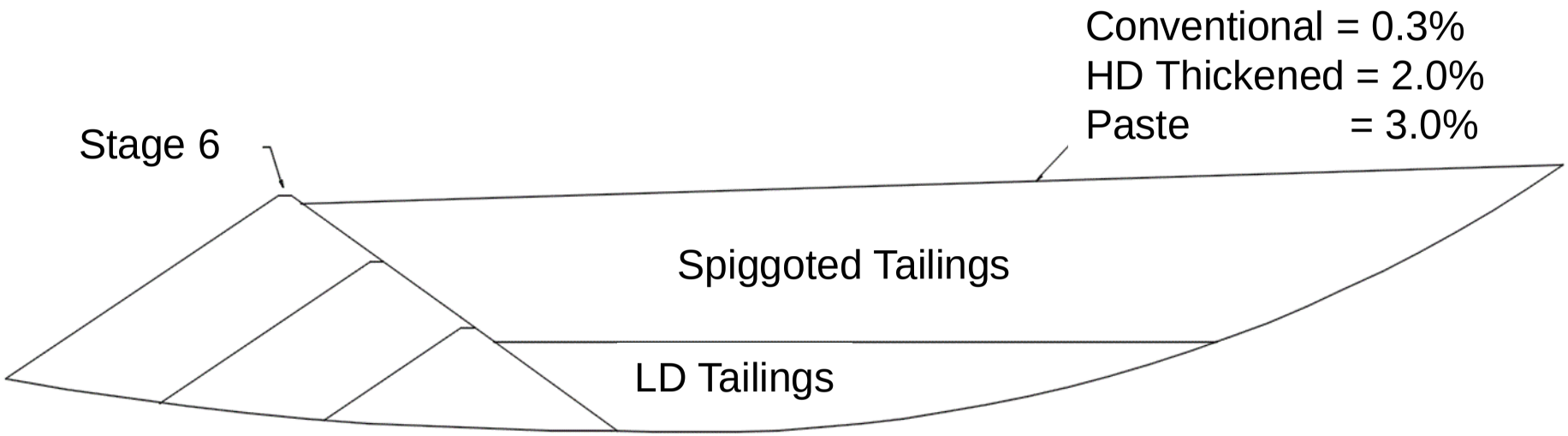


5. EVALUACION DE ALTERNATIVAS

5. EVALUACION OF ALTERNATIVES
Thickening Concepts

002870

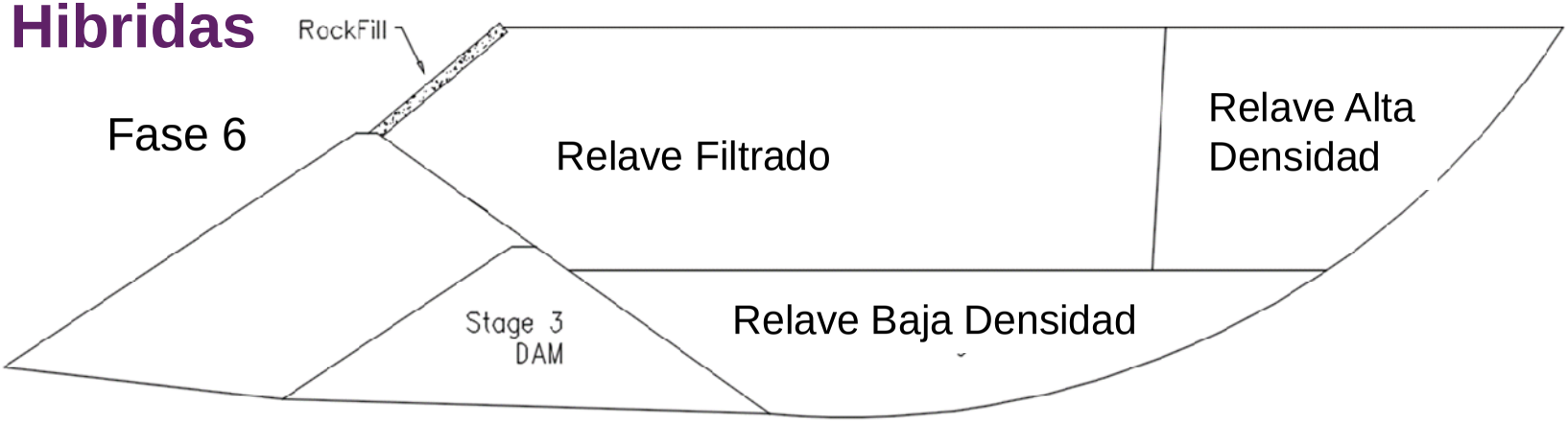
- Thickening



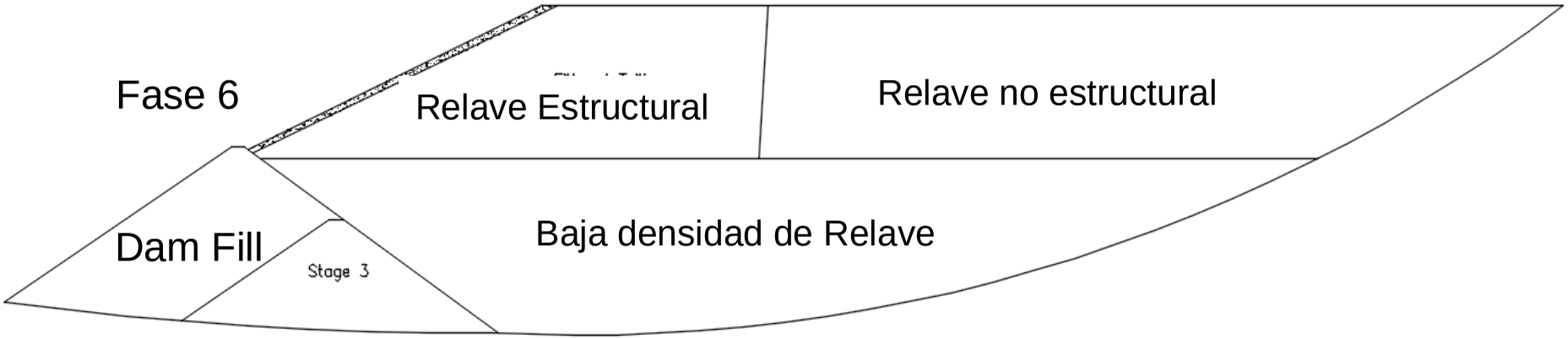
5. EVALUATION DE ALTERNATIVAS
Apilamiento y alternativas híbridas

002871

- **Hibridas**



- **Apilamiento**



ALTERNATIVAS – OPCIONES DE ESPESAMIENTO

002872

No.	Description
1	Operacion actual & Diseño = 6 HCTs @ 43m Diam. = 58% Solids = 0.5% pendinete + Adicional TSF
2	Mejoras de actual operación & Desiño = 6 HCTs @ 43m Diam. = 60-62% Solidos = 1.0% pendiente + Adicional TSF
3	5 Adicional HCTs = 63% - 66% Solidos = 2% pendiente + Adicional TSF
4	9 Adicional HCTs (13 Total) = 67% - 69% Solidos = 3% pendiente + Adicional TSF

ALTERNATIVAS – OPCION DE APILAMIENTO

002873

No.	Descripción
5	170 ktpd Alimentar a filtros – Todo relave filtrado en Cake
6	117 ktpd alimentar a filtros / 53 ktpd alimentar a ciclones - 19 ktpd U/F to TSF + 34 ktpd O/F to Filters
7	170 ktpd alimentar ciclones - 66 ktpd U/F to TSF + 104 ktpd O/F to Filters

ALTERNATIVAS – OPCION APILAMIENTO HIBRIDO

002874

No.	Description
8	85 ktpd Alimentar a existente 2 Additional HCTs, luego alimentar a Filtros / 85 ktpd alimentar to 4 Existentes HCTs = 63% - 66% Solids = 2% pendiente
9	53 ktpd alimentar a Existente HCT Espesadores, luego 117 kptd (37% Solids) a ciclones – 42 ktpd U/F a terraplen y 75ktpd O/F to HCT Espesadores y luego a TSF. Final etapa 6 empezar con filtros 128ktpd y cicloneo U/F of 42ktpd to TSF

ALTERNATIVAS – OPCION APILAMIENTO + POSIBLES REDUCCIONES DE LLENADO

002875

No.	Description
5A	170 ktpd Feed to Filters - Whole Tailings Filter Cake - Minimum Fill Option = 10 Mm3
5B	170 ktpd Feed to Filters - Whole Tailings Filter Cake - Intermediate Fill Option = 23 Mm3
6A	117 ktpd Feed to Filters / 53 ktpd Feed to Cyclones - 19 ktpd U/F to TSF + 34 ktpd O/F to Filters - Min Fill = 10 Mm3
6B	117 ktpd Feed to Filters / 53 ktpd Feed to Cyclones - 19 ktpd U/F to TSF + 34 ktpd O/F to Filters - Intermed Fill = 23 Mm3
7A	170 ktpd Feed to Cyclones - 66 ktpd U/F to TSF + 104 ktpd O/F to Filters - Min Fill = 10 Mm3
7B	170 ktpd Feed to Cyclones - 66 ktpd U/F to TSF + 104 ktpd O/F to Filters - Intermed Fill = 23 Mm3
8A	85 ktpd Feed to Existing 2 Additional HCTs, then feed to Filters / 85 ktpd Feed to 4 Existing HCTs = 63% - 66% Solids = 2% slope - Min Fill = 10 Mm3
8B	86 ktpd Feed to Existing 2 Additional HCTs, then feed to Filters / 85 ktpd Feed to 4 Existing HCTs = 63% - 66% Solids = 2% slope - Int Fill = 23 Mm3

6. EVALUACION DE FACTORES

6. EVALUATION FACTORS

- Basado en costo y riesgo
- Costo:
  - Capex Investment
  - Eficiencia operacional
  - VPN
- Riesgo:
  - Fuente de alimentación requerida (MW)
  - Riesgo inherente de estabilidad física
  - Potencial de contaminación ambiental
  - Acceso a la tierra / comunidades / permisos
  - Implementación / Operación
- Posibles banderas rojas

7. ESTIMACION COSTO - METODOLOGIA

CAPEX

- Cantidades estimadas a nivel conceptual para los principales movimientos de tierra y componentes mecánicos @ 170,000 tpd.
- Otras instalaciones basadas en factoring.
- Costos indirectos factorizados en 34%.
- Contingencia incluida: varía para cada alternativa.

OPEX

- Floculante - de Chinalco
- Mantenimiento y reemplazo de equipos principales: estimación de Amec FW
- Costo de energía - de Chinalco
- Tasas laborales - adaptadas de Chinalco
- Compactación de colocación de relaves - Estimación de Amec FW

8. DESCRIPCION DE ALTERNATIVAS

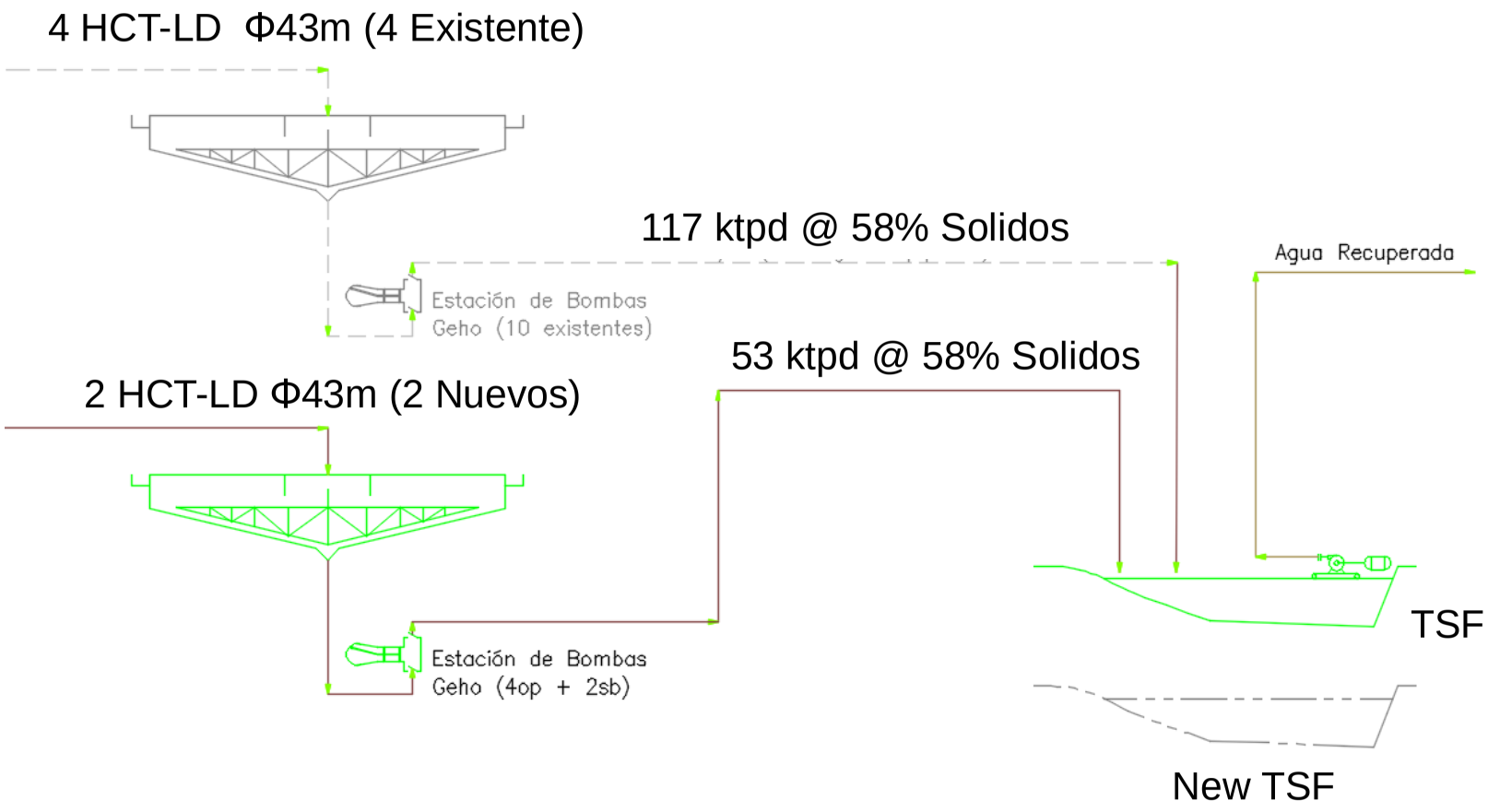
ESPESAMIENTO – OPCION 1

Caso base: diseño actual / operación / construcción

ESPESAMIENTO – OPCION 1

Caso Base – Diseño actual / Operación / Construccion

002881

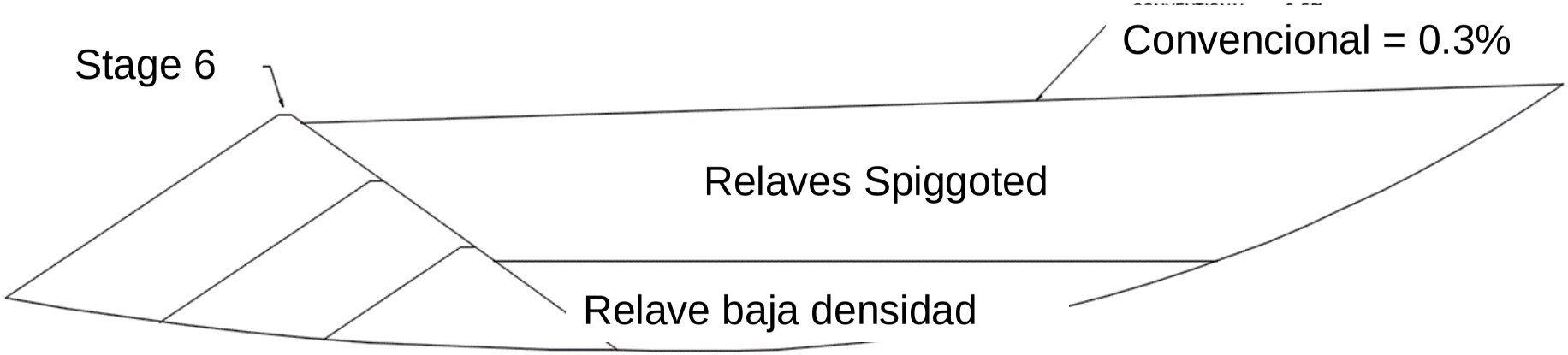


Para 1.5 Bt - Adicional TSF Requerido = 950 Mt

ESPESAMIENTO – OPCION 1

Caso Base – Diseño actual / Operación / Construccion

002882



ESPESAMIENTO – OPCION 1

Caso Base – Diseño actual / Operación / Construccion

002883

Comentarios

Inversión (US$M)

- Existente TSF: 495
- Nuevo TSF: 2,063
- Total Capex: 2,558
- NPV: -1,334

Eficiencia Operacional (US$)

- 2017-2024: 1.51 / t
- 2024 – 2040: 2.55 / t

Ventajas y desventajas técnicas

- Ningún cambio al método actual.
- Relativamente simple de operar
- Tecnología probada

Alertas Potenciales

- Necesita otro TSF
- Los aumentos de presas requieren acelerar

ESPESAMIENTO – OPCION 2

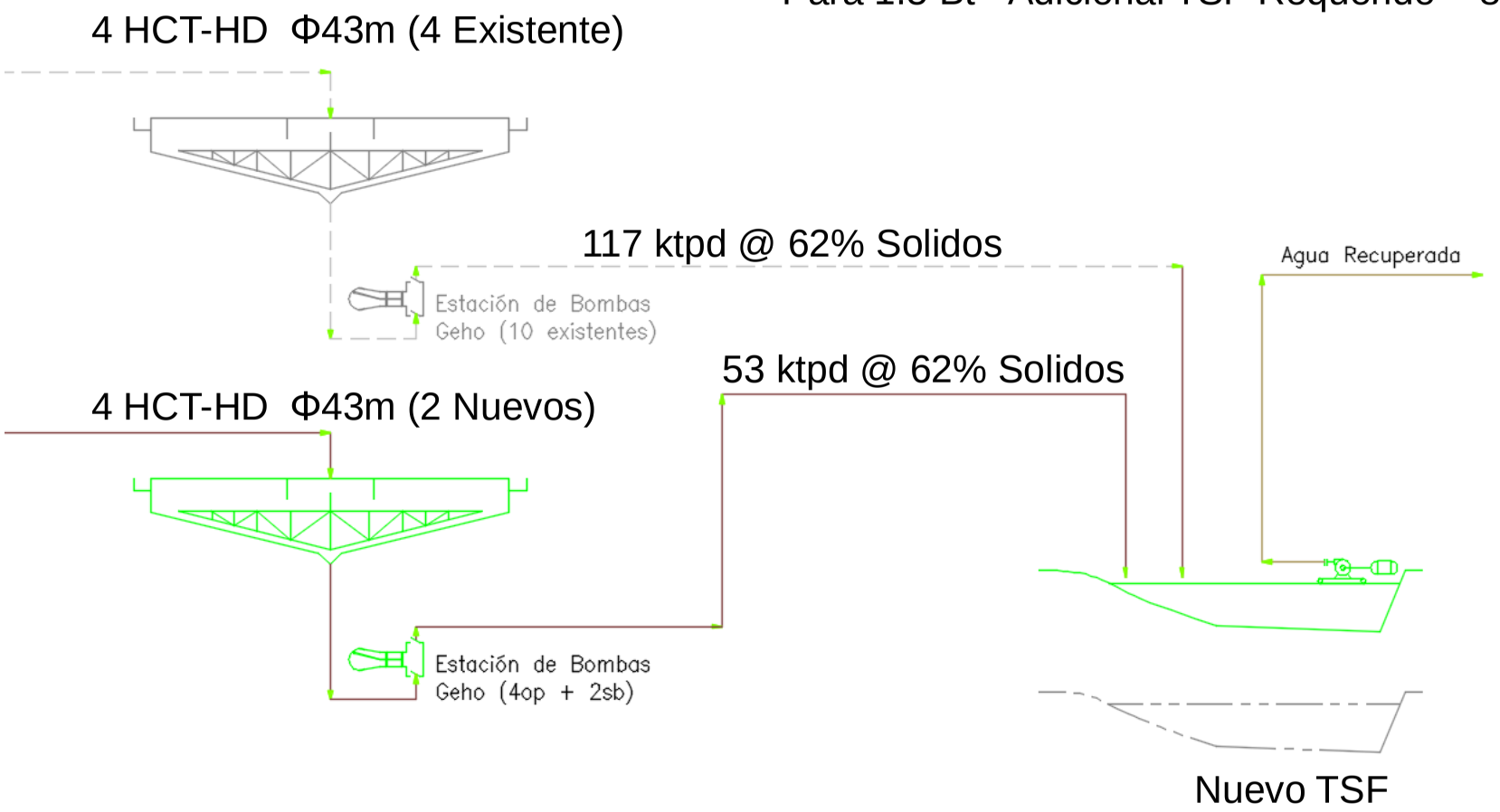
Cambios incrementales en la operación / diseño existente
(pendiente del 1%)

ESPESAMIENTO – OPCION 2

Cambios incrementales en la operación / Diseño existente (1% pendiente)

002885

Para 1.5 Bt - Adicional TSF Requerido = 850 Mt



Mejoras para operacion actual = 6 HCTs @ 43m Diam. = 60-62% Solidos = 1.0% pendiente

ESPESAMIENTO – OPCION 2

Cambios incrementales en la operación / Diseño existente (1% pendiente)

002886

ESPESAMIENTO – OPCION 2

Cambios incrementales en la operación / Diseño existente (1% pendiente)

002887

Comentarios

Inversion Capex (US$M)

- Existente TSF: 517
- Nuevo TSF: 1897
- Total Capex: 2,414
- NPV: -1,296

Efficiency Operacional (US$)

- 2017-2024: 1.40 / t
- 2024 – 2040: 2.73 / t

Ventajas y Desventajas Tecnicas

- Pequeños cambios en los métodos actuales
- Relativamente simple de operar
- Tecnología probada

Potential Red Flags

- Necesita otra TSF (850 Mt)
- Los aumentos de presas requieren acelerar

ESPEASMIENTO – OPCION 3

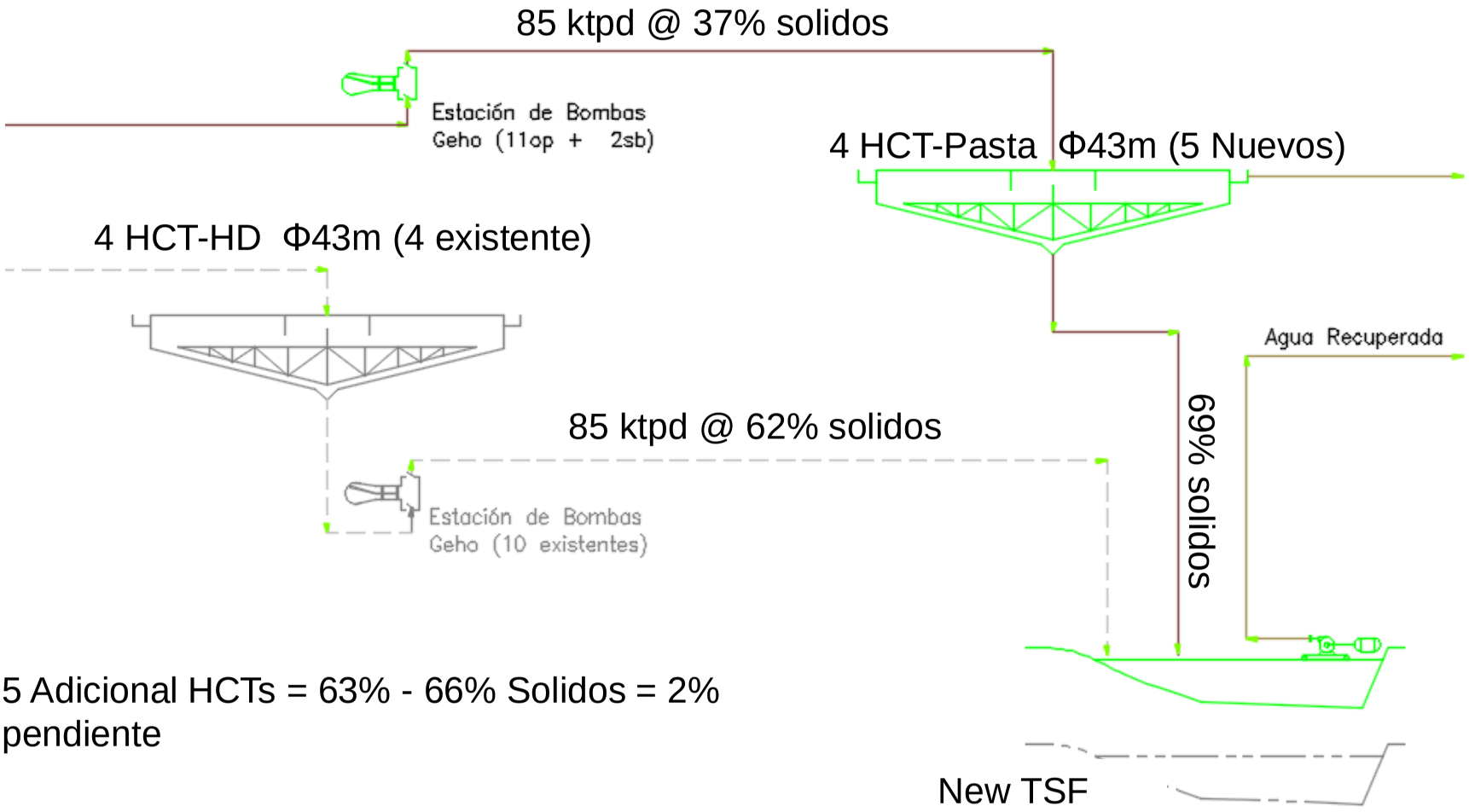
002888

Espesadores adicionales de alta densidad (pendiente del 2%) 5 HCT adicionales

ESPESAMIENTO – OPCION 3

Espesadores Adicionales de Alta Densidad (2% pendiente) 5 Adicionales HCTs

002889



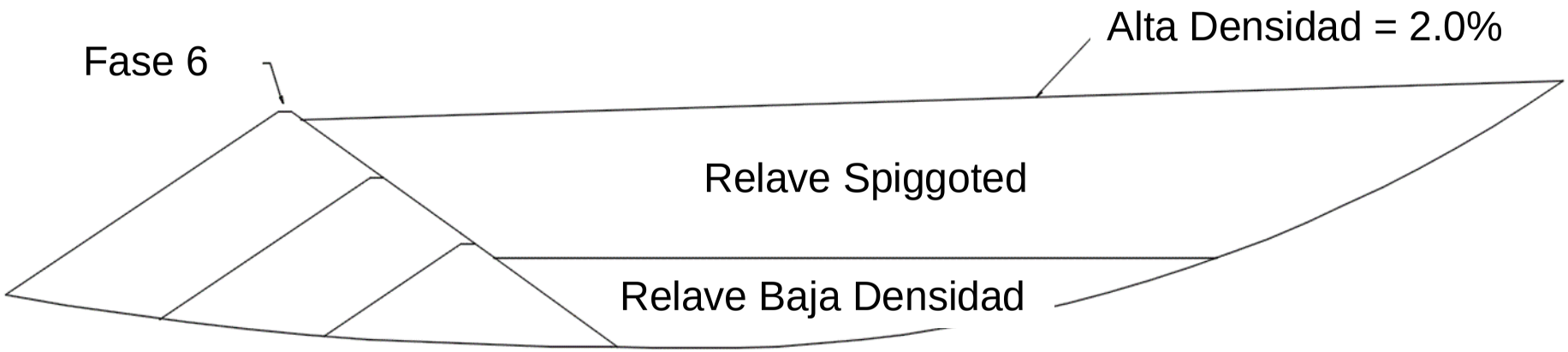
5 Adicional HCTs = 63% - 66% Solidos = 2% pendiente

Para 1.5 Bt - Adicional TSF Requiere = 750 Mt

ESPESAMIENTO – OPCION 3

Espesadores Adicionales de Alta Densidad (2% pendiente) 5 Adicionales HCTs

002890



ESPESAMIENTO – OPCION 3

Espesadores Adicionales de Alta Densidad (2% pendiente) 5 Adicionales HCTs

00289

Comentarios

Inversión Capex (US$M)

- Existente TSF: 517
- Nuevo TSF: 1897
- Total Capex: 2,414
- NPV: -1,296

Eficiencia Operational (US$)

- 2017-2024: 1.40 / t
- 2024 – 2040: 2.73 / t

Ventajas y Desventajas Tecnicas

- Cambios importantes en los métodos actuales.
- Incremento de capacidad

Potential Red Flags?

- Densidad - Estabilidad
- Capacidad para alcanzar una pendiente del 2%
- Necesita otro TSF (750Mt)

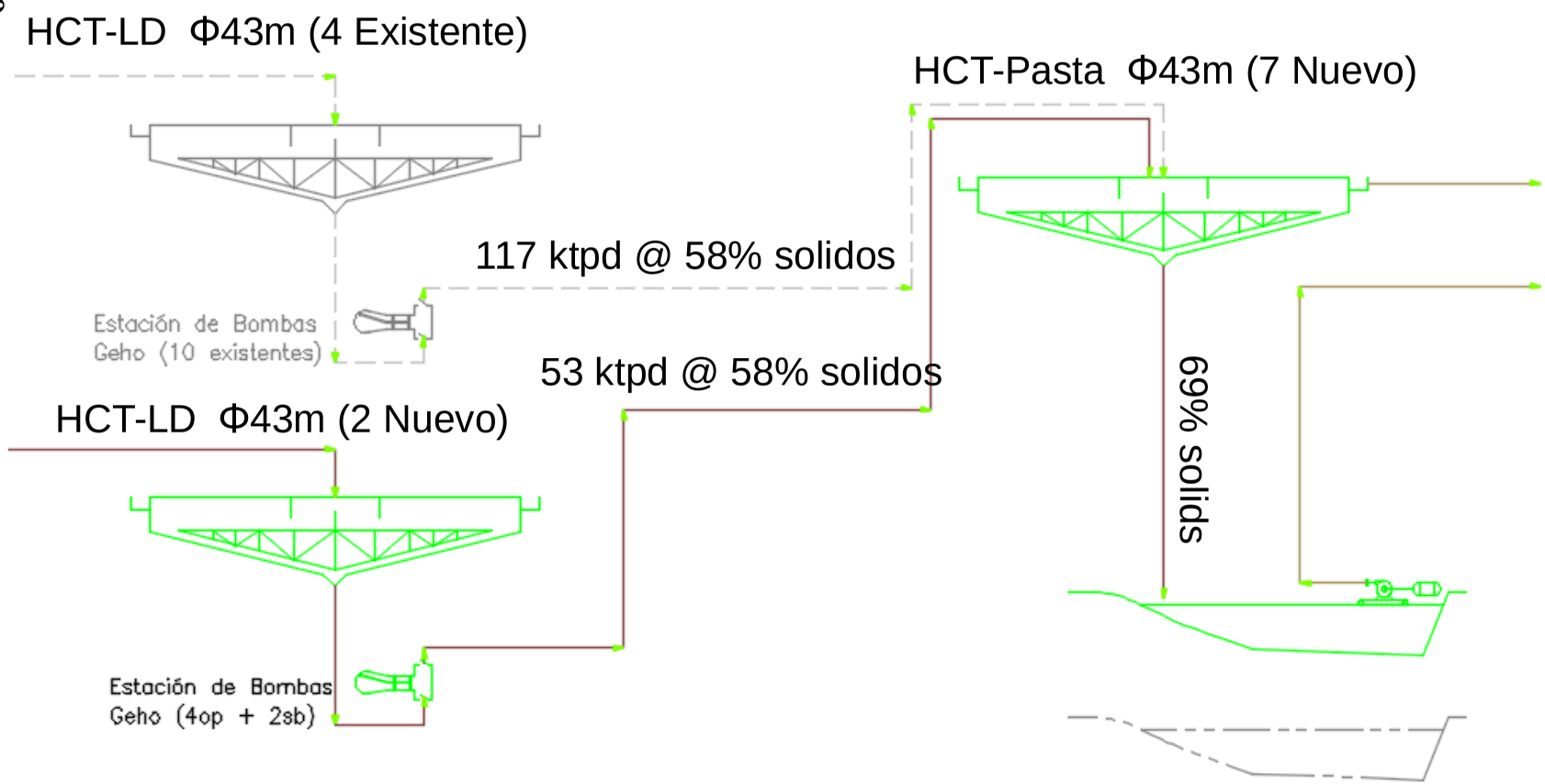
ESPESAMIENTO – OPCION 4

Relave en Pasta (3% pendiente) - 9 Adicional HCTs

ESPESAMIENTO – OPCION 4

Espesamiento Pasta (3% pendiente) - 9 Adicional HCTs

002893



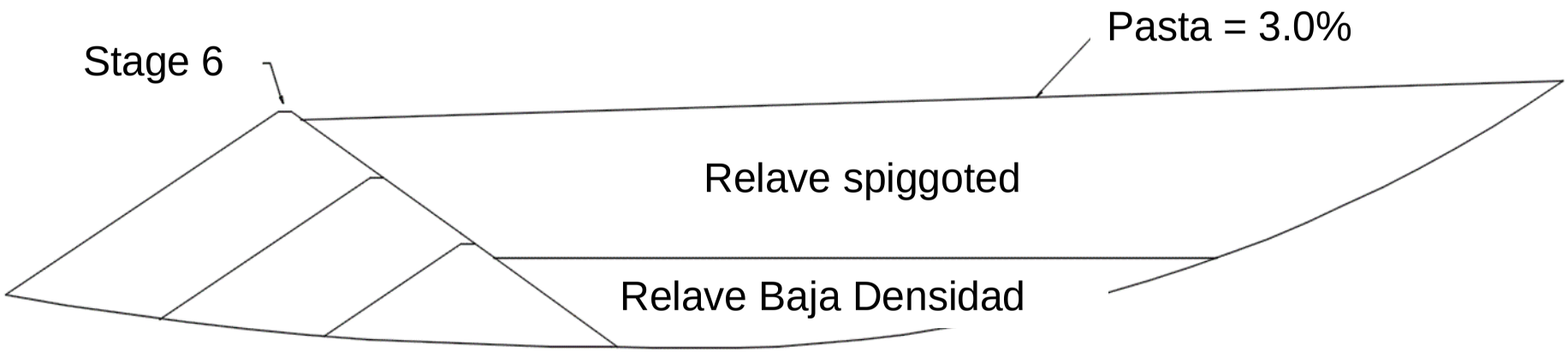
9 Adicional HCTs (13 Total) = 67% - 69% Solidos = 3% pendiente

Para 1.5 Bt - Adicional TSF Requiere = 600 Mt

ESPESAMIENTO – OPCION 4

Espesamiento Pasta (3% pendiente) - 9 Adicional HCTs

002894



ESPESAMIENTO – OPCION 4

Espesamiento Pasta (3% pendiente) - 9 Adicional HCTs

002895

Comentario

Inversion de Capex (US$M)

- Existente TSF: 828
- Nuevo TSF: 1,518
- Total Capex: 2,346
- NPV: -1,423

Eficiencia Operacional (US$)

- 2017-2024: 2.02 / t
- 2024 – 2040: 4.12 / t

Ventajas y Desventajas Tecnicas

- Cambios importantes en los métodos actuales.
- Incremento de capacidad
- Relativamente simple de operar

Potenciales alertas

- Densidad - Estabilidad
- Capacidad para lograr una pendiente del 3%
- Necesita otro TSF (600Mt)
- No comprobado a gran escala

8. DESCRIPCION DE ALTERNATIVAS

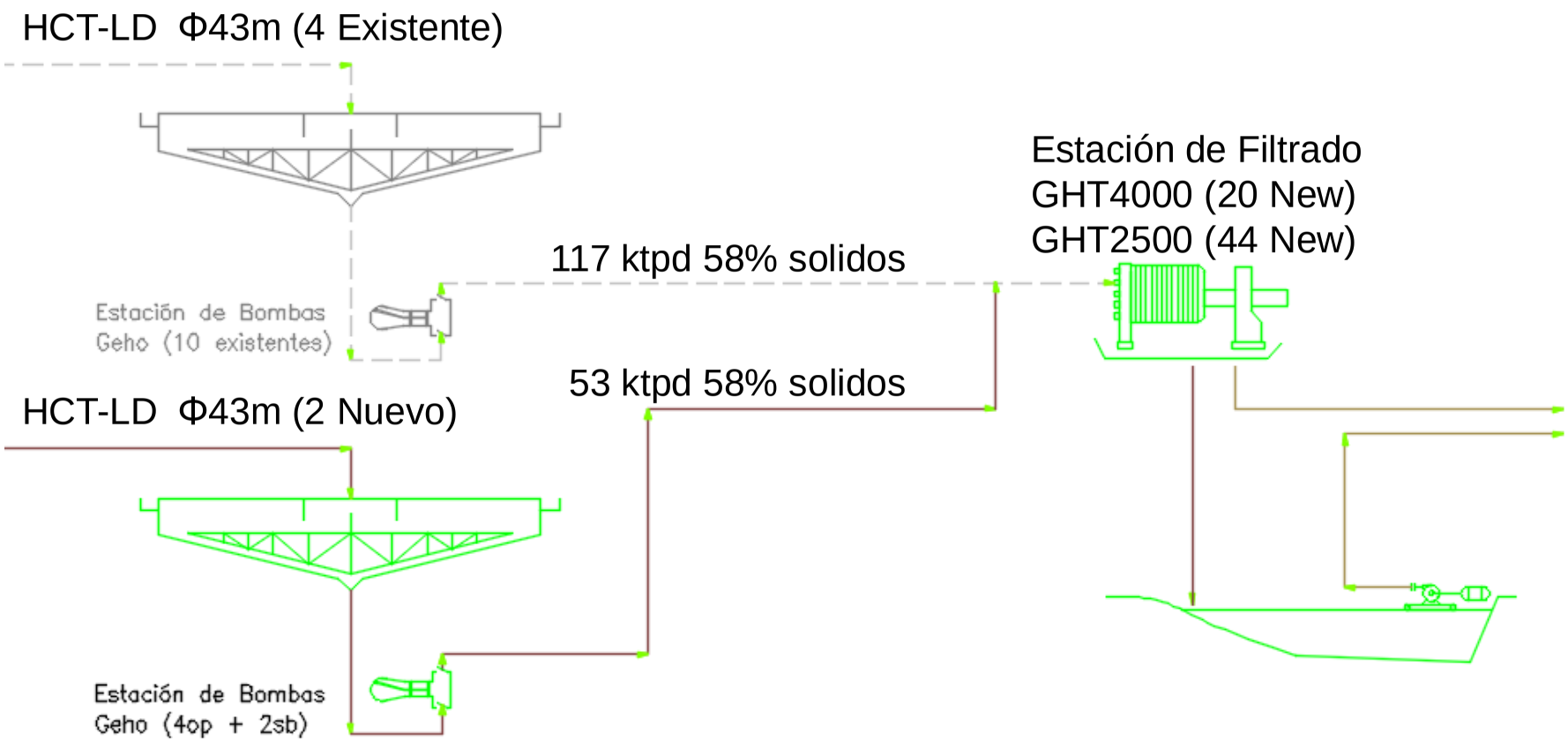
OPCION DE APILAMIENTO

APILAMIENTO – OPTION 5

Relave Filtrado @ 170 ktpd Alimentación a Filtros

APILAMIENTO – OPCION 5
Relave Filtrado @ 170 ktpd Alimentación a Filtros

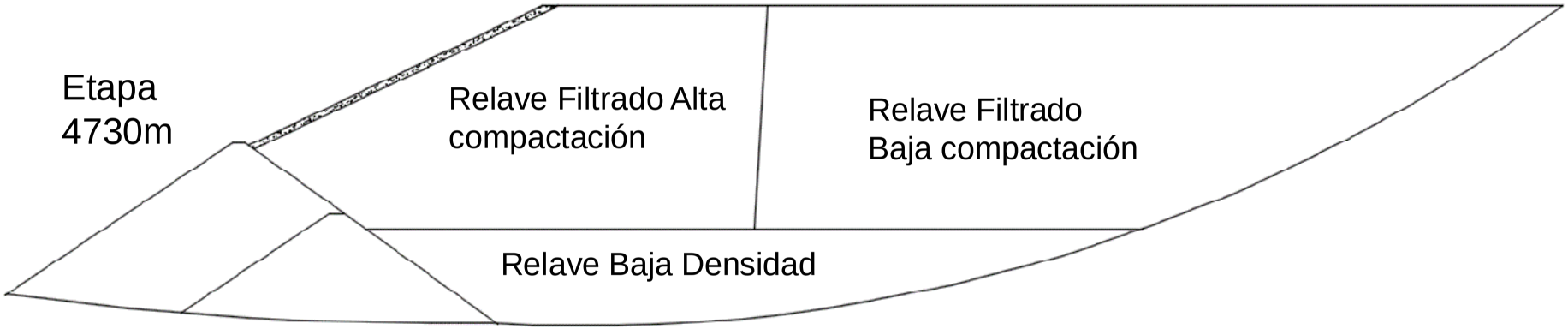
002898



170 ktpd Alimentación a Filtros – Todo Relave Filtrado en Pasta

APILAMIENTO – OPCION 5
Relave Filtrado @ 170 ktpd Alimentación a Filtros

002899



APILAMIENTO – OPCION 5
Relave Filtrado @ 170 ktpd Alimentación a Filtros

Comentarios

Inversión Capex (US$M)

- Existing TSF: 1,152
- New TSF: NA
- Total Capex: 1,152
- NPV: -1,461

Eficiencia Operaticional (US$)

- 2017-2024: 2.24 / t
- 2024 – 2040: 0.69 / t

Ventajas y Desventajas Tecnicas

- Almacenamiento de relaves LOM
- Escalabilidad / Diseño modular

Potenciales Alertas

- Sensible al clima
- No comprobado a gran escala
- Gran inversión inicial

APILAMIENTO – OPCION 6

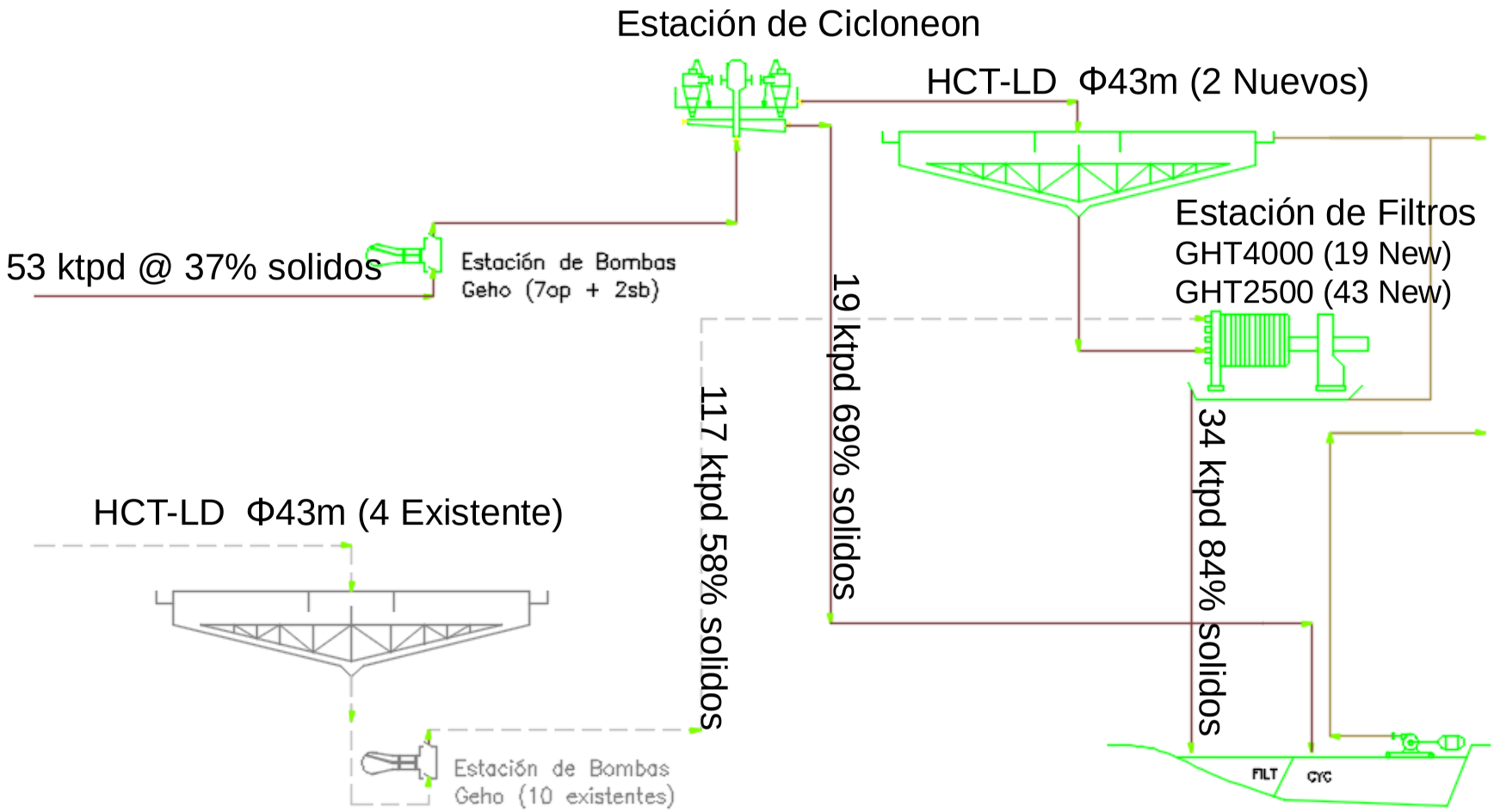
Alimentación a Filtros = 117 ktpd + Alimentación a Ciclones = 53 ktpd (U/F=19 ktpd; O/F = 34 ktpd)

U/F=under flow
O/F= over flow

APILAMIENTO – OPCION 6

Alimentación a Filtros = 117 ktpd + Alimentación a Ciclones = 53 ktpd (u/f = 19 ktpd; o/f = 34 ktpd)

002902

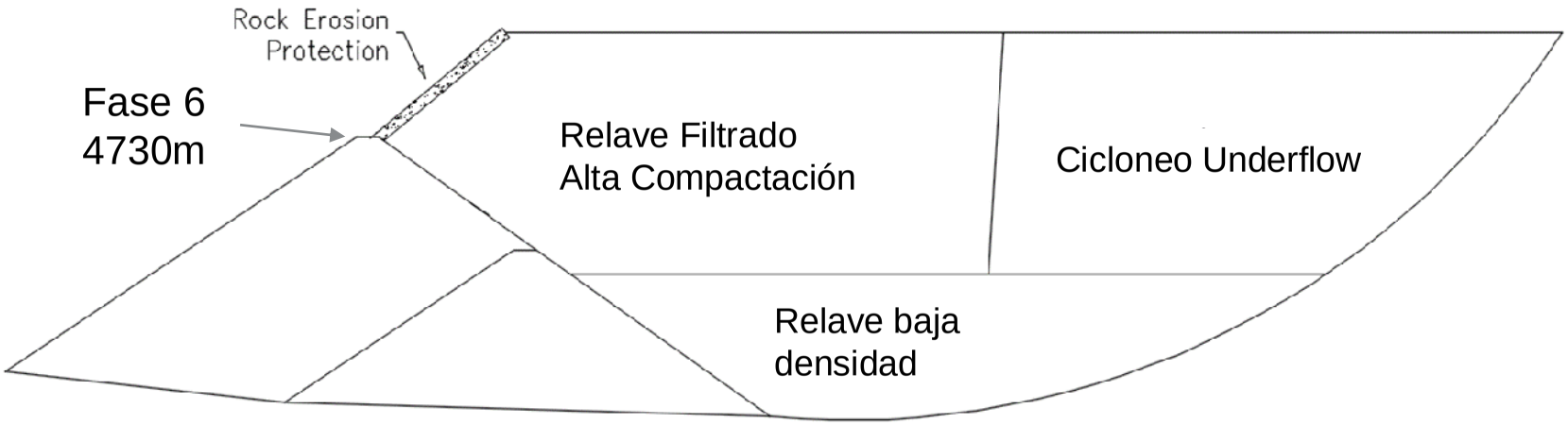


117 ktpd Feed to Filters / 53 ktpd Feed to Cyclones - 19 ktpd U/F to TSF + 34 ktpd O/F to Filters

APILAMIENTO – OPCION 6

Alimentación a Filtros = 117 ktpd + Alimentación a Ciclones = 53 ktpd (u/f = 19 ktpd; o/f = 34 ktpd)

002903



APILAMIENTO – OPCION 6

Alimentación a Filtros = 117 ktpd + Alimentación a Ciclones = 53 ktpd (u/f = 19 ktpd; o/f = 34 ktpd)

002904

Comentarios

Inversion Capex (US$M)

- Existente TSF: 1,176
- Nuevo TSF: NA
- Total Capex: 1,176
- NPV: -1,581

Eficiencia Operacional (US$)

- 2017-2024: 2.52 / t
- 2024 – 2040: 0.72 / t

Ventajas y Desventajas Tecnicas

- Almacenamiento de relaves LOM
- Escalabilidad / Diseño modular
- Relativamente complejo de operar (dos zonas de descarga)

Potenciales Alertas

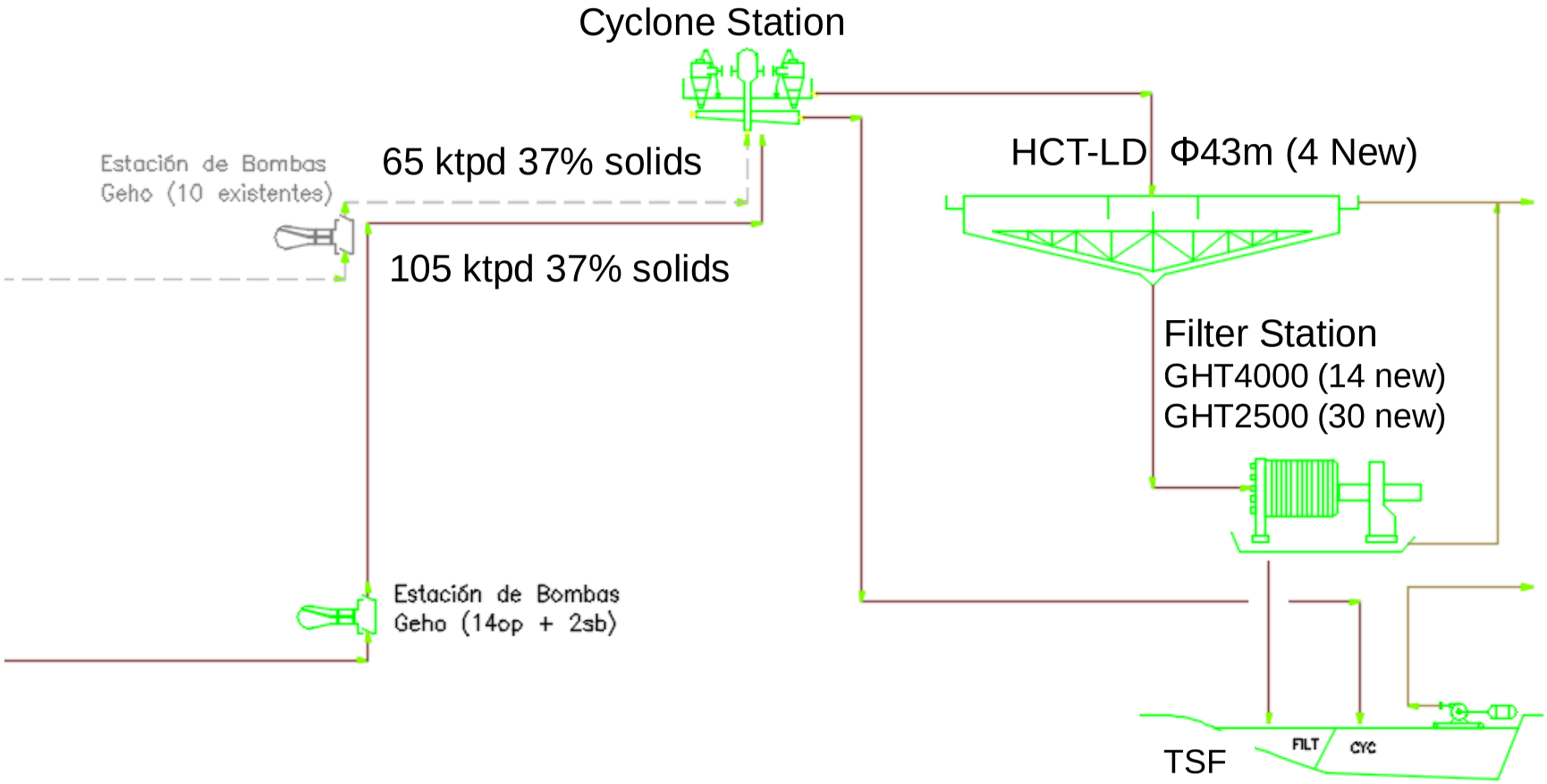
- Sensible al clima
- No comprobado a gran escala
- Gran inversión inicial

APILAMIENTO – OPCION 7

Alimentación a Ciclones = 170 ktpd (U/F=66 ktpd; O/F=104 ktpd) – O/F a filtros

APILAMIENTO – OPTION 7
Alimentacion a Ciclones = 170 ktpd (U/F=66 ktpd; O/F=104 ktpd) – O/F a filtros

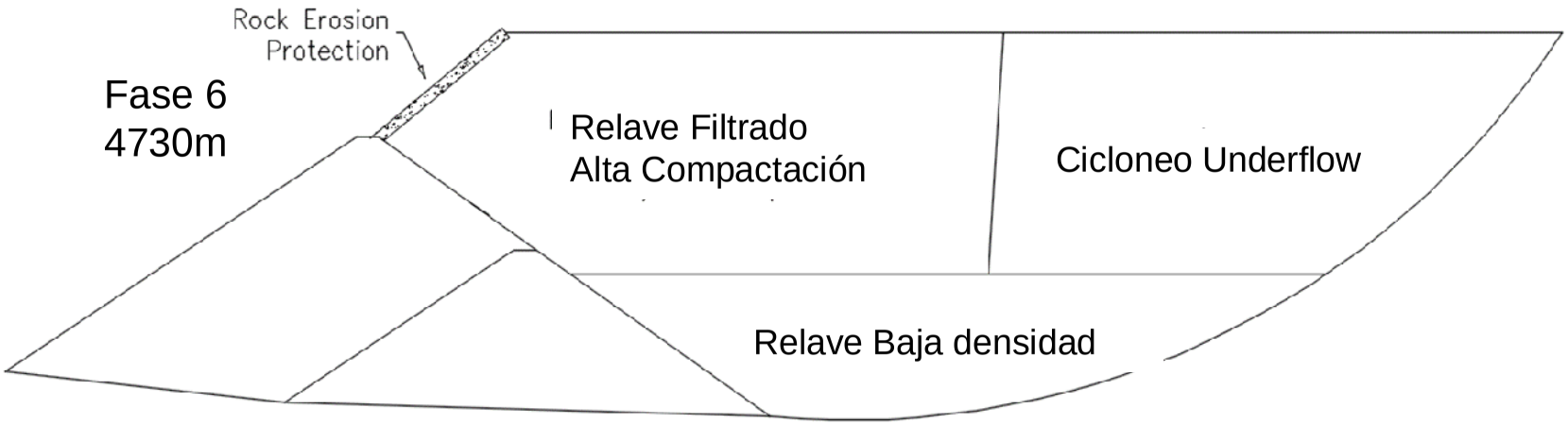
002906



170 ktpd Feed to Cyclones - 66 ktpd U/F to TSF + 104 ktpd O/F to Filters

APILAMIENTO – OPTION 7
Alimentacion a Ciclones = 170 ktpd (U/F=66 ktpd; O/F=104 ktpd) – O/F a filtros

002907



APILAMIENTO – OPTION 7
Alimentacion a Ciclones = 170 ktpd (U/F=66 ktpd; O/F=104 ktpd) – O/F a filtros

002908

Comentarios

Inversión Capex (US$M)

- Existente TSF : 1,320
- Nuevo TSF : NA
- Total Capex : 1,320
- NPV : -1,746

Eficiencia Operacional (US$)

- 2017-2024 : 2.80 / t
- 2024 – 2040 : 0.87 / t

Ventajas y Desventajas Tecnicas

- Almacenamiento de relaves LOM
- Escalabilidad / Diseño modular
- Relativamente complejo de operar (dos zonas de descarga)

Potential Red Flags?

- Sensible al clima
- No comprobado a gran escala
- Gran inversión inicial

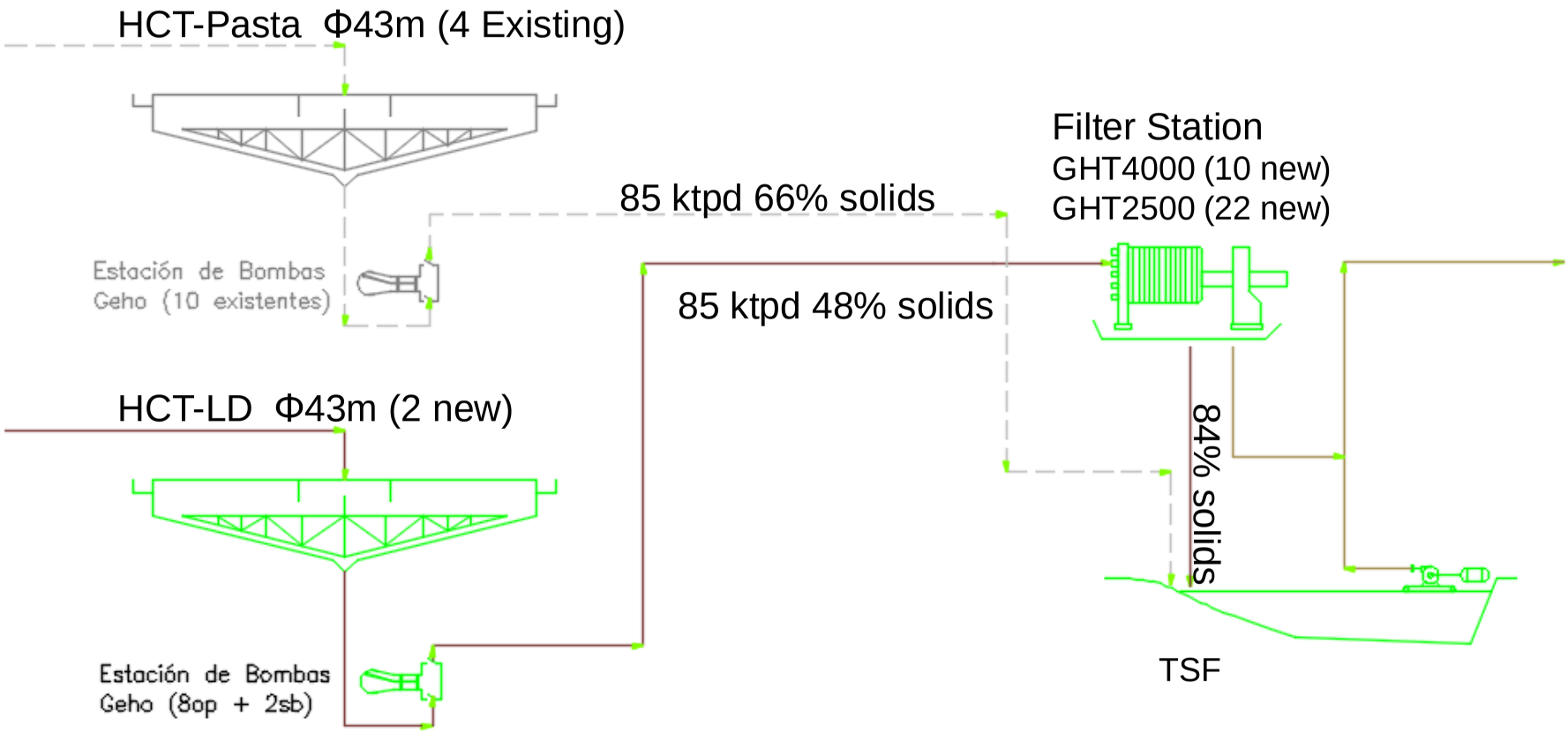
APILAMIENTO HIDRIDO / ESPESAMIENTO – OPCION 8

002909

85 ktpd Alimentar a 2 adicionales HCTs, luego alimentar a Filtros/ 85 ktpd Alimentar a 4 Existentes HCTs = 63-66% Solidos = 2% pendiente.

APILAMIENTO HIDRIDO / ESPESAMIENTO – OPCION 8

002910



85 ktpd Feed to 2 Additional HCTs, then feed to Filters / 85 ktpd Feed to 4 Existing HCTs = 63-66% Solids = 2% slope

APILAMIENTO HIDRIDO / ESPESAMIENTO – OPCION 8

002911

APILAMIENTO HIDRIDO / ESPESAMIENTO – OPCION 8

002912

Comentarios

Inversión Capex (US$M)

- Existente TSF : 924
- Nuevo TSF : NA
- Total Capex : 924
- NPV : -1,377

Eficiencia Operacional (US$)

- 2017-2024 : 2.19 / t
- 2024 – 2040 : 0.45 / t

Ventajas y Desventajas Tecnicas

- Almacenamiento de Relave LOM
- Relativamente complejo operar (dos descargas)

Potenciales Alertas?

- Sensible al clima
- No comprobado a gran escala
- Gran inversión inicial

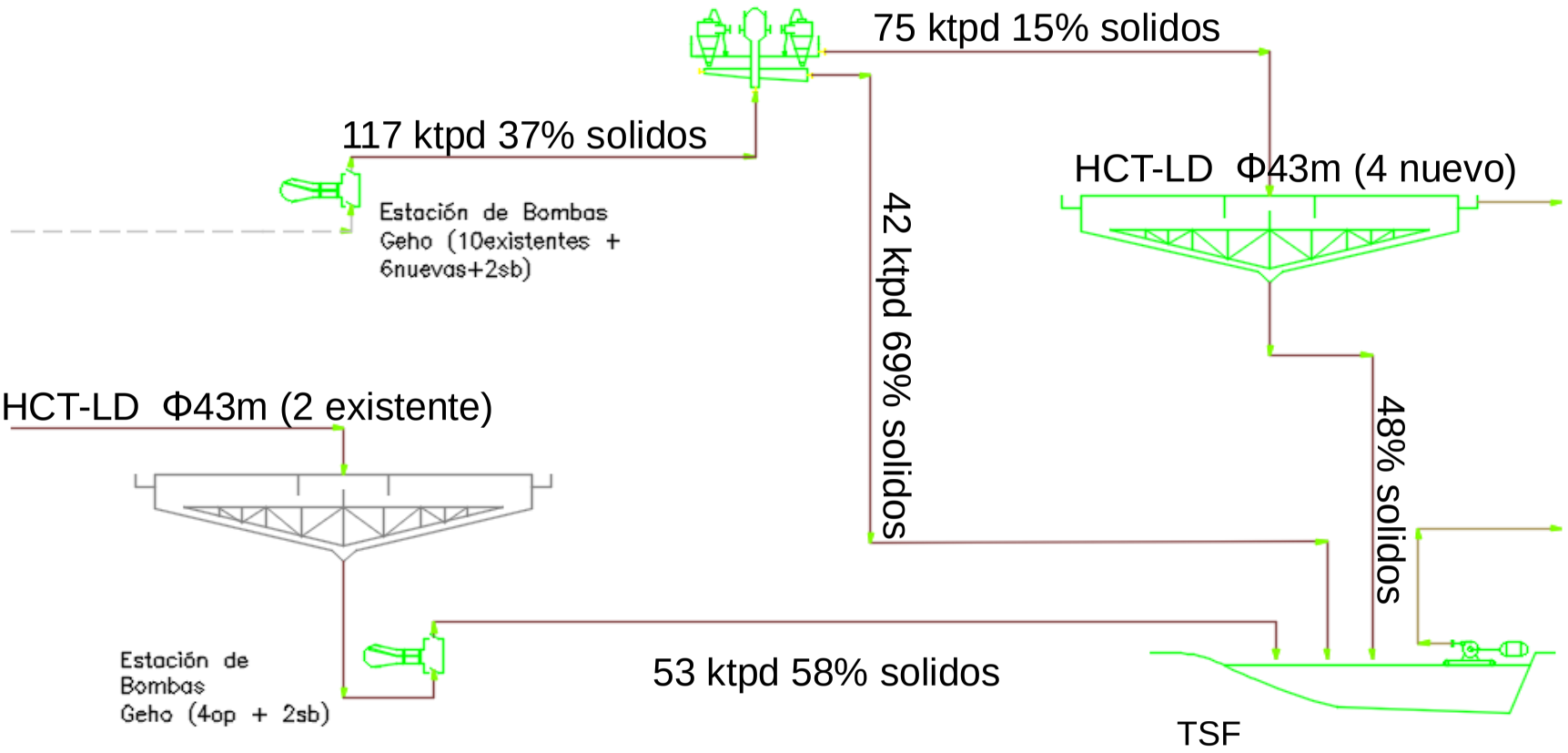
002913

ALMACENAMIENTO HIBRIDO / ESPESAMIENTO – OPCION 9 TEMPRANO

53ktpd Alimentar a existente HCT Espesadores, 117kptd a Ciclones - 42ktpd U/F a Terraplen y 75ktpd O/F a los 4 Adicionales HRT Thickeners

ALMACENAMIENTO HIBRIDO / ESPESAMIENTO – OPCION 9 TEMPRANO

002914



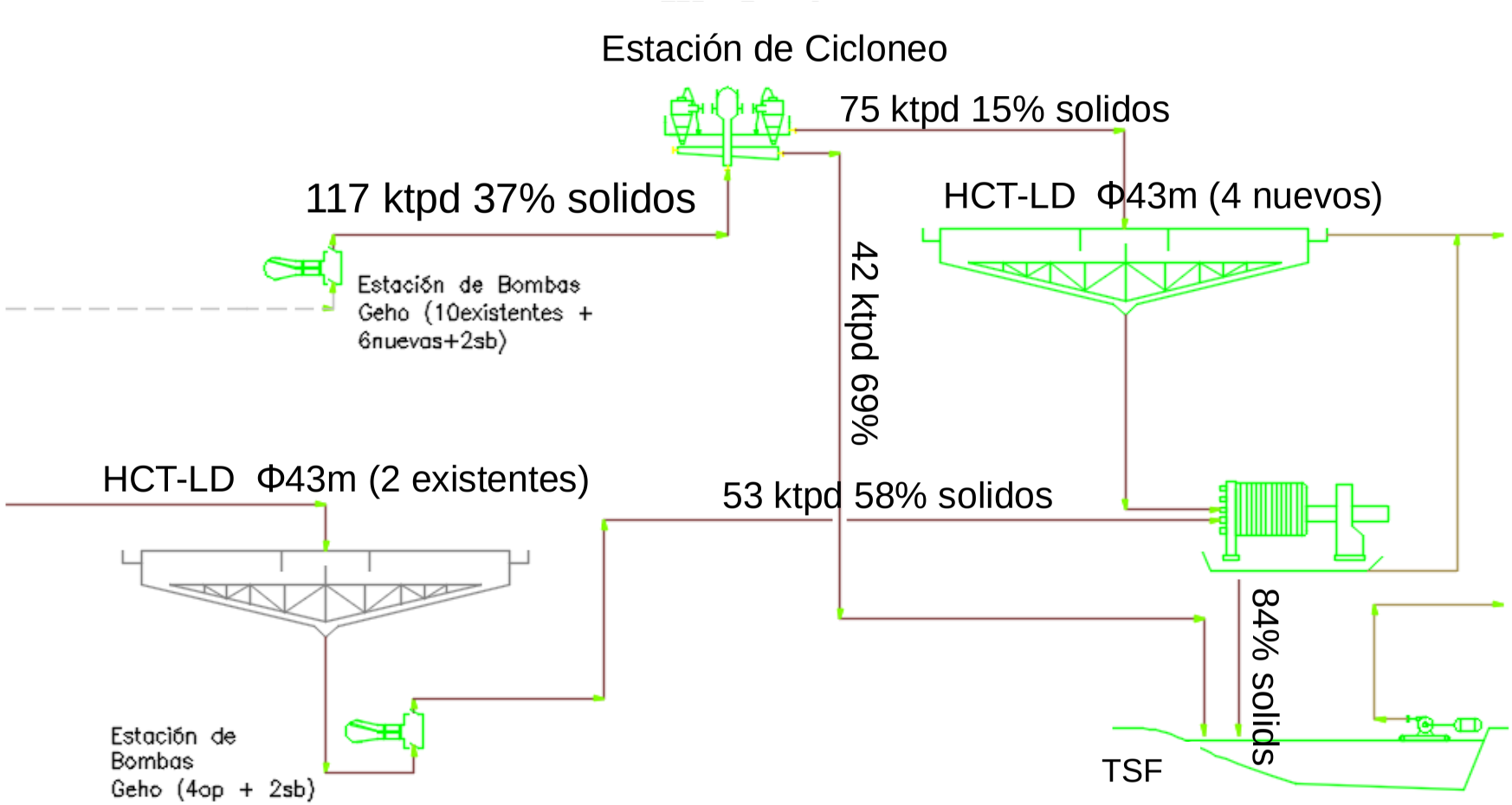
53ktpd Feed to Existing HCT Thickeners, 117kptd to Cyclones - 42ktpd U/F to Embankment and 75ktpd O/F to 4 Additional HRT Thickeners

ALMACENAMIENTO HIBRIDO / ESPESAMIENTO – OPCION 9 TEMPRANO

002915

53ktpd Alimentar a Existente 2 HCT Espesadores luego a Filtros, 117kptd a Ciclones - 42ktpd U/F a Terraplen y 75ktpd O/F a 4 Adicionales HRTs luego a Filtrado

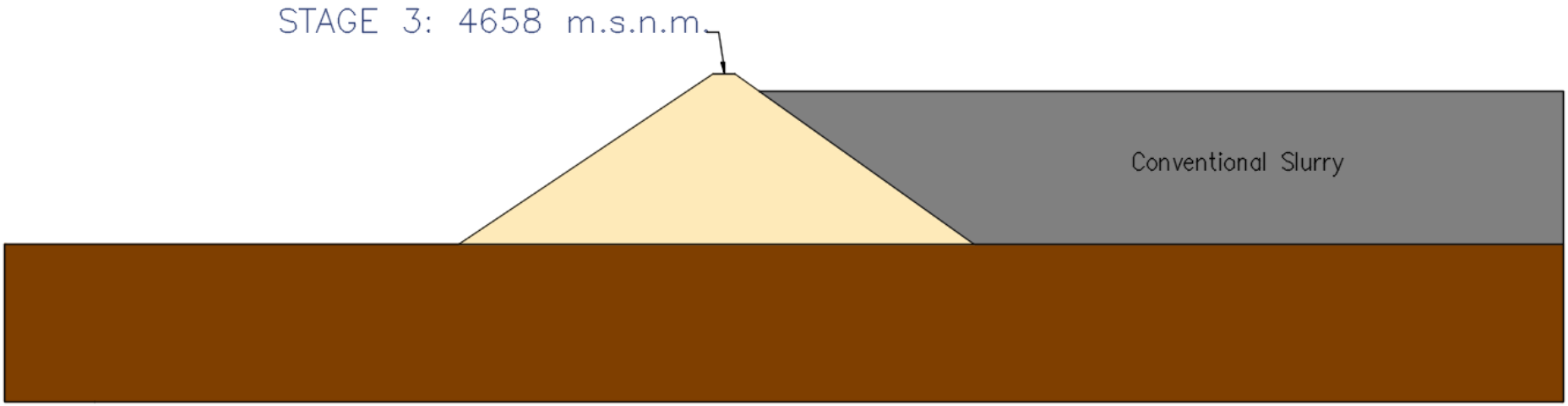
ALMACENAMIENTO HIBRIDO / ESPESAMIENTO – OPCION 9 TEMPRANO



53ktpd Feed to Existing 2 HCT Thickeners then to Filter, 117kptd to Cyclones - 42ktpd U/F to Embankment and 75ktpd O/F to 4 Additional HRTs then to Filter

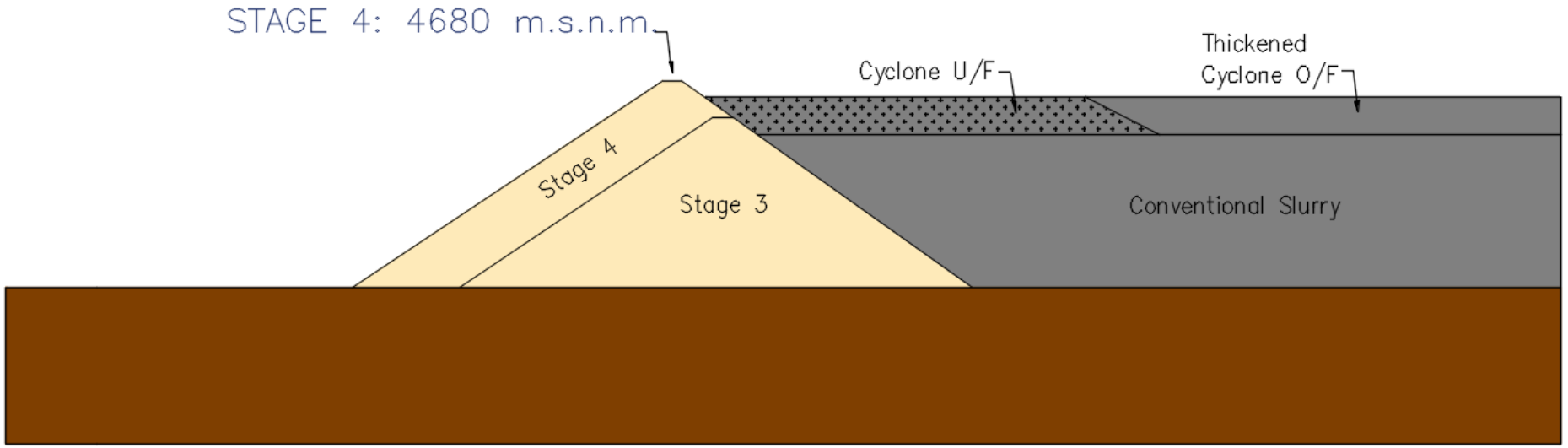
OPCION 9 ESQUEMA – FASE 3

002917



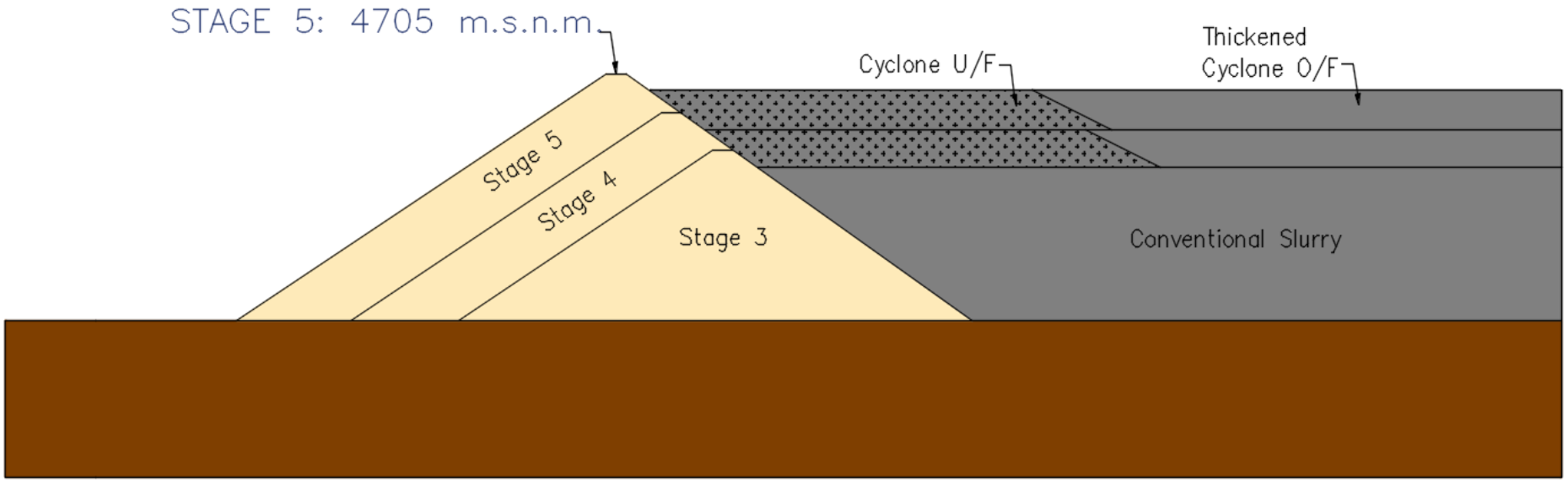
OPCION 9 ESQUEMA – FASE 4

002918



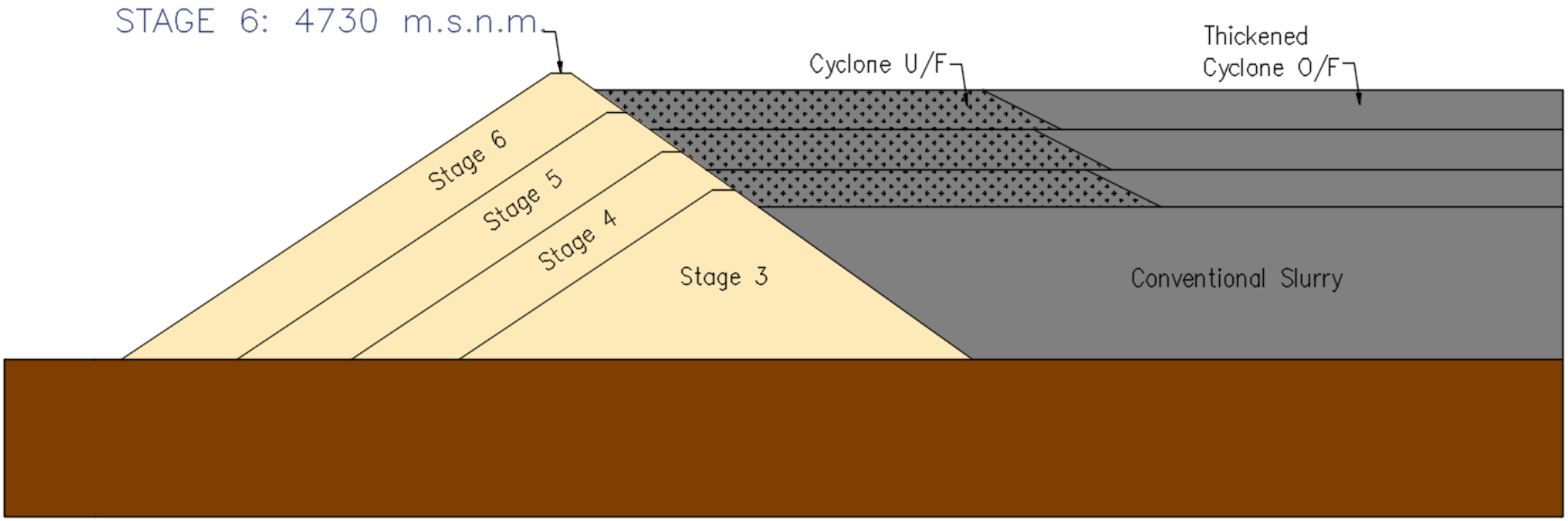
OPCION 9 ESQUEMA – FASE 5

002919



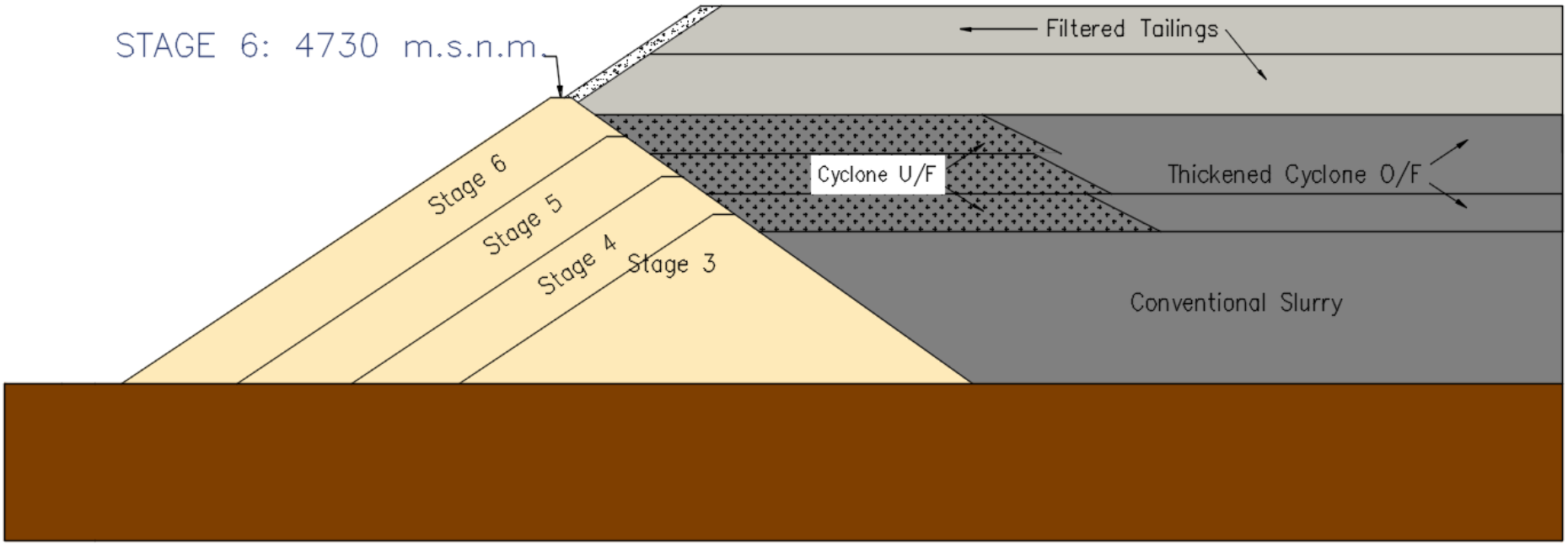
OPCION 9 ESQUEMA - FASE 6

002920



OPCION 9 ESQUEMA FASE 6 + Relave Filtrado

002921



APILAMIENTO HIBRIDO + ESPESAMIENTO – OPCION 9

002922

Comentarios

Inversión Capex (US$M)

- Existente TSF : 1,416
- Nuevo TSF : NA
- Total Capex : 1,416
- NPV : -1,599

Eficiencia Operacional (US$)

- 2017-2024 : 2.91 / t
- 2024 – 2040 : 0.97 / t

Ventajas y Desventajas Tecnicas

- Almacenamiento de relaves LOM
- Escalabilidad / Diseño modular
- Relativamente complejo de operar (tres corrientes)
- Inversión retrasada

Potencial Alerta

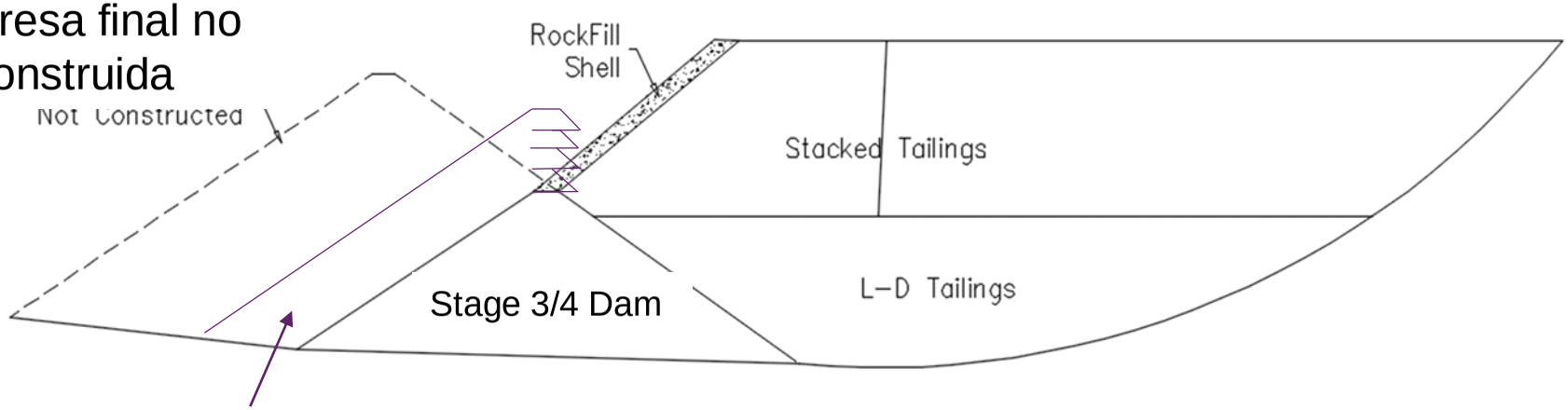
- Sensible al clima
- No comprobado a gran escala

STACKING OPTIONS – POTENTIAL FILL REDUCTION

OPCIONES DE APILAMIENTO, REDUCCIÓN DE RELLENO POTENCIAL

002924

Presa final no construida

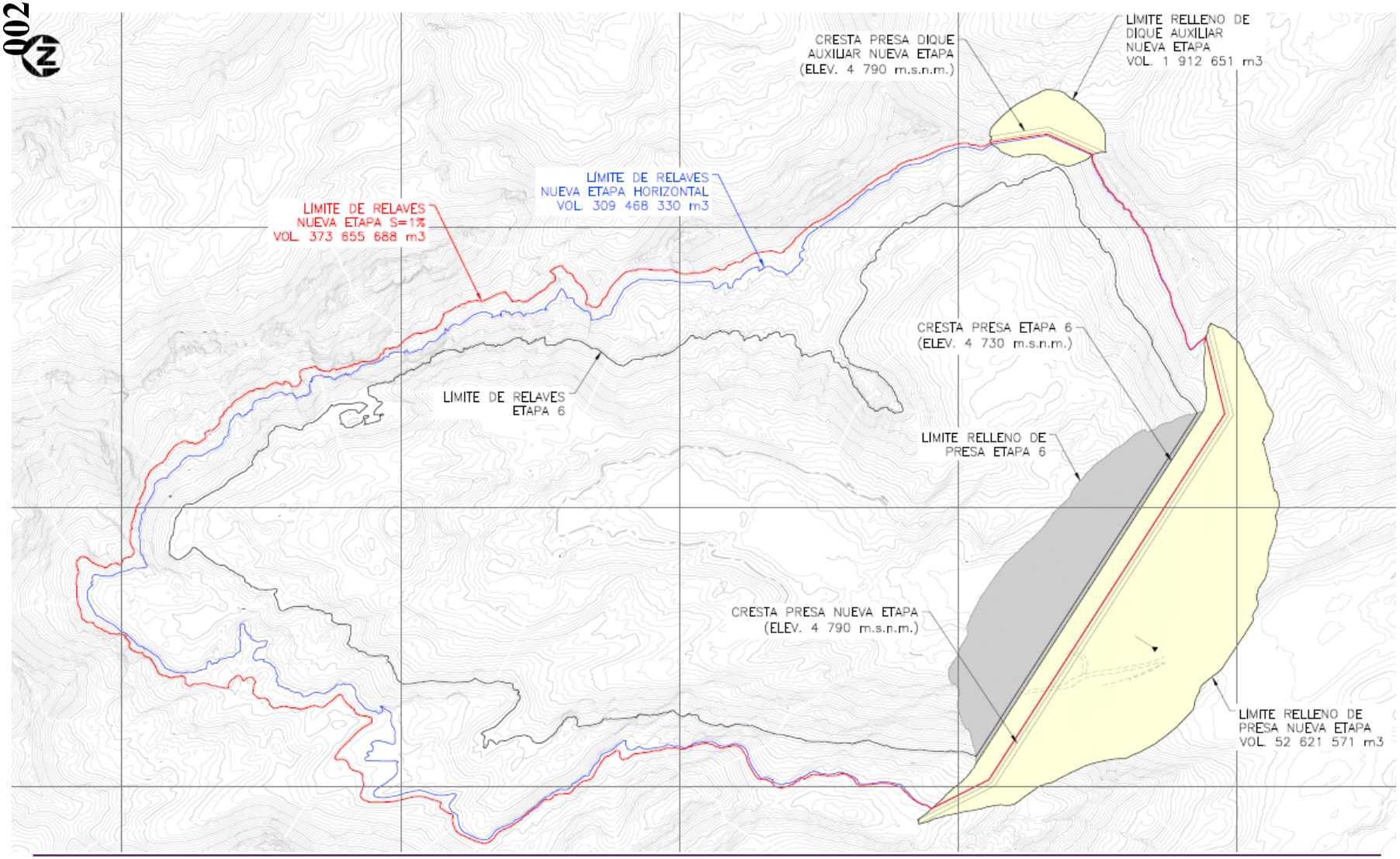


Terraplén de elevación de línea central

Elevación de terraplén alternativa no conforme (Etapa 7)

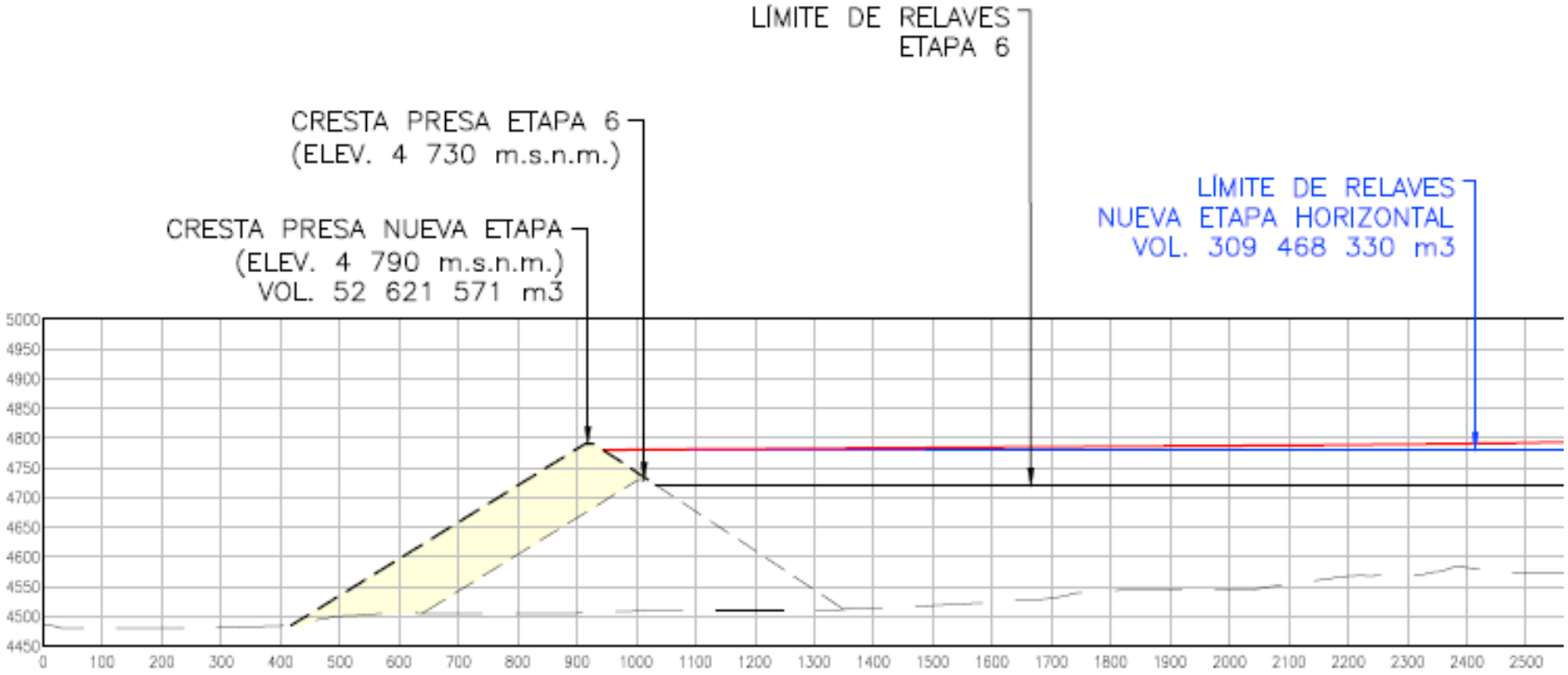
ALTENATIVA NO CONFORME
Levantamiento de Terraplen (Etapa 7)

002926



ALTENARTIVA NO CONFORME
Levantamiento de Terraplen (Etapa 7)

002927



002928

ALTERNATIVA NO CONFORME
Levantamiento de Terraplen (Etapa 7)

Item	Value
Llenar Terraplen (Fase 7, 30m Elevar)	55 Mm3
Costo Llenar Presa Cost 2024 to 2031	US$550 M
Capacidad Ganada (Relave horizontal tailings pendiente)	310 Mm3
Ratio Relave a Llenar Terraplen	5.6
Tonelaje (a 1.5 t/m3 Densidad Seca)	465 Mt
Vida de Almacenaje (at 170,000 tpd)	7.5 Years

ALTERNATIVA NO CONFORME
Levantamiento de Terraplen (Etapa 7)

Comentarios

Ventajas y Desventajas Tecnicas

- Ningún cambio al método actual.
- Relativamente simple de operar
- Tecnología probada
- La huella de TSF actual aumentó

Potenciales Alertas

- Necesita otro TSF
- Consideraciones geotécnicas (altura de terraplén de 290 m)
- Los aumentos de presas requieren acelerar
- Interferencia del terraplén con la infraestructura existente.

9. CLASIFICACION

002931

9. CLASIFICACION POR RIESGO

Option	Description	Required Power Supply (MW)	Inherent Physical Stability Risk	Potential for Environmental Contamination	Land Access / Communities / Permitting	Implementation / Operation	Red Flag?	Weighted Risk
		10%	30%	10%	30%	20%		
5	170 ktpd Feed to Filters - Whole Tailings Filter Cake	1	2	1	1	4	No	1.9
6	Filtration + cycloning	1	2	1	1	4	No	1.9
8	Filtration + High Density Thickening	1	2	1	1	4	No	1.9
7	Filration + cycloning split different	2	2	1	1	4	No	2.0
9	Cycloning + High Density Thickening + Filtration (Later)	3	2	1	1	4	No	2.1
1	Current Operation & Design	2	1	2	5	1	No	2.4
2	Improvements to Current Operation	2	1	2	5	1	Yes	2.4
5B	Filtration with intermediate fill (centreline raise)	1	3	1	2	4	No	2.5
6B	Filtration with cyclones and intermediate fill (centreline ra	1	3	1	2	4	No	2.5
7B	Filtration with cyclones and intermediate fill (centreline ra	2	3	1	2	4	No	2.6
5A	170 ktpd Feed to Filters - Whole Tailings Filter Cake - M	1	4	1	2	4	No	2.8
6A	Filtration with cyclones and minimum fill (end of Stage 4/	1	4	1	2	4	No	2.8
8A	Filtration + High Density Thickening and minimum fill (en	1	4	1	2	4	No	2.8
8B	Filtration + High Density Thickening and intermediate fill	1	4	1	2	4	No	2.8
7A	Filtration with cyclones and minimum fill (end of Stage 4/	2	4	1	2	4	No	2.9
3	5 Additional HCTs - High Density	3	2	1	5	4	Yes	3.3
4	9 Additional HCTs (13 Total) Paste	3	2	1	5	4	Yes	3.3

9 CLASIFICACION POR COSTO DE INVERSION

002932

Option	Alternative	Grand Total Capex	NPV @ 5%	NPV @ 7%
No.	Description	(US$M)	(US$M)	(US$M)
8A	Filtration + High Density Thickening and minimum fill (end of Stage 4A)	648	-1324	-1149
8B	Filtration + High Density Thickening and intermediate fill (centreline)	804	-1508	-1310
5A	Filtration at with minimum rockfill (end of Stage 4A)	876	-1427	-1252
6A	Filtration with cyclones and minimum fill (end of Stage 4A)	900	-1572	-1372
8	Filtration + High Density Thickening	924	-1583	-1377
5B	Filtration with intermediate fill (centreline raise)	1032	-1585	-1394
7A	Filtration with cyclones and minimum fill (end of Stage 4A)	1044	-1759	-1537
6B	Filtration with cyclones and intermediate fill (centreline raise)	1056	-1756	-1533
5	170 ktpd Feed to Filters - Whole Tailings Filter Cake	1152	-1660	-1461
6	Filtratiion + cycloning	1176	-1805	-1581
7B	Filtration with cyclones and intermediate fill (centreline raise)	1200	-1943	-1698
7	Filration + cycloning split different	1320	-1992	-1746
9	Cycloning + High Density Thickening + Filtration (Later)	1416	-1869	-1599
4	9 Additional HCTs (13 Total) Paste	2346	-1693	-1423
2	Improvements to Current Operation	2414	-1539	-1296
1	Current Operation & Design	2558	-1577	-1334
3	5 Additional HCTs - High Density	2620	-1848	-1554

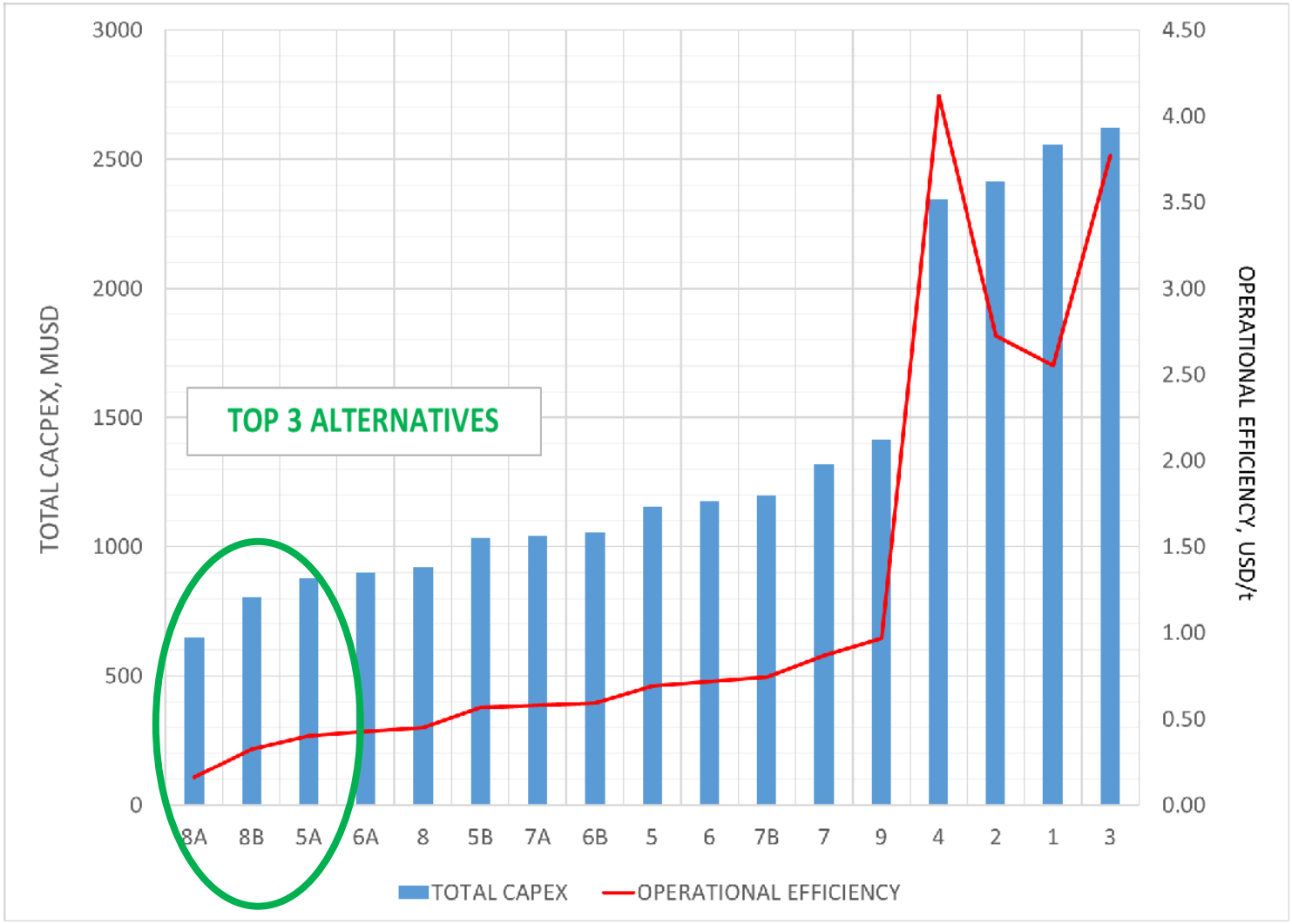
9. CLASIFICACION POR COSTO EFICIENTE

002933

Option	Alternative	Efficiency - Yrs 2017 to 2024	Efficiency - Yrs 2025 to 2040
No.	Description	(US$/tonne)	(US$/tonne)
8A	Filtration + High Density Thickening and minimum fill (end of Stage 4A)	2.00	0.16
5A	Filtration at with minimum rockfill (end of Stage 4A)	2.04	0.40
8B	Filtration + High Density Thickening and intermediate fill (centreline)	2.11	0.33
2	Improvements to Current Operation	1.40	2.73
6A	Filtration with cyclones and minimum fill (end of Stage 4A)	2.32	0.43
1	Current Operation & Design	1.51	2.55
8	Filtration + High Density Thickening	2.19	0.45
5B	Filtration with intermediate fill (centreline raise)	2.15	0.57
5	170 ktpd Feed to Filters - Whole Tailings Filter Cake	2.24	0.69
4	9 Additional HCTs (13 Total) Paste	2.02	4.12
7A	Filtration with cyclones and minimum fill (end of Stage 4A)	2.61	0.58
6B	Filtration with cyclones and intermediate fill (centreline raise)	2.44	0.59
6	Filtration + cycloning	2.52	0.72
3	5 Additional HCTs - High Density	2.19	3.77
9	Cycloning + High Density Thickening + Filtration (Later)	2.91	0.97
7B	Filtration with cyclones and intermediate fill (centreline raise)	2.72	0.74
7	Filration + cycloning split different	2.80	0.87

9. CLASIFICACION INVERSION & COSTO EFICIENTE

002934



9. CLASIFICACION – Top 3

002935

Top	INVESTMENT	OPERATIONAL EFFICIENCY	NPV	RISK
1	8A	8A	8A	5
2	8B	8B	5A	6
3	5A	5A	8B	8

002936

DISCUSSION – PROOF OF CONCEPT

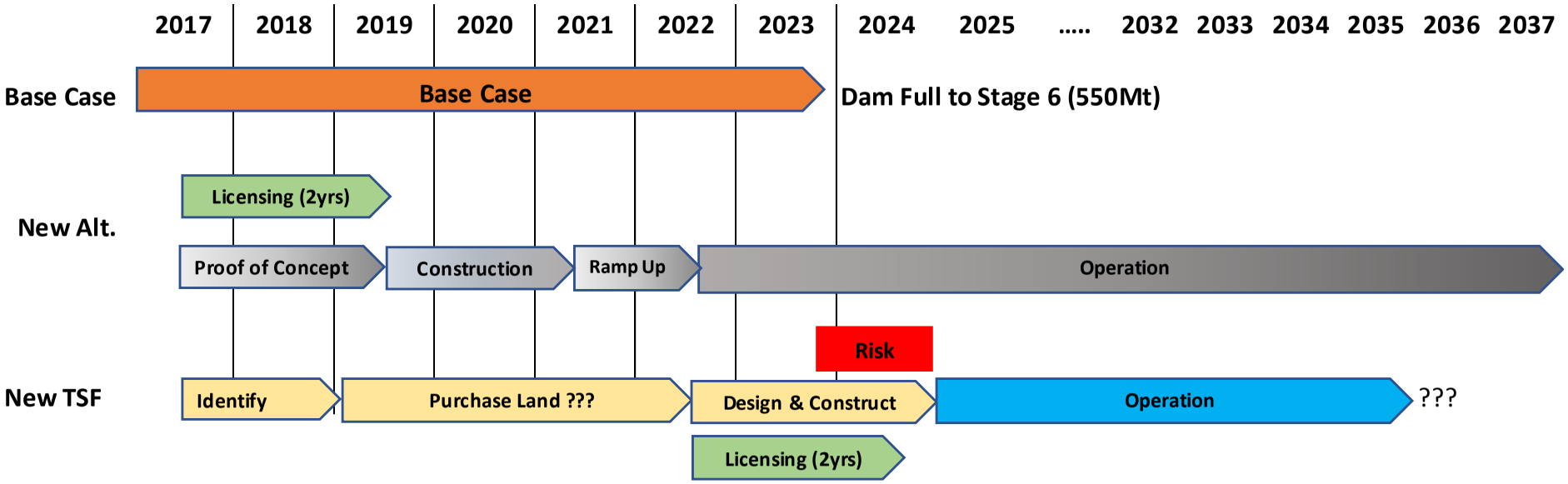
- Los conceptos considerados son creativos / innovadores
- Concepto Alta Densidad
  - Solo Esperanza / Centinela está cerca de la producción de 170 ktpd a 90 ktpd
  - El engrosamiento es un desafío (Toromocho!)
  - Pendiente de deposición
  - Estabilidad de la masa de relaves
- Conceptos de Apilamiento
  - Filtro prensa grande: pocos ejemplos de implementación (sin embargo, algunos buenos resultados)
  - El más grande es <20 ktpd (México)
  - Operación modular
  - Colocación por transportador y apilamiento: lixiviación en pilas
- **Conclusión = Prueba de concepto Fase necesaria**

11. PASOS A SEGUIR

- Finalizar la evaluación de alternativas
  - Riesgos - con ponderación
  - Combinar riesgos y costos
- Identificar la alternativa preferida
- Diseño de viabilidad
  - Preferred Alternative
- Recomendación: preparar la descripción de la prueba de concepto antes de iniciar el diseño de viabilidad.
  - Pruebas – Laboratorios y en el sitio
  - Planta Piloto
  - Implementación por etapas
  - Etc……

002938

11. PASOS A SEGUIR



ANEXO 2-8
ESTABILIDAD DMI VALLE NORTE

MINERA CHINALCO PERU S.A.

ANÁLISIS DE ESTABILIDAD FÍSICA DE LA AMPLIACIÓN DEL DMI VALLE NORTE

MCP-PT-252-INF-G-004

INFORME TÉCNICO

Rev. 1

APROBADO POR:

Gerente de Construcción de Proyectos José Luque Medina _____

Superintendente de Construcción de Proyectos Josías Gómez Fuchs _____

Revisión	Preparado Por	Emitido Para	Fecha	Revisado	Aprobado
B	M. Prudencio	Revisión Interna	19-04-2020	L. Solorzano	
0	M. Prudencio / L. Valdez	Revisión Interna	23-04-2020	L. Solorzano	
1	M. Prudencio / L. Valdez	Cliente	23-04-2020	L. Solorzano	J. Gómez
COMENTARIOS:					

CHINALCO

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1 INTRODUCCIÓN

Este Informe Técnico está hecho para proveer información acerca de las nuevas medidas y modificación del diseño del Depósito de Material Inadecuado Valle Norte (DMI Valle Norte), referidas a la Estabilidad Física.

El análisis de estabilidad DMI Valle Norte ha sido llevado a cabo para la ampliación de su capacidad y evaluación de la nueva configuración de los taludes finales y así analizar la estabilidad para la modificación del DMI Valle Norte. MCP Planeamiento ha elaborado este nuevo diseño para la evaluación de la configuración propuesta y sus efectos en la estabilidad física de las secciones geotécnicas analizadas como parte de la modificación del EIA. En la Fig. N° 1 se muestra la ubicación del DMI Valle Norte.

El Informe Técnico resume los resultados de los análisis del diseño propuesto de la nueva configuración del DMI Valle Norte, además entrega conclusiones generales y recomendaciones concernientes a la viabilidad del diseño propuesto para alcanzar los objetivos de estabilidad física.

2 GEOMETRIA DEL BOTADERO PROPUESTO

El DMI Valle Norte será construido en una serie de Lifts de 40m, 30m y 23m de altura, como se ilustra en las Figuras N° 2 y N° 3.
La geometría propuesta tiene los siguientes parámetros:

- Capacidad ampliada : 3,122,765 m3
- Ángulo de Banco : 37°
- Altura de Banco : 40m
- Ancho de set-back : 30m
- Altura Total : 135m
- Superficie Ocupada : 14.39 Has

3 ANÁLISIS DE ESTABILIDAD

3.1 Geometría del Botadero

Tal como se ha mencionado previamente, la nueva configuración propuesta para el “DMI Valle Norte” tiene como objetivo incrementar la capacidad de almacenamiento de material inadecuada proveniente de la cantera de caliza y es la base para el desarrollo del presente análisis.

3.2 Sección Geotécnica

Se ha seleccionado (3) secciones críticas geotécnicas para evaluar la distribución espacial de las unidades geotécnicas y el potencial de inestabilidades a nivel de falla interrampa y global del botadero. En dichas secciones se llevaron a cabo el análisis de estabilidad de equilibrio límite isotrópico y bidimensional para evaluar los modos de falla global y a nivel de interrampa y/o la combinación de ambos.

Las (3) secciones que fueron analizadas están ilustradas en Fig. N° 2. Estas secciones (en sentido horario) tienen la siguiente denominación: C-C', B-B' y A-A'.

3.3 Metodología

Se ha realizado el análisis de equilibrio límite estático y pseudo estático usando el software SLIDE v 7.0. Los análisis fueron conducidos usando el método de Equilibrio Límite General (GLE, por sus siglas en inglés). Este es un programa de análisis de estabilidad de taludes completamente integrado que permite desarrollar la geometría del talud interactivamente con la definición de los tipos y propiedades de los materiales de manera muy amigable para el usuario.

El análisis para calcular el factor de seguridad se lleva a cabo de manera bidimensional usando el concepto de equilibrio límite aproximando el problema a un estado de deformación plana. El programa tiene la opción de utilizar diferentes métodos de análisis de estabilidad de manera simultánea. Sin embargo, para el presente informe se ha utilizado el Método de Spencer empleando dovelas para el cálculo de superficies de falla. La superficie de falla crítica es definida como aquella que proporciona el menor factor de seguridad y fue encontrada en forma interactiva modificando las condiciones de búsqueda de la misma evaluándose superficies de falla circulares y bloque.

Como hipótesis del análisis se considera que las propiedades de los materiales que conforman las diferentes estructuras analizadas son homogéneas e isotrópicas y que el colapso se produciría como resultado de fallas simultáneas a lo largo de la superficie de deslizamiento. Cada material tiene sus propiedades y características físicas y mecánicas.

Para determinar las superficies críticas de falla con el Factor de Seguridad (FS) más bajo se han usado modos de falla tanto circular como no circular, y también rutinas de búsqueda de bloque y de caja.

3.4 Parámetros de Resistencia al Corte

Los parámetros geotécnicos como la resistencia al corte y la presión de poros de los materiales usados para el análisis de estabilidad se muestran en la Tabla I, estos parámetros están descritas en el reporte “Amec Foster Wheeler, 2019. Estudio de Estabilidad de los Depósitos Valle Norte y Sur “P031GSA-WO005-252-RP-G-004”.

3.5 Criterios de Aceptabilidad

Para evaluar la geometría propuesta del botadero a largo plazo, se han establecido los siguientes criterios de aceptabilidad, y los cuales están definidos en la Tabla II

- FS estático mínimo de diseño = 1,30
- FS pseudo estático mínimo de diseño = 1,0

Para el análisis de estabilidad pseudo estático, un FS < 1,0 también es aceptable si la magnitud de deformación calculada usando el análisis de deformación de Newmark es < 1% de la altura del botadero o del fallamiento potencial (cualquiera que sea menor).

3.6 Análisis de Estabilidad Pseudo-Estático

El análisis de estabilidad pseudo estático se realizó en base a los resultados de aceleración sísmica obtenidos con métodos probabilísticos en el último Estudio de Peligro Sísmico de la Unidad minera Toromocho 2019, en el que se establece lo siguiente:

- Para condiciones pseudo-estáticas se tomó en cuenta un coeficiente sísmico de 0,15, el cual representa el 50% de la aceleración pico del terreno que es 0.31g (suelo tipo B) que corresponde a un evento sísmico de un periodo de retorno de 475 años (vida útil de 50 años). Este valor se ha obtenido de la información proporcionada por el cliente: “Estudio de Peligro Sísmico de la Unidad minera Toromocho 2019- MPD005-OS98893-AMECFW-252-PR-G-001”.

- La Aceleraciones Máximas para el Proyecto Mina Chinalco Perú (PGA: Aceleración a T:0.02 seg) para un tiempo de retorno de 475 años es 0.31g.

- Para el método de diseño pseudo-estático de taludes, se recomienda valores de 1/3 a 1/2 de la aceleración horizontal máxima del período de retorno escogido.

- Para el método de diseño ***pseudo-estático de taludes***, se recomienda un valor de ***0.15g.***

4 RESULTADOS DEL ANÁLISIS DE ESTABILIDAD ESTÁTICO

Los resultados clave de los análisis están resumidos en la Tabla III. Los modelos, modos de fallamiento y resultados de los análisis también están ilustrados en el anexo A.

La geometría propuesta incorpora un ángulo de talud global pie-cresta de 29°, y con ángulo de interrampa desde 26°

También, la altura de los bancos mostrados en las secciones es de 23m de altura hasta 30m en material inadecuado y hasta 40m sobre este material.

Los resultados indican que las paredes del botadero cumplen con los criterios de aceptabilidad establecidos, es decir, FS mayores de 1.30 con el cual se puede concluir que es factible ejecutar este plan con la estabilidad física garantizada.

5 RESULTADOS DEL ANÁLISIS DE ESTABILIDAD PSEUDO-ESTÁTICO

Los resultados clave de los análisis de estabilidad pseudo estático están resumidos en Tabla III. Para el cual se ha utilizado el coeficiente sísmico horizontal de 0.15g, basado en el Estudio de Riesgo Sísmico realizado por el consultor AMECFW 2019, como se puede apreciar en la Tabla II (cuadro criterios de estabilidad, deformación y sismicidad).

Debido a que en el análisis de estabilidad pseudo estático se ha obtenido factores de seguridad mayor a 1.0, estos cumplen con el criterio de aceptabilidad FoS >1.0

6 MANEJO DE AGUAS DEL DMI VALLE NORTE

6.1 Consideraciones para el diseño de drenaje del Depósito Valle Norte

Para la captación y conducción de agua producto de la escorrentía superficial, se ha proyectado la construcción de canales de tierra, de sección trapezoidal y sin revestimiento, considerando que las aguas captadas y de infiltración del DMI Valle Norte serán derivadas y llegarán hacia el del vaso de la Presa de Relaves.

Se han considerado dos tipos de canales para el DMI Valle Norte: un canal principal o Tipo 1 que estará ubicado en el perímetro del depósito y canales secundarios o Tipo 2 ubicados sobre el depósito de material inadecuado.

Los canales Tipo 1 y Tipo 2 serán construidos durante la operación del DMI Valle Norte, la configuración final se alcanzará al completar la construcción del depósito.

Las estructuras hidráulicas del DMI Valle Norte se han consideradas como temporales, debido a que el depósito en su diseño final será cubierto parcialmente por los relaves almacenados, esto de acuerdo al plan de recrecimiento de la Presa de Relaves (HATCH, 2018).

6.2 Trazo de los canales en el depósito

Las estructuras hidráulicas consideradas son:

En la margen izquierda del DMI Valle Norte se ha proyectado un canal de derivación Tipo 1 de 557m de longitud aproximadamente, será de sección trapezoidal sin revestimiento y excavado en suelo natural con un talud de pendiente de 1:1; este canal estará alineado en paralelo al acceso existente.

En la margen derecha del depósito, se ha proyectado la construcción de un segundo tramo de canal de derivación Tipo 1 de 532m de longitud aproximadamente, será de sección trapezoidal sin revestimiento y excavado en suelo natural con un talud de pendiente de 1:1; de igual manera este canal estará alineado en paralelo al acceso existente.

Hacia el pie del depósito se ha considerado un tercer tramo de canal de derivación Tipo 1 de 584m de longitud aproximadamente, será de sección trapezoidal sin revestimiento y excavado en suelo natural con un talud de pendiente de 1:1.

Sobre el depósito se han proyectado canales de derivación secundarios o Tipo 2, que tienen una longitud total de 1,673 m aproximadamente. Los canales secundarios se construirán sobre las banquetas en cuatro tramos a diferente nivel con longitudes aproximadas de 232m, 495m, 711m y 235m respectivamente, estos canales serán construidos con una sección trapezoidal y sin revestimiento.

A lo largo de los canales Tipo 1 se ha proyectado la construcción de 05 pozas de pre-sedimentación sin revestimiento, estas pozas han sido distribuidas de tal forma que permitirán captar las aguas provenientes de los canales Tipo 2, a su vez servirán como elementos disipadores de energía para el sistema de drenaje y 02 pozas de sedimentación de sección trapezoidal revestidas con geotextil ubicadas previo a los puntos de descarga del sistema de drenaje.

Finalmente, las aguas captadas por los canales de derivación, serán descargadas hacia la quebrada ubicada aguas abajo del depósito, dicha quebrada descarga su flujo a la presa de relaves. En el Anexo B de este informe, se presentan los Planos del Manejo de Aguas Planta y Secciones Típicas de las Estructuras Hidráulicas.

7 CONCLUSIONES Y RECOMENDACIONES

- De acuerdo a la Evaluación Geotécnica del diseño propuesto en las diferentes secciones criticas S1 (A-A'), S2 (B-B') y S3 (C-C'), cumplen con el criterio de aceptabilidad FoS>1.0 para condiciones pseudo estáticas y FoS>1.3 para condiciones estáticas.

- Se recomienda realizar la limpieza de material de baja resistencia para conformar el dren de roca al pie del DMI Valle Norte.

- El área de limpieza de la fundación es de 9,427m2 y el volumen a remover será definido mediante las investigaciones geotécnicas a detalle.

- Se estima un volumen de 47,139 m3 para la conformación del dren de roca al pie del depósito, el cual tendrá una altura no menor de 8m en el sector de mayor potencia de material de baja resistencia.

- Importante asegurar la construcción del sistema de drenaje en el DMI Vale Norte para asegurar un adecuado manejo de agua pluviales.

- Se recomienda no realizar descargas de materiales inadecuados (lodos – Bofedal) hacia la cara final de los taludes.

- Debido a la consolidación del material es posible tener agrietamientos a nivel local cercanos a las crestas, las cuales se encuentran dentro del rango permisible (asentamientos diferenciales aceptables).

- El presente estudio fue realizado por MCP, la misma que deberá de ser validada por un consultor externo.

- La conducción de agua producto de la escorrentía superficial, se ha proyectado la construcción de canales de tierra, de sección trapezoidal y sin revestimiento, considerando que las aguas captadas y de infiltración del DMI Valle Norte serán derivadas y llegarán hacia el del vaso de la Presa de Relaves., para lo cual se han considerado dos tipos de canales para el DMI Valle Norte: un canal principal o Tipo 1 que estará ubicado en el perímetro del depósito y canales secundarios o Tipo 2 ubicados sobre el depósito de material inadecuado.

- Las aguas captadas por los canales de derivación, serán descargadas hacia la quebrada ubicada aguas abajo del depósito, dicha quebrada descarga su flujo a la presa de relaves. En el Anexo B de este informe, se presentan los Planos del Manejo de Aguas Planta y Secciones Típicas de las Estructuras Hidráulicas.

TABLAS

TABLA I

RESUMEN DE CRITERIOS DE RESISTENCIA AL CORTE

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Shear Normal Function	UCS (kPa)	mb	s	a	Water Surface
Rockfill		19	Mohr-Coulomb	5	40						Water Surface
Basamento Rocoso - Caliza		26.8	Generalized Hoek-Brown				110000	2.40551	0.00673795	0.504048	Water Surface
Depósito Morrenico - Norte		21.5	Mohr-Coulomb	5	39						Water Surface
Buttress		23.8	Shear Normal function			Material Tipo 3					None

Fuente:
Estudio de Estabilidad de los Depósitos Valle Norte y Sur (AMECFW) “P031GSA-WO005-252-RP-G-004”

TABLA II

CUADRO CRITERIOS DE ESTABILIDAD, DEFORMACION Y SISMICIDAD

Descripción	Unidad	Criterio	Fuente
Estabilidad de Taludes			
Factor de Seguridad Estático Mínimo (operación)	-	1,3(1)	MCP (2017)
Factor de Seguridad Pseudo-Estático Mínimo (Operación)	-	1,0(1)	
Sismicidad			

Fuentes:

- Amec Foster Wheeler, 2019. Estudio de Estabilidad de los Depósitos Valle Norte y Sur “P031GSA-WO005-252-RP-G-004”
- Actualización del Estudio de Peligro Sísmico de la Unidad minera Toromocho 2019, MPD005-OS98893-AMECFW-252-PR-G-001.

TABLA III

CUADRO RESUMEN DE LOS FACTORES DE SEGURIDAD ESTÁTICO Y PSEUDO ESTÁTICO

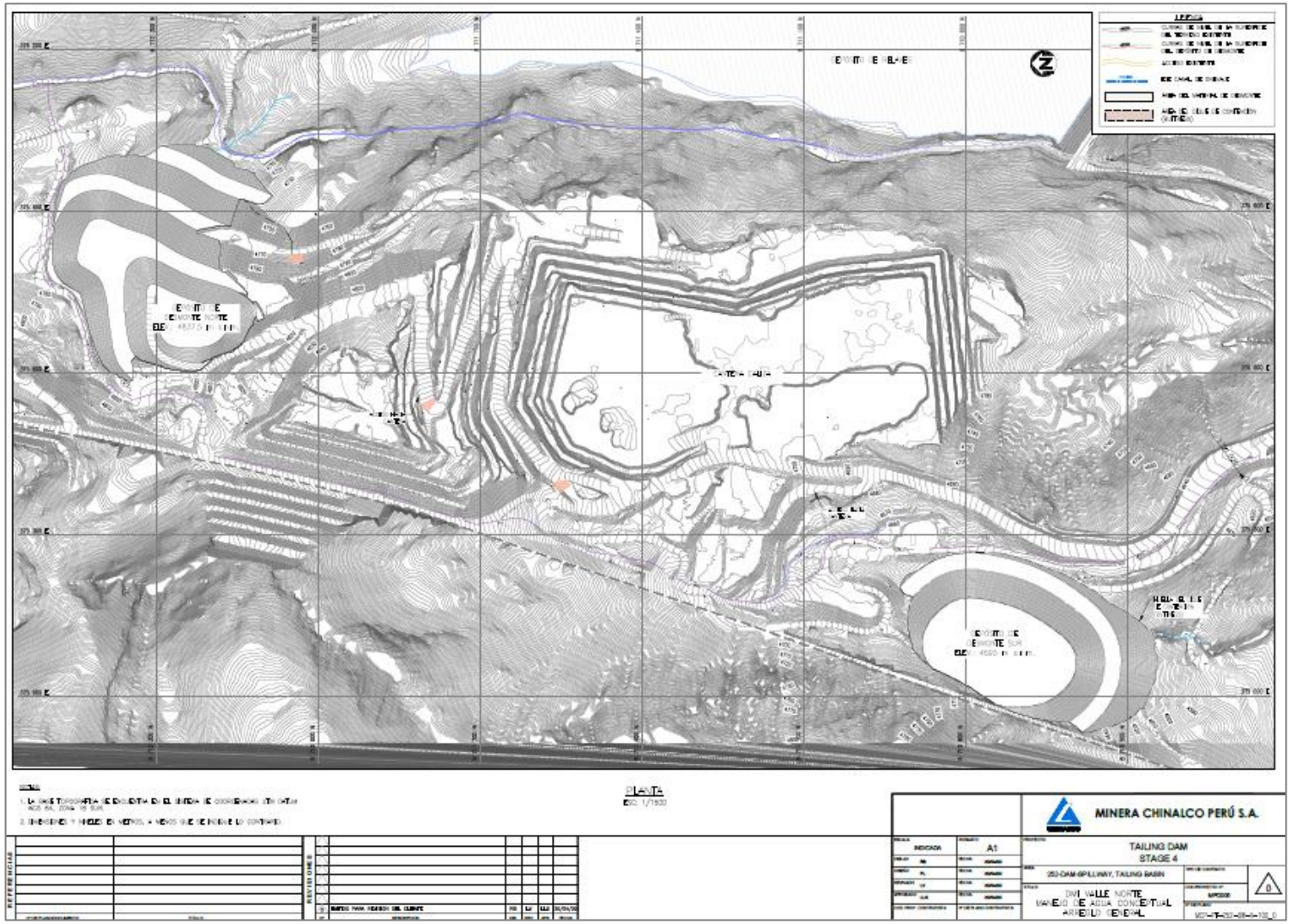
Geometría	Sección	AMPLIACION DMI VALLE NORTE		
		FoS Estático	FoS Pseudo Estático (K=0.15)	Anexo
S1	A-A'	1.850	1.374	A1-A2
S2	B-B'	2.238	1.654	A3-A4
S3	C-C'	3.302	2.561	A5-A6

TABLA IV

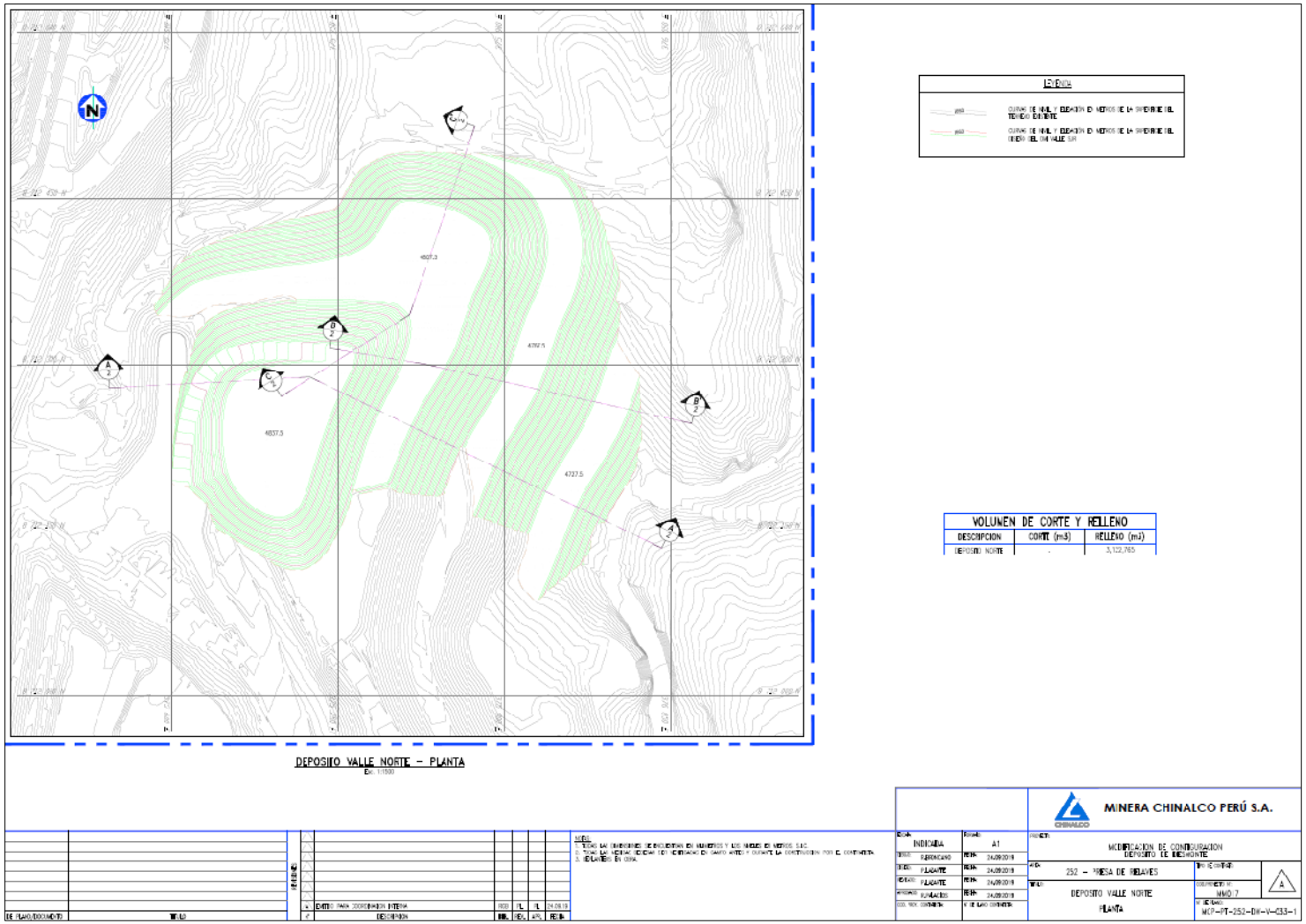
CARACTERÍSTICAS GEOMÉTRICAS DE LOS TIPOS DE CANALES

Canal	Progresiva (m)	Características Geométricas		
		Base (m)	Altura (m)	Talud
Canal de Derivación Margen Izquierdo del Depósito Valle Norte				
Canal Tipo 1	0+000 A 0+557	0.5	0.6	1:1
Canal de Derivación Margen Derecho del Depósito Valle Norte				
Canal Tipo 1	0+000 A 0+532	0.5	0.6	1:1
Canal de Derivación Aguas abajo del Depósito Valle Norte				
Canal Tipo 1	0+000 A 0+584	0.5	0.6	1:1
Canal de Derivación sobre el Depósito Valle Norte				
Canal Tipo 2 Nv. 4837.50	0+000 A 0+232	0.4	0.4	1:1
Canal Tipo 2 Nv. 4807.50	0+000 A 0+495	0.4	0.4	1:1
Canal Tipo 2 Nv. 4767.50	0+000 A 0+711	0.4	0.4	1:1
Canal Tipo 2 Nv 4727.50	0+000 A 0+235	0.4	0.4	1:1

FIGURAS


PLANTA
MINERA CHINALCO PERÚ S.A.
TAILING DAM
STAGE 4
DMI VALLE NORTE
MANEJO DE AGUA CONCEPTUAL
ARREGLO GENERAL

002952


LEYENDA
VOLUMEN DE CORTE Y RELLENO
DESCRIPCION
CORTE (m3)
RELLENO (m3)
DEPOSITO NORTE
3,122,765
DEPOSITO VALLE NORTE – PLANTA
MINERA CHINALCO PERÚ S.A.
MODIFICACION DE CONFIGURACION DEPOSITO DE DESMONTE
252 – MESA DE RELAVES
DEPOSITO VALLE NORTE
PLANTA
MCP-PT-252-DM-V-033-1

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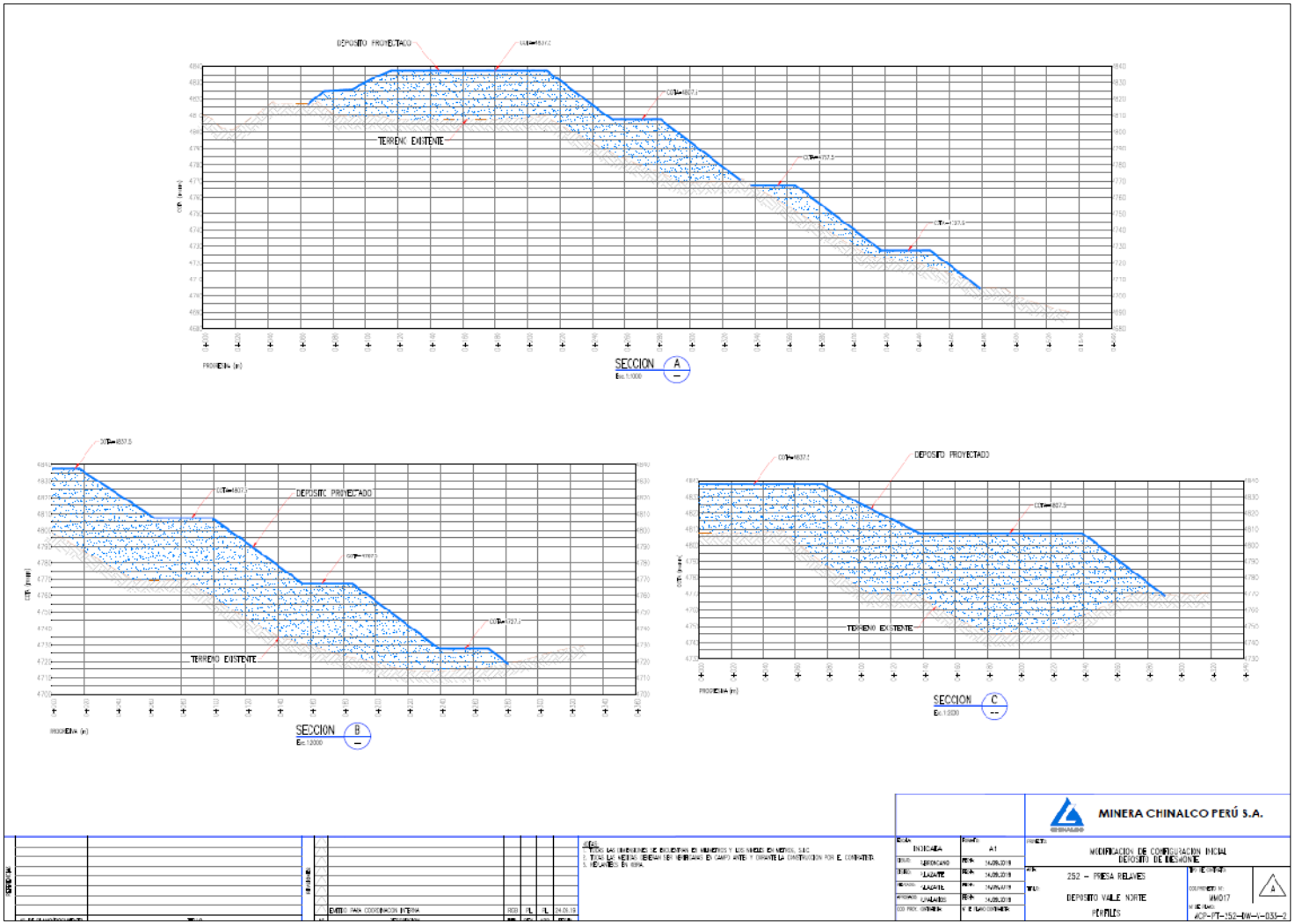
DEPOSITO PROYECTADO
TERRENO EXISTENTE
SECCION A
DEPOSITO PROYECTADO
TERRENO EXISTENTE
SECCION B
DEPOSITO PROYECTADO
TERRENO EXISTENTE
SECCION C
MINERA CHINALCO PERÚ S.A.
MODIFICACION DE CONFIGURACION INICIAL DEPOSITO DE DESMONTE
252 – PRESA RELAVES
DEPOSITO VALLE NORTE
PERFILES

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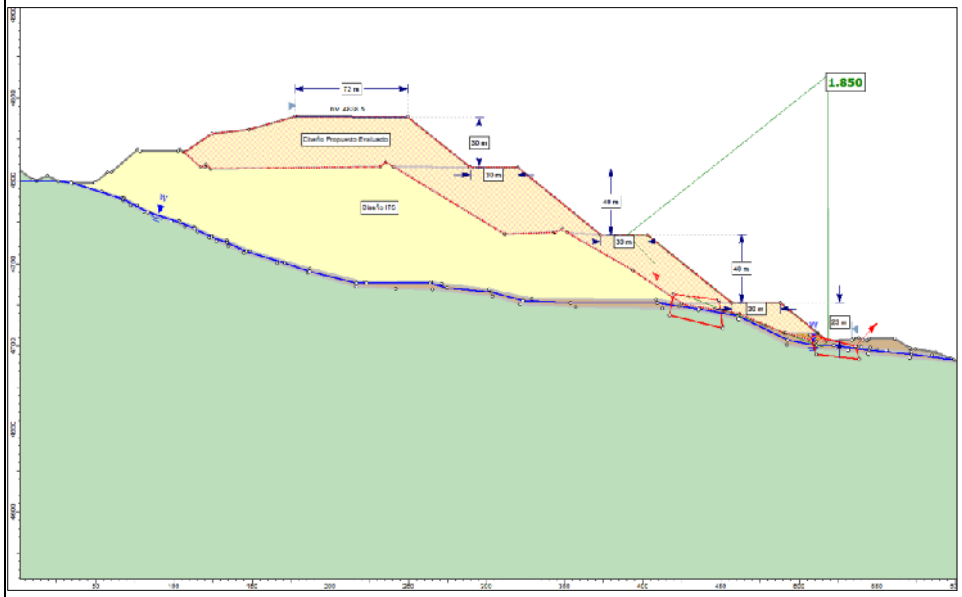
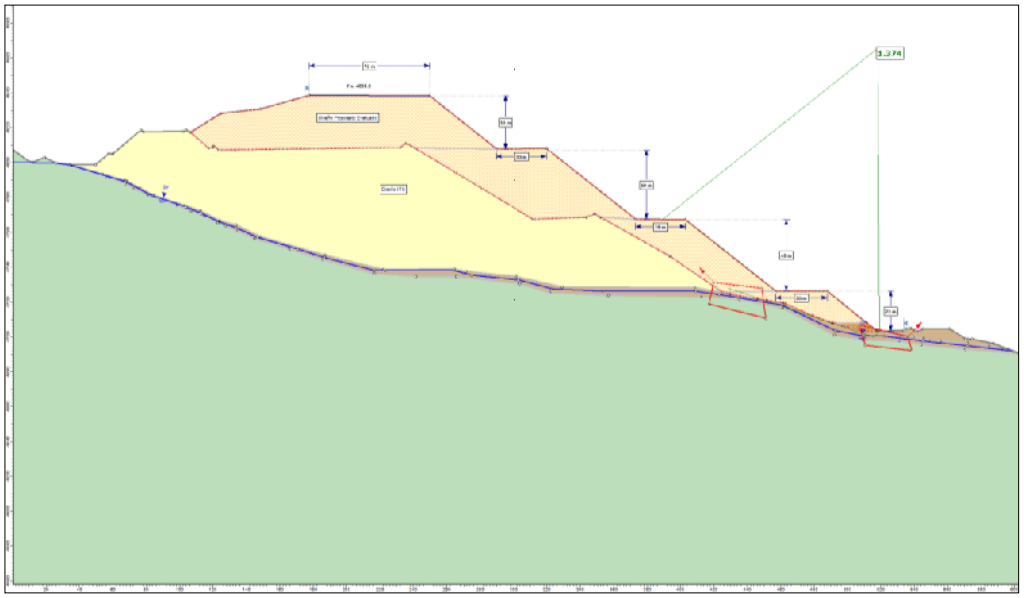
ANEXOS

ANEXO A: ANALISIS DE ESTABILIDAD

Anexo A-1	Anexo A-2
Sección S1	Sección S1
Análisis Estático	Análisis pseudo Estático (K=0.15)
	

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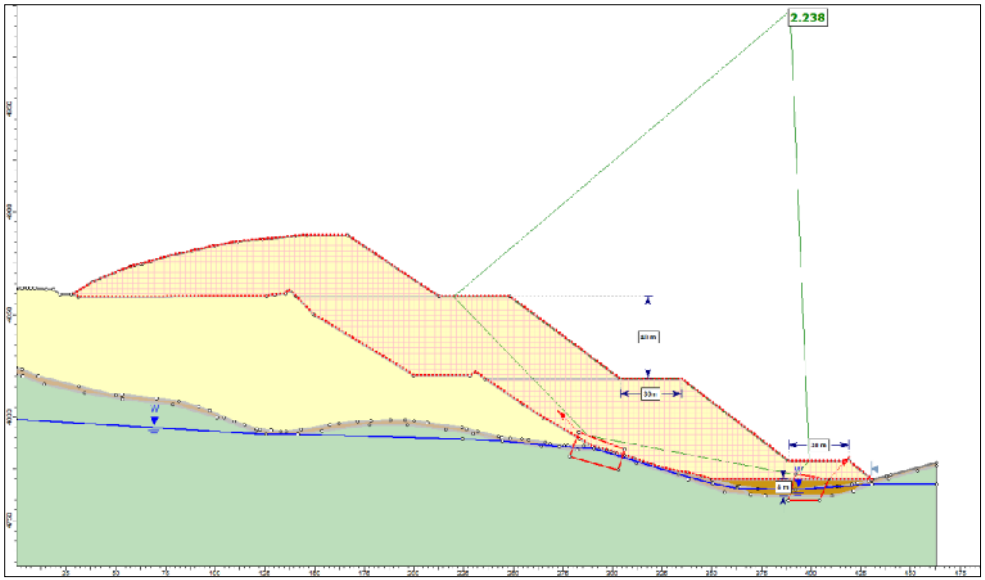
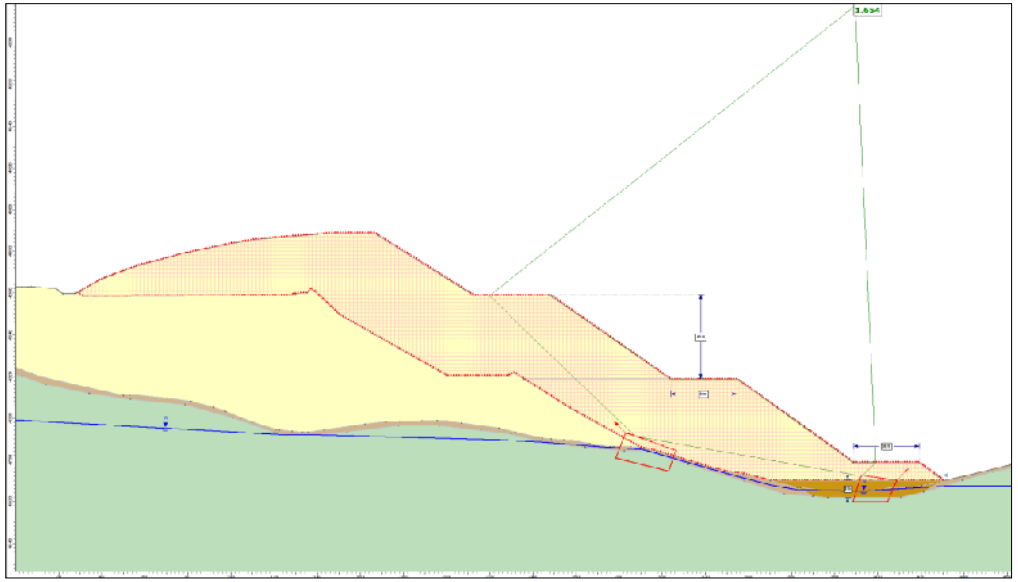
Anexo A-3	Anexo A-4
Sección S2	Sección S2
Análisis Estático	Análisis pseudo Estático (K=0.15)
	

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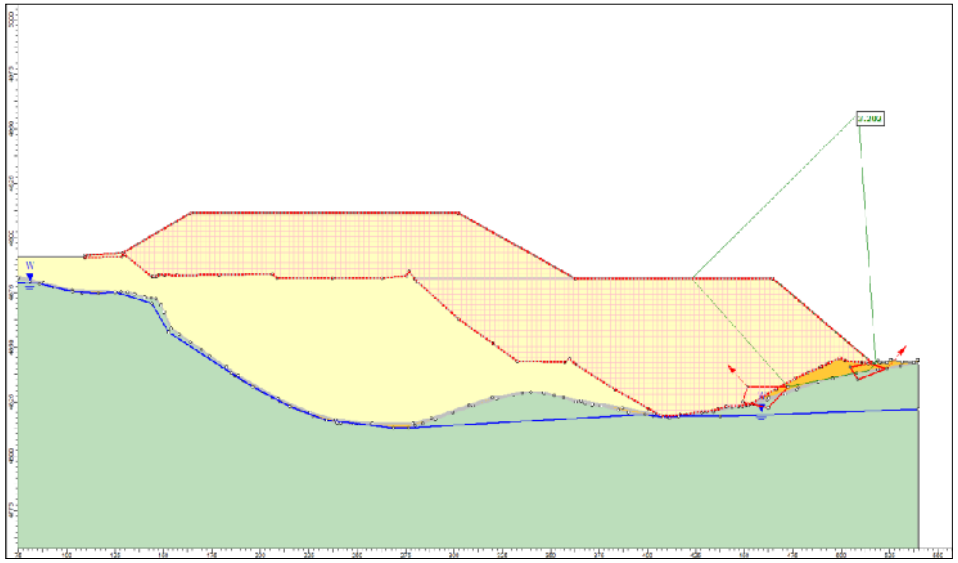
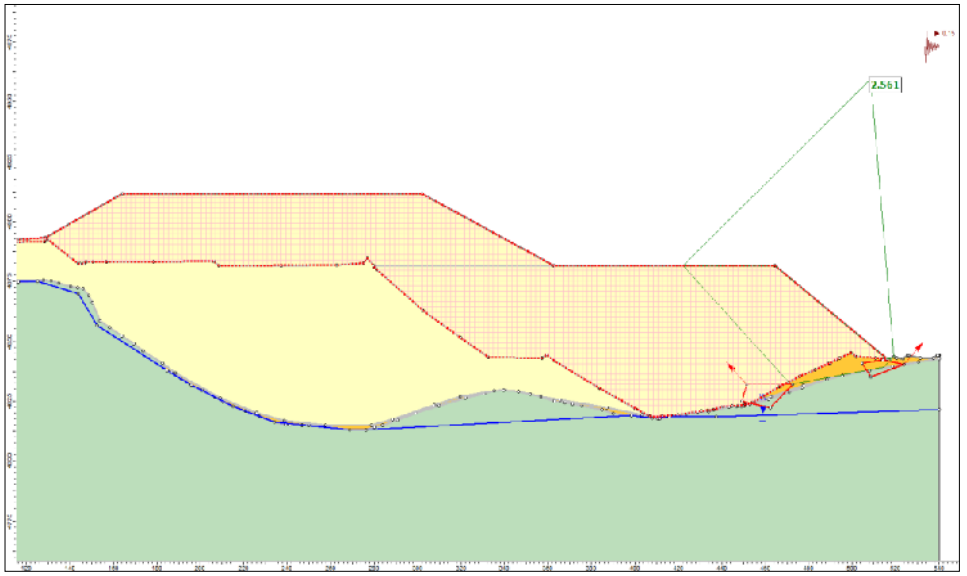
Anexo A-5	Anexo A-6
Sección S3	Sección S3
Análisis Estático	Análisis pseudo Estático (K=0.15)
	

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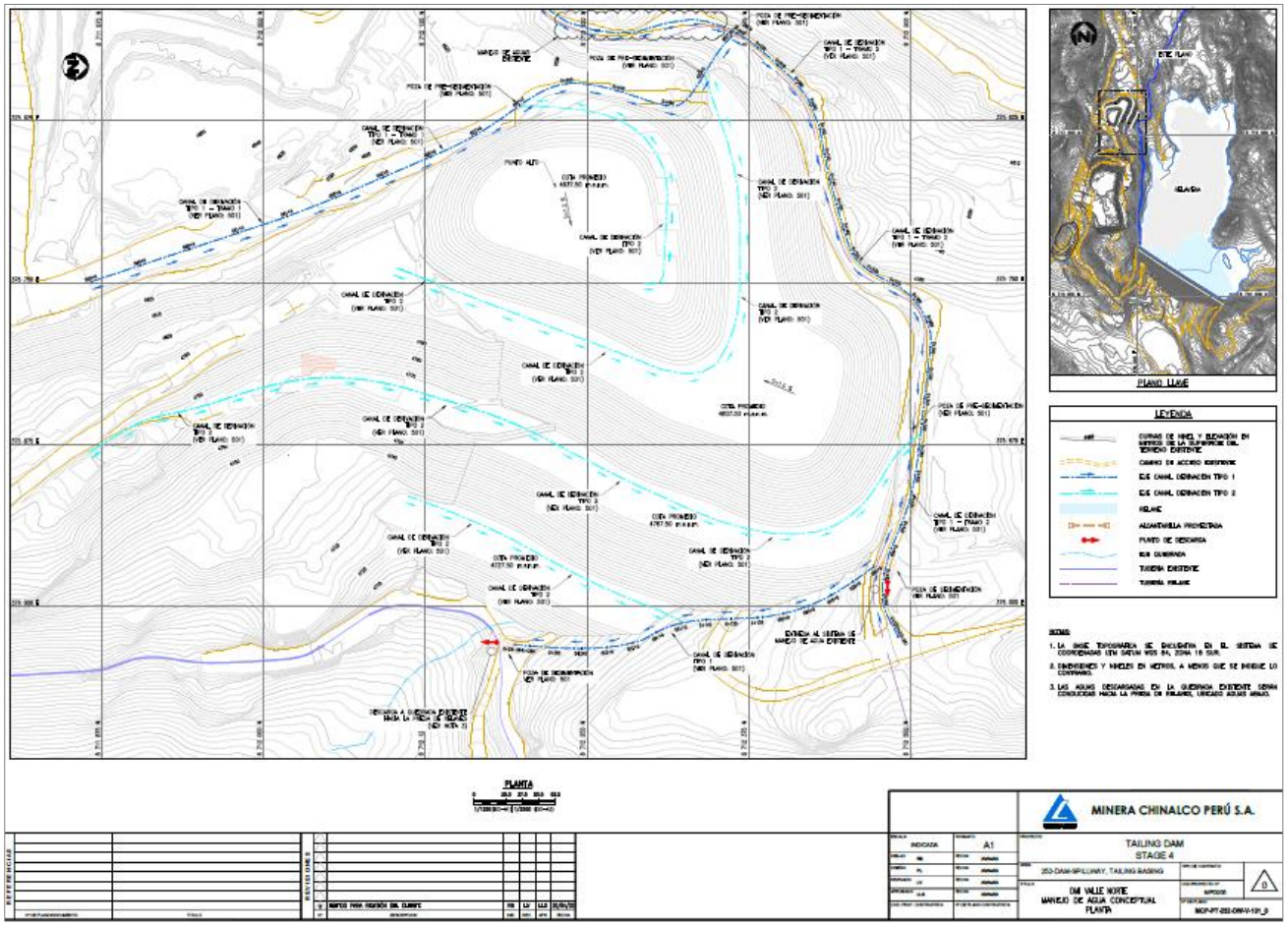
ANEXO B: PLANOS DEL SISTEMA DE DRENAJE

Anexo B-1

DMI Valle Norte – Manejo de aguas Planta



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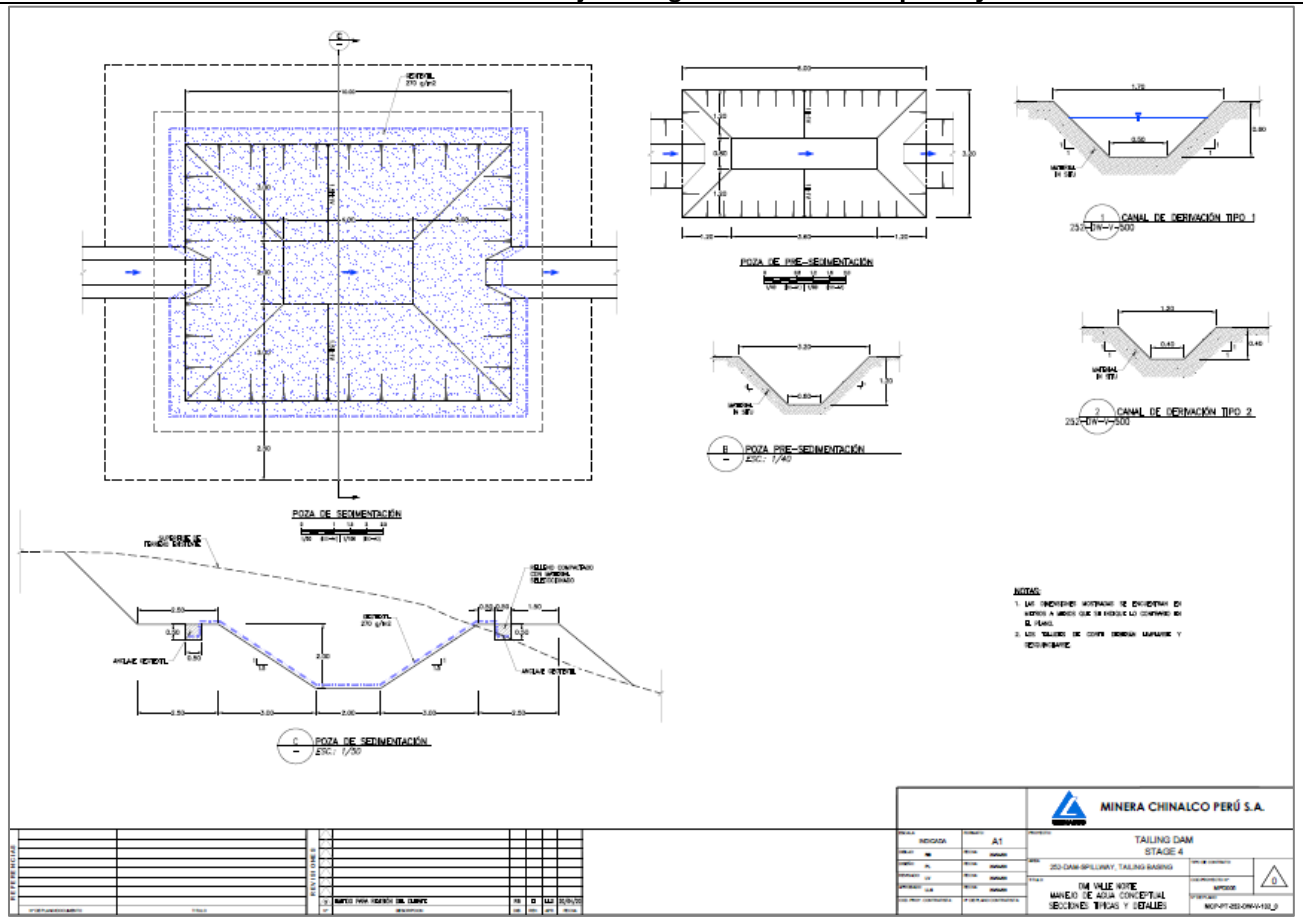
Anexo B-2

DMI Valle Norte – Manejo de Aguas Secciones Típicas y Detalles



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ANEXO 2-9
TRADE OFF NUEVO ACCESO

TRADE - OFF
NUEVO ACCESO A LA UNIDAD MINERA TOROMOCHO

MCP-PT-510-SW-G-006

REV. 0

FECHA	ELABORADO POR	REVISADO POR	APROBADO POR	REVISION
15/10/2019	LValentin	JCarranza	JCarranza	Rev. A
22/10/2019	LValentin	JCarranza	JCarranza	Rev. B
29/10/2019	**LValentin**	**JCarranza**	**JCarranza**	**Rev. 0**

NOTAS:

Revisión A: Emisión Interna

Revisión B, C, D : Para comentarios

Revisión 0: Para licitación, revisión final.

TABLA DE CONTENIDOS

1 ANTECEDENTES 3
2 OBJETIVO 3
3 TRADE-OFF 3
4 EVALUACIÓN TÉCNICA DE ALTERNATIVAS 5
5 EVALUACIÓN SOCIOAMBIENTAL DE ALTERNATIVAS 6
6 CONCLUSION 7

1 ANTECEDENTES

La Unidad Minera Toromocho cuenta actualmente con un acceso principal de aproximadamente 11km de longitud de 10m de ancho a nivel de afirmado, se inicia desde el km 142 de la Carretera Central, paradero “el casco”, hasta la planta concentradora de minerales, la vía es utilizada para el transporte de los colaboradores de Minera Chinalco Peru (MCP), proveedores, etc.

Dicha vía cruza por dos puntos con el haul road minero, donde transitan los camiones 777, para el transporte del mineral hacia la chancadora primaria y los depósitos de material de desmonte y de baja ley; en los dos puntos de cruce los buses de transporte de personal y proveedores, camionetas se detienen a esperar la señal verde del semáforo para poder cruzarla con la precaución de los camiones mineros.

Por otro lado, esta vía se ve afectada por los nuevos trazos que se deben de hacer debido al cambio que sufre los haul road minero, en concordancia con el plan de minado planificado.

A la fecha ya se han presentado incidentes de alto potencial en los dos cruces con vehículos y/o buses de personal con los camiones mineros.

En ese sentido MCP ha decidido evaluar otro trazo para la vía principal a la unidad minera que represente una mayor seguridad que la actual y con un mínimo posibilidad de cambio de trazo debido a la explotación minera.

2 OBJETIVO

Desarrollar un trade-off de trazo a nivel conceptual que nos permitan seleccionar la mejor alternativa.

3 TRADE-OFF

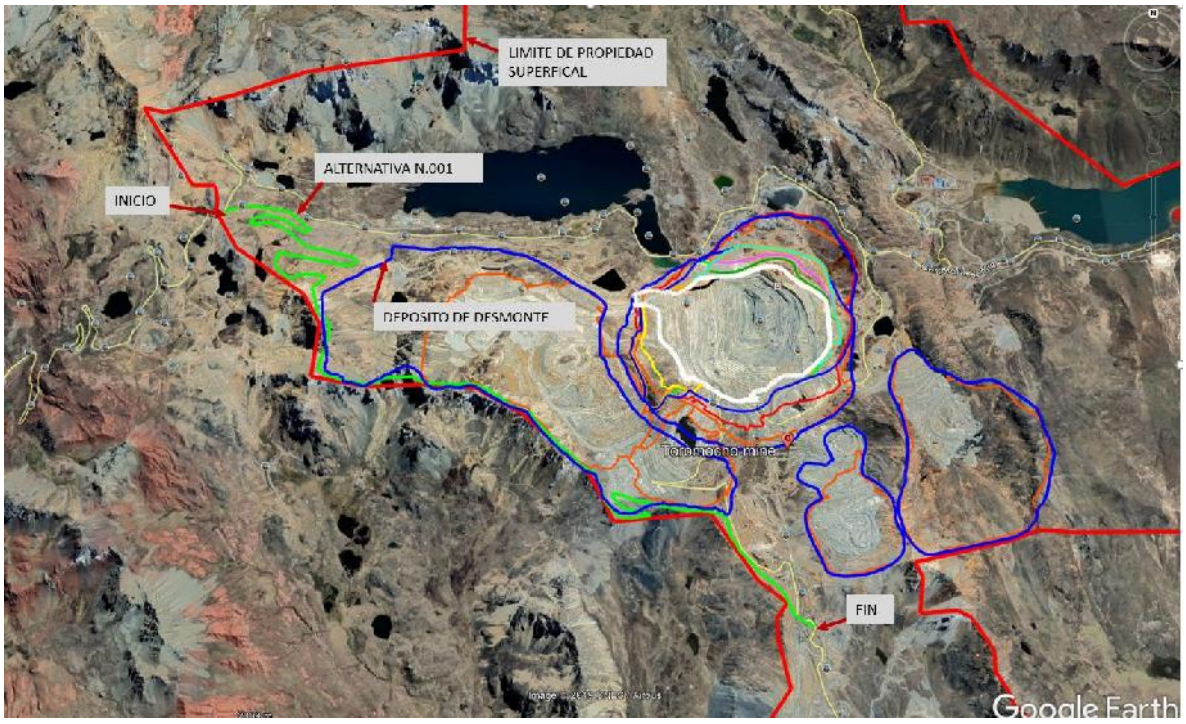
Criterios que considerar:

* Trazo dentro de la propiedad superficial minera.
* Ancho mínimo de 10 m.
* Evitar las vías de haul road minero.
* Evitar infraestructura o componente minero que impacte con el desarrollo de la vía.
* Velocidad directriz 30 km/h

Se han analizado dos alternativas, comparables entre si, desde el punto de vista de seguridad, longitud y permanencia en el tiempo.

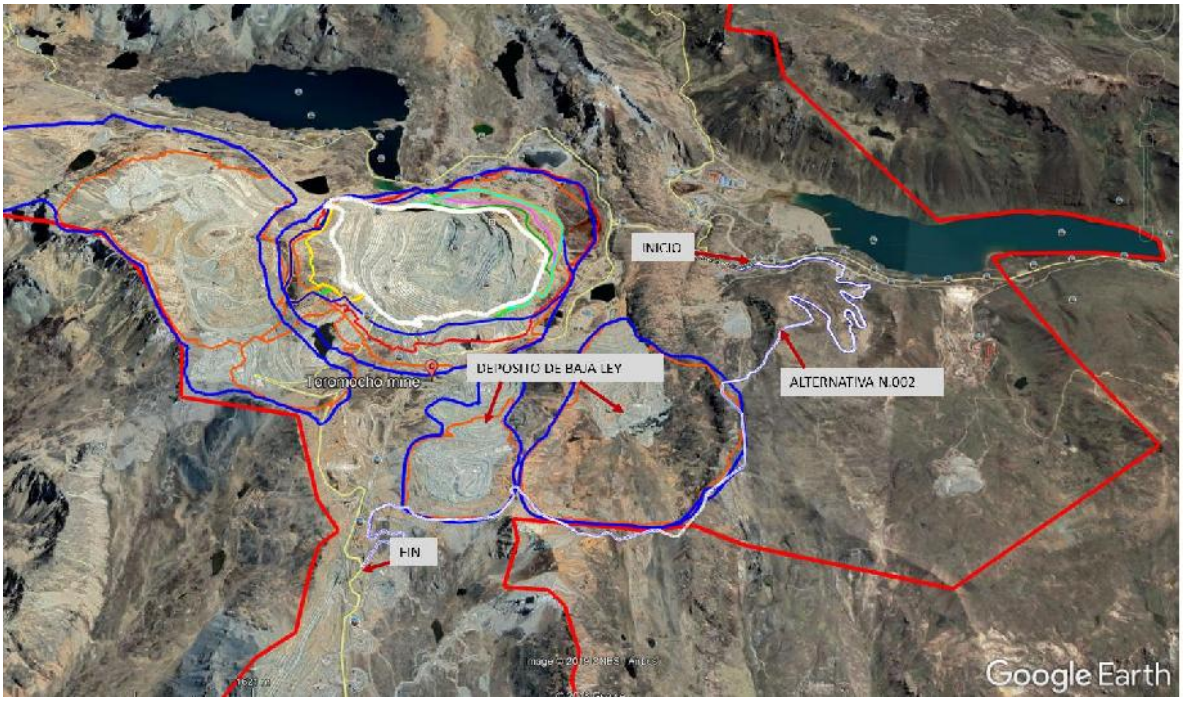
Alternativa N.001

Se encuentra dentro de la propiedad superficial, se inicia desde la carretera central, a la altura de la zona denominada como Ticlio a 4,820 msnm, hacia la margen oeste, logrando ascender hasta el punto más alto 5,150 msnsm, atravesando los depósitos de desmonte mineros este, cubriendo una longitud de 12.5 km, como se puede ver en el siguiente gráfico.



Alternativa N.002

Se encuentra dentro de la propiedad superficial, se inicia desde la carretera central, a la altura del km 145 de la Carretera Central (frente al ingreso de Tuctu) a 4,470 msnm, dirigiéndose hacia el sur, logrando ascender hasta el punto más alto 5,000 msnsm, atravesando por el extremo sur los depósitos de baja ley, cubriendo una longitud de 10.5 km, como se puede ver en el siguiente gráfico.



4 EVALUACIÓN TÉCNICA DE ALTERNATIVAS

Considerando los parámetros antes mencionados se presenta el siguiente cuadro:

Cuadro N 1: Evaluación Técnica

Parámetro	ALTERNATIVA N.001	ALTERNATIVA N.002
Trazo dentro de la propiedad superficial	CUMPLE	CUMPLE
Ancho de la vía	MÍNIMO 10M	MÍNIMO 10 M
Evita el cruce con el Haul Road	CUMPLE	CUMPLE
Riesgo de cambio en el tiempo	ALTA Debido a que gran parte de la vía cruza los depósitos de desmonte minero	BAJA Debido que el trazo evita el impacto con los depósitos de baja ley
LONGITUD	12.5 KM	10. KM
VELOCIDAD DIRECTRIZ	30 KM/H	30 KM/H
CAPEX ESTIMADO CLASE 4	30-35 MMUS$	25-30 MMUS$

5 EVALUACIÓN SOCIOAMBIENTAL DE ALTERNATIVAS

Se evalúan las dos alternativas consideradas en base a los impactos y riesgos socioambientales que previsiblemente generarían. Para ello, se identifican todos los indicadores ambientales significativos, agrupados por factor económico, ambiental y sociocultural. Estos indicadores son valorados según el nivel del impacto o riesgo que generaría la alternativa considerada.

Un valor de 1 significa que el impacto o riesgo es de nivel alto; un valor de 2 significa que el impacto o riesgo es de nivel moderado; un valor de 3 significa que el impacto o riesgo es de nivel bajo; un valor de 4 significa que el impacto o riesgo son nulos. Esta escala de 1 a 4 también se aplica para valorar los costos y otras variables técnicas descritas en el cuadro anterior.

La alternativa mejor calificada es aquella que acumule el mayor puntaje. Eso significa que tendrá un menor costo y/o generará una menor afectación socioambiental.

Cuadro N 2: Evaluación económica y socioambiental

Criterio	Indicador	Alternativa N.001	Punt.	Alternativa N.002	Punt.
Factor económico	Longitud	12.5 km	1	10 km	2
	Compra de tierras	Nulo	4	Nulo	4
	Riesgo de cambio en el tiempo	Alto	1	Bajo	3
	Costo de construcción	US$ 30 MM	1	US$ 25 MM	3
	Costo de operación / año	US$ 0.2 MM	1	USS 0.1 MM	2

Criterio	Indicador	Alternativa N.001	Punt.	Alternativa N.002	Punt.
Factor ambiental	Impacto sobre la calidad del aire	Bajo	3	Bajo	3
	Impacto sobre la calidad del agua	Moderado	2	Bajo	3
	Pérdida de suelo	Bajo	3	Bajo	3
	Impacto visual	Moderado	2	Bajo	3
	Fragmentación de ecosistemas	Moderado	2	Moderado	2
	Impacto sobre ecosistemas frágiles	Nulo	4	Nulo	4
	Afectación de hábitats de especies en categorías de conservación	Bajo	3	Bajo	3
Factor Socio cultural	Reasentamiento	Nulo	4	Nulo	4
	Cambio en patrones de uso del suelo	Nulo	4	Bajo	3
	Afectación de patrimonio cultural – arqueológico, recurso turístico	Bajo	3	Nulo	4
PUNTAJE TOTAL		**Alternativa N.001**	**38**	**Alternativa N.002**	**46**

6 CONCLUSION

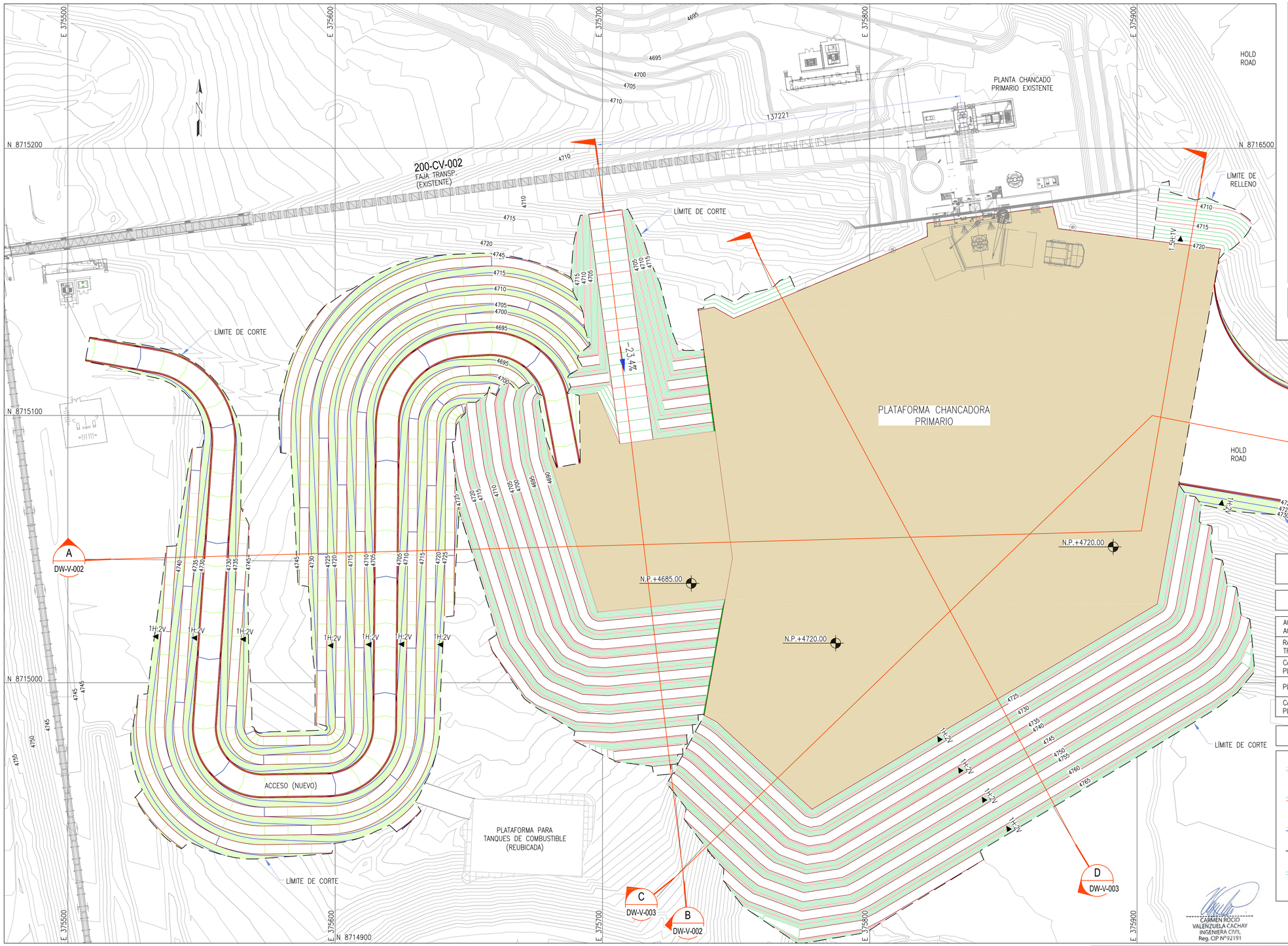
En base al cuadro N 1 presentado se puede concluir que la alternativa N.002 es la mejor opción debido a su menor longitud vs a la alternativa N.001, evita los depósitos de baja ley, se encuentra dentro de la propiedad superficial con ajustes mínimos.

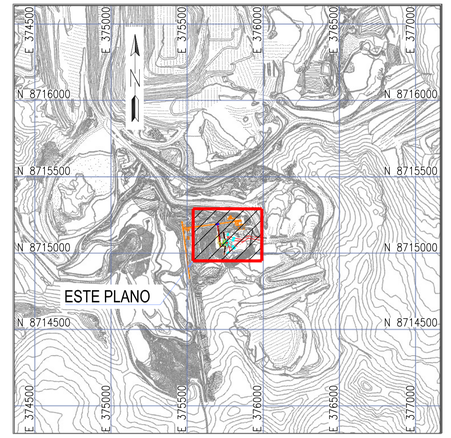
En base al cuadro N 2 se concluye que la alternativa N.002 es la mejor opción desde el punto de vista de sus efectos previsibles (impactos y riesgos) sobre el medio socioambiental, juntamente con sus implicancias económicas.

// FIN DEL DOCUMENTO

ANEXO 2-10
MOVIMIENTO DE TIERRAS

1.
Chancadora





PLANO LLAVE
ESC.1/10000

PLANTA
PLATAFORMA Y ACCESOS
ESC.:1/750

TABLA Nº 1
MOVIMIENTO DE TIERRAS

DESCRIPCIÓN	CORTE (m³)	RELLENO (m³)
ACCESOS A TANQUES DE AGUA	367048.01	14.68
RAMPA PARA FAJA TRANSPORTADORA	28102.68	355.01
CAMINO DE ACCESO PARA PLATAFORMA	248723.25	456.86
PLATAFORMA 2	676114.75	22600.65
CAMINO DE ACCESO PARA PLATAFORMA 2	20378.78	455.28

LEYENDA

- CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO NATURAL
- CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO PROYECTADO DE PLATAFORMA
- CURVAS DE NIVEL DE LA SUPERFICIE TERRENO PROYECTADO DE LOS ACCESOS
- LÍMITE DE CORTE Y RELLENO
- ACCESO EXISTENTE
- INSTALACIONES EXISTENTES

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

NOTAS:

1. ESTE PLANO ESTA PRESENTADO EN:
   - SISTEMA DE COORDENADAS: UTM WGS84.
   - SISTEMA DE UNIDADES: DIMENSIONES (mm) ELEVACIONES (m)
2. EL DIMENSIONAMIENTO DE LOS EQUIPOS SON REFERENCIALES HASTA QUE SE TENGAN LOS PLANOS CERTIFICADOS DE LOS MISMOS.

REFERENCIAS

Nº DE PLANO/DOCUMENTO	TITULO
MTE13-OS91173-2010-DW-V-003	PLANTA DE CHANCADO PRIMARIO SECCIONES 2 DE 2
MTE13-OS91173-2010-DW-V-002	PLANTA DE CHANCADO PRIMARIO SECCIONES 1 DE 2

REVISIONES

Nº	DESCRIPCION	DIB.	REV.	APR.	FECHA
C	RE EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	J.O.	G.CH.	P.M.	01/04/19
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	J.C	G.C.	P.M.	29/03/19
A	EMITIDO PARA COORDINACION INTERNA	J.C.	G.C.	P.M.	29/03/19

BISA INGENIERÍA DE PROYECTOS S.A.

MINERA CHINALCO PERÚ S.A.

ESCALA: 1/750	FORMATO: A1
DIBUJO: J.CAJAHUANCA	FECHA: 29/03/19
DISEÑO: G.CHAPOÑAN	FECHA: 29/03/19
REVISADO: B.RODRIGUEZ	FECHA: 29/03/19
APROBADO: P. MARIN	FECHA: 29/03/19
COD. PROY. CONTRATISTA: 395CM00666B	Nº DE PLANO CONTRATISTA:

PROYECTO: AMPLIACIÓN PLANTA CONCENTRADORA TOROMOCHO A 170 KTPD

AREA: 2010 – CHANCADO PRIMARIO

TIPO DE CONTRATO:

TITULO: PLANTA DE CHANCADO PRIMARIO
PLATAFORMA Y ACCESOS PLANTA

COD.PROYECTO Nº: OS91173

Nº DE PLANO: MTE13-OS91173-2010-DW-V-001

C

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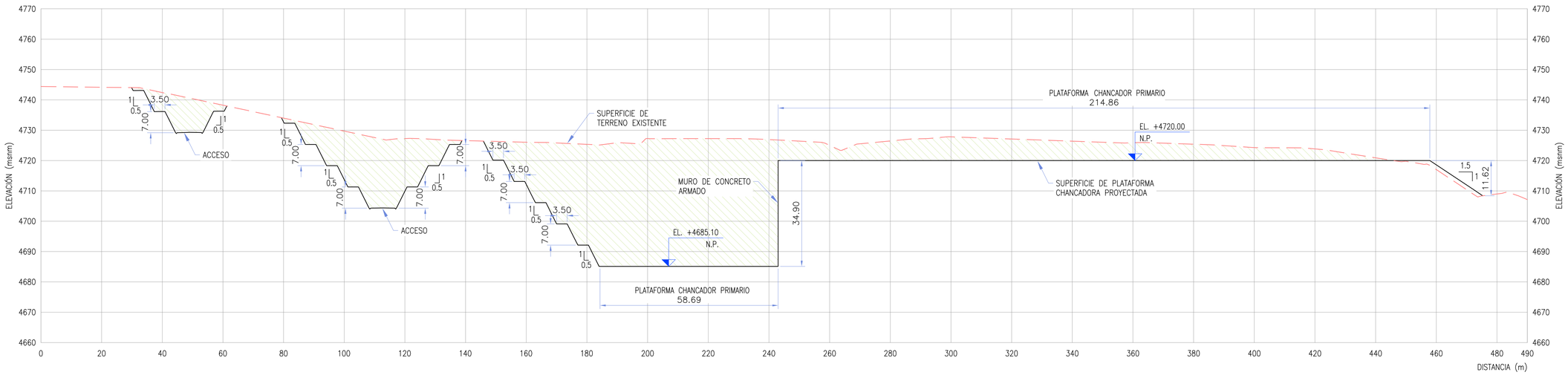
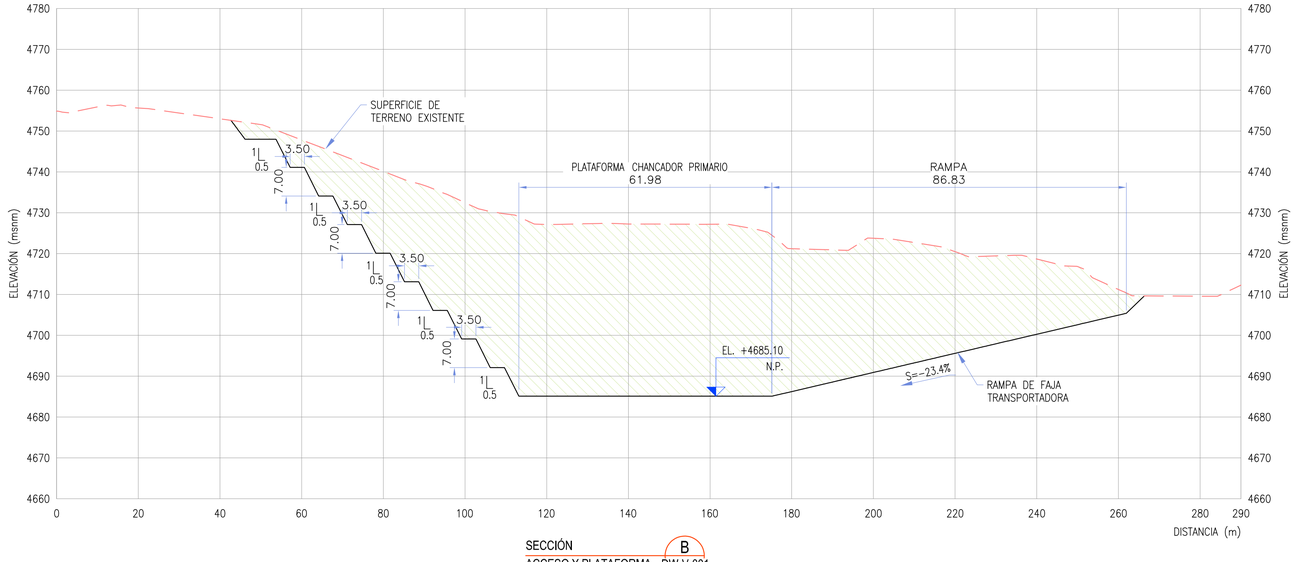
LEYENDA

- SUPERFICIE DE TERRENO NATURAL
- LÍNEA DE PLATAFORMA
- CORTE
- RELLENO
- TERRENO NATURAL



SECCIÓN A
ACCESO Y PLATAFORMA DW-V-001
ESC.: 1/750



SECCIÓN B
ACCESO Y PLATAFORMA DW-V-001
ESC.: 1/750

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

REFERENCIAS							
MTE13-OS91173-2010-DW-V-001	PLANTA DE CHANCADO PRIMARIO						
Nº DE PLANO/DOCUMENTO	TITULO						

REVISIONES						
Nº	DESCRIPCION	DIB.	REV.	APR.	FECHA	
C	RE EMTIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	J.O.	G.CH.	P.M.	01/04/19	
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	P.Z.	V.V.	P.M.	29/03/19	
A	EMITIDO PARA COORDINACION INTERNA	P.Z.	V.V.	P.M.	29/03/19	

NOTAS:

1. ESTE PLANO ESTA PRESENTADO EN:
   - –SISTEMA DE COORDENADAS: UTM WGS84.
   - –SISTEMA DE UNIDADES DIMENSIONES (mm) ELEVACIONES (m)
2. EL DIMENSIONAMIENTO DE LOS EQUIPOS SON REFERENCIALES HASTA QUE SE TENGAN LOS PLANOS CERTIFICADOS DE LOS MISMOS.

BISA INGENIERÍA DE PROYECTOS S.A.

MINERA CHINALCO PERÚ S.A.

ESCALA: 1/750	FORMATO: A1	PROYECTO: AMPLIACIÓN PLANTA CONCENTRADORA TOROMOCHO A 170 KTPD	
DIBUJO: J.CAJAHUANCA	FECHA: 29/03/19		
DISEÑO: G.CHAPOÑAN	FECHA: 29/03/19	AREA: 2010 – CHANCADO PRIMARIO	TIPO DE CONTRATO: C
REVISADO: B.RODRIGUEZ	FECHA: 29/03/19	TITULO: CHANCADO PRIMARIO SECCIONES 1 DE 2	COD.PROYECTO Nº: OS91173
APROBADO: P. MARIN	FECHA: 29/03/19		Nº DE PLANO: MTE13-OS91173-2010-DW-V-002
COD. PROY. CONTRATISTA: 395CM00660B	Nº DE PLANO CONTRATISTA:		

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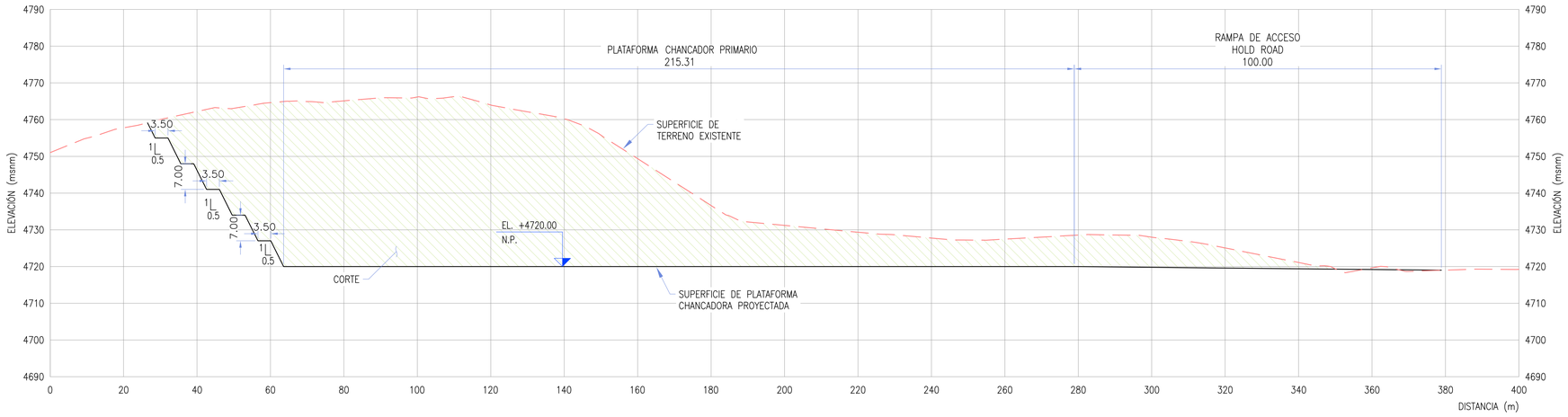
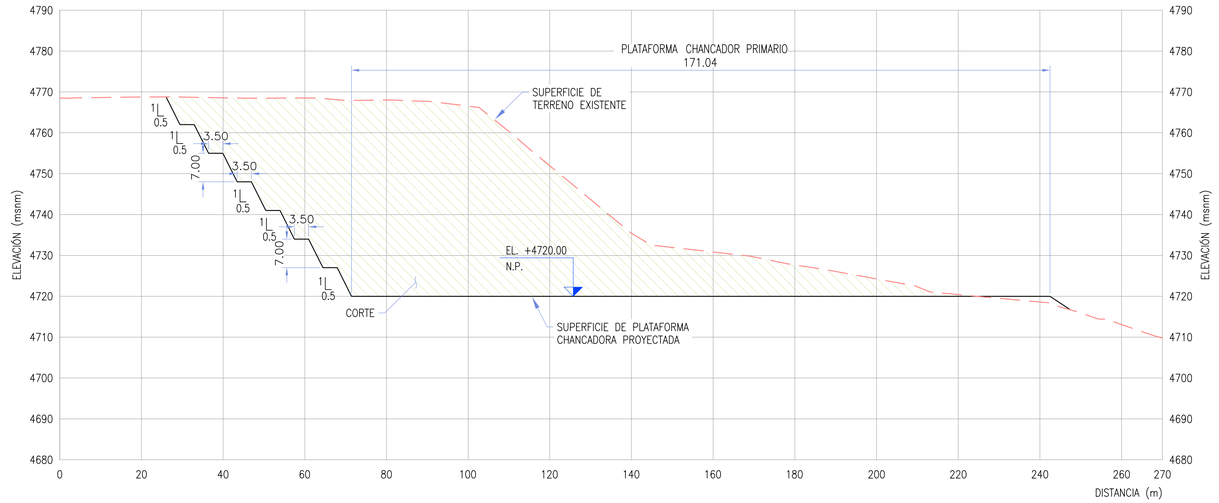
LEYENDA

- SUPERFICIE DE TERRENO NATURAL
- LÍNEA DE PLATAFORMA
- CORTE
- RELLENO
- TERRENO NATURAL



SECCIÓN C
ACCESO Y PLATAFORMA DW-V-001
ESC.: 1/750



SECCIÓN D
ACCESO Y PLATAFORMA DW-V-001
ESC.: 1/750

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

CARMEN ROCIO
VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

REFERENCIAS		
MTE13-OS91173-2010-DW-V-001	PLANTA DE CHANCADO PRIMARIO	
Nº DE PLANO/DOCUMENTO	TITULO	

REVISIONES					
Nº	DESCRIPCION	DIB.	REV.	APR.	FECHA
C	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	J.O.	G.CH.	P.M.	01/04/19
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	J.C.	G.C.	P.M.	29/03/19
A	EMITIDO PARA COORDINACION INTERNA	J.C.	G.C.	P.M.	29/03/19

NOTAS:

1. ESTE PLANO ESTA PRESENTADO EN:
   - SISTEMA DE COORDENADAS: UTM WGS84.
   - SISTEMA DE UNIDADES DIMENSIONES (mm)
     ELEVACIONES (m)
2. EL DIMENSIONAMIENTO DE LOS EQUIPOS SON REFERENCIALES HASTA QUE SE TENGAN LOS PLANOS CERTIFICADOS DE LOS MISMOS.

BISA INGENIERÍA DE PROYECTOS S.A.

MINERA CHINALCO PERÚ S.A.

ESCALA: 1/750	FORMATO: A1	PROYECTO: AMPLIACIÓN PLANTA CONCENTRADORA TOROMOCHO A 170 KTPD	
DIBUJO: J.CAJAHUANCA	FECHA: 29/03/19		
DISEÑO: G.CHAPOÑAN	FECHA: 29/03/19	AREA: 2010 – CHANCADO PRIMARIO	TIPO DE CONTRATO:
REVISADO: B.RODRIGUEZ	FECHA: 29/03/19	TITULO: CHANCADO PRIMARIO SECCIONES 2 DE 2	COD.PROYECTO N°: OS91173
APROBADO: P. MARIN	FECHA: 29/03/19		C
COD. PROY. CONTRATISTA: 395CM00666B	N° DE PLANO CONTRATISTA:		N° DE PLANO: MTE13-OS91173-2010-DW-V-003

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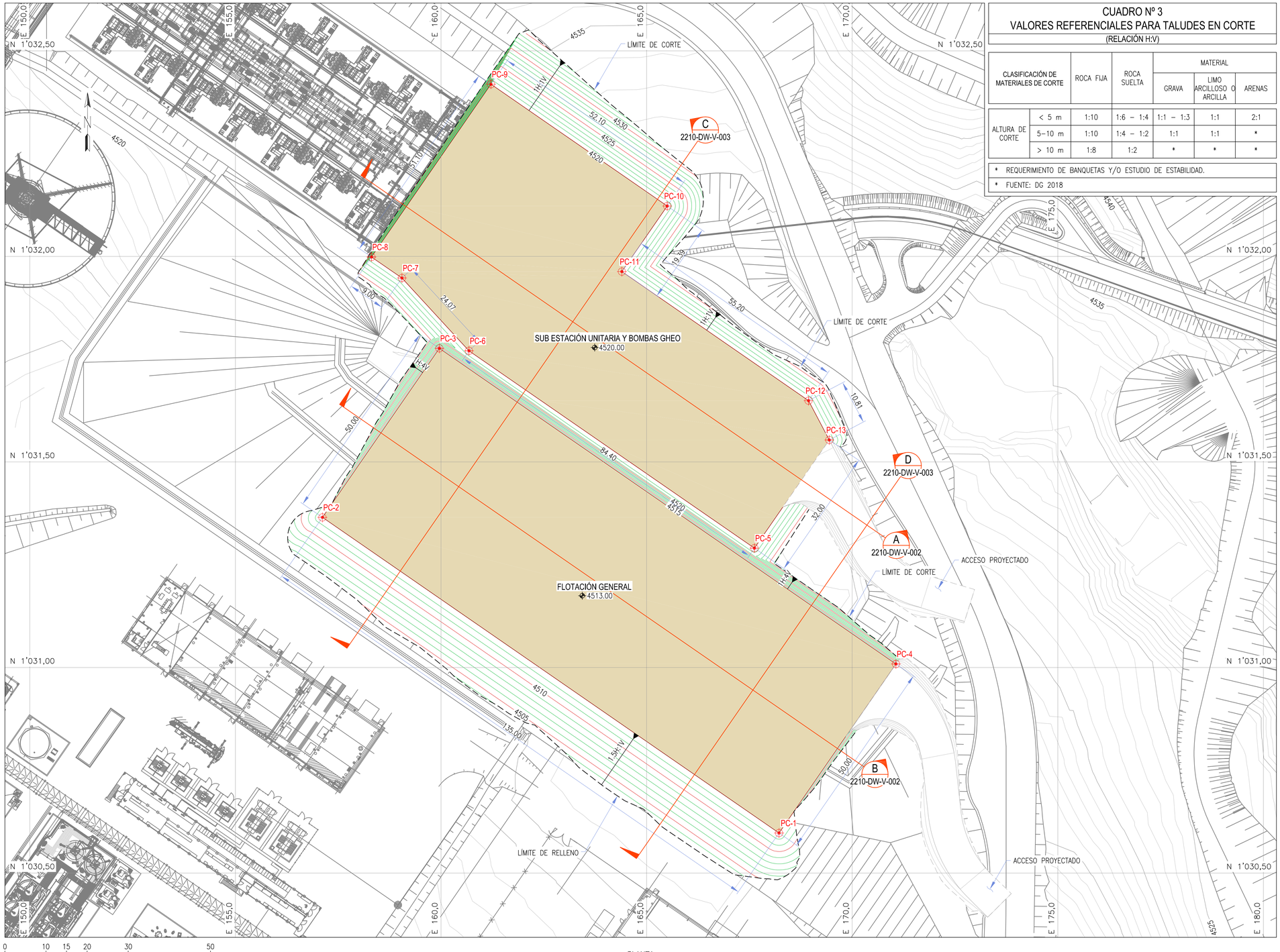
2.
Concentradora



0 10 15 20 30 50

PLANTA
PLATAFORMADOS
ESC.:1/500

CUADRO Nº 3
VALORES REFERENCIALES PARA TALUDES EN CORTE
(RELACIÓN H:V)

CLASIFICACIÓN DE MATERIALES DE CORTE		ROCA FIJA	ROCA SUELTA	MATERIAL		
				GRAVA	LIMO ARCILLOSO O ARCILLA	ARENAS
ALTURA DE CORTE	< 5 m	1:10	1:6 – 1:4	1:1 – 1:3	1:1	2:1
	5–10 m	1:10	1:4 – 1:2	1:1	1:1	*
	> 10 m	1:8	1:2	*	*	*

* REQUERIMIENTO DE BANQUETAS Y/O ESTUDIO DE ESTABILIDAD.

* FUENTE: DG 2018

LEYENDA

4000	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO NATURAL
4000	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO PROYECTADO DE PLATAFORMA
4000	CURVAS DE NIVEL DE LA SUPERFICIE TERRENO PROYECTADO DE LOS ACCESOS
	LÍMITE DE CORTE Y RELLENO
	ACCESO EXISTENTE
	INSTALACIONES EXISTENTES

CUADRO Nº 1
MOVIMIENTO DE TIERRAS - PLATAFORMAS

DESCRIPCIÓN	CORTE (m³)	RELLENO (m³)
FLOTACIÓN GENERAL	50211.50	3232.70
SUB ESTACIÓN UNITARIA	47720.00	0.00

CUADRO N°2
COORDENADAS DE PUNTOS DE REPLANTEO

PUNTOS	NORTE	ESTE	ELEVACIÓN (m.s.n.m.)
PC-1	103059.73	1682.2059	4513.00
PC-2	103136.52	1571.1664	4513.00
PC-3	103177.64	1599.6036	4513.00
PC-4	103100.86	1710.6431	4513.00
PC-5	103129.03	1676.2245	4520.00
PC-6	103177.03	1606.8043	4520.00
PC-7	103194.74	1590.4983	4520.00
PC-8	103199.86	1583.0956	4520.00
PC-9	103241.89	1612.1585	4520.00
PC-10	103212.26	1655.0115	4520.00
PC-11	103196.31	1643.9820	4520.00
PC-12	103164.91	1689.3848	4520.00
PC-13	103155.35	1694.4243	4520.00

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 82425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP N°92191

NOTAS:

1. TODOS LOS DATOS TOPOGRÁFICOS PARA EL REPLANTEO DEBERÁN SER APROBADOS POR EL SUPERVISOR EN CAMPO ANTES DE LA CONSTRUCCIÓN.
2. SI LA TOPOGRAFÍA DEL TERRENO DIFIERE DE LA MOSTRADA EN LOS PLANOS, EL SUPERVISOR DEBERÁ AJUSTAR EL DISEÑO A LAS CONDICIONES EXISTENTES.
3. EL RELLENO SERÁ CONFORMADO CON MATERIAL INDICADO EN LAS ESPECIFICACIONES TÉCNICAS DE MINERA CHINALCO PERÚ.
4. EL RELLENO ESTRUCTURAL COMPACTADO AL 95% DEL PROCTOR MODIFICADO, EN CAPAS DE 0.30M.
5. DEBIDO A QUE NO SE CUENTA CON ESTUDIOS DE SUELOS EN LA ZONA, EL TALUD DE CORTE ES REFERENCIAL, PUDIENDOSE UTILIZAR LOS TALUDES DE CORTE INDICADOS EN EL CUADRO N° 3 DE ACUERDO AL MATERIAL ENCONTRADO EN CAMPO.
6. OBLIGATORIAMENTE DEBERÁN CONSTRUIRSE LOS SISTEMAS DE DRENAJE AL NIVEL DE LA PLATAFORMA.
7. EL CONTRATISTA ES RESPONSABLE POR EL DRENAJE Y CONTROL DEL AGUA SUPERFICIAL Y SUBTERRÁNEA QUE PUDIERA IDENTIFICARSE DURANTE LAS EXCAVACIONES. EL ÁREA DE TRABAJO DEBE MANTENERSE SECO DURANTE LA CONSTRUCCIÓN.
8. DURANTE LA CONSTRUCCIÓN DEBERÁN MONITOREARSE LAS DEFORMACIONES QUE PUDIERA HABER TANTO EN LA LADERA SUPERIOR COMO LOS TALUDES DE CORTE. EL CONTRATISTA Y EL SUPERVISOR SERÁN RESPONSABLES DEL CUMPLIMIENTO DE ESTA ACTIVIDAD. LOS PUNTOS TOPOGRÁFICOS ESTÁN ADECUADAMENTE GEO–REFERENCIADOS.

REFERENCIAS

N° DE PLANO/DOCUMENTO	TITULO
MTE13–0S91173–2210–DW–V–003	PLATAFORMADOS – SECCIONES 2 DE 2
MTE13–0S91173–2210–DW–V–002	PLATAFORMADOS – SECCIONES 1 DE 2

REVISIONES

N°	DESCRIPCION	DIB.	REV.	APR.	FECHA
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	I.C.	G.CH.	P.M.	11/12/18
A	EMITIDO PARA COORDINACION INTERNA	I.C.	G.CH.	P.M.	05/12/18

NOTAS:

1. ESTE PLANO ESTA PRESENTADO EN:
   – SISTEMA DE COORDENADAS: LOCALES (PLANTA)
   – SISTEMA DE UNIDADES DIMENSIONES (mm)
   ELEVACIONES (m)
2. EL DIMENSIONAMIENTO DE LOS EQUIPOS SON REFERENCIALES HASTA QUE SE TENGAN LOS PLANOS CERTIFICADOS DE LOS MISMOS.
3. LA TOPOGRAFÍA FUE ENTREGADA POR MINERA CHINALCO PERÚ, NOVIEMBRE 2018.

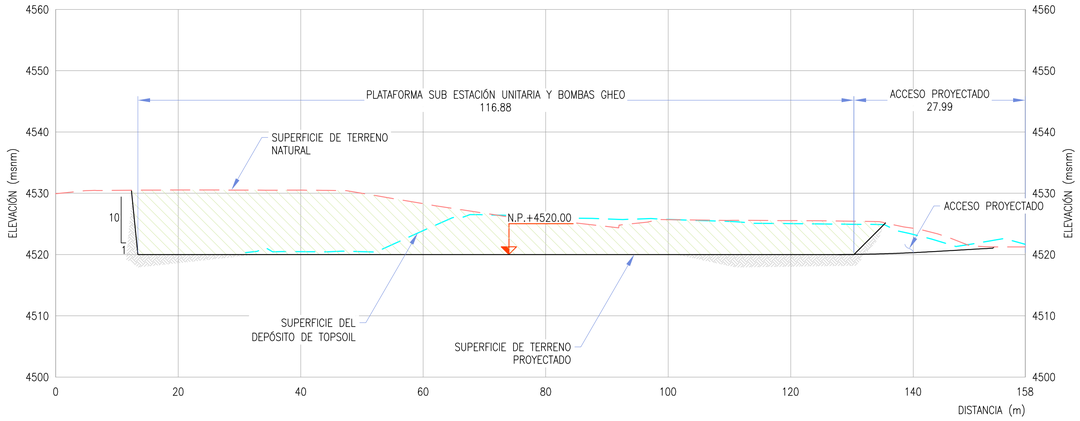
BISA INGENIERÍA DE PROYECTOS S.A.

MINERA CHINALCO PERÚ S.A.

ESCALA: 1/500	FORMATO: A1	PROYECTO: AMPLIACIÓN PLANTA CONCENTRADORA TOROMOCHO A 170 KTPD	
DIBUJO: I. CORDERO	FECHA: 05–12–18		
DISEÑO: G. CHAPOÑAN	FECHA: 05–12–18		
REVISADO: B. RODRIGUEZ	FECHA: 05–12–18		
APROBADO: P. MARIN	FECHA: 05–12–18		
COD. PROY. CONTRATISTA: 395CM0066GB	N° DE PLANO CONTRATISTA:	AREA: 2210 – FLOTACION GENERAL	TIPO DE CONTRATO:
		TITULO: PLATAFORMADOS PLANTA	COD.PROYECTO N°: OS91173
			N° DE PLANO: MTE13–0S91173–2210–DW–V–001

B

P:\VP. CONSTRUCCION\GERENCIA DE CONSTRUCCION\PT – PROJECT\02. Proy Internos MCP\01.– Proyectos



SECCIÓN A
SUB ESTACIÓN UNITARIA 2210-DW-V-001
ESC.: 1/500

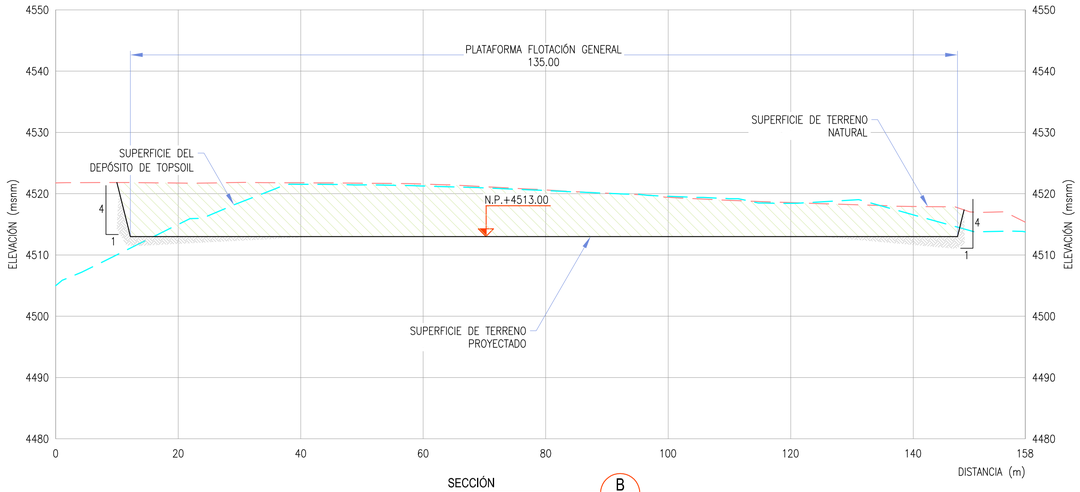
LEYENDA

- SUPERFICIE DE TERRENO NATURAL
- SUPERFICIE DEL DEPÓSITO DE TOPSOIL
- SUPERFICIE DE TERRENO PROYECTADO (LÍNEA DE PLATAFORMA)
- CORTE
- RELLENO ESTRUCTURAL

CUADRO Nº 1
VALORES REFERENCIALES PARA TALUDES EN CORTE
(RELACIÓN H:V)

CLASIFICACIÓN DE MATERIALES DE CORTE		ROCA FIJA	ROCA SUELTA	MATERIAL		
				GRAVA	LIMO ARCILLOSO O ARCILLA	ARENAS
ALTURA DE CORTE	< 5 m	1:10	1:6 – 1:4	1:1 – 1:3	1:1	2:1
	5–10 m	1:10	1:4 – 1:2	1:1	1:1	*
	> 10 m	1:8	1:2	*	*	*

* REQUERIMIENTO DE BANQUETAS Y/O ESTUDIO DE ESTABILIDAD.
* FUENTE: DG 2018



SECCIÓN B
FLOTACIÓN GENERAL 2210-DW-V-001
ESC.: 1/500

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

NOTAS:

1. TODOS LOS DATOS TOPOGRÁFICOS PARA EL REPLANTEO DEBERÁN SER APROBADOS POR EL SUPERVISOR EN CAMPO ANTES DE LA CONSTRUCCIÓN.
2. SI LA TOPOGRAFÍA DEL TERRENO DIFIERE DE LA MOSTRADA EN LOS PLANOS, EL SUPERVISOR DEBERÁ AJUSTAR EL DISEÑO A LAS CONDICIONES EXISTENTES.
3. EL RELLENO SERÁ CONFORMADO CON MATERIAL INDICADO EN LAS ESPECIFICACIONES TÉCNICAS DE MINERA CHINALCO PERÚ.
4. EL RELLENO ESTRUCTURAL COMPACTADO AL 95% DEL PROCTOR MODIFICADO, EN CAPAS DE 0.30M.
5. DEBIDO A QUE NO SE CUENTA CON ESTUDIOS DE SUELOS EN LA ZONA, EL TALUD DE CORTE ES REFERENCIAL, PUDIENDOSE UTILIZAR LOS TALUDES DE CORTE INDICADOS EN EL CUADRO N° 1 DE ACUERDO AL MATERIAL ENCONTRADO EN CAMPO.
6. OBLIGATORIAMENTE DEBERÁN CONSTRUIRSE LOS SISTEMAS DE DRENAJE AL NIVEL DE LA PLATAFORMA.
7. EL CONTRATISTA ES RESPONSABLE POR EL DRENAJE Y CONTROL DEL AGUA SUPERFICIAL Y SUBTERRÁNEA QUE PUDIERA IDENTIFICARSE DURANTE LAS EXCAVACIONES. EL ÁREA DE TRABAJO DEBE MANTENERSE SECO DURANTE LA CONSTRUCCIÓN.
8. DURANTE LA CONSTRUCCIÓN DEBERÁN MONITOREARSE LAS DEFORMACIONES QUE PUDIERA HABER TANTO EN LA LADERA SUPERIOR COMO LOS TALUDES DE CORTE. EL CONTRATISTA Y EL SUPERVISOR SERÁN RESPONSABLES DEL CUMPLIMIENTO DE ESTA ACTIVIDAD. LOS PUNTOS TOPOGRÁFICOS ESTÁN ADECUADAMENTE GEO–REFERENCIADOS.

REFERENCIAS

Nº DE PLANO/DOCUMENTO	TITULO
MTE13-OS91173-2210-DW-V-001	PLATAFORMADOS – PLANTA

REVISIONES

Nº	DESCRIPCION	DIB.	REV.	APR.	FECHA
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	I.C.	G.CH.	P.M.	11/12/18
A	EMITIDO PARA COORDINACION INTERNA	I.C.	G.CH.	P.M.	05/12/18

NOTAS:

1. ESTE PLANO ESTA PRESENTADO EN:
   – SISTEMA DE COORDENADAS: LOCALES (PLANTA)
   – SISTEMA DE UNIDADES DIMENSIONES (mm)
   ELEVACIONES (m)
2. EL DIMENSIONAMIENTO DE LOS EQUIPOS SON REFERENCIALES HASTA QUE SE TENGAN LOS PLANOS CERTIFICADOS DE LOS MISMOS.
3. LA TOPOGRAFÍA FUE ENTREGADA POR MINERA CHINALCO PERÚ, NOVIEMBRE 2018.

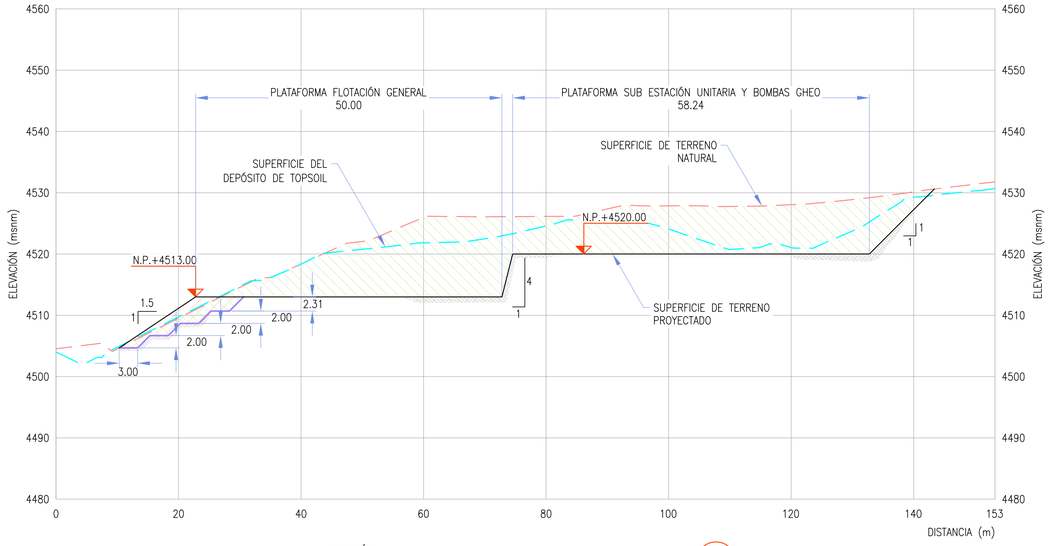
BISA INGENIERÍA DE PROYECTOS S.A.

MINERA CHINALCO PERÚ S.A.

ESCALA: 1/500	FORMATO: A1		
DIBUJO: I. CORDERO	FECHA: 05-12-18		
DISEÑO: G. CHAPOÑAN	FECHA: 05-12-18		
REVISADO: B. RODRIGUEZ	FECHA: 05-12-18		
APROBADO: P. MARIN	FECHA: 05-12-18		
COD. PROY. CONTRATISTA: 395CM0066GB	Nº DE PLANO CONTRATISTA:		

PROYECTO: AMPLIACIÓN PLANTA CONCENTRADORA TOROMOCHO A 170 KTPD
AREA: 2210 – FLOTACION GENERAL
TIPO DE CONTRATO:
TITULO: PLATAFORMADOS
SECCIONES 1 DE 2
COD.PROYECTO Nº: OS91173
Nº DE PLANO: MTE13-OS91173-2210-DW-V-002
B

P:\VP_CONSTRUCCION\GERENCIA DE CONSTRUCCION\PT – PROJECT\02. Proy Internos MCP\01.– Proyectos



SECCIÓN C
PLATAFORMA FLOTACIÓN GENERAL Y SUB ESTACIÓN UNITARIA 2210-DW-V-001
ESC.: 1/500

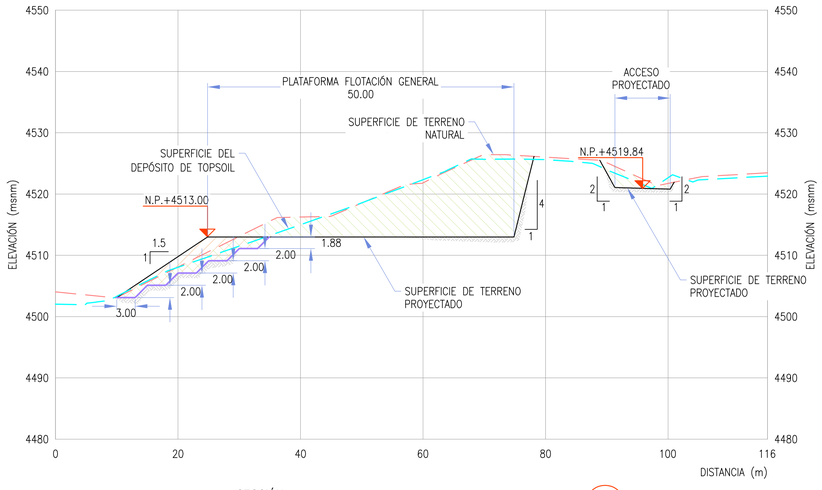
LEYENDA

- SUPERFICIE DE TERRENO NATURAL
- SUPERFICIE DEL DEPÓSITO DE TOPSOIL
- SUPERFICIE DE TERRENO PROYECTADO (LÍNEA DE PLATAFORMA)
- LÍNEA DE EXCAVACIÓN
- CORTE
- RELLENO ESTRUCTURAL

CUADRO N° 1
VALORES REFERENCIALES PARA TALUDES EN CORTE
(RELACIÓN H:V)

CLASIFICACIÓN DE MATERIALES DE CORTE		ROCA FIJA	ROCA SUELTA	MATERIAL		
				GRAVA	LIMO ARCILLOSO O ARCILLA	ARENAS
ALTURA DE CORTE	< 5 m	1:10	1:6 – 1:4	1:1 – 1:3	1:1	2:1
	5–10 m	1:10	1:4 – 1:2	1:1	1:1	*
	> 10 m	1:8	1:2	*	*	*

* REQUERIMIENTO DE BANQUETAS Y/O ESTUDIO DE ESTABILIDAD.
* FUENTE: DG 2018



SECCIÓN D
PLATAFORMA FLOTACIÓN GENERAL Y SUB ESTACIÓN UNITARIA 2210-DW-V-001
ESC.: 1/500

NOTAS:

1. TODOS LOS DATOS TOPOGRÁFICOS PARA EL REPLANTEO DEBERÁN SER APROBADOS POR EL SUPERVISOR EN CAMPO ANTES DE LA CONSTRUCCIÓN.
2. SI LA TOPOGRAFÍA DEL TERRENO DIFIERE DE LA MOSTRADA EN LOS PLANOS, EL SUPERVISOR DEBERÁ AJUSTAR EL DISEÑO A LAS CONDICIONES EXISTENTES.
3. EL RELLENO SERÁ CONFORMADO CON MATERIAL INDICADO EN LAS ESPECIFICACIONES TÉCNICAS DE MINERA CHINALCO PERÚ.
4. EL RELLENO ESTRUCTURAL COMPACTADO AL 95% DEL PROCTOR MODIFICADO, EN CAPAS DE 0.30M.
5. DEBIDO A QUE NO SE CUENTA CON ESTUDIOS DE SUELOS EN LA ZONA, EL TALUD DE CORTE ES REFERENCIAL, PUDIENDOSE UTILIZAR LOS TALUDES DE CORTE INDICADOS EN EL CUADRO N° 1 DE ACUERDO AL MATERIAL ENCONTRADO EN CAMPO.
6. OBLIGATORIAMENTE DEBERÁN CONSTRUIRSE LOS SISTEMAS DE DRENAJE AL NIVEL DE LA PLATAFORMA.
7. EL CONTRATISTA ES RESPONSABLE POR EL DRENAJE Y CONTROL DEL AGUA SUPERFICIAL Y SUBTERRÁNEA QUE PUDIERA IDENTIFICARSE DURANTE LAS EXCAVACIONES. EL ÁREA DE TRABAJO DEBE MANTENERSE SECO DURANTE LA CONSTRUCCIÓN.
8. DURANTE LA CONSTRUCCIÓN DEBERÁN MONITOREARSE LAS DEFORMACIONES QUE PUDIERA HABER TANTO EN LA LADERA SUPERIOR COMO LOS TALUDES DE CORTE. EL CONTRATISTA Y EL SUPERVISOR SERÁN RESPONSABLES DEL CUMPLIMIENTO DE ESTA ACTIVIDAD. LOS PUNTOS TOPOGRÁFICOS ESTÁN ADECUADAMENTE GEO–REFERENCIADOS.

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP N°92191

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 82425

REFERENCIAS

N° DE PLANO/DOCUMENTO	TITULO
MTE13-OS91173-2210-DW-V-001	PLATAFORMADOS – PLANTA

REVISIONES

N°	DESCRIPCION	DIB.	REV.	APR.	FECHA
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	I.C.	G.CH.	P.M.	11/12/18
A	EMITIDO PARA COORDINACION INTERNA	I.C.	G.CH.	P.M.	05/12/18

NOTAS:

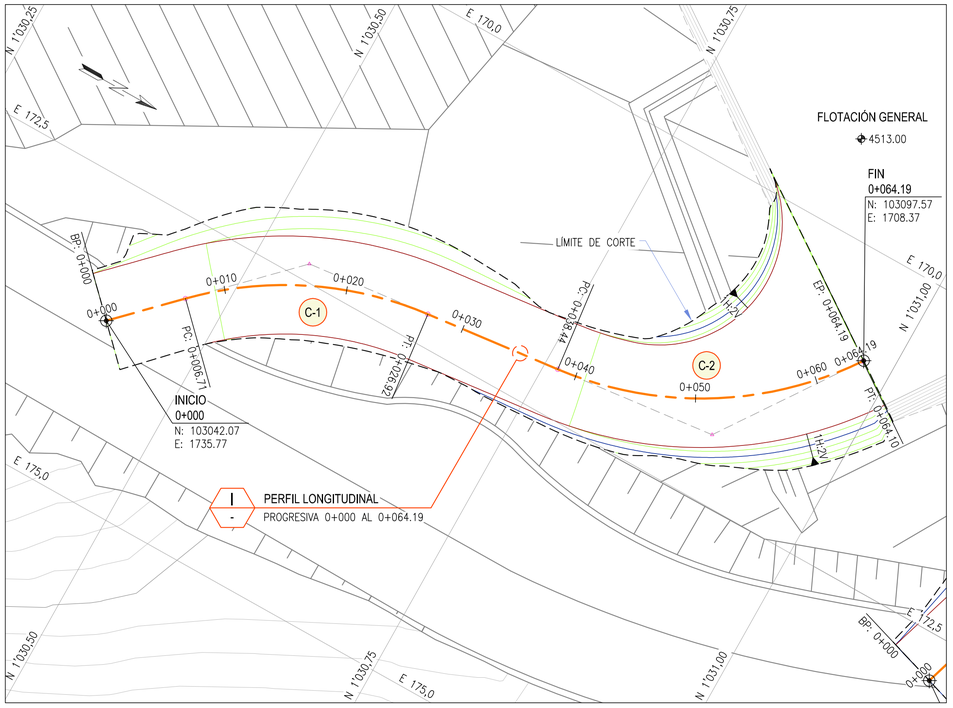
1. ESTE PLANO ESTA PRESENTADO EN:
   –SISTEMA DE COORDENADAS: LOCALES (PLANTA)
   –SISTEMA DE UNIDADES DIMENSIONES (mm)
   ELEVACIONES (m)
2. EL DIMENSIONAMIENTO DE LOS EQUIPOS SON REFERENCIALES HASTA QUE SE TENGAN LOS PLANOS CERTIFICADOS DE LOS MISMOS.
3. LA TOPOGRAFÍA FUE ENTREGADA POR MINERA CHINALCO PERÚ, NOVIEMBRE 2018.

BISA INGENIERÍA DE PROYECTOS S.A.

MINERA CHINALCO PERÚ S.A.

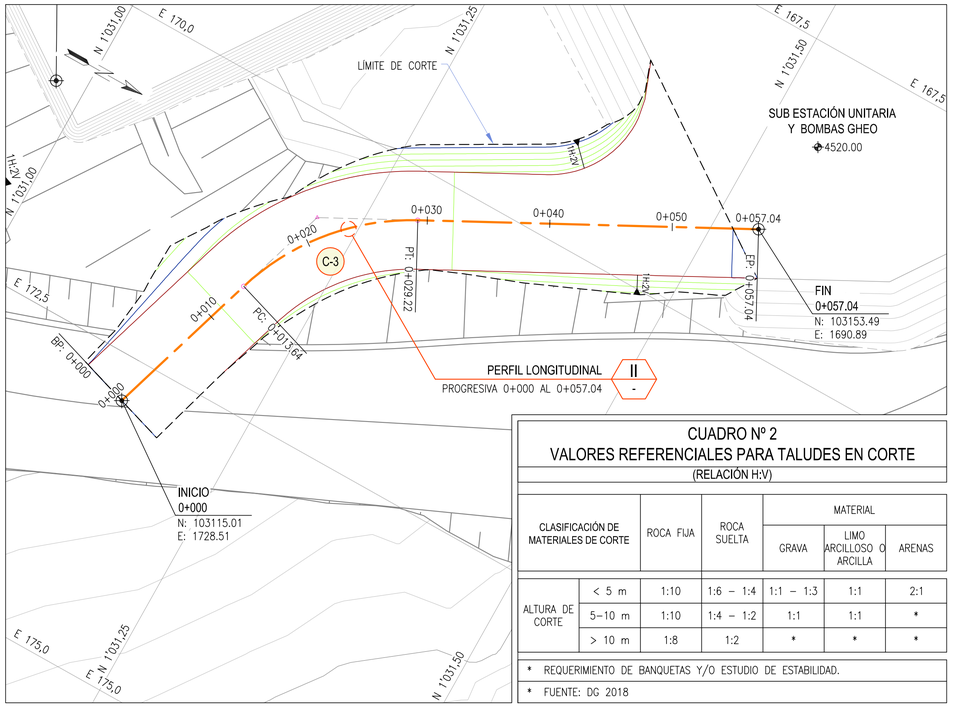
ESCALA: 1/500	FORMATO: A1	PROYECTO: AMPLIACIÓN PLANTA CONCENTRADORA TOROMOCHO A 170 KTPD	
DIBUJO: I. CORDERO	FECHA: 05-12-18		
DISEÑO: G. CHAPOÑAN	FECHA: 05-12-18	AREA: 2210 – FLOTACION GENERAL	TIPO DE CONTRATO:
REVISADO: B. RODRIGUEZ	FECHA: 05-12-18	TITULO: PLATAFORMADOS SECCIONES 2 DE 2	COD.PROYECTO N°: OS91173
APROBADO: P. MARIN	FECHA: 05-12-18		N° DE PLANO: MTE13-OS91173-2210-DW-V-003
COD. PROY. CONTRATISTA: 395CM0066GB	N° DE PLANO CONTRATISTA:		B

P:\VP. CONSTRUCCION\GERENCIA DE CONSTRUCCION\PT – PROJECT\02. Proy Internos MCP\01.– Proyectos



PLANTA
ACCESO A FLOTACIÓN GENERAL
ESC.:1/250

0 5 7.5 10 15 25



PLANTA
ACCESO A SUBESTACIÓN UNITARIA Y BOMBAS GHEO
ESC.:1/250

0 5 7.5 10 15 25

CUADRO Nº 2
VALORES REFERENCIALES PARA TALUDES EN CORTE
(RELACIÓN H:V)

CLASIFICACIÓN DE MATERIALES DE CORTE		ROCA FIJA	ROCA SUELTA	MATERIAL		
				GRAVA	LIMO ARCILLOSO O ARCILLA	ARENAS
ALTURA DE CORTE	< 5 m	1:10	1:6 – 1:4	1:1 – 1:3	1:1	2:1
	5–10 m	1:10	1:4 – 1:2	1:1	1:1	*
	> 10 m	1:8	1:2	*	*	*

* REQUERIMIENTO DE BANQUETAS Y/O ESTUDIO DE ESTABILIDAD.

* FUENTE: DG 2018

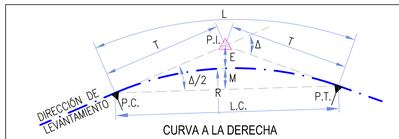
LEYENDA

4000	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO NATURAL
4000	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO PROYECTADO DE PLATAFORMA
4000	CURVAS DE NIVEL DE LA SUPERFICIE TERRENO PROYECTADO DE LOS ACCESOS
	LÍMITE DE CORTE Y RELLENO
	ACCESO EXISTENTE
	EJE DE ACCESO PROYECTADO
	INSTALACIONES EXISTENTES

CUADRO Nº 1
MOVIMIENTO DE TIERRAS - ACCESOS

DESCRIPCIÓN	CORTE (m³)	RELLENO (m³)
FLOTACIÓN GENERAL	1032.00	271.00
SUB ESTACIÓN UNITARIA	727.00	194.00

SIMBOLOGÍA DE CURVA CIRCULAR



CURVA A LA DERECHA

P.C.	=	PUNTO DE INICIO DE LA CURVA	
P.I.	=	PUNTO DE INTERSECCIÓN	
P.T.	=	PUNTO DE TANGENCIA	
E	=	DISTANCIA EXTERNA (m)	T = R tan Δ/2
M	=	DISTANCIA DE LA ORDENADA MEDIA (m)	L.C. = 2R sen Δ/2
R	=	LONGITUD DEL RADIO DE LA CURVA (m)	L = 2π R Δ/360
T	=	LONGITUD DE LA SUBTANGENTE (P.C. A P.I. A P.T.) (m)	M = R [1−cos (Δ/2)]
L	=	LONGITUD DE LA CURVA (m)	E = R [sec (Δ/2) − 1]
L.C.	=	LONGITUD DE LA CUERDA (m)	
Δ	=	ÁNGULO DE DEFLEXIÓN	

COORDENADAS UTM

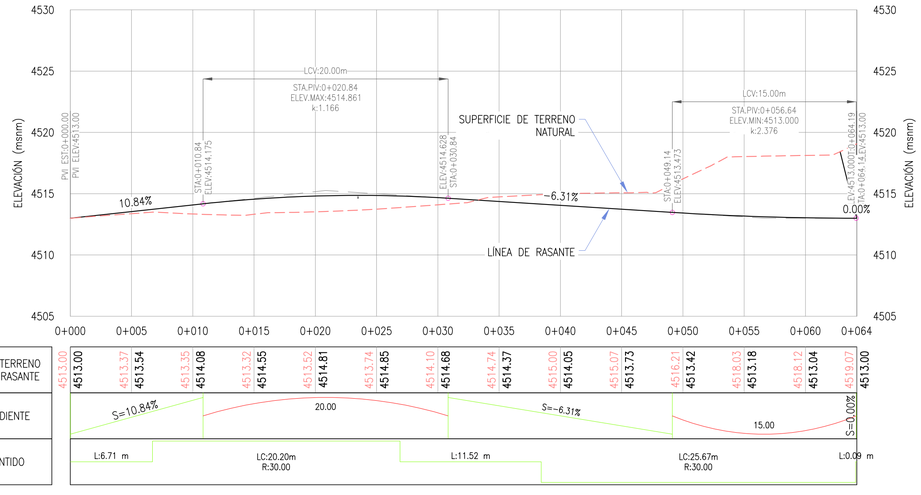
N°	N (PI)	E (PI)	N (PC)	E (PC)	N (PT)	E (PT)
C–1	103054.26	1723.62	103046.82	1731.03	103064.70	1722.46
C–2	103089.74	1719.69	103076.15	1721.20	103097.52	1708.44
C–3	103121.61	1707.68	103119.13	1715.51	103128.87	1703.85

ELEMENTOS DE CURVA

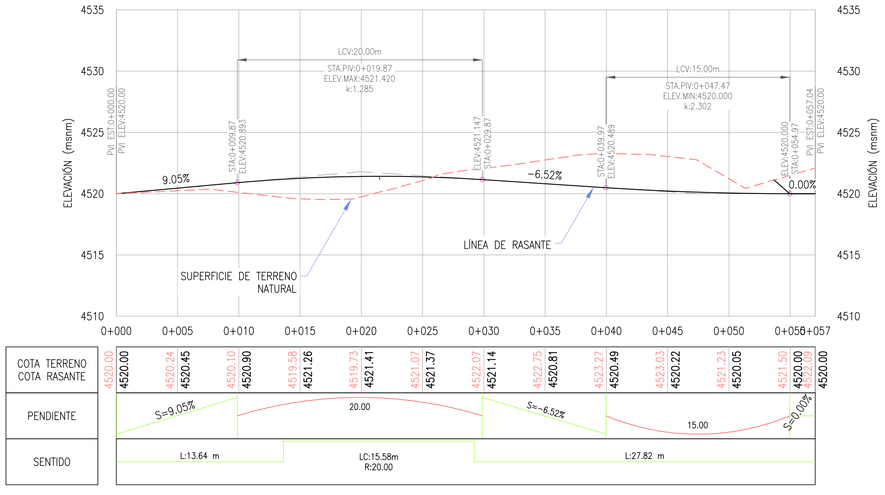
N°	C1 PROG	Δ	T	R	CL
C–1	Km 0+017.22	038°35'03"	10.50	30.00	19.82
C–2	Km 0+052.11	049°01'07"	13.68	30.00	24.89
C–3	Km 0+021.85	044°37'59"	8.21	20.00	15.19

NOTAS:

1. TODOS LOS DATOS TOPOGRÁFICOS PARA EL REPLANTEO DEBERÁN SER APROBADOS POR EL SUPERVISOR EN CAMPO ANTES DE LA CONSTRUCCIÓN.
2. SI LA TOPOGRAFÍA DEL TERRENO DIFIERE DE LA MOSTRADA EN LOS PLANOS, EL SUPERVISOR DEBERÁ AJUSTAR EL DISEÑO A LAS CONDICIONES EXISTENTES.
3. EL RELLENO SERÁ CONFORMADO CON MATERIAL INDICADO EN LAS ESPECIFICACIONES TÉCNICAS DE MINERA CHINALCO PERÚ.
4. EL RELLENO ESTRUCTURAL COMPACTADO AL 95% DEL PROCTOR MODIFICADO, EN CAPAS DE 0.30M.
5. DEBIDO A QUE NO SE CUENTA CON ESTUDIOS DE SUELOS EN LA ZONA, EL TALUD DE CORTE ES REFERENCIAL, PUDIENDOSE UTILIZAR LOS TALUDES DE CORTE INDICADOS EN EL CUADRO N° 2 DE ACUERDO AL MATERIAL ENCONTRADO EN CAMPO.
6. OBLIGATORIAMENTE DEBERÁN CONSTRUIRSE LOS SISTEMAS DE DRENAJE AL NIVEL DE LA PLATAFORMA.
7. EL CONTRATISTA ES RESPONSABLE POR EL DRENAJE Y CONTROL DEL AGUA SUPERFICIAL Y SUBTERRÁNEA QUE PUDIERA IDENTIFICARSE DURANTE LAS EXCAVACIONES. EL ÁREA DE TRABAJO DEBE MANTENERSE SECO DURANTE LA CONSTRUCCIÓN.
8. DURANTE LA CONSTRUCCIÓN DEBERÁN MONITOREARSE LAS DEFORMACIONES QUE PUDIERA HABER TANTO EN LA LADERA SUPERIOR COMO LOS TALUDES DE CORTE. EL CONTRATISTA Y EL SUPERVISOR SERÁN RESPONSABLES DEL CUMPLIMIENTO DE ESTA ACTIVIDAD. LOS PUNTOS TOPOGRÁFICOS ESTÁN ADECUADAMENTE GEO–REFERENCIADOS.



PERFIL LONGITUDINAL
ACCESO A FLOTACIÓN GENERAL
PROGRESIVA 0+000 AL 0+064.19



PERFIL LONGITUDINAL
ACCESO A SUBESTACIÓN UNITARIA Y BOMBAS GHEO
PROGRESIVA 0+000 AL 0+057.04

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP N°92191

BISA INGENIERÍA DE PROYECTOS S.A.

MINERA CHINALCO PERÚ S.A.

REFERENCIAS		
MTE13–OS91173–2210–GA–V–001	DISPOSICIÓN GENERAL – PLANTA	
N° DE PLANO/DOCUMENTO	TITULO	

REVISIONES					
N°	DESCRIPCION	DIB.	REV.	APR.	FECHA
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	I.C.	G.CH.	P.M.	11/12/18
A	EMITIDO PARA COORDINACION INTERNA	I.C.	G.CH.	P.M.	05/12/18

NOTAS:

1. ESTE PLANO ESTA PRESENTADO EN:
   –SISTEMA DE COORDENADAS: LOCALES (PLANTA)
   –SISTEMA DE UNIDADES DIMENSIONES (mm)
   ELEVACIONES (m)
2. EL DIMENSIONAMIENTO DE LOS EQUIPOS SON REFERENCIALES HASTA QUE SE TENGAN LOS PLANOS CERTIFICADOS DE LOS MISMOS.
3. LA TOPOGRAFÍA FUE ENTREGADA POR MINERA CHINALCO PERÚ, NOVIEMBRE 2018.

ESCALA:	1/250	FORMATO:	A1
DIBUJO:	I. CORDERO	FECHA:	05–12–18
DISEÑO:	G. CHAPOÑAN	FECHA:	05–12–18
REVISADO:	B. RODRIGUEZ	FECHA:	05–12–18
APROBADO:	P. MARIN	FECHA:	05–12–18
COD. PROY. CONTRATISTA:	395CM00666B	N° DE PLANO CONTRATISTA:	

PROYECTO: AMPLIACIÓN PLANTA CONCENTRADORA TOROMOCHO A 170 KTPD

AREA: 2210 – FLOTACION GENERAL

TIPO DE CONTRATO:

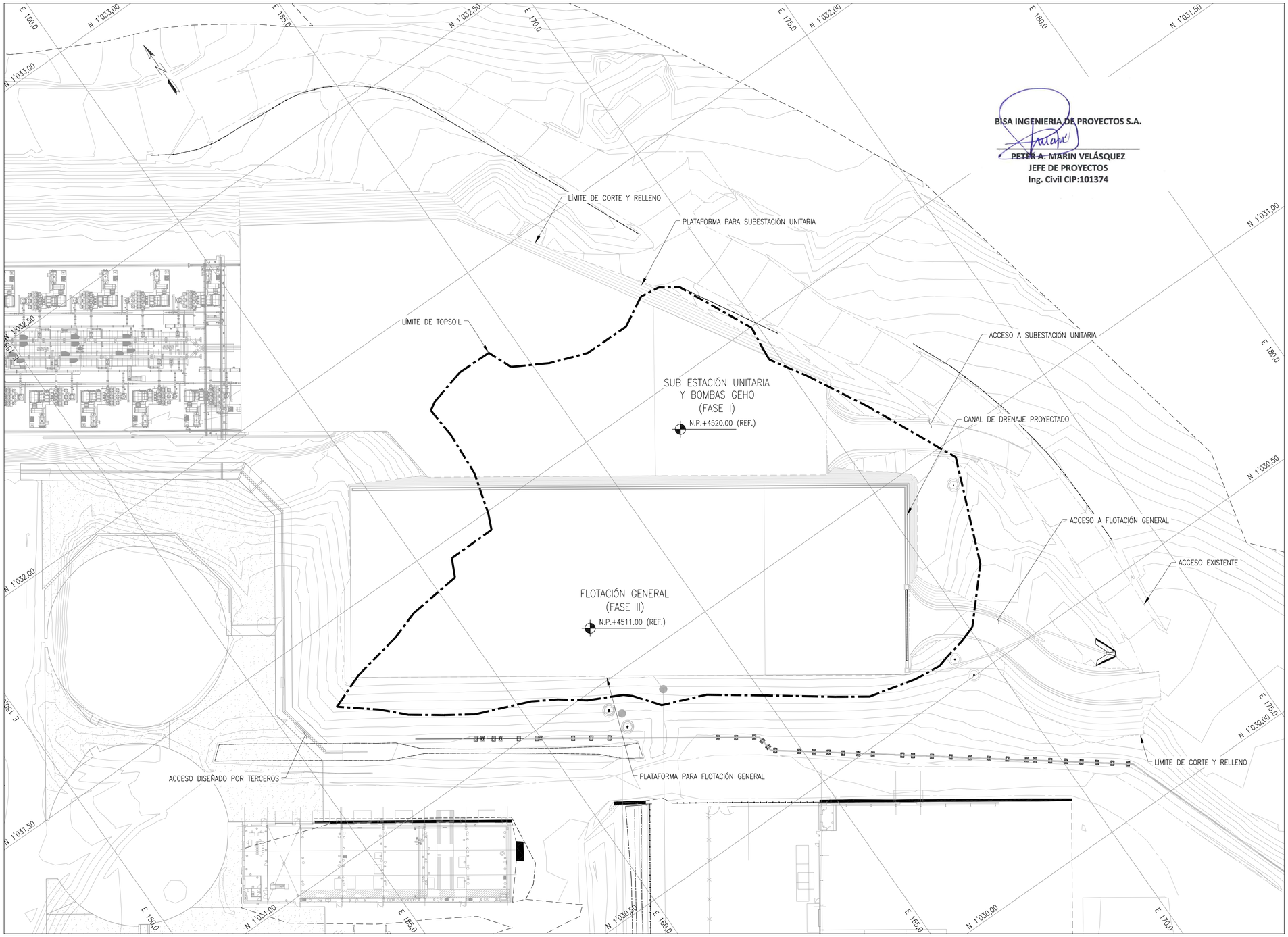
TITULO: ACCESOS
PLANTA Y PERFIL

COD.PROYECTO N°: OS91173

N° DE PLANO: MTE13–OS91173–2210–DW–V–004

B

P:\VP_CONSTRUCCION\GERENCIA DE CONSTRUCCION\PT – PROJECT\02. Proy Internos MCP\01.– Proyectos



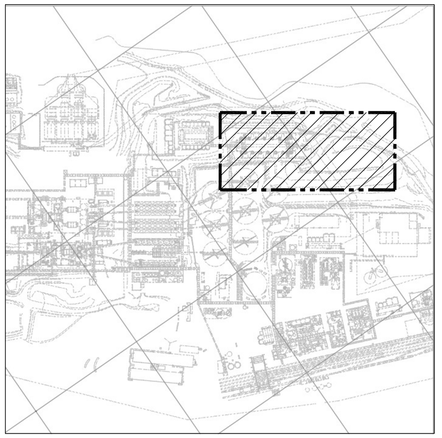
PLANTA

UBICACIÓN DE LOS DEPÓSITOS DE TOPSOIL

ESC.:1/500

BISA INGENIERIA DE PROYECTOS S.A.

PETER A. MARIN VELÁSQUEZ
JEFE DE PROYECTOS
Ing. Civil CIP:101374



PLANO LLAVE

LEYENDA

4000	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO NATURAL
4000	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO PROYECTADO DE PLATAFORMA
4000	CURVAS DE NIVEL DE LA SUPERFICIE TERRENO PROYECTADO DE LOS ACCESOS
	LÍMITE DE CORTE Y RELLENO
	ACCESO EXISTENTE
	INSTALACIONES EXISTENTES
	LÍMITE DE TOPSOIL

MIGUEL ANGEL INFANTES OURJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

NOTAS:

1. TODOS LOS DATOS TOPOGRÁFICOS PARA EL REPLANTEO DEBERÁN SER APROBADOS POR EL SUPERVISOR EN CAMPO ANTES DE LA CONSTRUCCIÓN.
2. SI LA TOPOGRAFÍA DEL TERRENO DIFIERE DE LA MOSTRADA EN LOS PLANOS, EL SUPERVISOR DEBERÁ AJUSTAR EL DISEÑO A LAS CONDICIONES EXISTENTES.

REFERENCIAS

Nº DE PLANO/DOCUMENTO	TITULO

REVISIONES

Nº	DESCRIPCION	DIB.	REV.	APR.	FECHA
0	EMITIDO PARA INFORMACIÓN DEL CLIENTE	J.O.	G.CH.	P.M.	11/04/19
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	J.O.	G.CH.	P.M.	03/04/19
A	EMITIDO PARA COORDINACIÓN INTERNA	J.O.	G.CH.	P.M.	03/04/19

NOTAS GENERALES.–

1. TODAS LAS ELEVACIONES SE MOSTRARÁN EN METROS.
2. LAS UNIDADES DE LOS PLANOS SE ENCUENTRAN EN EL SISTEMA INTERNACIONAL, SALVO OTRA INDICACIÓN.
3. LAS ELEVACIONES ESTÁN REFERIDAS A ALTURAS ORTOMÉTRICAS (msnm).
4. BASE TOPOGRÁFICA PROPORCIONADO POR MINERA CHINALCO PERÚ S.A.
5. LA CUADRÍCULA ESTÁ REPRESENTADA EN EL SISTEMA DE COORDENADAS LOCALES.

BISA INGENIERÍA DE PROYECTOS S.A.

MINERA CHINALCO PERÚ S.A.

ESCALA: INDICADA	FORMATO: A1		
DIBUJO: J. OLAZABAL	FECHA: 03/04/19		
DISEÑO: G. CHAPOÑAN	FECHA: 03/04/19		
REVISADO: B. RODRIGUEZ	FECHA: 03/04/19		
APROBADO: P. MARIN	FECHA: 03/04/19		
COD. PROY. CONTRATISTA: 395CM00666B	Nº DE PLANO CONTRATISTA:		

PROYECTO: Y CELDAS DE FLOTACIÓN

AREA: 2210 – FLOTACIÓN GENERAL

TIPO DE CONTRATO:

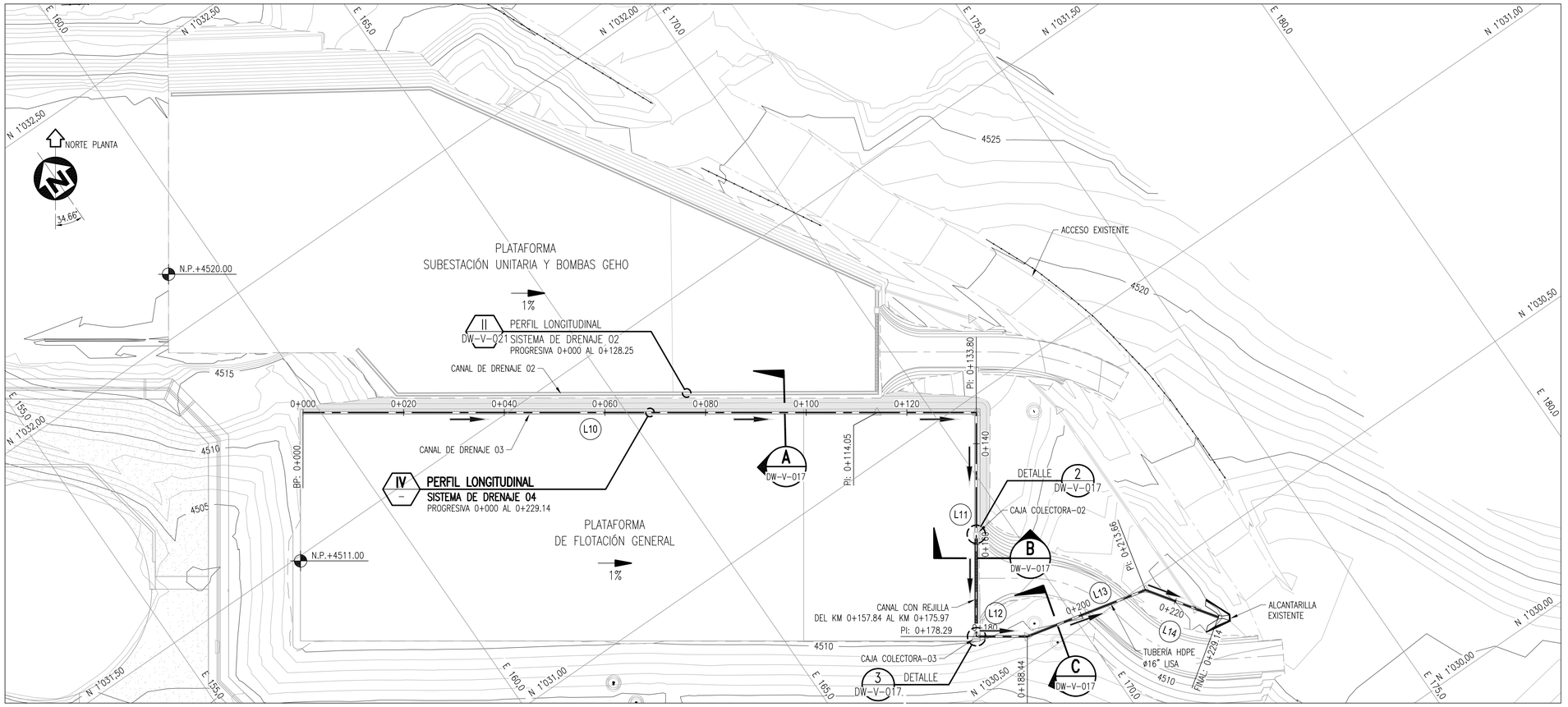
COD.PROYECTO Nº: OS91173

0

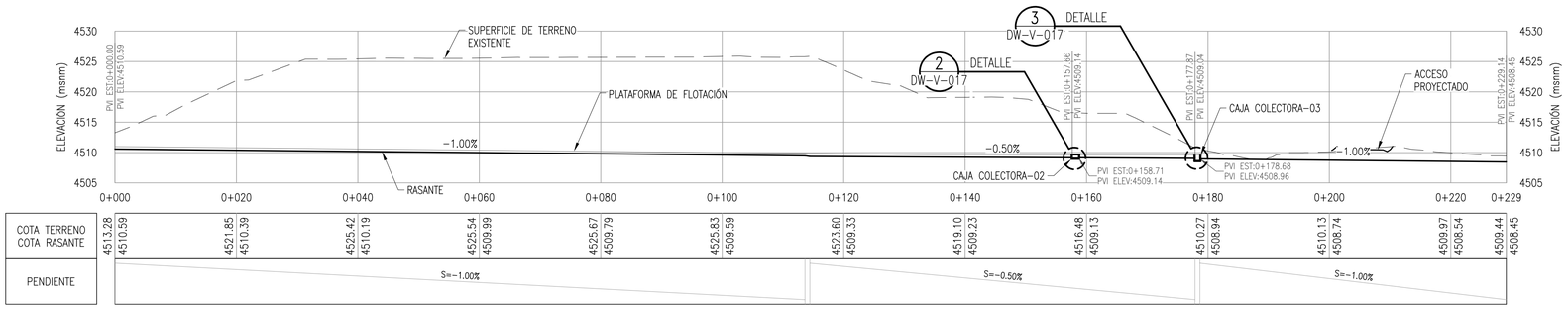
TITULO: UBICACIÓN DE LOS DEPÓSITOS DE TOPSOIL
PLANTA

Nº DE PLANO: MTE13-OS91173-2210-DW-V-005

P:\VP CONSTRUCCION\GERENCIA DE CONSTRUCCION\PT – PROJECT\02. Proy Internos MCP\01.– Proyectos



SISTEMA DE DRENAJES
Esc. 1:500



COTA TERRENO COTA RASANTE	4513.28 4510.59	4521.85 4510.39	4525.42 4510.19	4525.54 4509.99	4525.67 4509.79	4525.83 4509.59	4523.60 4509.33	4519.10 4509.23	4516.48 4509.13	4510.27 4508.94	4510.13 4508.74	4509.97 4508.54	4509.44 4508.45
PENDIENTE	S=−1.00%						S=−0.50%				S=−1.00%		

PERFIL LONGITUDINAL
SISTEMA DE DRENAJE 04 (IV)
PROGRESIVA 0+000 AL 0+229.14
ESC.:1/500

LEYENDA

4140	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO NATURAL
4140	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO PROYECTADO CANAL DE DRENAJE
	LÍMITE DE CORTE Y RELLENO
	SENTIDO DE FLUJO
	SUPERFICIE DE TERRENO NATURAL
	LÍNEA DE RASANTE
	CANAL CON REJILLA
	CAJAS COLECTORAS
	EJE CANAL DE DRENAJE

SISTEMA DE DRENAJE 04 – CUADRO DE DATOS

Elemento	PROGRESIVA Inical	PROGRESIVA Final	Longitud	Azimuth	INICIO	FINAL
L10	0+000	0+114.05	114.05	124° 39' 42.55"	N:103173.12 E:1597.08	N:103108.25 E:1690.90
L11	0+133.80	0+178.29	44.49	214° 39' 45.66"	N:103097.02 E:1707.14	N:103060.42 E:1681.83
L12	0+178.29	0+188.44	10.15	124° 39' 45.66"	N:103060.42 E:1681.83	N:103054.65 E:1690.18
L13	0+188.44	0+213.66	25.22	103° 11' 14.11"	N:103054.65 E:1690.18	N:103048.90 E:1714.73
L14	0+213.66	0+229.14	15.48	145° 07' 21.70"	N:103048.90 E:1714.73	N:103036.20 E:1723.58

BISA INGENIERIA DE PROYECTOS S.A.
PETER A. MARIN VELÁSQUEZ
JEFE DE PROYECTOS
Ing. Civil CIP:101374

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP N°92191

NOTAS.–

1. LA PENDIENTE MÍNIMA PARA EL CANAL DE DRENAJE ES 0.5%.
2. LAS PLATAFORMAS TIENEN UNA PENDIENTE DE 1%.
3. LOS CANALES DE DRENAJE CONVERGEN HACIA LA ALCANTARILLA EXISTENTE.
4. VER PERFILES LONGITUDINALES I, II Y III EN PLANO MTE13-OS91173-2210-DW-V-021

NOTAS GENERALES.–

1. TODAS LAS ELEVACIONES SE MOSTRARÁN EN METROS.
2. LAS UNIDADES DE LOS PLANOS SE ENCUENTRAN EN EL SISTEMA INTERNACIONAL, SALVO OTRA INDICACIÓN.
3. LAS ELEVACIONES ESTÁN REFERIDAS A ALTURAS ORTOMÉTRICAS (msnm).
4. BASE TOPOGRÁFICA PROPORCIONADO POR MINERA CHINALCO PERÚ S.A.
5. LA CUADRÍCULA ESTÁ REPRESENTADA EN EL SISTEMA DE COORDENADAS LOCALES.

REFERENCIAS

Nº DE PLANO/DOCUMENTO	TITULO
MTE13-OS91173-2210-DW-V-021	PLATAFORMADO PARA SUBESTACIÓN UNITARIA Y BOMBAS GEHO SISTEMA DE DRENAJE
MTE13-OS91173-2210-DW-V-017	SISTEMA DE DRENAJE – DETALLES

REVISIONES

Nº	DESCRIPCION	DIB.	REV.	APR.	FECHA
0	EMITIDO PARA CONSTRUCCIÓN	V.C.	G.CH.	P.M.	13/02/19
C	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	V.C.	G.CH.	P.M.	07/02/19
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	I.C.	G.CH.	P.M.	24/01/19
A	EMITIDO PARA COORDINACIÓN INTERNA	I.C.	G.CH.	P.M.	24/01/19

BISA INGENIERÍA DE PROYECTOS S.A.

MINERA CHINALCO PERÚ S.A.

ESCALA: INDICADA	FORMATO: A1		
DIBUJO: I. CORDERO	FECHA: 24/01/19		
DISEÑO: G. CHAPOÑAN	FECHA: 24/01/19		
REVISADO: B. RODRIGUEZ	FECHA: 24/01/19		
APROBADO: P. MARIN	FECHA: 24/01/19		
COD. PROY. CONTRATISTA: 395CM0066GP	Nº DE PLANO CONTRATISTA:		

PROYECTO: INGENIERÍA DE DETALLE PLATAFORMAS PARA BOMBAS GEHO Y CELDAS DE FLOTACIÓN

AREA: 2210 – FLOTACIÓN GENERAL

TIPO DE CONTRATO:

TITULO: SISTEMA DE DRENAJE INTEGRAL – FASE II
PLANTA Y PERFILES LONGITUDINALES

COD.PROYECTO Nº: OS91173

Nº DE PLANO: MTE13-OS91173-2210-DW-V-016

REVISIÓN: 0

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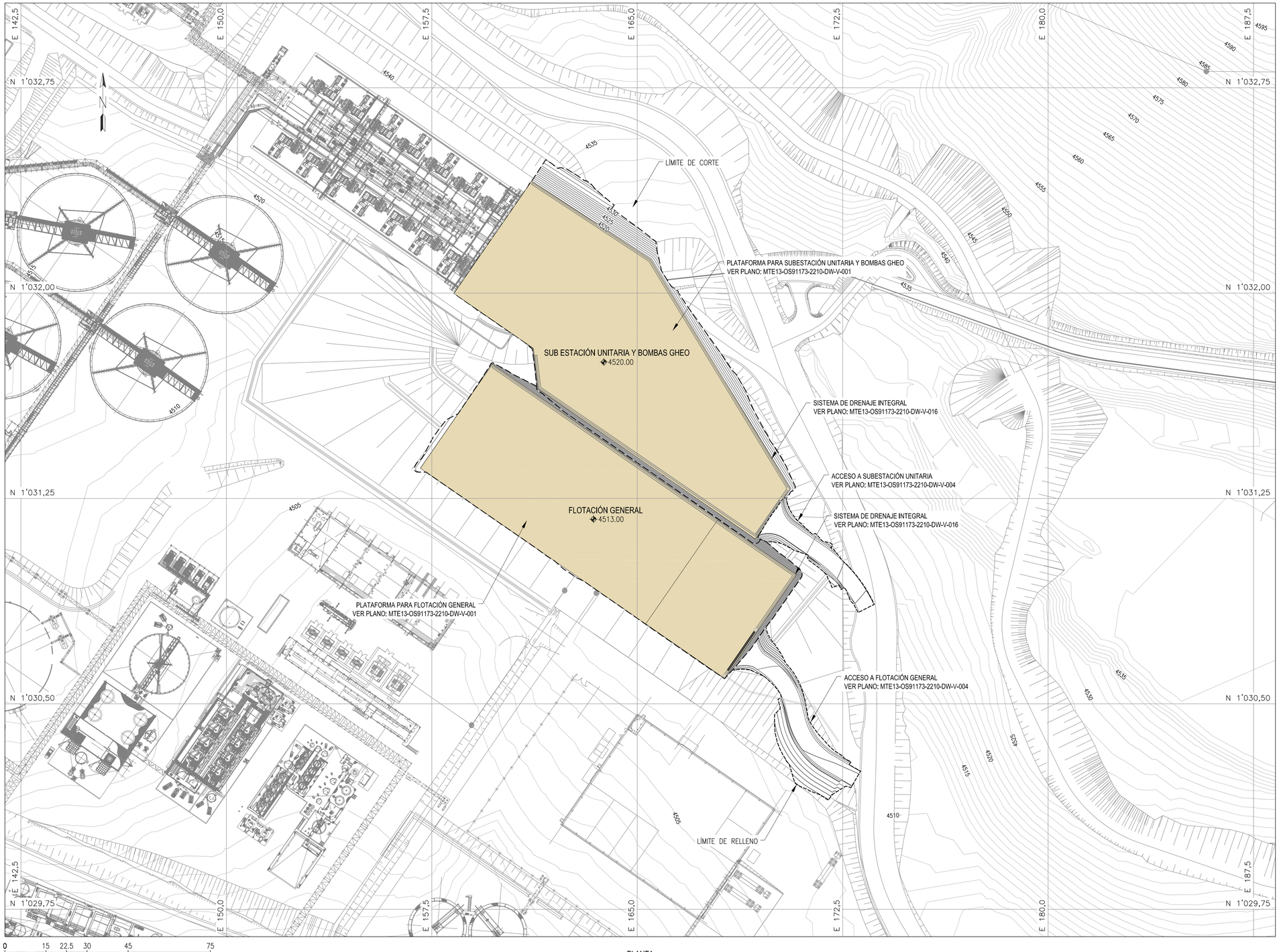
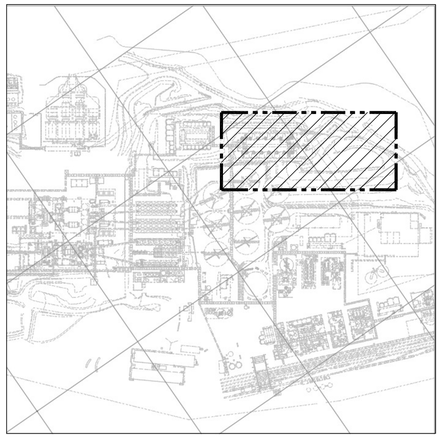


PLANTA
DISPOSICIÓN GENERAL
ESC.:1/750



PLANO LLAVE
ESC.1/50000

LEYENDA

4000	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO NATURAL
4000	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO PROYECTADO DE PLATAFORMA
4000	CURVAS DE NIVEL DE LA SUPERFICIE TERRENO PROYECTADO DE LOS ACCESOS
	LÍMITE DE CORTE Y RELLENO
	ACCESO EXISTENTE
	INSTALACIONES EXISTENTES

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP N°92191

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

NOTAS:

1. TODOS LOS DATOS TOPOGRÁFICOS PARA EL REPLANTEO DEBERÁN SER APROBADOS POR EL SUPERVISOR EN CAMPO ANTES DE LA CONSTRUCCIÓN.
2. SI LA TOPOGRAFÍA DEL TERRENO DIFIERE DE LA MOSTRADA EN LOS PLANOS, EL SUPERVISOR DEBERÁ AJUSTAR EL DISEÑO A LAS CONDICIONES EXISTENTES.

REFERENCIAS		
MTE13-OS91173-2210-DW-V-016	SISTEMA DE DRENAJE INTEGRAL – PLANTA Y PERFILES	
MTE13-OS91173-2210-DW-V-004	ACCESOS – PLANTA Y PERFIL	
MTE13-OS91173-2210-DW-V-001	PLATAFORMADOS – PLANTA	
Nº DE PLANO/DOCUMENTO	TITULO	

REVISIONES						
Nº	DESCRIPCION	DIB.	REV.	APR.	FECHA
0	EMITIDO PARA INFORMACIÓN DEL CLIENTE	J.O.	G.CH.	P.M.	12/04/19
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	I.C.	G.CH.	P.M.	11/12/18
A	EMITIDO PARA COORDINACION INTERNA	I.C.	G.CH.	P.M.	05/12/18

NOTAS:

1. ESTE PLANO ESTA PRESENTADO EN:
   –SISTEMA DE COORDENADAS: LOCALES (PLANTA)
   –SISTEMA DE UNIDADES DIMENSIONES (mm)
   ELEVACIONES (m)
2. EL DIMENSIONAMIENTO DE LOS EQUIPOS SON REFERENCIALES HASTA QUE SE TENGAN LOS PLANOS CERTIFICADOS DE LOS MISMOS.
3. LA TOPOGRAFÍA FUE ENTREGADA POR MINERA CHINALCO PERÚ, NOVIEMBRE 2018.

BISA INGENIERÍA DE PROYECTOS S.A.

MINERA CHINALCO PERÚ S.A.

ESCALA: 1/750	FORMATO: A1		
DIBUJO: I. CORDERO	FECHA: 05-12-18	PROYECTO: AMPLIACIÓN PLANTA CONCENTRADORA TOROMOCHO A 170 KTPD	
DISEÑO: G. CHAPOÑAN	FECHA: 05-12-18		
REVISADO: B. RODRIGUEZ	FECHA: 05-12-18	AREA: 2210 – FLOTACION GENERAL	TIPO DE CONTRATO:
APROBADO: P. MARIN	FECHA: 05-12-18	TITULO: DISPOSICIÓN GENERAL PLANTA	COD.PROYECTO N°: OS91173
COD. PROY. CONTRATISTA: 395CM0066GB	N° DE PLANO CONTRATISTA:		N° DE PLANO: MTE13-OS91173-2210-GA-V-001

0

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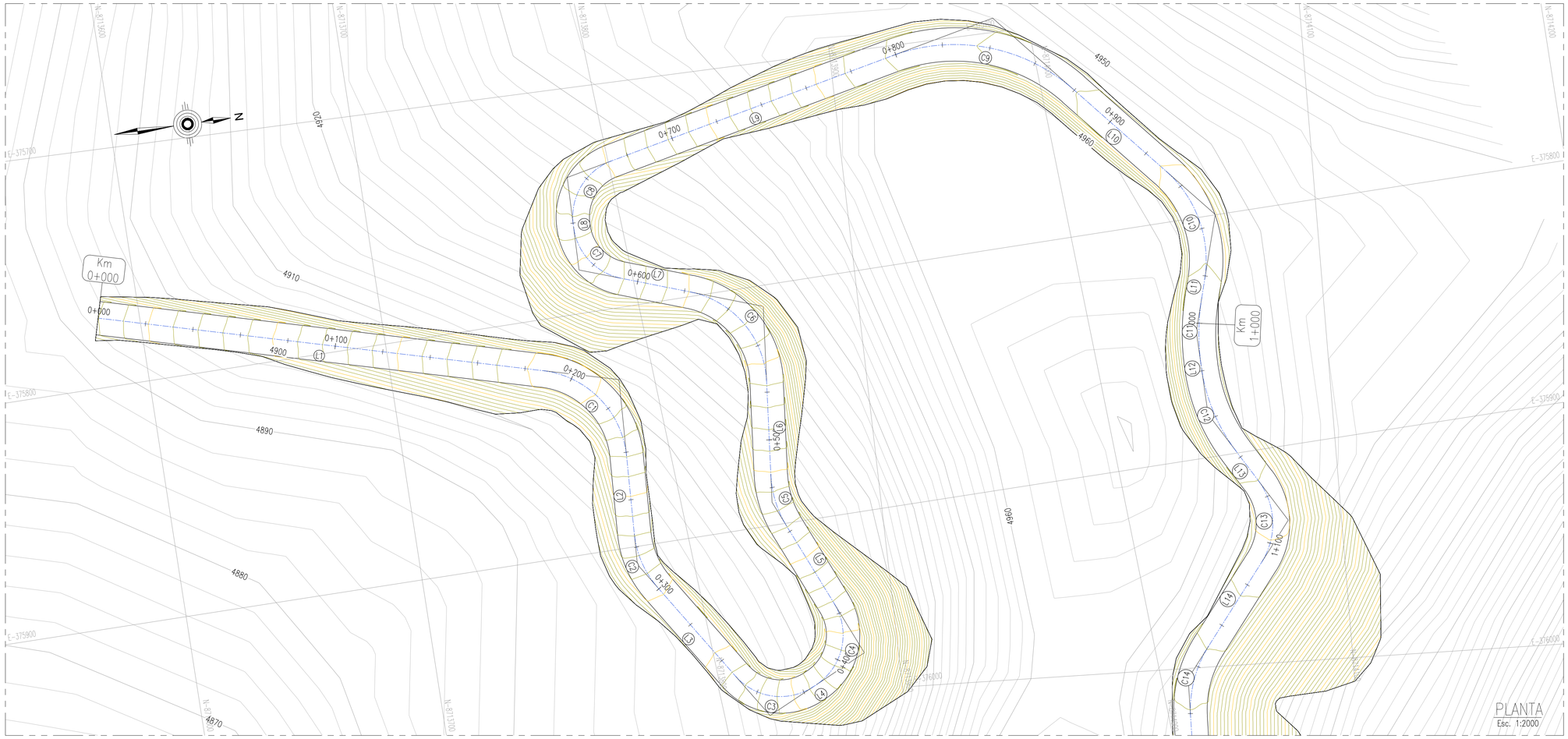
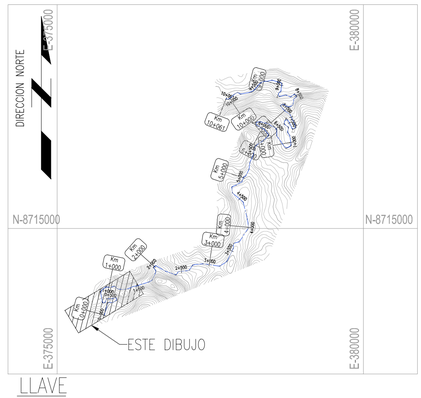
3.
Camino de acceso



PLANTA
Esc. 1:2000



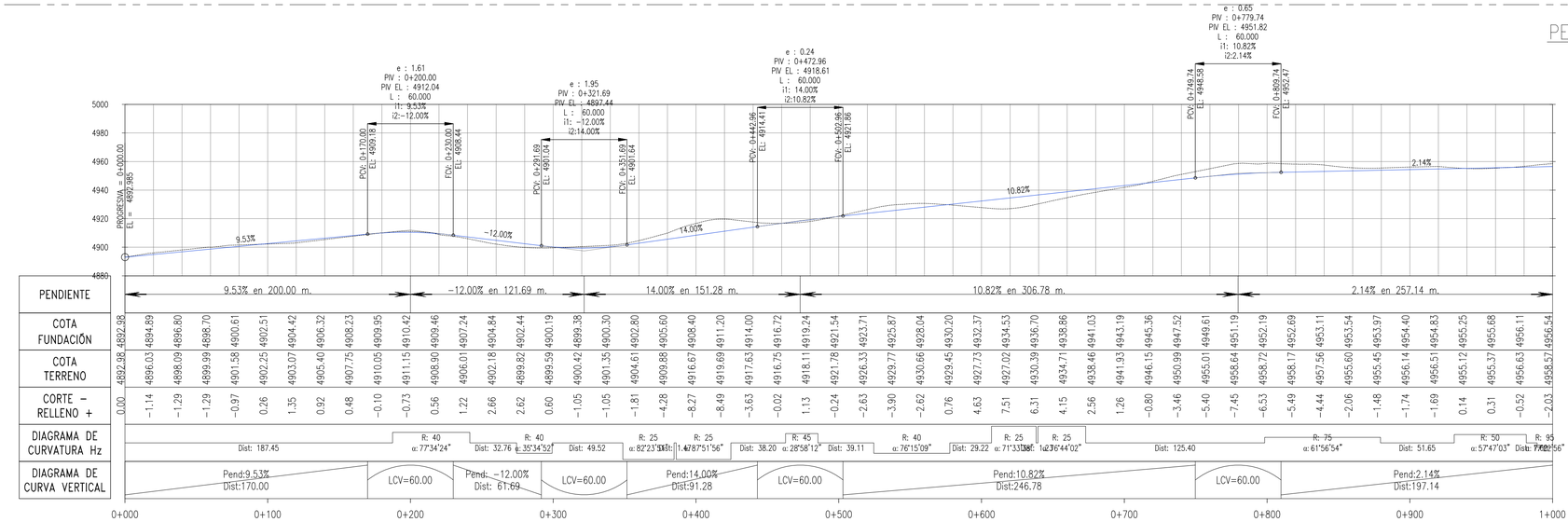
LLAVE
Esc. 1:50000

LEYENDA	
	Curva Mayor C/5.00m
	Curva Menor C/1.00m
	Acceso
	Eje Proyectado

NOTAS:
1.- EL LEVANTAMIENTO TOPOGRAFICO ESTA REFERIDO AL DATUM WGS-84.
2.- ELEVACIONES EN MSNM.
3.- LA EQUIDISTANCIA ENTRE CURVAS DE NIVEL ES DE UN METRO.

0 20 40 60 80 100m
1: 2000—A1 1: 4000—A3
ESCALA GRAFICA

PERFIL LONGITUDINAL
Esc. H 1:2000
Esc. V 1:200

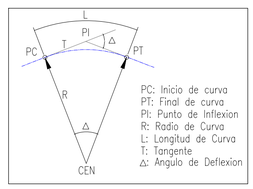


PENDIENTE	9.53% en 200.00 m.		−12.00% en 121.69 m.	14.00% en 151.28 m.	10.82% en 306.78 m.	2.14% en 257.14 m.
COTA FUNDACIÓN	4892.98	4896.03 4894.89 4896.80 4898.09 4898.70 4899.99 4898.70 4900.61 4901.58 4902.25 4902.51 4903.07 4904.42 4905.40 4906.32 4907.75 4908.23 4909.95 4910.05 4909.95	4910.42 4911.15 4908.90 4909.46 4906.01 4907.24 4902.18 4904.84 4902.44 4899.82 4899.59 4900.19 4900.42 4899.38 4900.30 4901.35 4900.80 4902.80 4904.61 4902.80 4905.60 4908.88 4908.40 4906.67 4911.20 4919.69 4914.00 4917.63 4916.72 4916.75 4919.24 4918.11 4921.54 4921.78 4923.71 4926.33 4925.87 4929.77 4928.04 4930.66 4930.20 4928.45 4927.73 4927.37 4934.53 4927.02 4936.70 4930.39 4938.86 4934.71 4941.03 4938.46 4943.19 4941.93 4945.36 4946.15 4950.99 4947.52 4955.01 4949.61 4951.19 4958.64 4952.19 4958.72 4952.69 4958.17 4957.56 4953.11 4955.60 4953.54 4955.45 4953.97 4956.14 4954.40 4956.51 4954.83 4956.12 4955.25 4955.37 4955.68 4956.11 4956.63 4956.54 4958.57 4956.54				
CORTE − RELLENO +	0.00	−1.14 −1.29 −1.29 −0.97 0.26 1.35 0.92 0.48 −0.10 −0.73 0.56 1.22 2.66 2.62 0.60 −1.05 −1.05 −1.81 −4.28 −8.27 −8.49 −3.63 −0.02 1.13 −0.24 −2.63 −3.90 −2.62 0.76 4.63 7.51 6.31 4.15 2.56 1.26 −0.80 −3.46 −5.40 −7.45 −6.53 −5.49 −4.44 −2.06 −1.48 −1.74 −1.69 0.14 0.31 −0.52 −2.03					
DIAGRAMA DE CURVATURA Hz	Dist: 187.45	R: 40 α: 77°34'24"	Dist: 32.76	R: 40 α: 35°34'52"	Dist: 49.52	R: 25 α: 82°23'51" Dist: 11.47 R: 25 α: 87°51'56" Dist: 38.20 R: 45 α: 28°58'12" Dist: 39.11 R: 40 α: 76°15'09" Dist: 29.22 R: 25 α: 71°33'58" R: 25 α: 136°44'02" Dist: 125.40 R: 75 α: 61°56'54" Dist: 51.65 R: 50 α: 57°47'03" Dist: 77.02 R: 95 α: 17°36'56"
DIAGRAMA DE CURVA VERTICAL	Pend:9.53% Dist:170.00	LCV=60.00	Pend: −12.00% Dist: 61.69	LCV=60.00	Pend:14.00% Dist:91.28	LCV=60.00 Pend:10.82% Dist:246.78 LCV=60.00 Pend:2.14% Dist:197.14				
	0+000	0+100	0+200	0+300	0+400	0+500 0+600 0+700 0+800 0+900 1+000				

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 82425

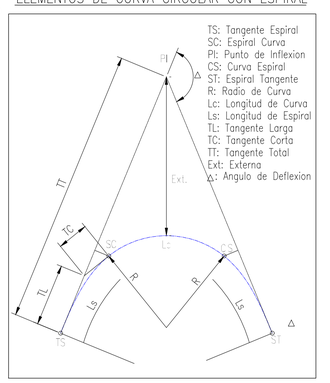
CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

ELEMENTOS DE CURVA CIRCULAR



PC: Inicio de curva
PT: Final de curva
PI: Punto de Inflexion
R: Radio de Curva
L: Longitud de Curva
T: Tangente
Δ: Angulo de Deflexion

ELEMENTOS DE CURVA CIRCULAR CON ESPIRAL



TS: Tangente Espiral
SC: Espiral Curva
PI: Punto de Inflexion
CS: Curva Espiral
ST: Espiral Tangente
R: Radio de Curva
Lc: Longitud de Curva
Ls: Longitud de Espiral
TL: Tangente Larga
TC: Tangente Corta
TT: Tangente Total
Ext: Externa
Δ: Angulo de Deflexion

REVISIONES

	FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS

PLANO NO.	REFERENCIA

EMISIONES

REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
			COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO
CARRETERA TRAMO 1
0+000 − 1+000

PLANO
PLANTA
Y
PERFIL LONGITUDINAL

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

CHINALCO

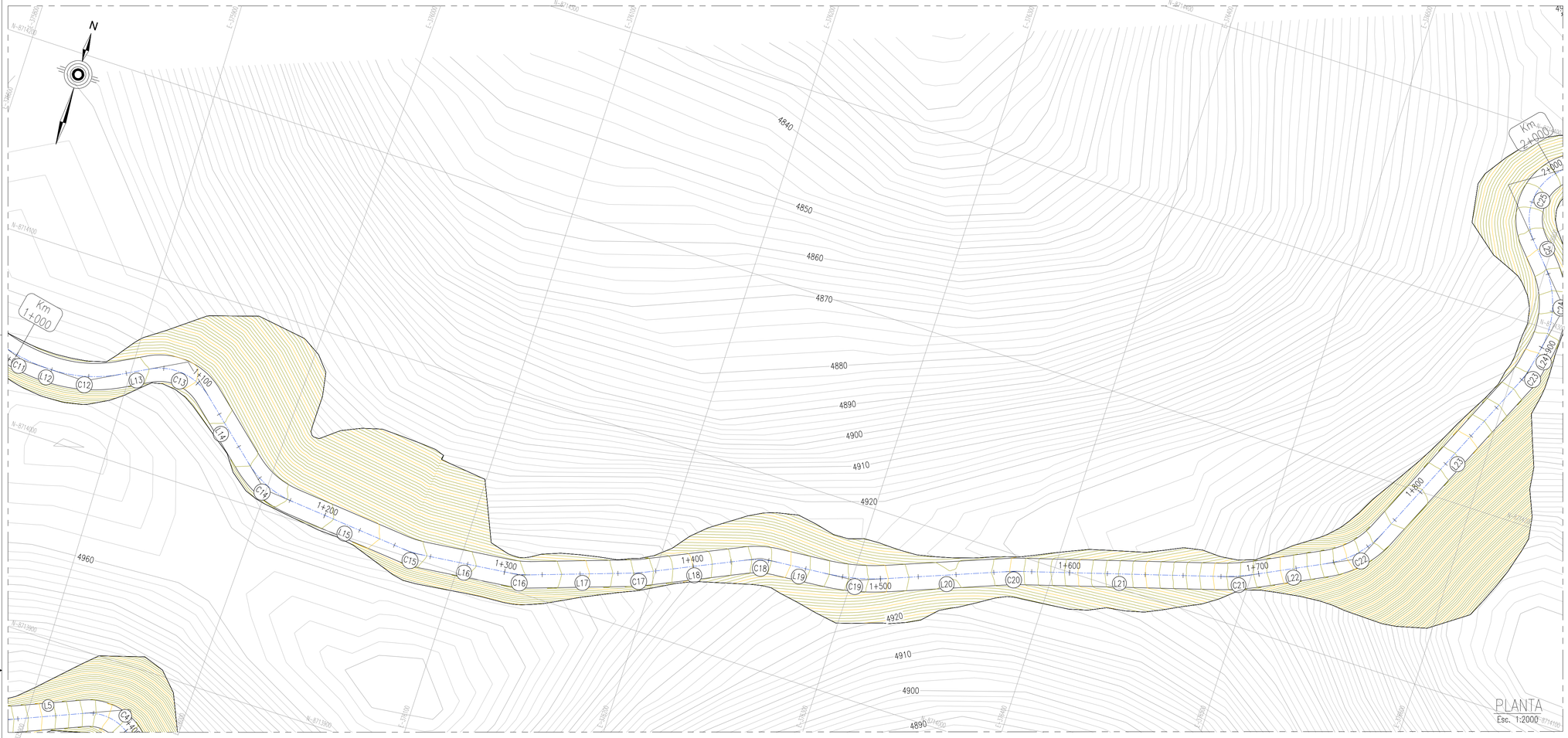
FECHA: Jan 25 / 2019 / 4:01pm

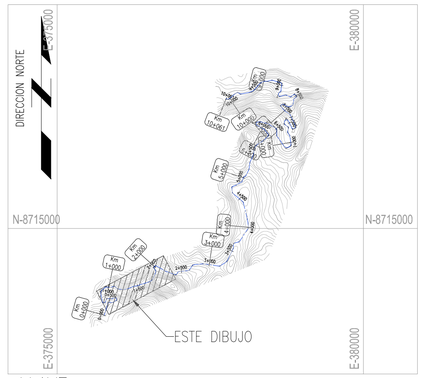
ESCALA METRICA 1:75 1:100 1:50 1:25 1:20

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2018

002985



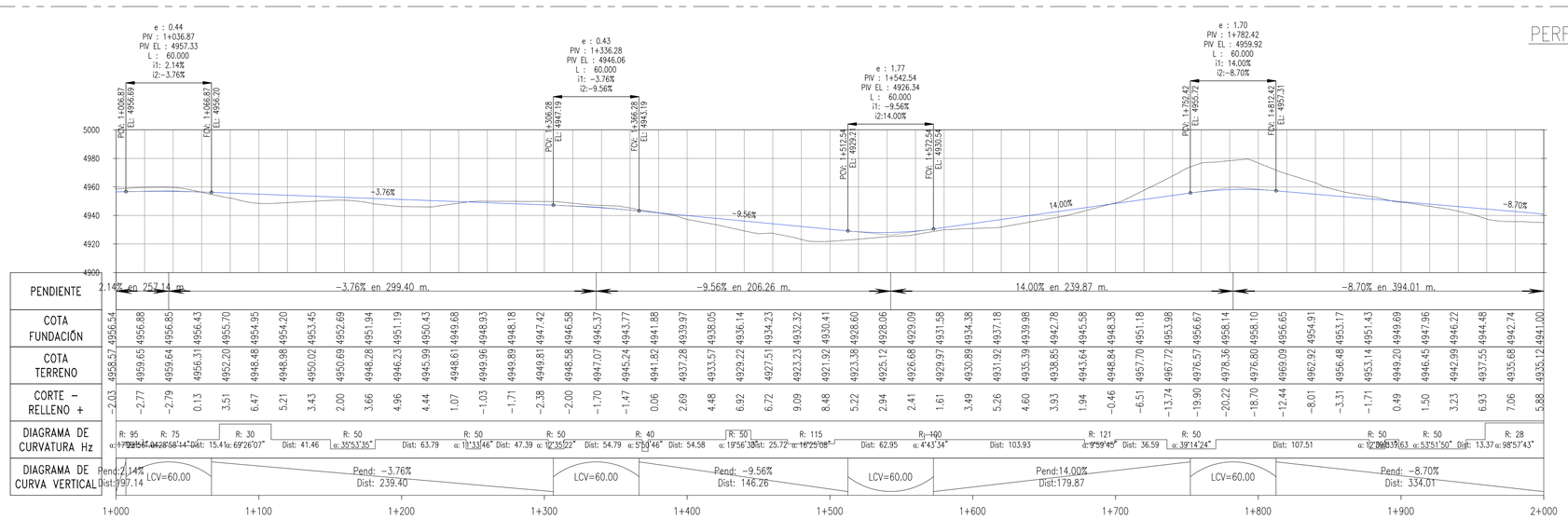


LLAVE
Esc. 1:50000

LEYENDA	
	Curva Mayor C/5.00m
	Curva Menor C/1.00m
	Acceso
	Eje Proyectado

NOTAS:
1.- EL LEVANTAMIENTO TOPOGRAFICO ESTA REFERIDO AL DATUM WGS-84.
2.- ELEVACIONES EN MSNM.
3.- LA EQUIDISTANCIA ENTRE CURVAS DE NIVEL ES DE UN METRO.

0 20 40 60 80 100m
1:2000-A1 1:4000-A3
ESCALA GRAFICA



PERFIL LONGITUDINAL
Esc. H 1:2000
Esc. V 1:200

MIGUEL ANGEL INFANTES QUIJANO
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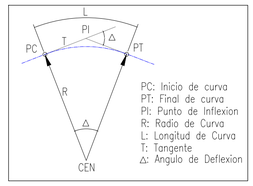
Reg. CIP Nº 62425

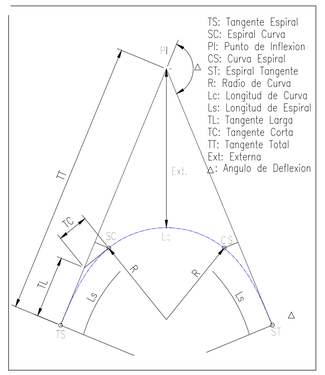
CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

ELEMENTOS DE CURVA CIRCULAR



PC: Inicio de curva
PT: Final de curva
PI: Punto de Inflexion
R: Radio de Curva
L: Longitud de Curva
T: Tangente
Δ: Angulo de Deflexion

ELEMENTOS DE CURVA CIRCULAR CON ESPIRAL



TS: Tangente Espiral
SC: Espiral Curva
PI: Punto de Inflexion
CS: Curva Espiral
ST: Espiral Tangente
R: Radio de Curva
Lc: Longitud de Curva
Ls: Longitud de Espiral
TL: Tangente Larga
TC: Tangente Corta
TT: Tangente Total
Ext: Externa
Δ: Angulo de Deflexion

REVISIONES								REFERENCIAS		
	FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT		PLANO NO.	REFERENCIA
						–				

EMISIONES					
REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS	

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA		
DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO
CARRETERA TRAMO 1
1+000 – 2+000

PLANO
PLANTA
Y
PERFIL LONGITUDINAL

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA: Jan 25 / 2019 / 4:04pm

ESCALA METRICA 1:25 1:100 1:75

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2019

002986

PLANTA
Esc. 1:2000

LLAVE
Esc. 1:50000

LEYENDA	
	Curva Mayor C/5.00m
	Curva Menor C/1.00m
	Acceso
	Eje Proyectado

NOTAS:
1.– EL LEVANTAMIENTO TOPOGRAFICO ESTA REFERIDO AL DATUM WGS–84.
2.– ELEVACIONES EN MSNM.
3.– LA EQUIDISTANCIA ENTRE CURVAS DE NIVEL ES DE UN METRO.

0 20 40 60 80 100m
1:2000–A1 1:4000–A3
ESCALA GRAFICA

PERFIL LONGITUDINAL
Esc. H 1:2000
Esc. V 1:200

PENDIENTE: –8.70% en 394.01 m. | –14.34% en 392.11 m. | –13.27% en 361.34 m. | 2.16% en 247.08 m.

COTA FUNDACIÓN	COTA TERRENO	CORTE – RELLENO +
4941.00	4935.12	5.88
4939.26	4935.92	3.34
4937.52	4935.73	1.79
4935.78	4937.64	–1.86
4934.04	4936.54	–2.50
4932.30	4935.11	–2.81
4930.56	4933.67	–3.10
4928.82	4932.37	–3.54
4927.00	4931.07	–4.07
4924.81	4929.78	–4.96
4922.26	4928.22	–5.96
4919.41	4926.02	–6.61
4916.54	4923.31	–6.77
4913.67	4920.38	–6.71
4910.81	4915.21	–4.40
4907.94	4909.83	–1.89
4905.07	4905.18	–0.11
4902.20	4900.98	1.22
4899.34	4897.20	2.14
4896.47	4896.55	–0.08
4893.60	4891.49	2.12
4890.73	4886.32	4.42
4887.87	4882.00	5.87
4885.00	4879.79	5.21
4882.13	4880.23	1.90
4879.27	4880.71	–1.44
4876.40	4881.19	–4.79
4873.53	4881.17	–7.64
4870.70	4879.21	–8.50
4867.95	4876.30	–8.35
4865.27	4873.40	–8.13
4862.61	4869.04	–6.43
4859.96	4865.22	–5.26
4857.30	4859.84	–2.53
4854.65	4855.86	–1.21
4852.00	4851.21	0.78
4849.34	4847.53	1.81
4846.69	4845.10	1.59
4844.04	4844.55	–0.51
4841.38	4844.77	–3.38
4838.73	4843.95	–5.22
4836.08	4841.62	–5.54
4833.42	4839.29	–5.86
4830.77	4836.75	–5.98
4828.12	4834.01	–5.90
4825.46	4831.97	–6.51
4823.33	4830.32	–6.99
4822.23	4828.38	–6.15
4822.15	4826.34	–4.19
4822.58	4824.36	–1.78
4823.02	4822.35	0.67

DIAGRAMA DE CURVATURA Hz: R: 28 α: 93°57'43" | R: 30 α: 63°26'03" | Dist: 157.61 | R: 120 α: 9°30'24" | Dist: 148.75 | R: 30 α: 76°28'18" | Dist: 29.59 | R: 30 α: 50°45'26" | Dist: 138.54 | R: 50 α: 52°46'57" | Dist: 53.05 | R: 60 α: 52°02'54" | Dist: 127.37 | R: 100 α: 15°07'51" | Dist: 233.92

DIAGRAMA DE CURVA VERTICAL: Pend: –8.70% Dist: 334.01 | LCV=60.00 | Pend: –14.34% Dist: 332.11 | LCV=60.00 | Pend: –13.27% Dist: 301.34 | LCV=60.00 | Pend:2.16% Dist:187.08

2+000 2+100 2+200 2+300 2+400 2+500 2+600 2+700 2+800 2+900 3+000

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP N°92191

ELEMENTOS DE CURVA CIRCULAR

ELEMENTOS DE CURVA CIRCULAR CON ESPIRAL

	FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT
REVISIONES			–	–	–	–	–

PLANO NO.	REFERENCIA
–	–

EMISIONES

REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
			COPIAS		

CONFIDENCIAL
ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA		
DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO
CARRETERA TRAMO 1 2+000 – 3+000

PLANO
PLANTA Y PERFIL LONGITUDINAL

ESCALA: INDICADA | NUMERO PLANO: | REV.: | COD PROYECTO: XX–XX–XXX

CHINALCO

FECHA: Jan 25 / 2019 / 4:06pm

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2018

PLANTA
Esc. 1:2000

LLAVE
Esc. 1:50000

LEYENDA	
	Curva Mayor C/5.00m
	Curva Menor C/1.00m
	Acceso
	Eje Proyectado

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

NOTAS:

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2.- ELEVACIONES EN MSNM.
3.- LA EQUIDISTANCIA ENTRE CURVAS DE NIVEL ES DE UN METRO.

0 20 40 60 80 100m
1:2000–A1 1:4000–A3
ESCALA GRAFICA

PERFIL LONGITUDINAL

Esc. H 1:2000
Esc. V 1:200

PENDIENTE: 2.16% en 247.08 m. | 12.17% en 154.66 m. | -5.39% en 514.79 m. | 1.27% en 199.18 m.

COTA FUNDACIÓN	COTA TERRENO	CORTE – RELLENO +
4823.02	4822.35	0.67
4823.45	4821.50	1.95
4823.88	4822.41	1.47
4824.32	4822.63	1.69
4824.75	4823.19	1.56
4825.18	4825.01	0.17
4825.61	4824.76	0.85
4826.05	4826.12	-0.07
4826.62	4827.95	-1.33
4827.82	4829.20	-1.38
4829.69	4830.89	-1.20
4832.08	4832.77	-0.68
4834.52	4834.98	-0.46
4836.95	4837.31	-0.36
4839.38	4839.65	-0.26
4841.82	4842.91	-1.09
4843.76	4845.10	-1.34
4844.53	4845.71	-1.18
4844.13	4844.69	-0.55
4843.06	4843.43	-0.37
4841.98	4842.13	-0.14
4840.91	4841.30	-0.40
4839.83	4840.48	-0.65
4838.75	4839.93	-1.18
4837.67	4840.12	-2.45
4836.60	4840.25	-3.66
4835.52	4840.38	-4.86
4834.44	4840.48	-6.04
4833.37	4840.01	-6.65
4832.29	4836.54	-4.26
4831.21	4832.99	-1.78
4830.13	4830.20	-0.07
4829.06	4830.87	-1.82
4827.98	4833.03	-5.05
4826.90	4832.03	-5.13
4825.83	4830.67	-4.85
4824.75	4830.19	-5.44
4823.67	4828.48	-4.81
4822.59	4825.88	-3.28
4821.52	4823.40	-1.88
4820.44	4821.54	-1.10
4819.37	4819.66	-0.29
4818.59	4818.12	0.47
4818.26	4818.11	0.15
4818.37	4818.72	-0.35
4818.62	4819.82	-1.19
4818.88	4821.11	-2.23
4819.13	4821.77	-2.64
4819.39	4821.80	-2.41
4819.64	4820.35	-0.71
4819.90	4819.94	-0.05

DIAGRAMA DE CURVATURA Hz:
- Dist: 233.92
- R: 73, α: 41°24'30"
- Dist: 90.15
- R: 85, α: 31°06'22"
- Dist: 198.56
- R: 80, α: 24°09'43"
- Dist: 39.96
- R: 35, α: 73°19'47"
- Dist: 52.88
- R: 50, α: 41°36'17"
- Dist: 233.78
- R: 55, α: 41°33'33"

DIAGRAMA DE CURVA VERTICAL:
- Pend:2.16%, Dist:187.08
- LCV=60.00
- Pend:12.17%, Dist:94.66
- LCV=60.00
- Pend: -5.39%, Dist: 454.79
- LCV=60.00
- Pend:1.27%, Dist:139.18

3+000 3+100 3+200 3+300 3+400 3+500 3+600 3+700 3+800 3+900 4+000

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

ELEMENTOS DE CURVA CIRCULAR

ELEMENTOS DE CURVA CIRCULAR CON ESPIRAL

	FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REVISIONES

PLANO NO.	REFERENCIA
–	–

REFERENCIAS

EMISIONES

REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
			COPIAS		

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RECORD DE INGENIERÍA		
DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1 3+000 – 4+000

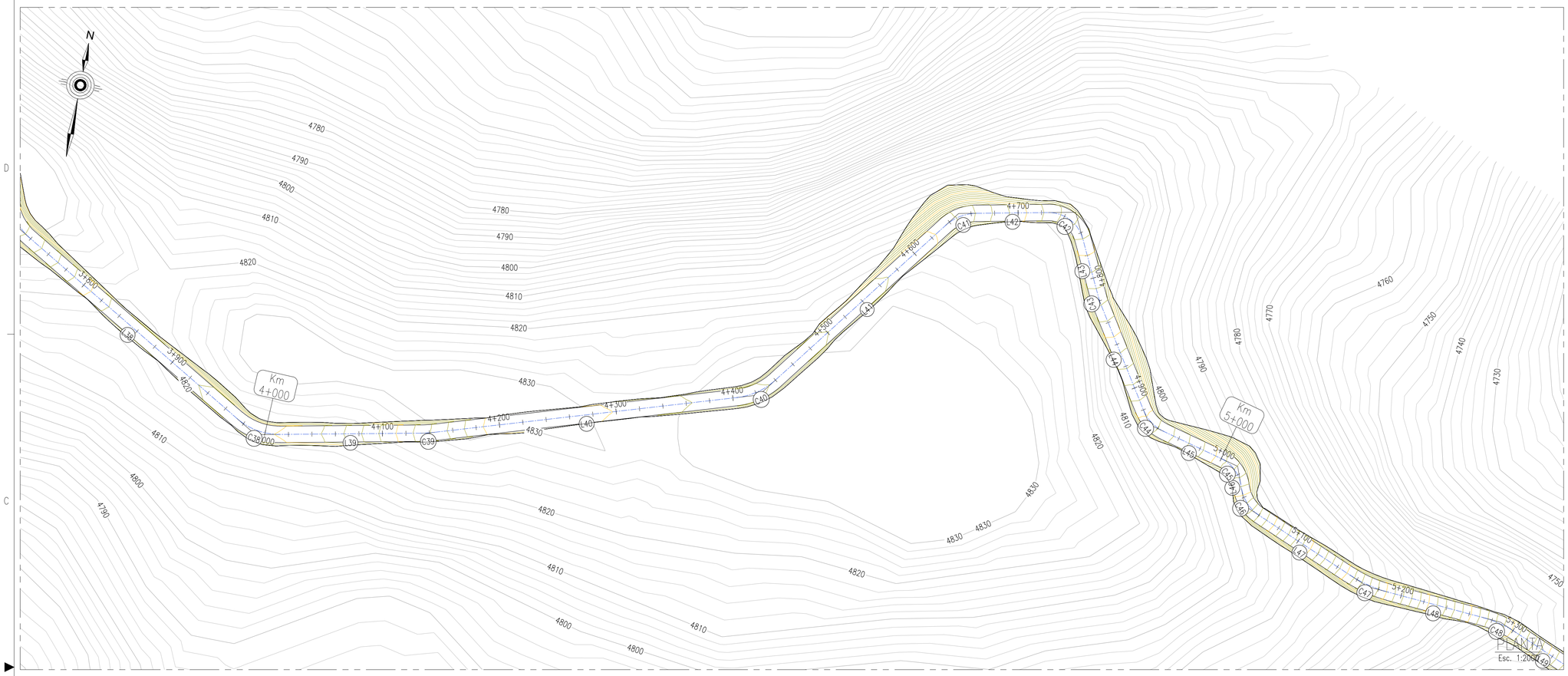
PLANO: PLANTA Y PERFIL LONGITUDINAL

ESCALA: INDICADA | NUMERO PLANO | REV. | COD PROYECTO

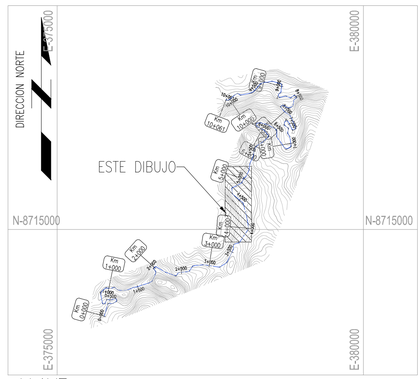
CHINALCO

FECHA: Jan 25 / 2019 / 4:08pm

002988



PLANTA
Esc. 1:2000



LLAVE
Esc. 1:50000

LEYENDA

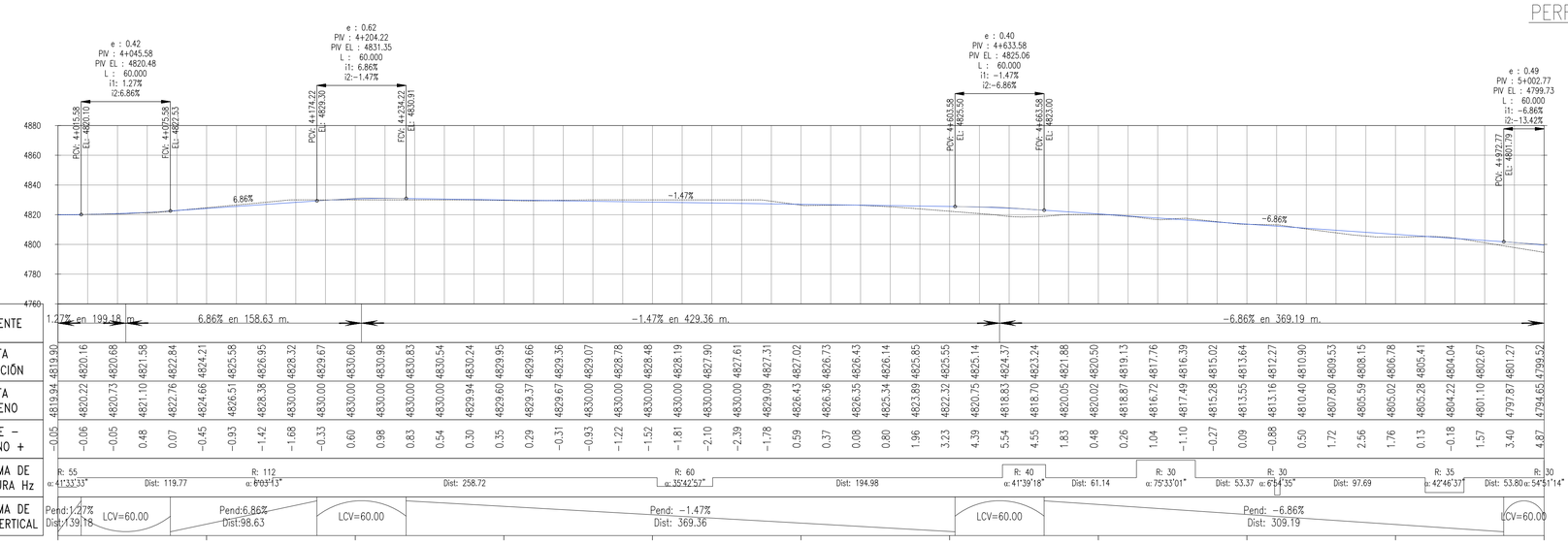
Curva Mayor C/5.00m
Curva Menor C/1.00m
Acceso
Eje Proyectado

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

NOTAS:
1.- EL LEVANTAMIENTO TOPOGRAFICO ESTA REFERIDO AL DATUM WGS-84.
2.- ELEVACIONES EN MSNM.
3.- LA EQUIDISTANCIA ENTRE CURVAS DE NIVEL ES DE UN METRO.

0 20 40 60 80 100m
1:2000–A1 1:4000–A3
ESCALA GRAFICA

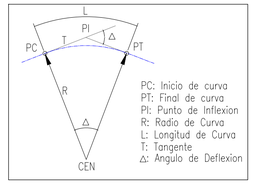
PERFIL LONGITUDINAL
Esc. H 1:2000
Esc. V 1:200



PENDIENTE	1.27% en 199.18 m.	6.86% en 158.63 m.	−1.47% en 429.36 m.	−6.86% en 369.19 m.
COTA FUNDACIÓN	4819.90 4820.16 4820.68 4821.58 4822.84 4824.21 4825.58 4826.95 4828.32 4829.67 4830.60 4830.98 4830.83 4830.54 4830.24 4829.95 4829.66 4829.36 4829.07 4828.78 4828.48 4828.19 4827.90 4827.61 4827.31 4827.02 4826.73 4826.43 4826.14 4825.85 4825.55 4825.14 4824.37 4823.24 4821.88 4820.50 4818.13 4815.02 4813.64 4812.27 4810.90 4809.53 4808.15 4806.78 4805.41 4804.04 4802.67 4801.27 4799.52			
COTA TERRENO	4819.94 4820.22 4820.73 4821.10 4822.76 4824.66 4826.51 4826.38 4826.95 4830.00 4830.00 4830.00 4830.00 4830.00 4830.00 4829.94 4829.60 4829.37 4829.67 4829.36 4830.00 4830.00 4830.00 4830.00 4830.00 4830.00 4830.00 4830.00 4830.00 4830.00 4829.09 4826.43 4826.36 4826.35 4825.34 4823.89 4822.32 4820.75 4818.83 4818.70 4820.05 4820.02 4818.87 4816.72 4817.49 4815.28 4813.55 4813.16 4810.40 4807.80 4805.59 4805.02 4805.28 4804.22 4801.10 4797.87 4794.65			
CORTE − RELLENO +	−0.05 −0.06 −0.05 0.48 0.07 −0.45 −0.93 −1.42 −1.68 −0.33 0.60 0.98 0.83 0.54 0.30 0.35 0.29 −0.31 −0.93 −1.22 −1.52 −1.81 −2.10 −2.39 −1.78 0.59 0.37 0.08 0.80 1.96 3.23 4.39 5.54 4.55 1.83 0.48 0.26 1.04 −1.10 −0.27 0.09 −0.88 0.50 1.72 2.56 1.76 0.13 −0.18 1.57 3.40 4.87			
DIAGRAMA DE CURVATURA Hz	R: 55 α: 41°33'33"	Dist: 119.77	R: 112 α: 6°03'13"	Dist: 258.72 R: 60 α: 35°42'52" Dist: 194.98 R: 40 α: 41°39'18" Dist: 61.14 R: 30 α: 75°33'01" Dist: 53.37 R: 30 α: 67°54'35" Dist: 97.69 R: 35 α: 42°46'37" Dist: 53.80 R: 30 α: 54°51'14"
DIAGRAMA DE CURVA VERTICAL	Pend: 1.27% Dist: 139.18	LCV=60.00	Pend:6.86% Dist:98.63	LCV=60.00 Pend: −1.47% Dist: 369.36 LCV=60.00 Pend: −6.86% Dist: 309.19 LCV=60.00
	4+000	4+100	4+200	4+300 4+400 4+500 4+600 4+700 4+800 4+900 5+000

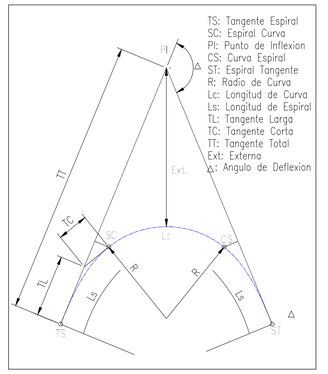
CARMEN ROCIO
VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

ELEMENTOS DE CURVA CIRCULAR



PC: Inicio de curva
PT: Final de curva
PI: Punto de Inflexion
R: Radio de Curva
L: Longitud de Curva
T: Tangente
Δ: Angulo de Deflexion

ELEMENTOS DE CURVA CIRCULAR CON ESPIRAL



TS: Tangente Espiral
SC: Espiral Curva
PI: Punto de Inflexion
CS: Curva Espiral
ST: Espiral Tangente
R: Radio de Curva
Lc: Longitud de Curva
Ls: Longitud de Espiral
TL: Tangente Larga
TC: Tangente Corta
TT: Tangente Total
Ext: Externa
Δ: Angulo de Deflexion

REVISIONES

	FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS

PLANO NO.	REFERENCIA

EMISIONES

REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
			COPIAS		

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RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO
CARRETERA TRAMO 1
4+000 – 5+000

PLANO
PLANTA
Y
PERFIL LONGITUDINAL

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

CHINALCO

FECHA: Jan 25 / 2019 / 4:10pm

ESCALA METRICA 1:100 1:50 1:25 1:75 1:125

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2019

PLANTA
Esc. 1:2000

LLAVE
Esc. 1:50000

LEYENDA
Curva Mayor C/5.00m
Curva Menor C/1.00m
Acceso
Eje Proyectado

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

NOTAS:
1.– EL LEVANTAMIENTO TOPOGRAFICO ESTA REFERIDO AL DATUM WGS–84.
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3.– LA EQUIDISTANCIA ENTRE CURVAS DE NIVEL ES DE UN METRO.

0 20 40 60 80 100m
1:2000–A1 1:4000–A3
ESCALA GRAFICA

PERFIL LONGITUDINAL
Esc. H 1:2000
Esc. V 1:200

PENDIENTE: –4.44% en 254.25 m. | –10.32% en 421.47 m. | –7.59% en 418.75 m. | –8.55% en 221.73 m.

COTA FUNDACIÓN	COTA TERRENO	CORTE – RELLENO +
4711.04	4711.33	–0.28
4710.15	4710.68	–0.53
4709.27	4709.52	–0.26
4708.37	4708.55	–0.18
4707.21	4707.82	–0.60
4705.66	4707.84	–2.18
4703.72	4704.77	–1.04
4701.66	4697.95	3.71
4699.59	4692.22	7.37
4697.53	4691.44	6.09
4695.47	4691.02	4.45
4693.40	4691.62	1.78
4691.34	4691.52	–0.18
4689.27	4690.87	–1.59
4687.21	4688.64	–1.43
4685.15	4685.82	–0.67
4683.08	4682.98	0.10
4681.02	4679.80	1.22
4678.95	4677.80	1.15
4676.89	4675.77	1.12
4674.83	4673.79	1.04
4672.76	4672.58	0.19
4670.70	4671.86	–1.16
4668.63	4671.14	–2.51
4666.57	4668.61	–2.04
4664.62	4664.79	–0.17
4662.85	4663.01	–0.16
4661.26	4663.11	–1.85
4659.74	4663.78	–4.04
4658.22	4664.45	–6.23
4656.71	4665.17	–8.47
4655.19	4662.35	–7.17
4653.67	4659.11	–5.44
4652.15	4655.17	–3.02
4650.63	4651.22	–0.59
4649.11	4649.13	–0.02
4647.59	4647.20	0.39
4646.07	4645.29	0.78
4644.56	4644.18	0.38
4643.04	4642.98	0.05
4641.52	4641.61	–0.09
4640.00	4640.79	–0.79
4638.48	4639.12	–0.64
4636.96	4637.97	–1.00
4635.44	4636.54	–1.10
4633.92	4636.04	–2.12
4632.36	4635.77	–3.41
4630.73	4634.56	–3.83
4629.05	4632.81	–3.76
4627.34	4630.65	–3.31
4625.63	4627.59	–1.97

DIAGRAMA DE CURVATURA Hz: Dist: 128.07 | R: 30 α: 143°59'52" | Dist: 27.90 | R: 40 α: 22°51'31" | Dist: 110.22 | R: 100 α: 15°27'26" | Dist: 136.68 | R: 40 α: 62°29'45" | Dist: 65.32 | R: 65 α: 39°12'28" | Dist: 95.96 | R: 30 α: 3°09'32" | Dist: 76.17 | R: 65 α: 83°29'32" | Dist: 0.13 | R: 65 α: 72°16'06" | Dist: 113.96

DIAGRAMA DE CURVA VERTICAL: Pend: –4.44% Dist: 194.25 | LCV=60.00 | Pend: –10.32% Dist: 361.47 | LCV=60.00 | Pend: –7.59% Dist: 358.75 | LCV=60.00 | Pend: –8.55% Dist: 161.73

6+000 6+100 6+200 6+300 6+400 6+500 6+600 6+700 6+800 6+900 7+000

CARMEN ROCIO
VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

ELEMENTOS DE CURVA CIRCULAR

ELEMENTOS DE CURVA CIRCULAR CON ESPIRAL

FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REVISIONES

PLANO NO.	REFERENCIA

REFERENCIAS

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			COPIAS		

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RECORD DE INGENIERÍA		
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DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1 6+000 – 7+000

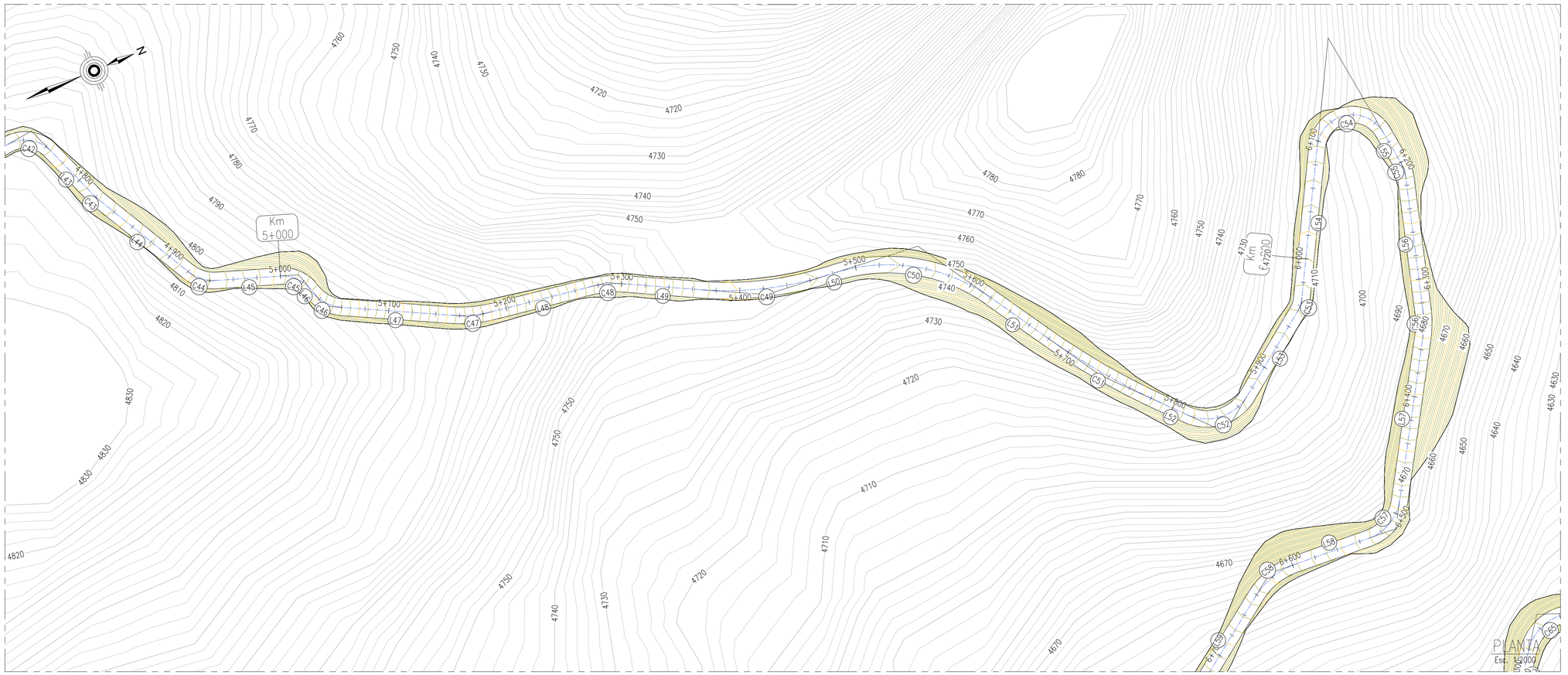
PLANO: PLANTA Y PERFIL LONGITUDINAL

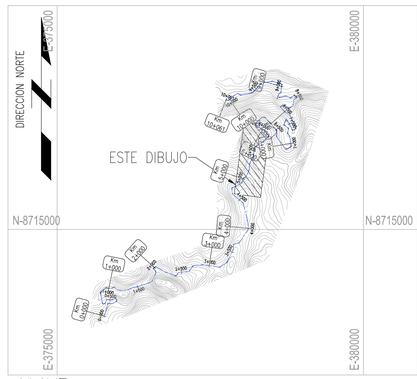
ESCALA: INDICADA | NUMERO PLANO | REV. | COD PROYECTO

CHINALCO

FECHA: Jan 25 / 2019 / 4:12pm

002990





LLAVE
Esc. 1:50000

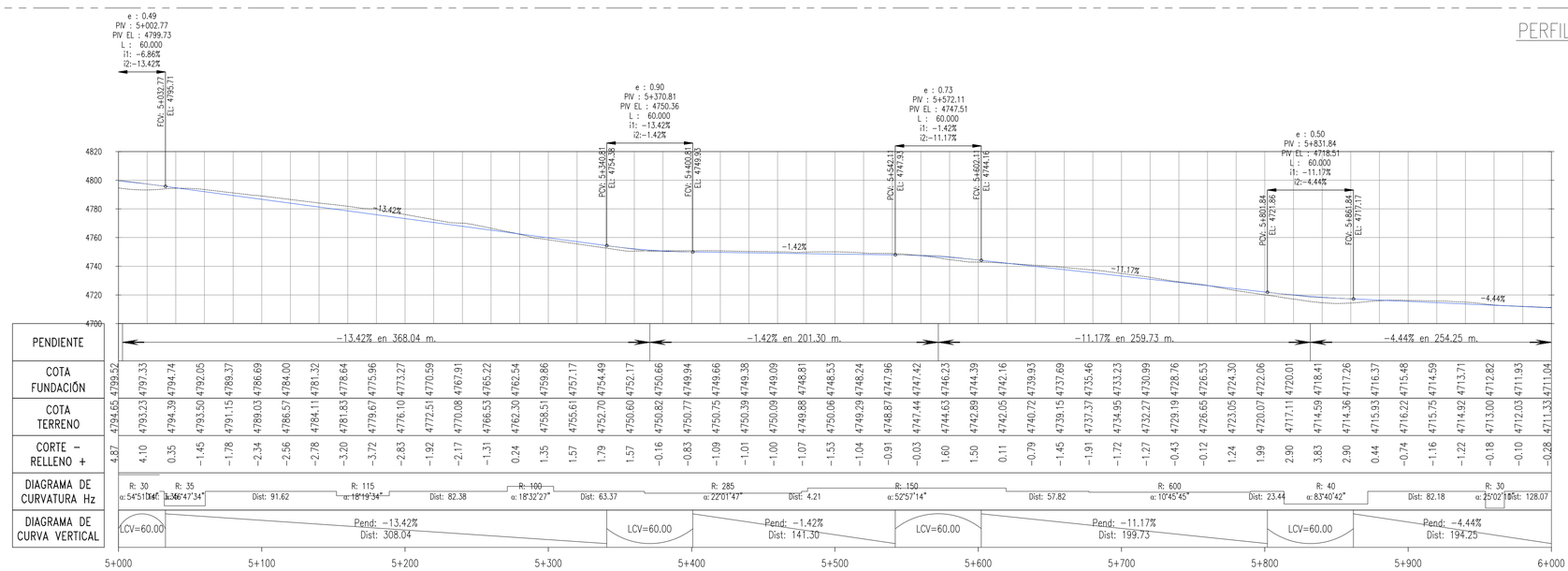
LEYENDA	
	Curva Mayor C/5.00m
	Curva Menor C/1.00m
	Acceso
	Eje Proyectado

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 82425

NOTAS:
1.- EL LEVANTAMIENTO TOPOGRAFICO ESTA REFERIDO AL DATUM WGS-84.
2.- ELEVACIONES EN MSNM.
3.- LA EQUIDISTANCIA ENTRE CURVAS DE NIVEL ES DE UN METRO.

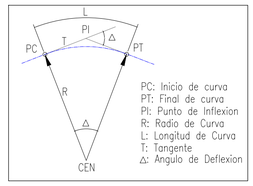
0 20 40 60 80 100m
1: 2000—A1 1: 4000—A3
ESCALA GRAFICA

PERFIL LONGITUDINAL
Esc. H 1:2000
Esc. V 1:200



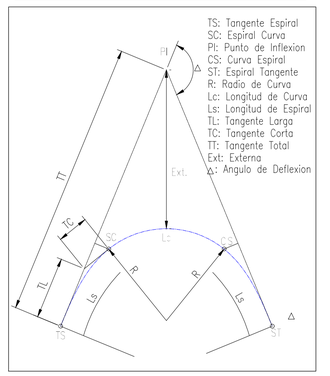
CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP N°92191

ELEMENTOS DE CURVA CIRCULAR



PC: Inicio de curva
PT: Final de curva
PI: Punto de Inflexion
R: Radio de Curva
L: Longitud de Curva
T: Tangente
Δ: Angulo de Deflexion

ELEMENTOS DE CURVA CIRCULAR CON ESPIRAL



TS: Tangente Espiral
SC: Espiral Curva
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R: Radio de Curva
Lc: Longitud de Curva
Ls: Longitud de Espiral
TL: Tangente Larga
TC: Tangente Corta
TT: Tangente Total
Ext: Externa
Δ: Angulo de Deflexion

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT
				–	–	–	–	–

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
					COPIAS	

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA		
DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO
CARRETERA TRAMO 1
5+000 – 6+000

PLANO
PLANTA
Y
PERFIL LONGITUDINAL

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA: Jan 25 / 2019 / 4:11pm

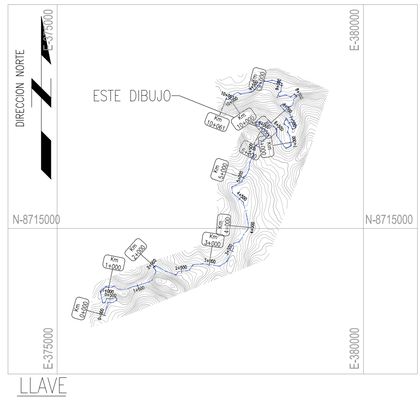
ESCALA METRICA 1:25 1:50 1:100 1:125 1:75

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2019

002991



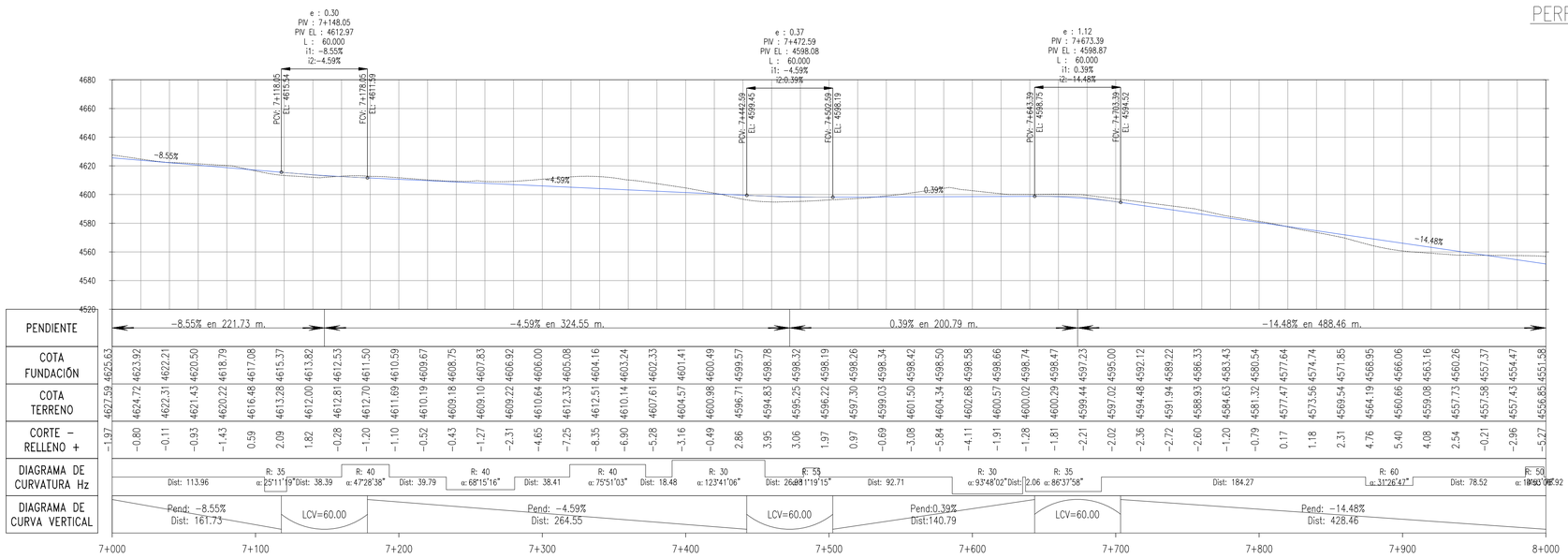
LLAVE
Esc. 1:50000

LEYENDA	
	Curva Mayor C/5.00m
	Curva Menor C/1.00m
	Acceso
	Eje Proyectado

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 82425

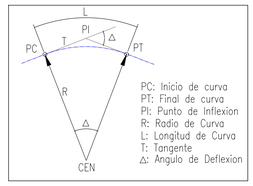
NOTAS:
1.- EL LEVANTAMIENTO TOPOGRAFICO ESTA REFERIDO AL DATUM WGS-84.
2.- ELEVACIONES EN MSNM.
3.- LA EQUIDISTANCIA ENTRE CURVAS DE NIVEL ES DE UN METRO.

0 20 40 60 80 100m
1: 2000–A1 1: 4000–A3
ESCALA GRAFICA



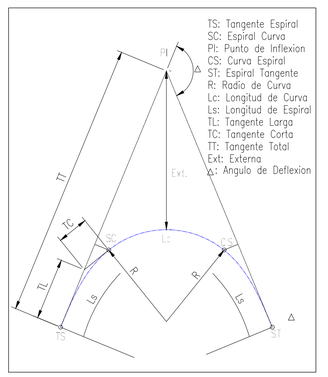
CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

ELEMENTOS DE CURVA CIRCULAR



PC: Inicio de curva
PT: Final de curva
PI: Punto de Inflexion
R: Radio de Curva
L: Longitud de Curva
T: Tangente
Δ: Angulo de Deflexion

ELEMENTOS DE CURVA CIRCULAR CON ESPIRAL



TS: Tangente Espiral
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REVISIONES	FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

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RECORD DE INGENIERÍA		
DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO
CARRETERA TRAMO 1
7+000 – 8+000

PLANO
PLANTA
Y
PERFIL LONGITUDINAL

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA:

ESCALA METRICA 1:25 1:100 1:75

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

ARCHIVO:

002992

PLANTA
Esc. 1:2000

LLAVE
Esc. 1:50000

LEYENDA	
	Curva Mayor C/5.00m
	Curva Menor C/1.00m
	Acceso
	Eje Proyectado

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

NOTAS:
1.– EL LEVANTAMIENTO TOPOGRAFICO ESTA REFERIDO AL DATUM WGS–84.
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3.– LA EQUIDISTANCIA ENTRE CURVAS DE NIVEL ES DE UN METRO.

0 20 40 60 80 100m
1:2000–A1 1:4000–A3
ESCALA GRAFICA

PERFIL LONGITUDINAL
Esc. H 1:2000
Esc. V 1:200

PENDIENTE: –14.48% en 488.46 m. | –4.55% en 167.71 m. | –9.74% en 455.26 m. | –10.35% en 223.49 m.

COTA FUNDACIÓN	COTA TERRENO	CORTE – RELLENO +
4551.58	4556.85	–5.27
4548.68	4555.35	–6.67
4545.79	4553.85	–8.06
4542.89	4552.33	–9.44
4539.99	4550.76	–10.77
4537.10	4544.01	–6.91
4534.20	4534.50	–0.30
4531.36	4528.44	2.92
4529.07	4526.58	2.48
4527.43	4526.30	1.14
4526.41	4525.82	0.59
4525.50	4525.52	–0.02
4524.59	4524.46	0.13
4523.68	4523.54	0.14
4522.76	4525.00	–2.24
4521.85	4526.77	–4.92
4520.76	4530.01	–9.24
4519.33	4529.09	–9.76
4517.54	4524.27	–6.73
4515.60	4519.11	–3.52
4513.65	4514.81	–1.16
4511.70	4510.80	0.90
4509.75	4508.11	1.65
4507.81	4506.54	1.26
4505.86	4502.50	3.36
4503.91	4494.99	8.92
4501.96	4488.46	13.50
4500.01	4486.93	13.09
4498.07	4489.00	9.07
4496.12	4492.04	4.08
4494.17	4494.53	–0.36
4492.22	4493.88	–1.65
4490.28	4491.31	–1.03
4488.33	4488.00	0.32
4486.38	4484.35	2.03
4484.43	4482.23	2.20
4482.48	4482.67	–0.19
4480.52	4484.14	–3.62
4478.54	4485.61	–7.08
4476.54	4486.93	–10.39
4474.53	4484.82	–10.30
4472.50	4479.75	–7.26
4470.45	4474.63	–4.18
4468.39	4470.48	–2.09
4466.32	4468.90	–2.58
4464.25	4467.78	–3.54
4462.18	4465.55	–3.37
4460.10	4462.95	–2.85
4458.03	4460.58	–2.55
4455.96	4458.81	–2.84
4454.36	4457.18	–2.82

DIAGRAMA DE CURVATURA Hz: Dist: 78.92 | R: 28 α: 94°33'36" | Dist: 2.00 | R: 30 α: 68°11'41" | Dist: 56.47 | R: 65 α: 59°36'49" | Dist: 21.77 | R: 40 α: 53°55'34" | Dist: 70.98 | R: 30 α: 46°23'37" | Dist: 21.45 | R: 27 α: 99°14'04" | Dist: 2.69 | R: 27 α: 82°54'37" | Dist: 39.69 | R: 30 α: 59°19'31" | Dist: 56.20 | R: 60 α: 38°48'58" | Dist: 57.97 | R: 30 α: 129°59'28" | Dist: 12.34 | R: 30 α: 0°56'10" | Dist: 7.88 | R: 30 α: 59°39'07" | Dist: 47.30 | R: 110 α: 11°07'02" | Dist: 22.10

DIAGRAMA DE CURVA VERTICAL: Pend: –14.48% Dist: 428.46 | LCV=60.00 | Pend: –4.55% Dist: 107.71 | LCV=60.00 | Pend: –9.74% Dist: 350.26 | LCV=150.00 | Pend: –10.35% Dist: 118.49 | LCV=60.00

8+000 8+100 8+200 8+300 8+400 8+500 8+600 8+700 8+800 8+900 9+000

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

ELEMENTOS DE CURVA CIRCULAR

PC: Inicio de curva
PT: Final de curva
PI: Punto de Inflexion
R: Radio de Curva
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△: Angulo de Deflexion

ELEMENTOS DE CURVA CIRCULAR CON ESPIRAL

TS: Tangente Espiral
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REVISIONES	FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT
			–	–	–	–	–

REFERENCIAS	PLANO NO.	REFERENCIA
	–	–

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL
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RECORD DE INGENIERÍA		
DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO
CARRETERA TRAMO 1 8+000 – 9+000

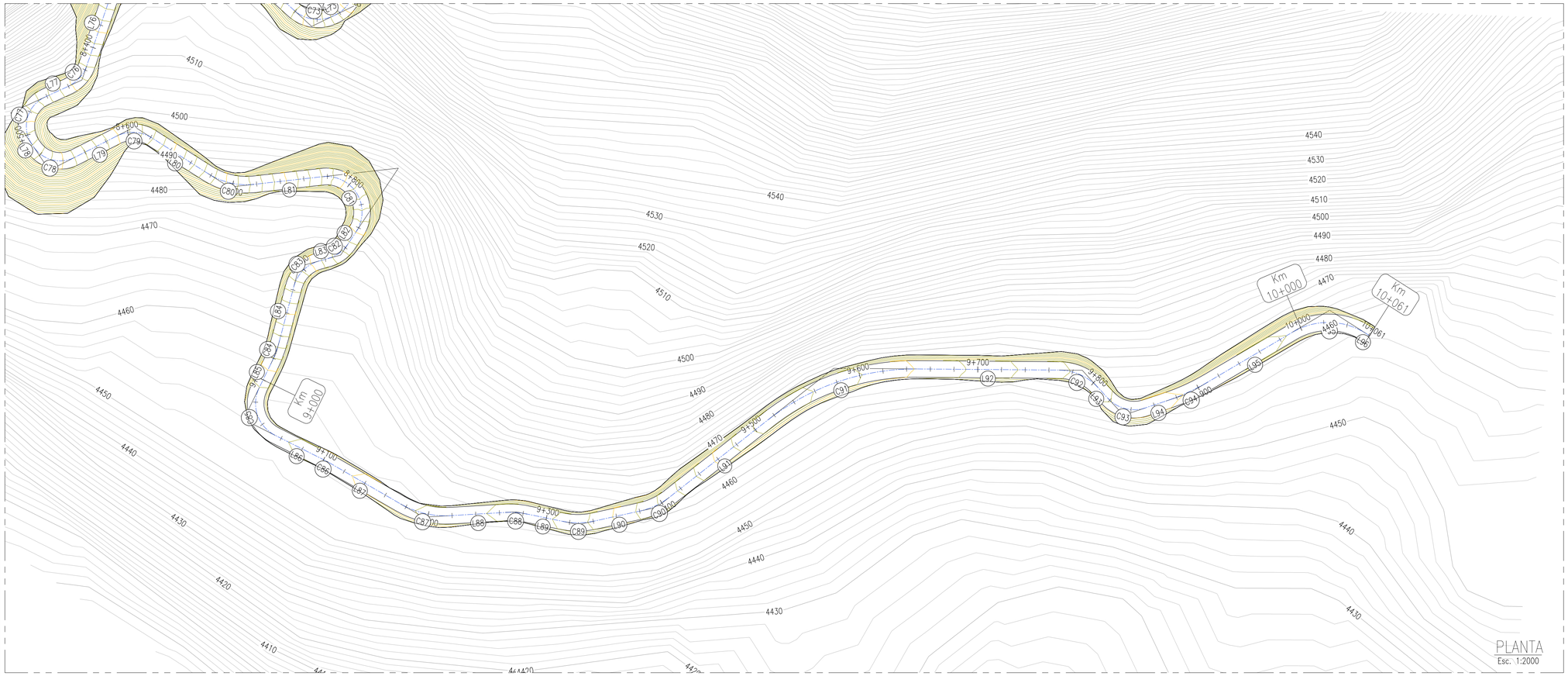
PLANO
PLANTA Y PERFIL LONGITUDINAL

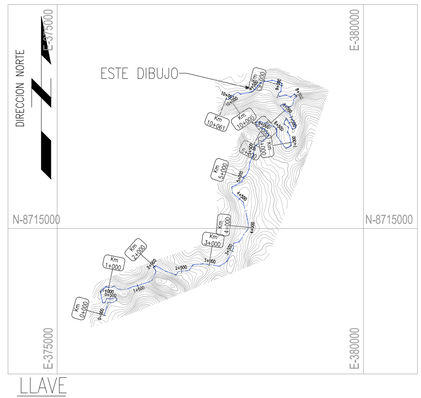
ESCALA: INDICADA | NUMERO PLANO | REV. | COD PROYECTO

CHINALCO

FECHA: Jan 25 / 2019 / 4:15pm

002993





LLAVE
Esc. 1:50000

LEYENDA

	Curva Mayor C/5.00m
	Curva Menor C/1.00m
	Acceso
	Eje Proyectado

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

NOTAS:
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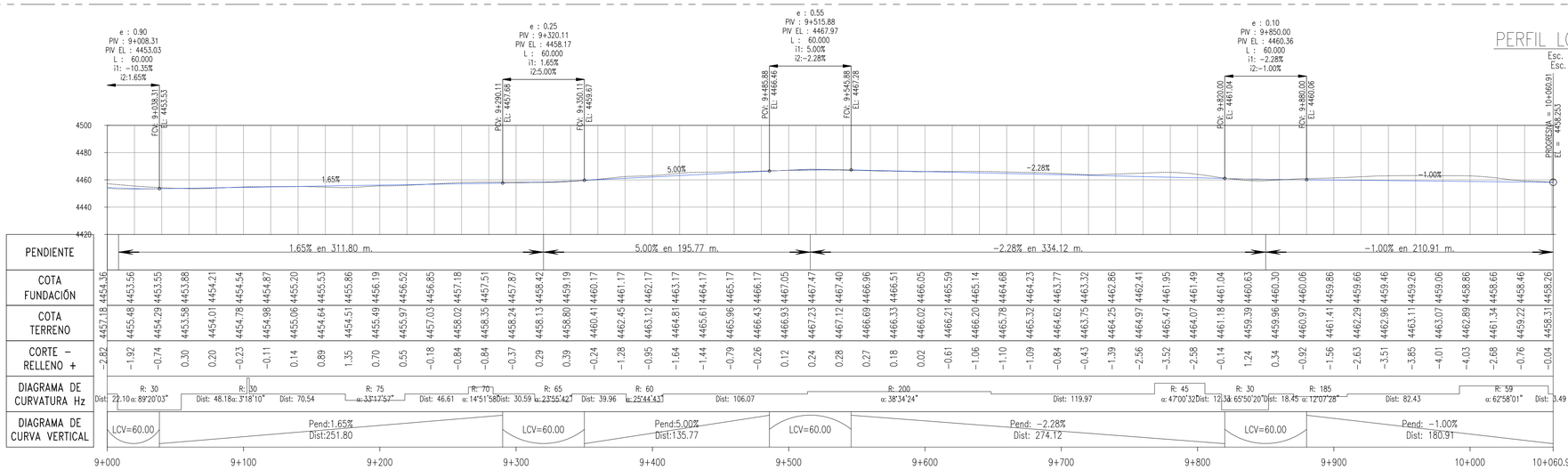
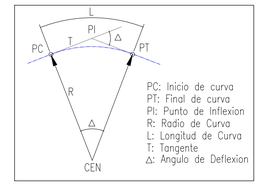
0 20 40 60 80 100m
1: 2000–A1 1: 4000–A3
ESCALA GRAFICA



CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

ELEMENTOS DE CURVA CIRCULAR



PC: Inicio de curva
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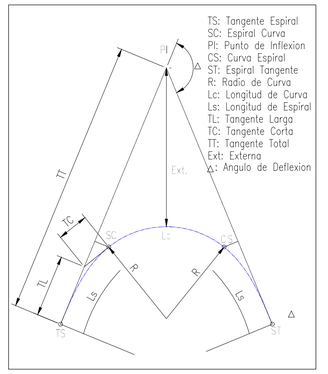
ELEMENTOS DE CURVA CIRCULAR CON ESPIRAL



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CS: Curva Espiral
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REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT
				–	–	–	–	–

REFERENCIAS	PLANO NO.	REFERENCIA
	–	–

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	COPIAS	NOTAS

CONFIDENCIAL
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RECORD DE INGENIERÍA

	FECHA APROB.	FIRMA
DIBUJADO POR		
DISEÑADO POR		
REVISADO POR		
APROBADO POR		
USUARIO		

PROYECTO
CARRETERA TRAMO 1
9+000 – 10+060.91

PLANO
PLANTA
Y
PERFIL LONGITUDINAL

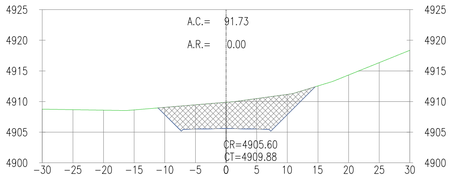
CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA: Jan 25 / 2019 / 4:16pm

ESCALA METRICA

KM 0+380.00



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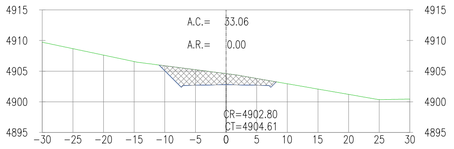

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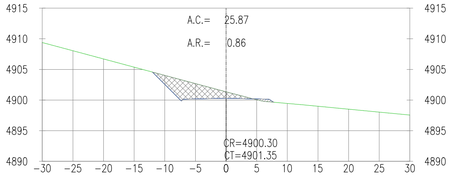

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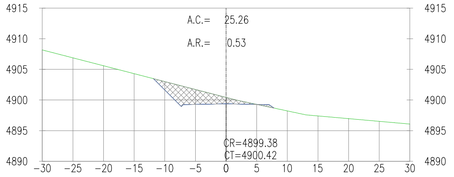

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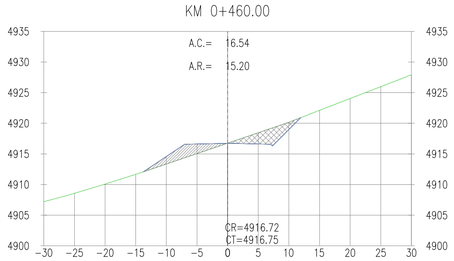
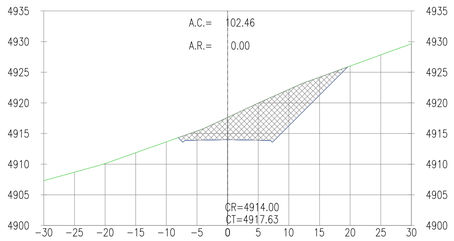
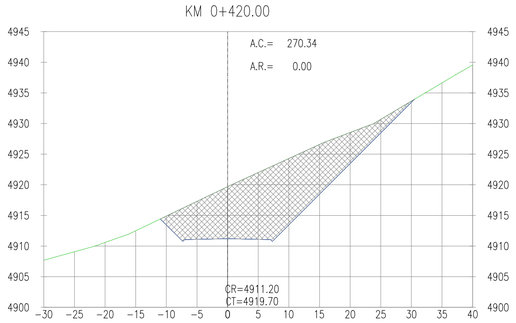


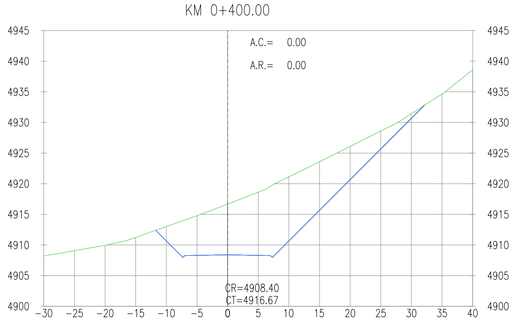
KM 0+440.00



KM 0+420.00



KM 0+400.00



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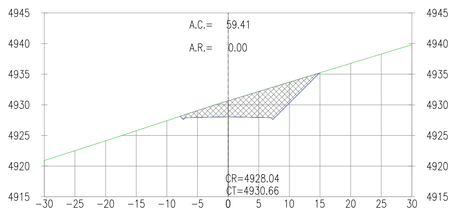
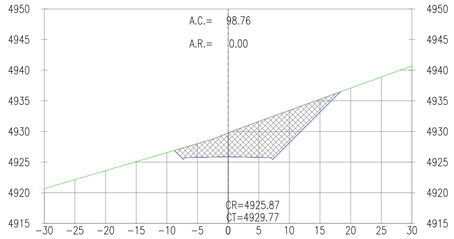


KM 0+540.00



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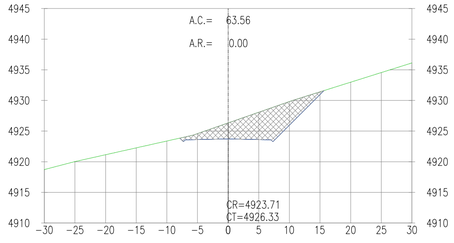

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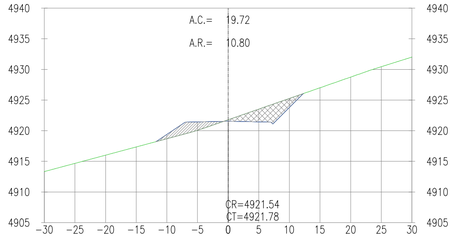

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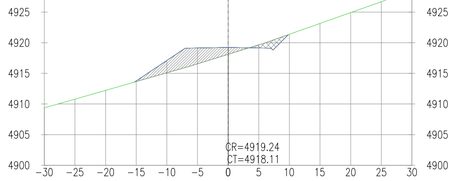

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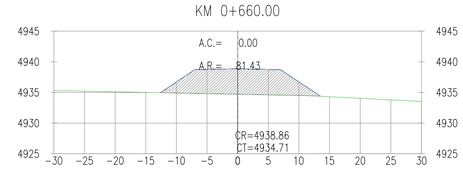

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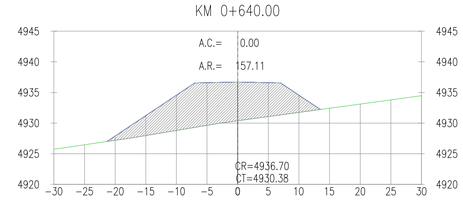

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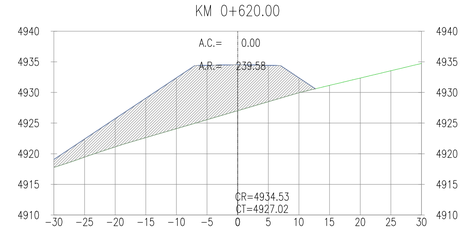

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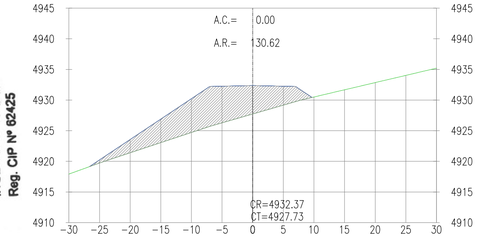

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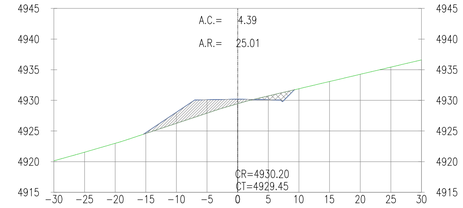


MIGUEL ANGEL INFANTES OLIVANO
INGENIERO CIVIL
Reg. CIP Nº 62425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT
				–	–	–	–	–

REFERENCIAS	PLANO NO.	REFERENCIA
	–	–

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1 0+320 – 0+660

PLANO: SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA: Jan 25 / 2019 / 4:18pm

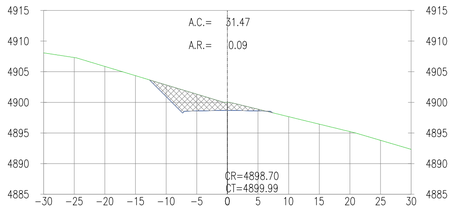
ESCALA METRICA 1:75

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2018

KM 0+060.00



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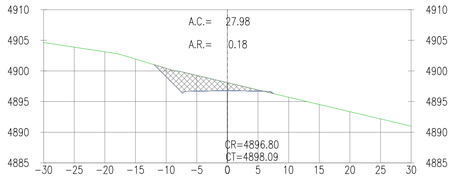
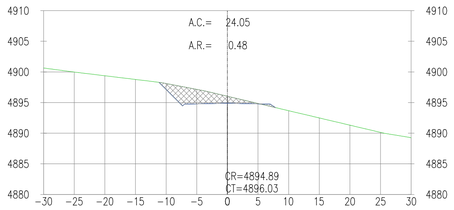
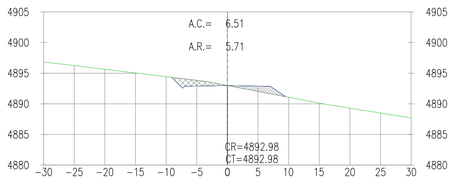


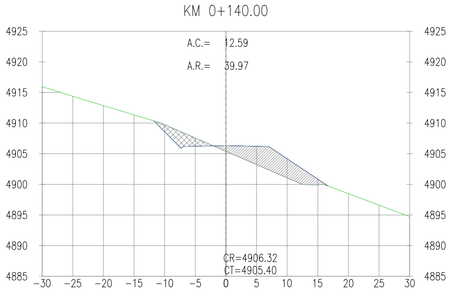
KM 0+020.00



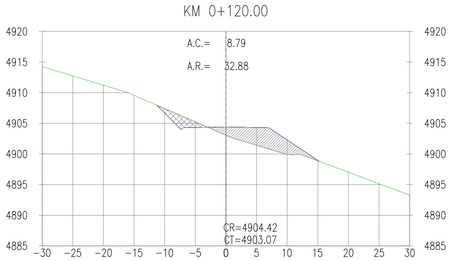
KM 0+000.00



KM 0+140.00



KM 0+120.00



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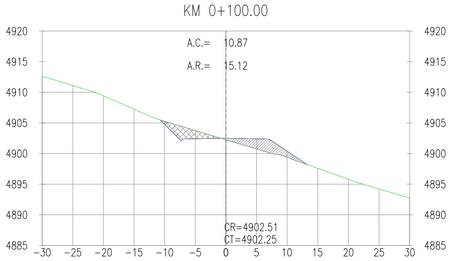
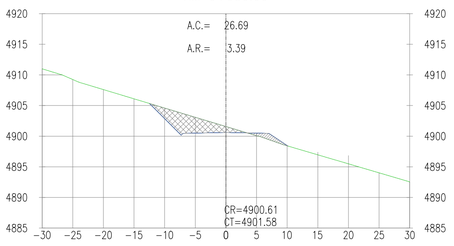


KM 0+080.00



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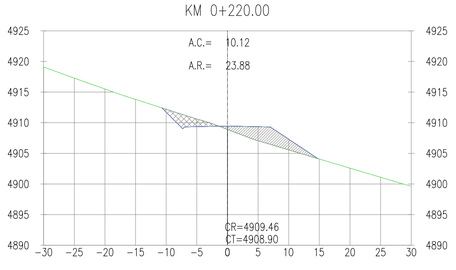
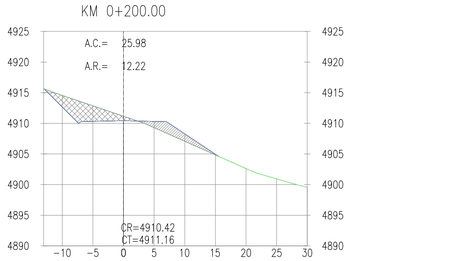


KM 0+200.00



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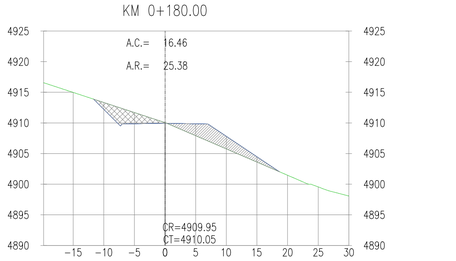

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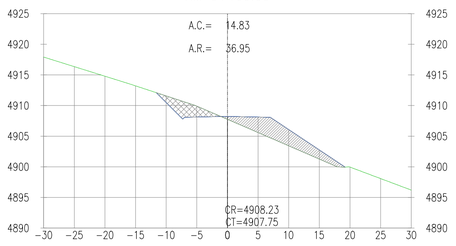

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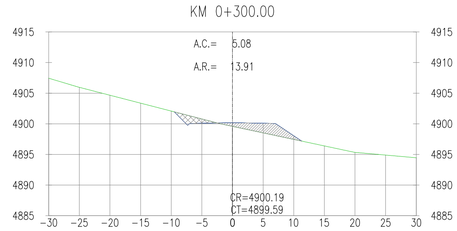
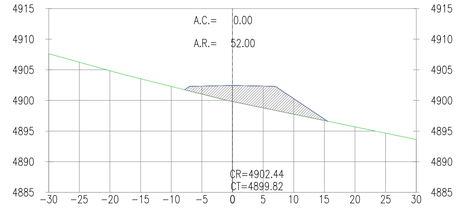


KM 0+280.00



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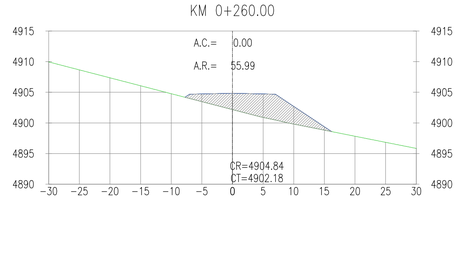
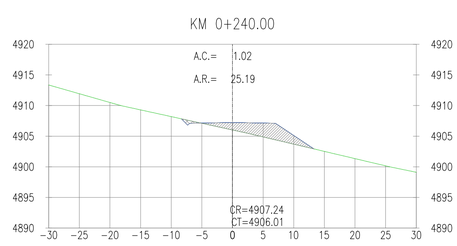


KM 0+240.00



SECCIONES TRANSVERSALES

Esc. 1:500

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA
	–	–

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA
SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1 0+000 – 0+300

PLANO: SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA: Jan 25 / 2019 / 4:17pm

ESCALA METRICA 1:25 1:100 1:75

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2019

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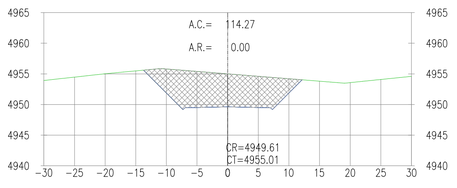

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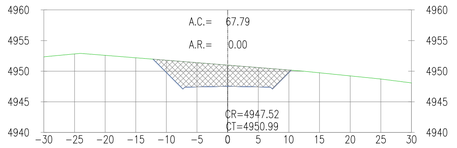

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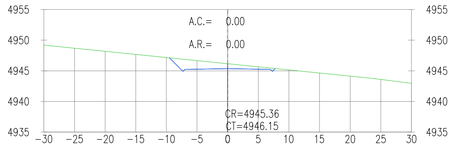

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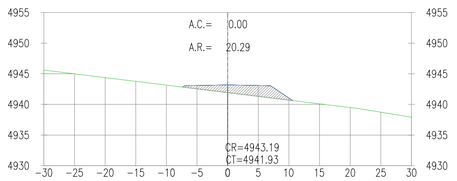

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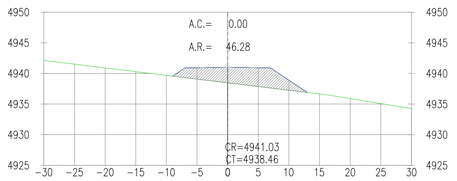

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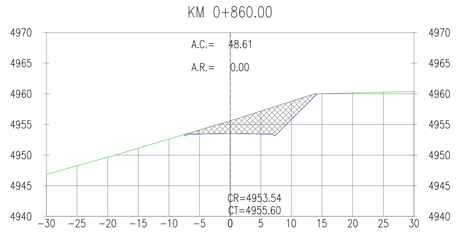

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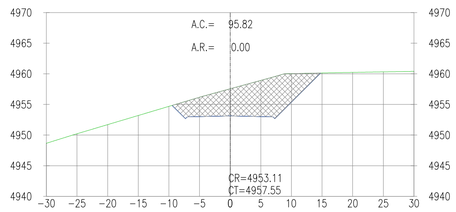

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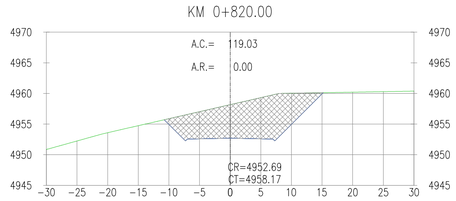

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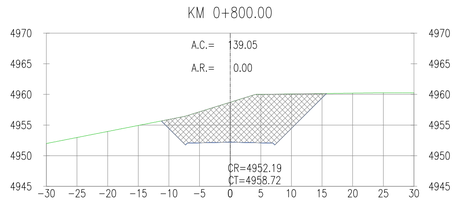

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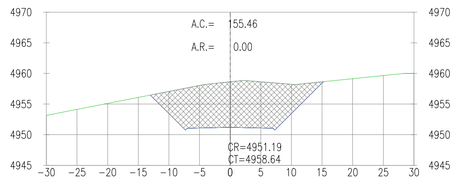

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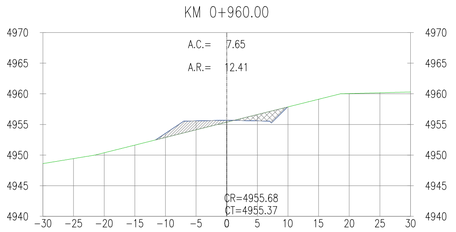

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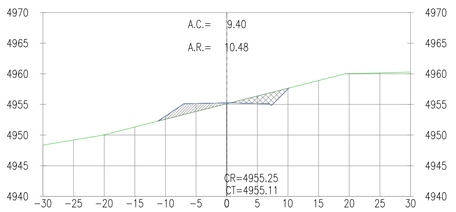

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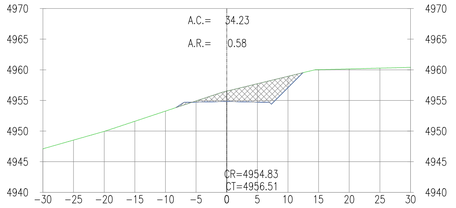

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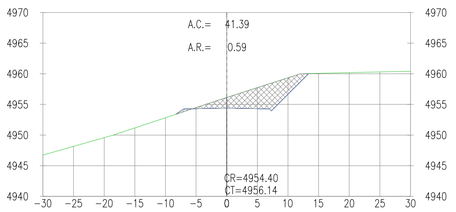

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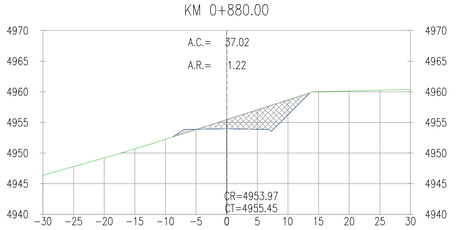
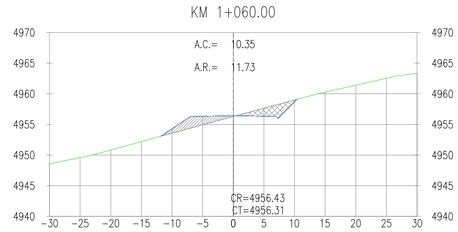


KM 1+060.00



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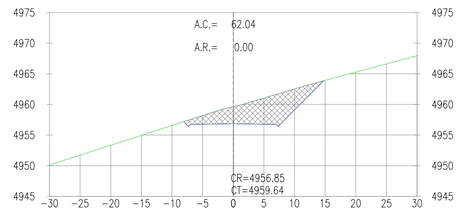
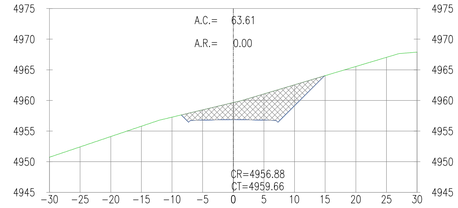
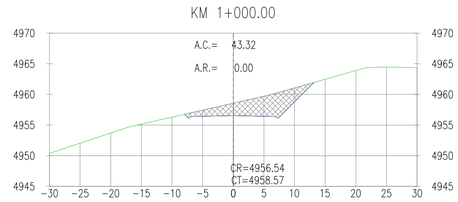


KM 1+020.00



KM 1+000.00



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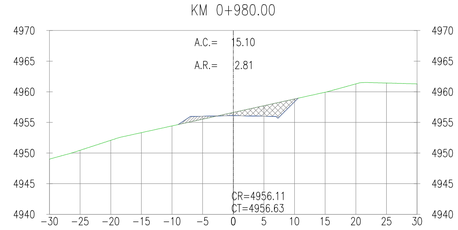

MIGUEL ANGEL INFANTES OLIVANO
INGENIERO CIVIL
Reg. CIP Nº 82425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA
	–	

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO

CARRETERA TRAMO 1
0+680 – 1+060

PLANO

SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

ESCALA METRICA 1:75

FECHA Jan 25 / 2019 / 4:19pm

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2018

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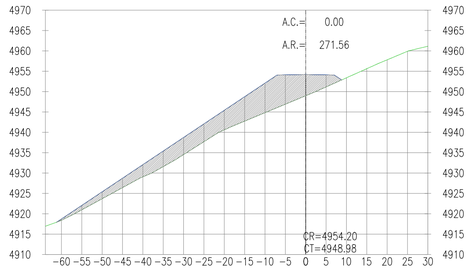

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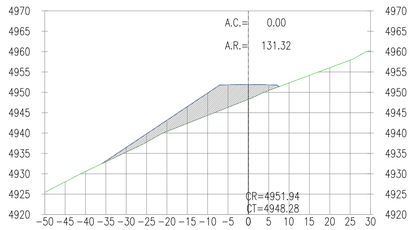

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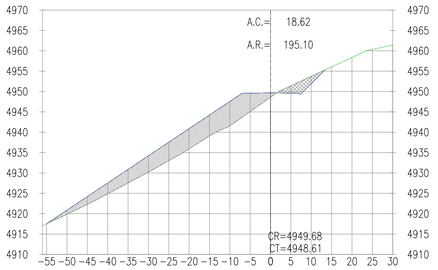

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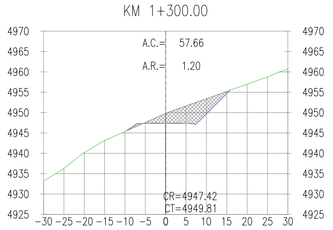

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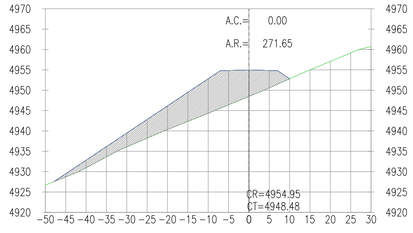

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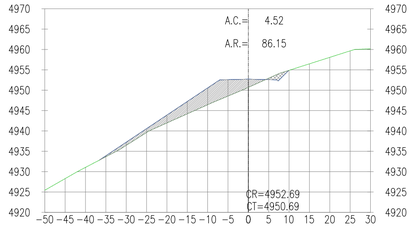

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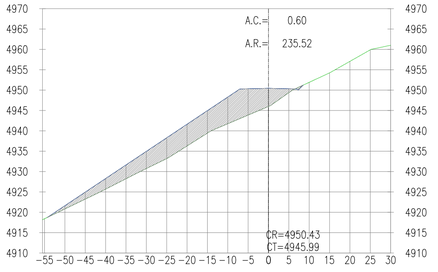

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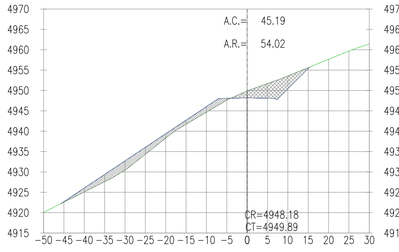

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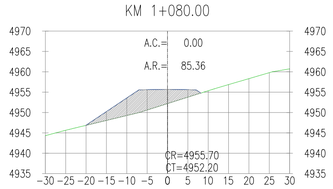

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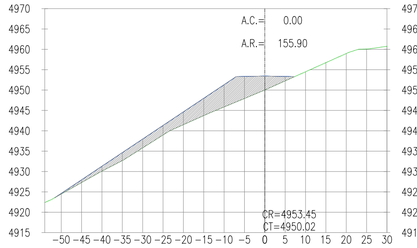

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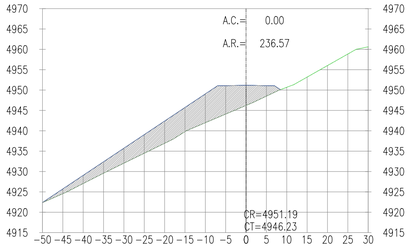

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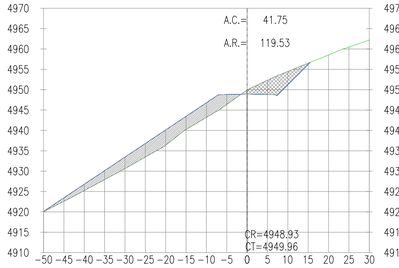


MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO

CARRETERA TRAMO 1
1+080 – 1+300

PLANO

SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

ESCALA METRICA 1:75

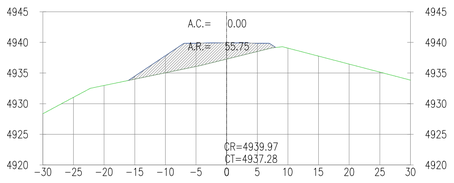
COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

ARCHIVO:

FECHA:

KM 1+400.00



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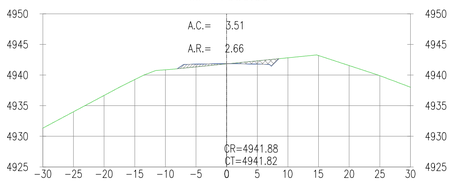

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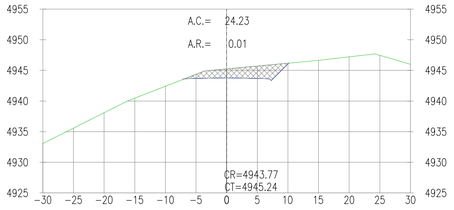

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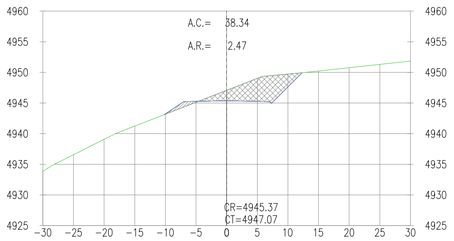

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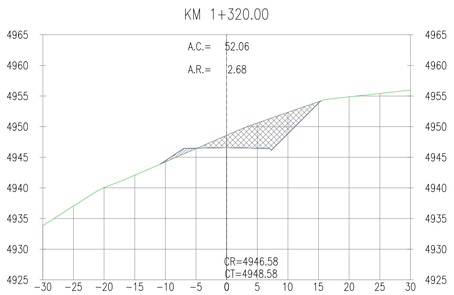

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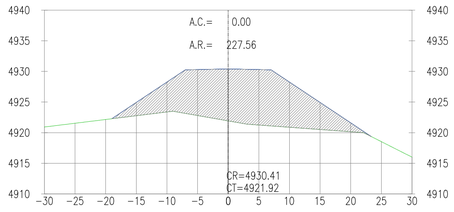

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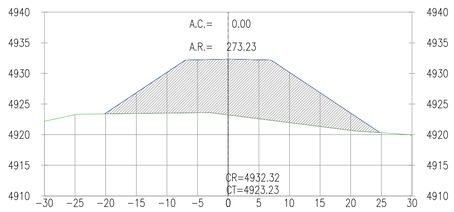

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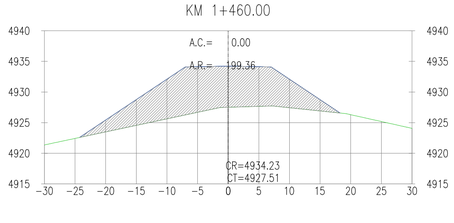
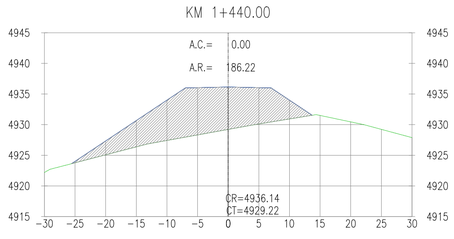


KM 1+440.00



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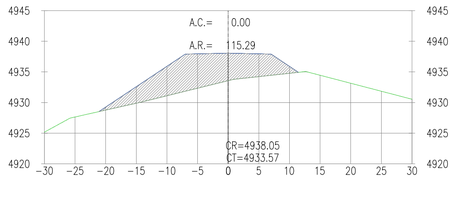
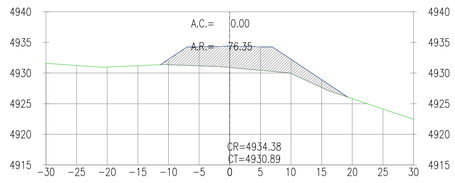


KM 1+600.00



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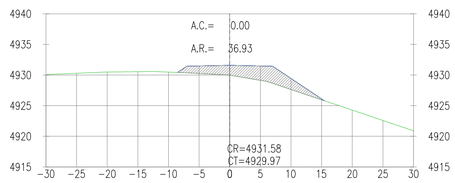
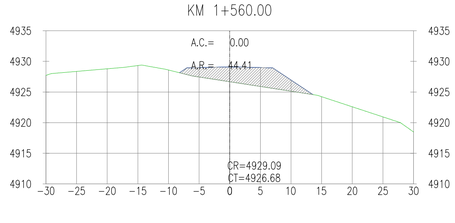


KM 1+560.00



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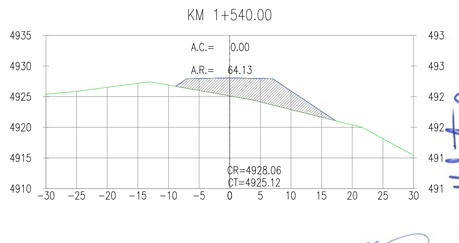
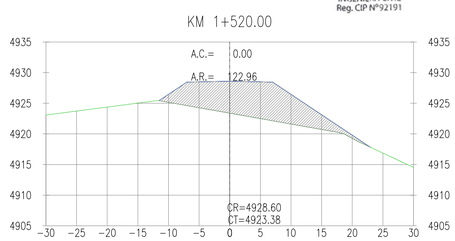


KM 1+520.00



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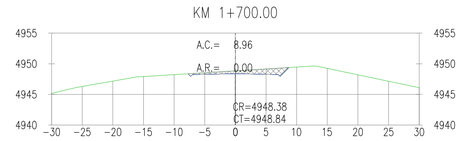

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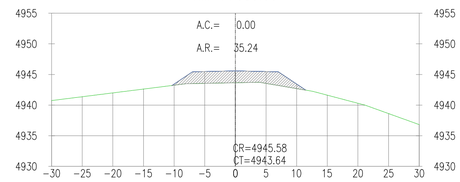

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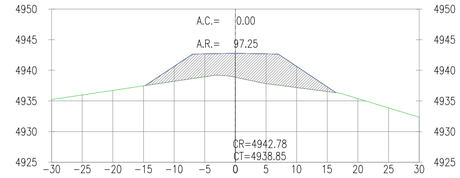

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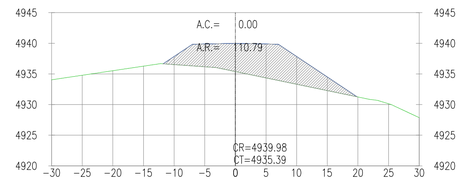

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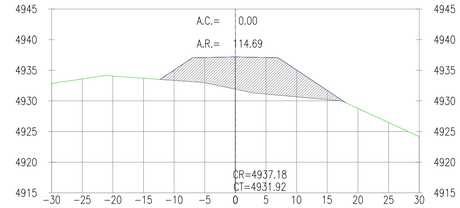

MIGUEL ANGEL INFANTES CAMUJANO
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Reg. CIP Nº 82425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1 1+320 – 1+700

PLANO: SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

ARCHIVO:

FECHA:

ESCALA METRICA 1:75

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

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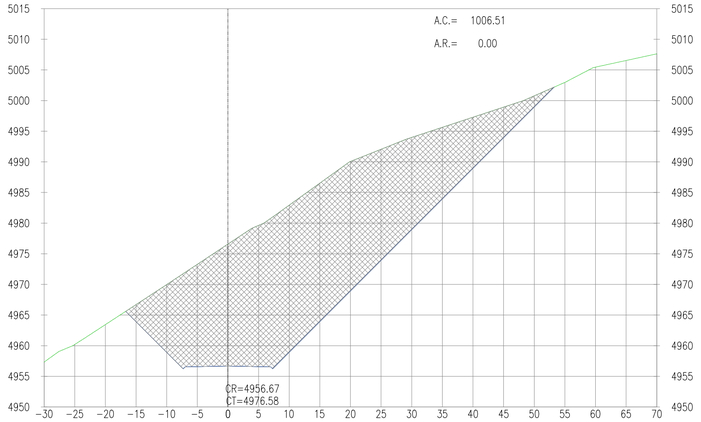
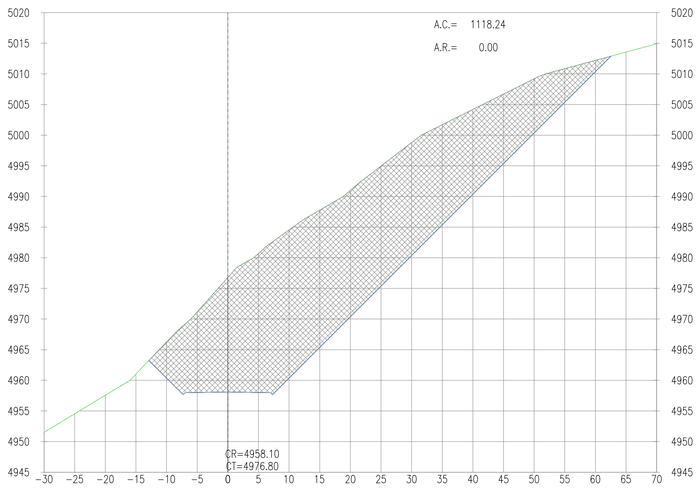
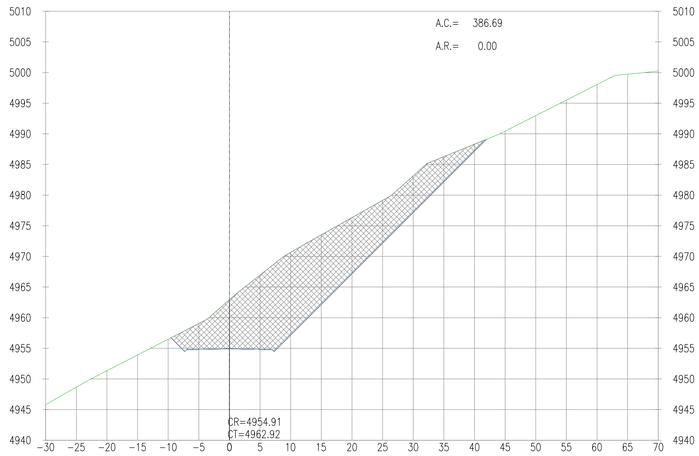


KM 1+800.00



KM 1+840.00



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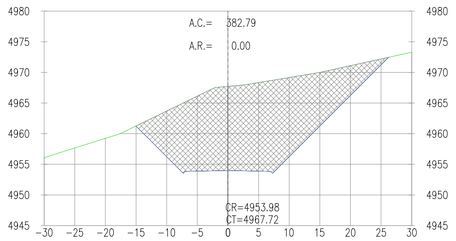

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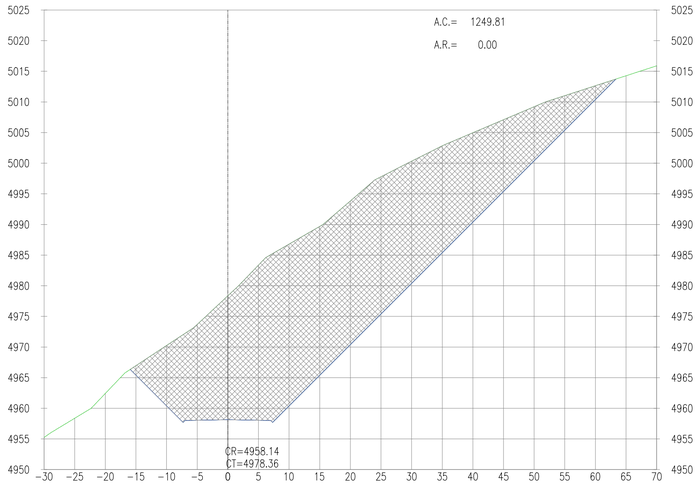
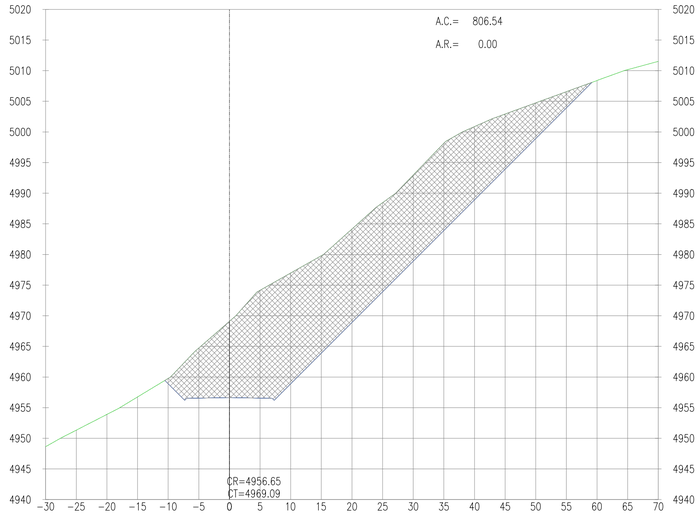
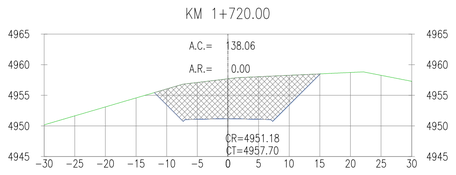


KM 1+820.00



KM 1+720.00



MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

CARMEN ROCIO
VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES

	FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS

PLANO NO.	REFERENCIA

EMISIONES

REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS	

CONFIDENCIAL

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SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1
1+720 – 1+840

PLANO: SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA: Jan 25 / 2019 / 4:21pm

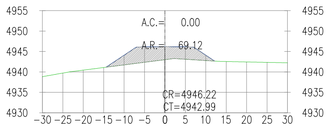
ESCALA METRICA 1:25 1:100 1:25 1:25 1:50 1:25

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

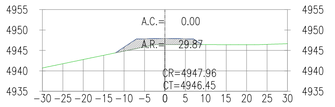
FORMATO OFICIAL A1

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2019

KM 1+940.00



KM 1+920.00



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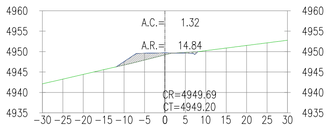

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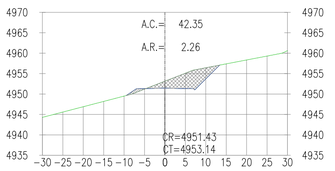

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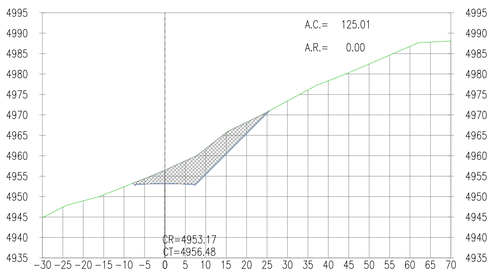
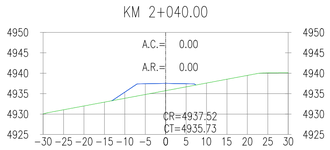


KM 2+040.00



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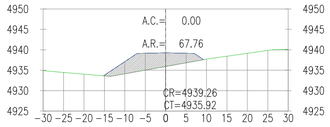

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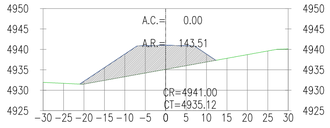

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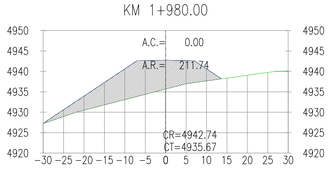

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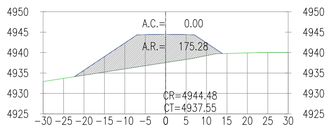

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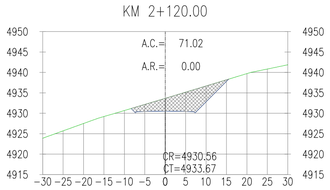

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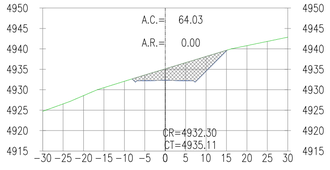

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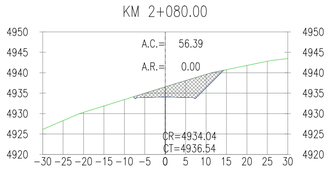

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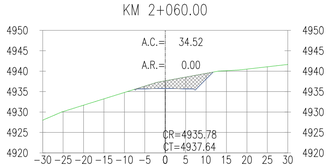

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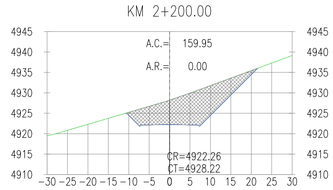

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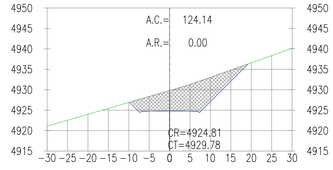

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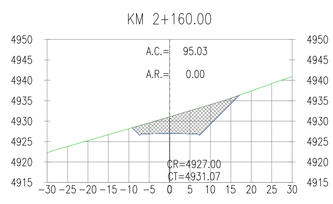

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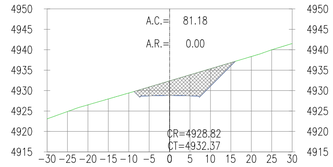

MIGUEL ANGEL INFANTES QUIJANO
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Reg. CIP Nº 82425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES

	FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS

PLANO NO.	REFERENCIA

EMISIONES

REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
			COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1 1+860 – 2+200

PLANO: SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA: Jan 25 / 2019 / 4:22pm

ESCALA METRICA 1:75

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2018

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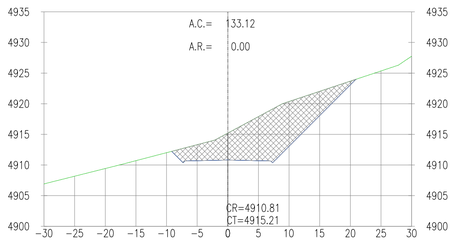

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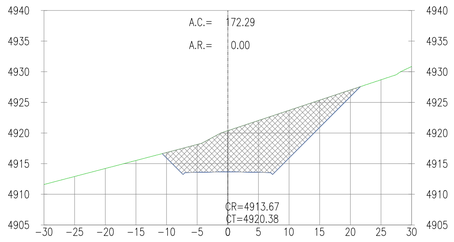
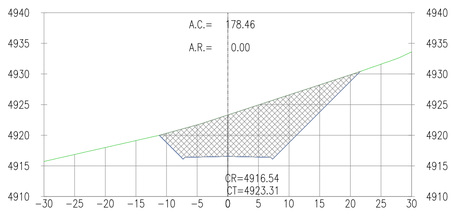


KM 2+240.00



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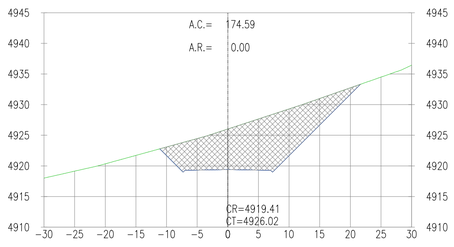

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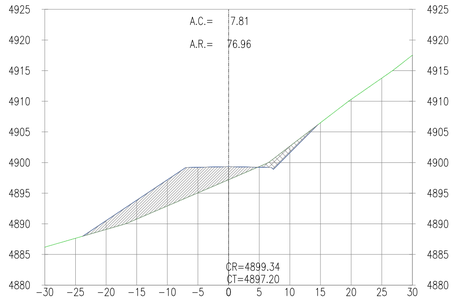

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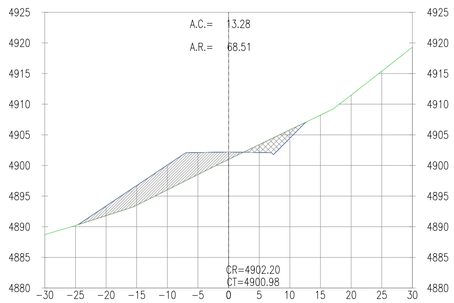

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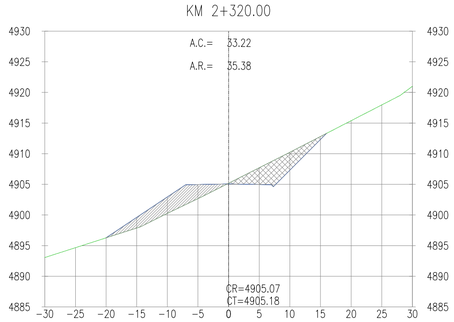

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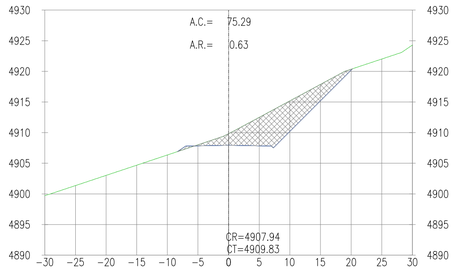

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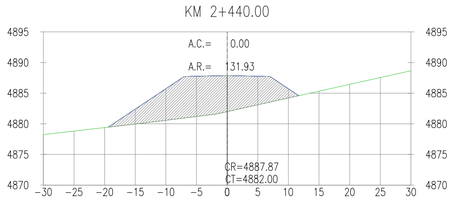

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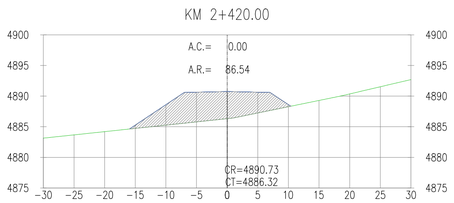

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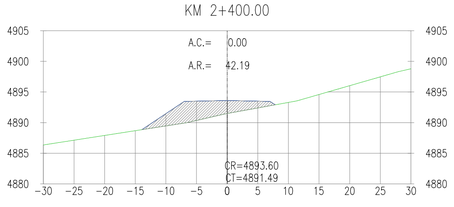

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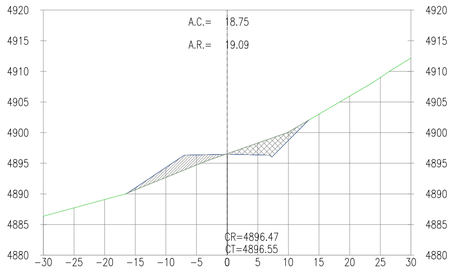

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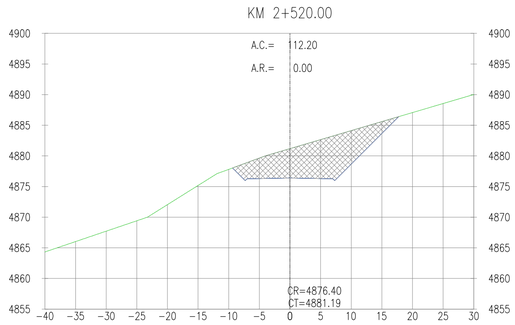

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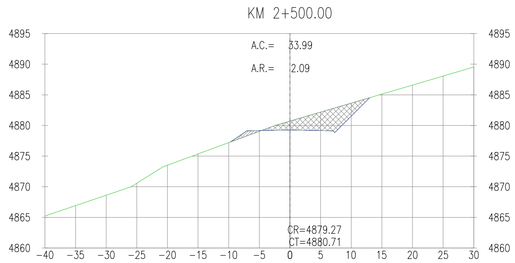

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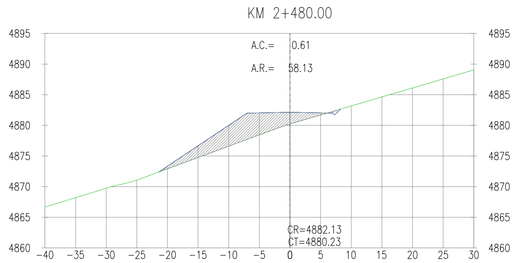
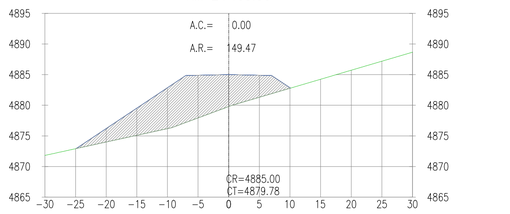


KM 2+460.00



MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 82425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES

	FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS

PLANO NO.	REFERENCIA

EMISIONES

REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
			COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO

CARRETERA TRAMO 1
2+220- 2+520

PLANO

SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA: Jan 25 / 2019 / 4:23pm

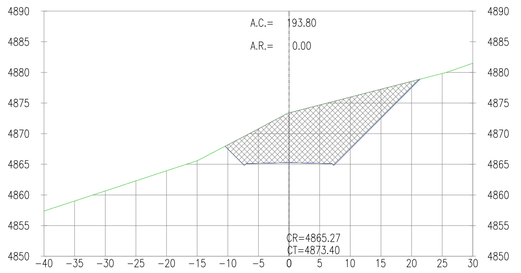
ESCALA METRICA 1:25 1:100 1:25

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2019

KM 2+600.00



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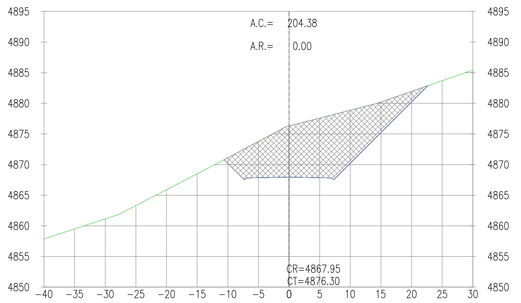

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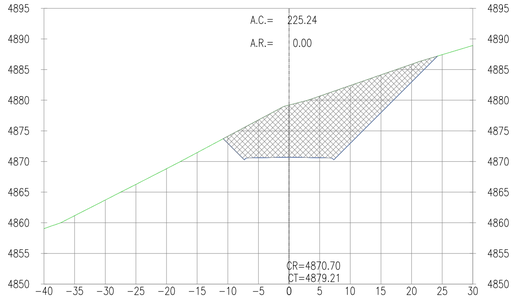

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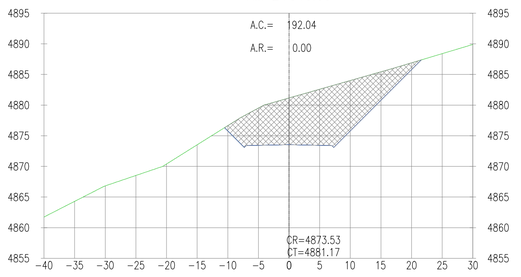

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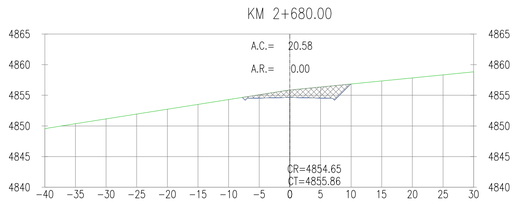

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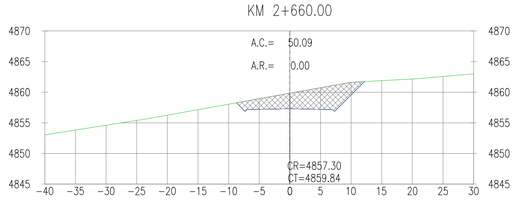

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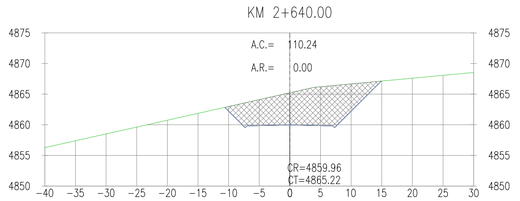

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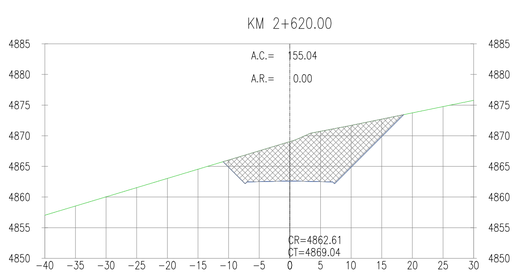

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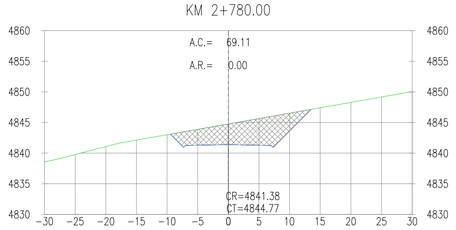

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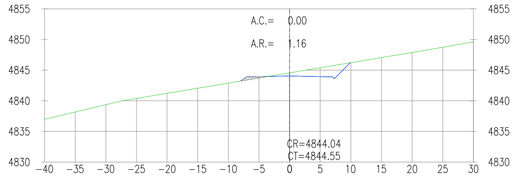

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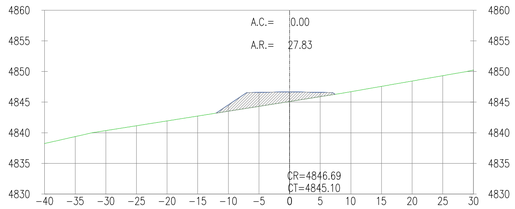

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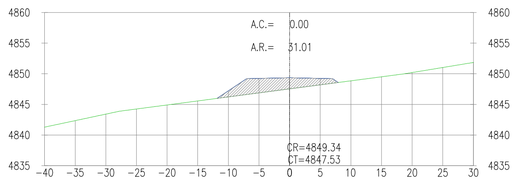

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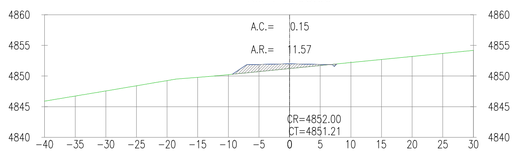

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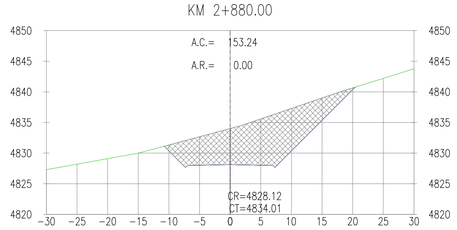

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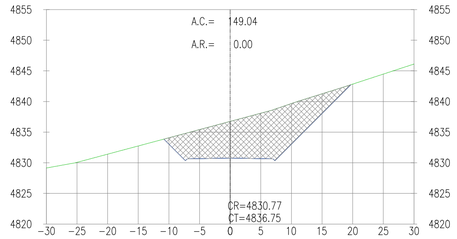

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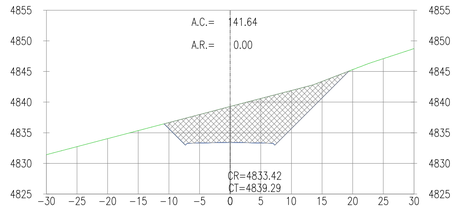

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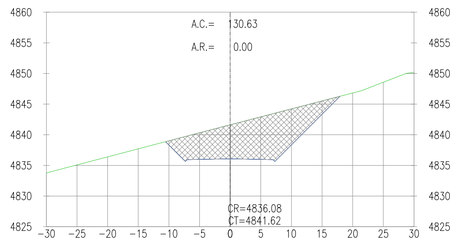

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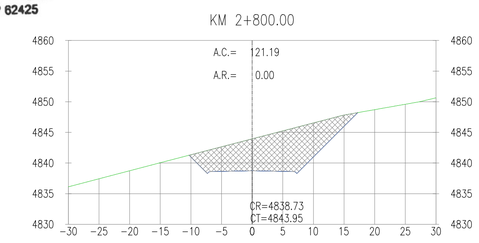

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INGENIERO CIVIL
Reg. CIP Nº 82425

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA		
DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1 2+520- 2+880

PLANO: SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA: Jan 25 / 2019 / 4:24pm

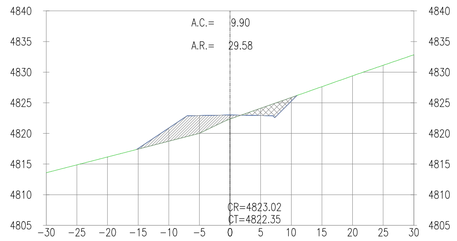
ESCALA METRICA 1:25 1:100 1:75 1:50 1:20

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2018

KM 3+000.00



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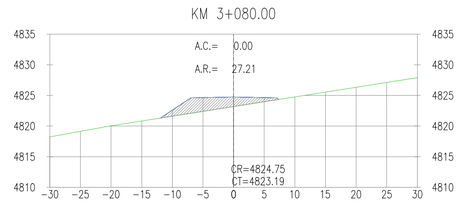

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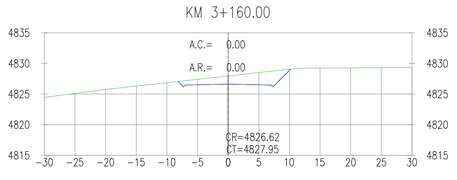

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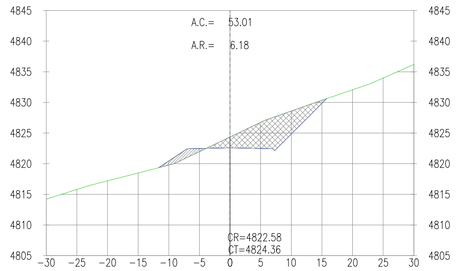

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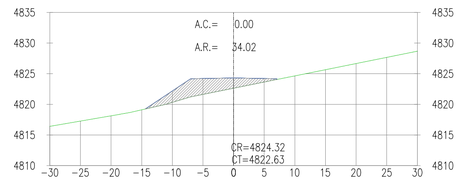

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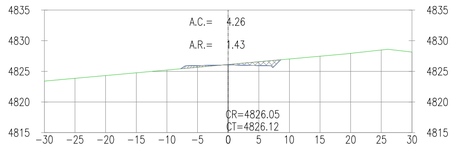

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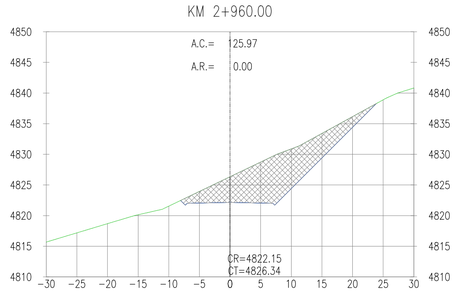

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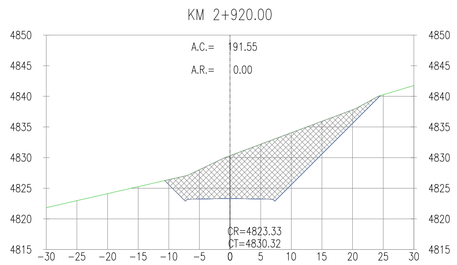

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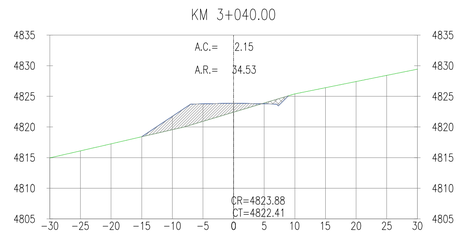

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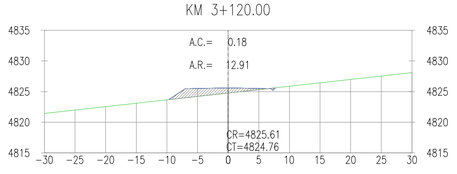

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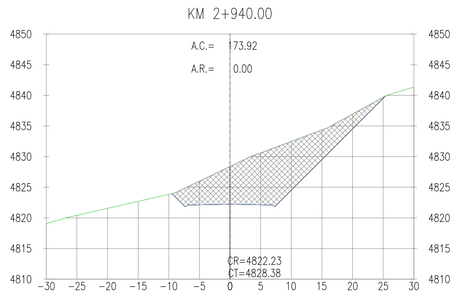

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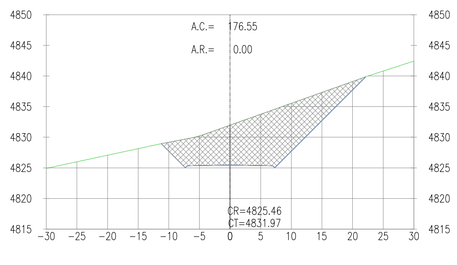

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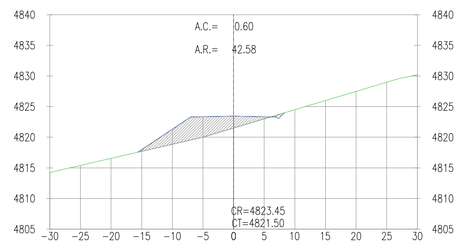

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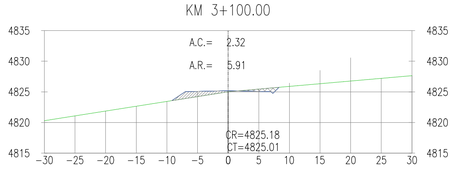

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 82425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA
	–	–

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

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RECORD DE INGENIERÍA

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DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1 2+880 – 3+160

PLANO: SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA: Jan 25 / 2019 / 4:24pm

ESCALA METRICA 1:25 1:100 1:75

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2019

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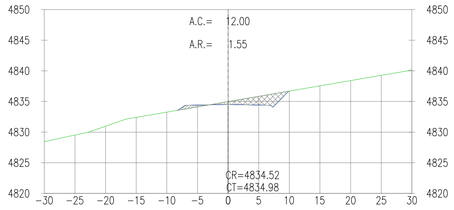

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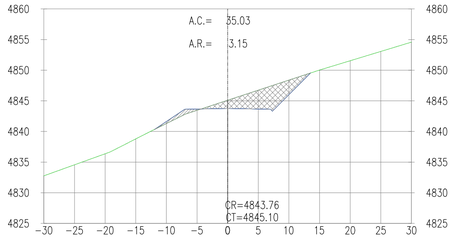

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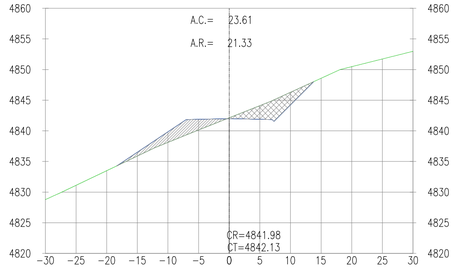

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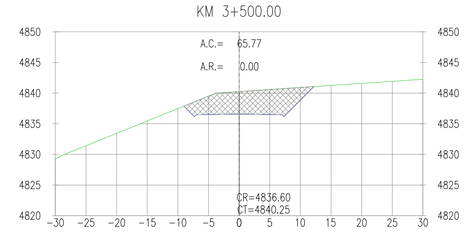

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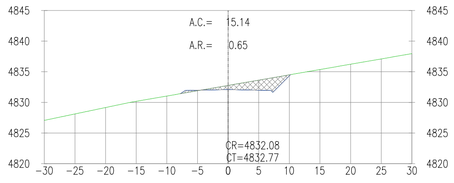

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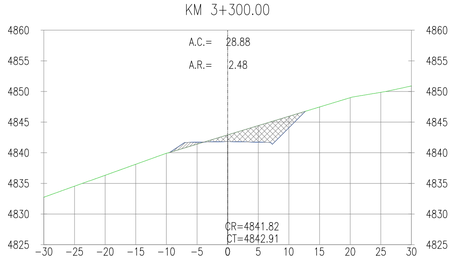

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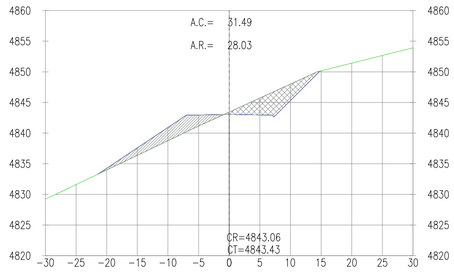

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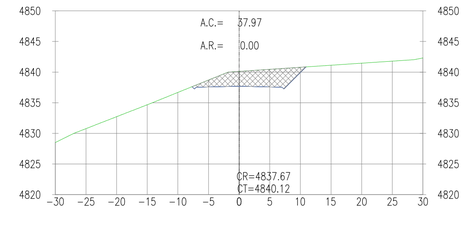

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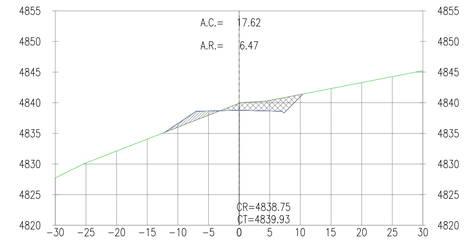

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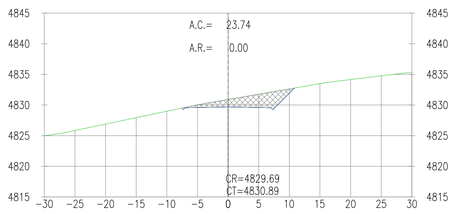

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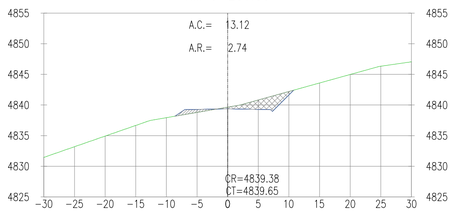

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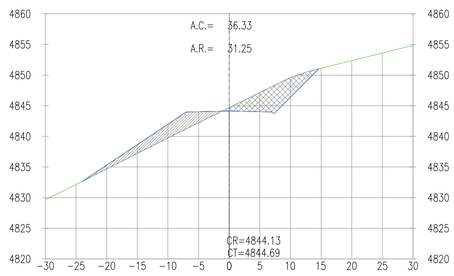

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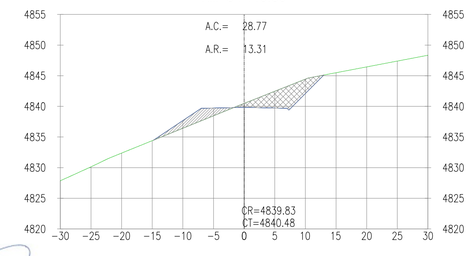

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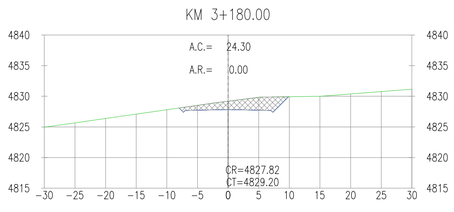

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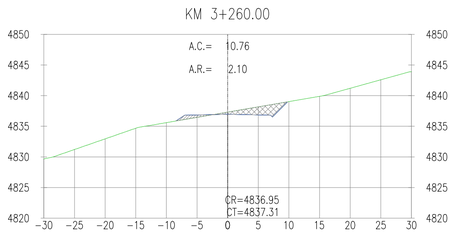

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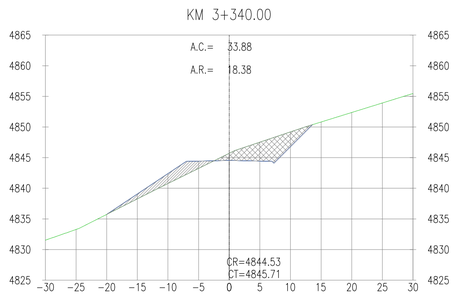

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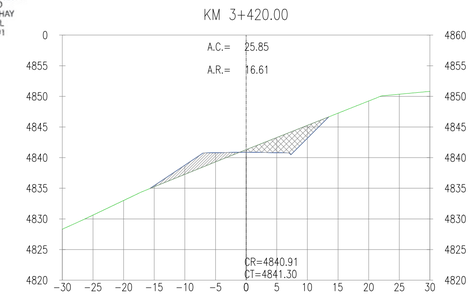

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP N°92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES

	FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS

PLANO NO.	REFERENCIA
	–

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 82425

EMISIONES

REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
			COPIAS		

CONFIDENCIAL

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RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1 3+160– 3+500

PLANO: SECCIONES TRANSVERSALES

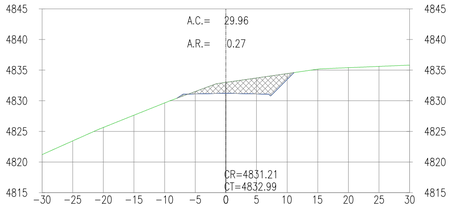
CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA: Jan 25 / 2019 / 4:25pm

ESCALA METRICA 1:75

KM 3+600.00



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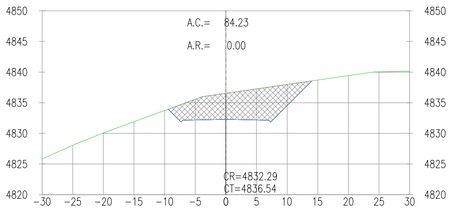

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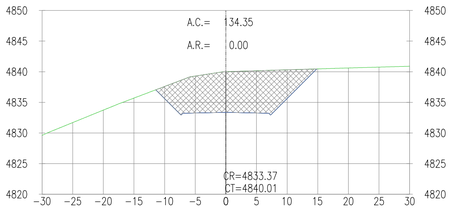

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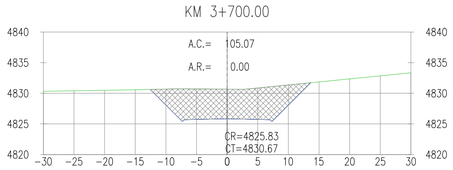

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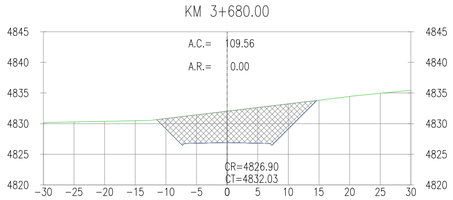
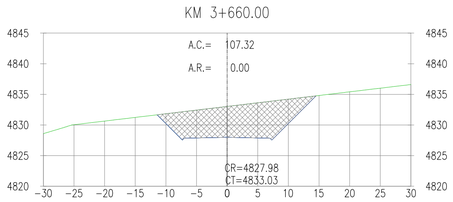


KM 3+660.00



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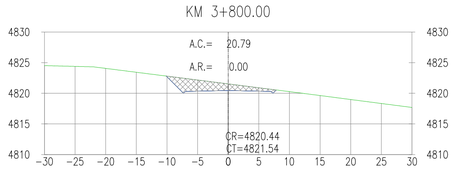

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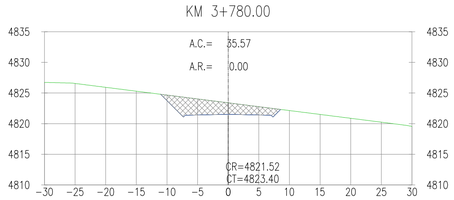

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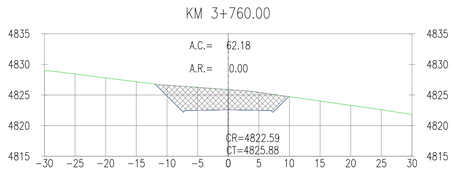
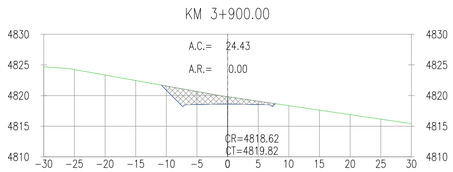
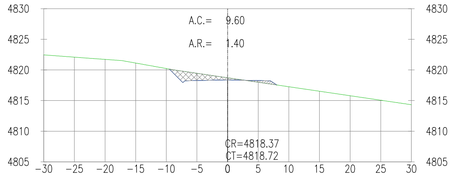


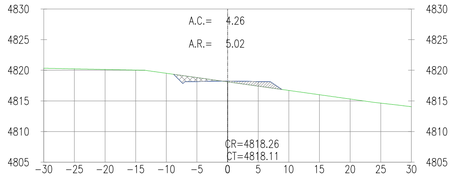
KM 3+900.00



KM 3+880.00



KM 3+860.00



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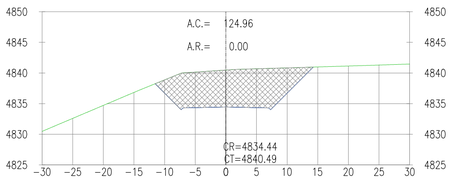
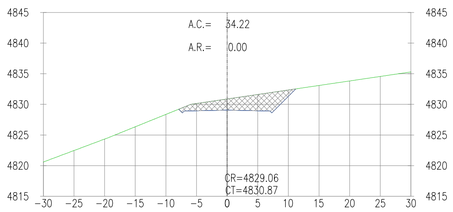
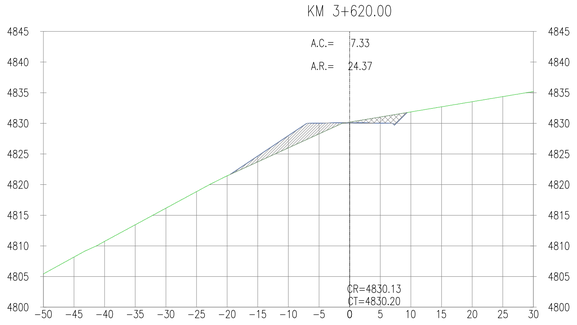


KM 3+640.00



KM 3+620.00



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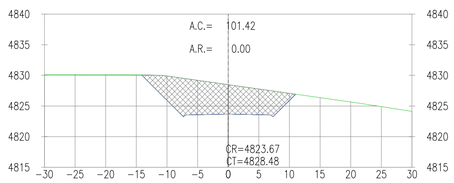

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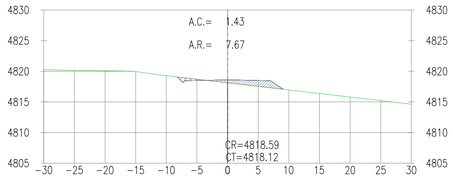

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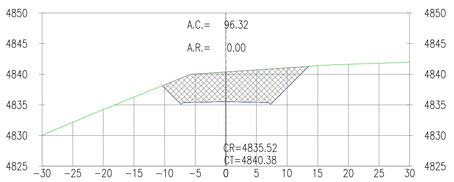

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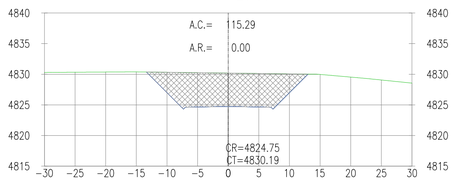

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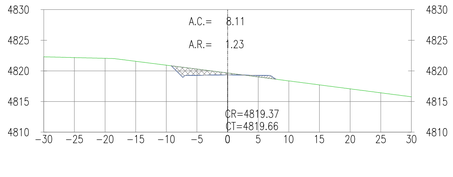


CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP N°92191

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 82425

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT
	A	23/04/2018	EMITIDO PARA REVISIÓN INTERNA	–	–	–	–	–

REFERENCIAS	PLANO NO.	REFERENCIA
	–	–

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	COPIAS	NOTAS

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

DIBUJADO POR: J.ROJAS D.	FECHA APROB.: 23/04/2018	FIRMA
DISEÑADO POR: J.ROJAS D.	FECHA APROB.: 23/04/2018	FIRMA
REVISADO POR: ---	FECHA APROB.: 23/04/2018	FIRMA
APROBADO POR: ---	FECHA APROB.: 23/04/2018	FIRMA
USUARIO: CLIENTE	FECHA APROB.: --/--/--	FIRMA

PROYECTO: CARRETERA TRAMO 1 3+500– 3+900

PLANO: SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

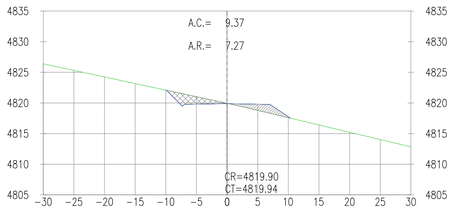
FECHA: Jan 25 / 2019 / 4:26pm

ESCALA METRICA 1:75

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2018

KM 4+000.00



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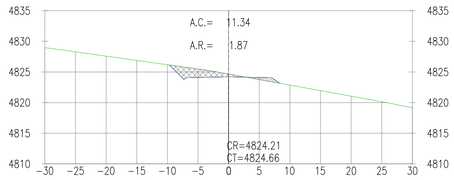

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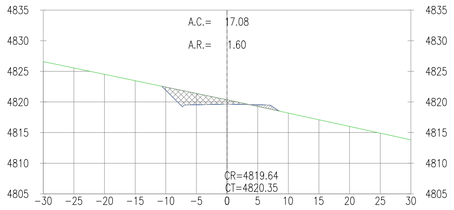

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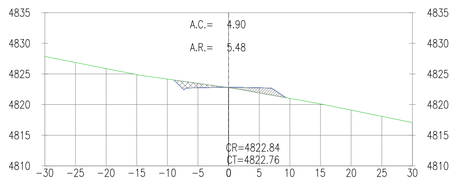

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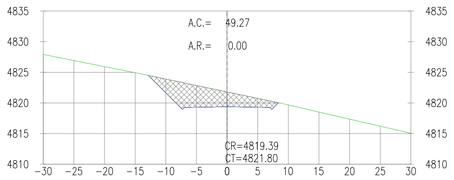
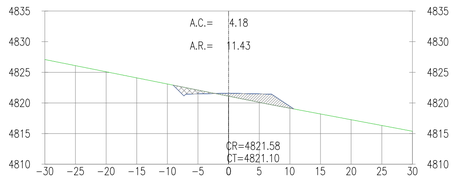
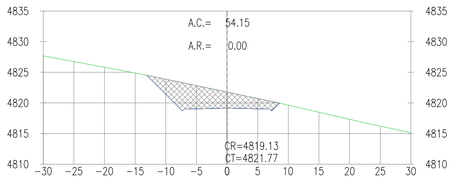


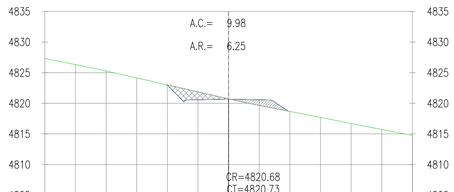
KM 4+060.00



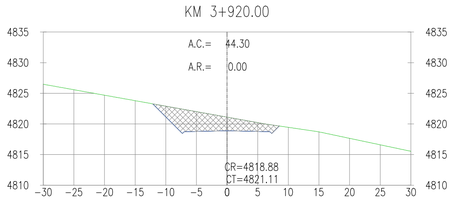
KM 3+940.00



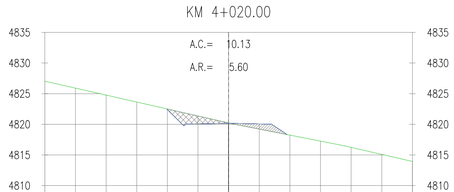
KM 4+040.00



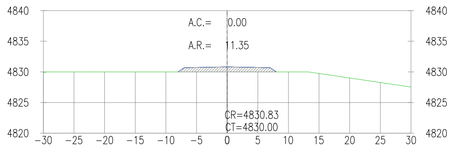
KM 3+920.00



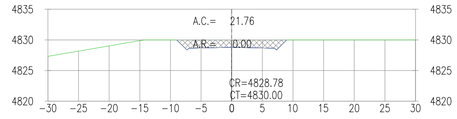
KM 4+020.00



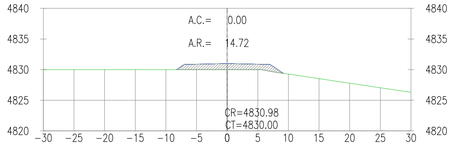
KM 4+240.00



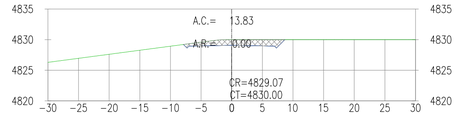
KM 4+380.00



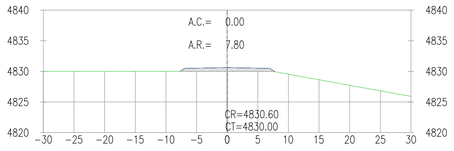
KM 4+220.00



KM 4+360.00



KM 4+200.00



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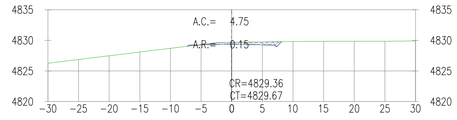
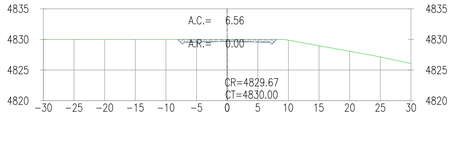
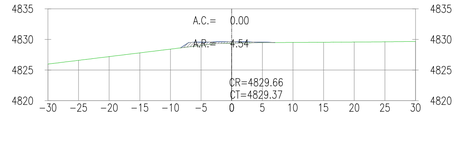


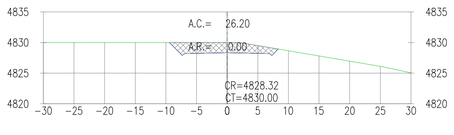
KM 4+180.00



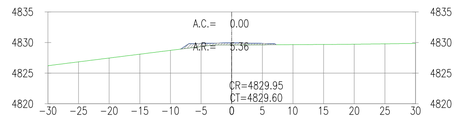
KM 4+320.00



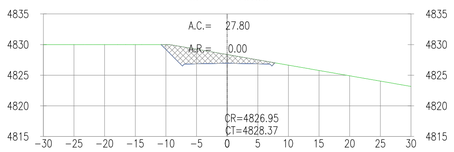
KM 4+160.00



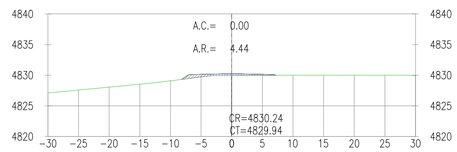
KM 4+300.00



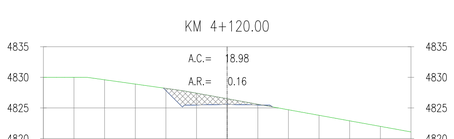
KM 4+140.00



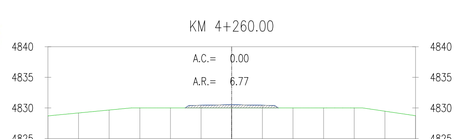
KM 4+280.00



KM 4+120.00



KM 4+260.00



MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 82425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
					COPIAS	

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1 3+900– 4+380

PLANO: SECCIONES TRANSVERSALES

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

CHINALCO

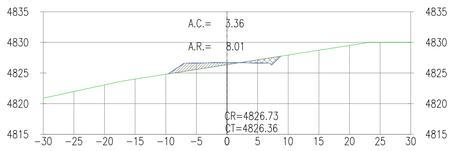
FECHA: Jan 25 / 2019 / 4:27pm

ESCALA METRICA 1:25

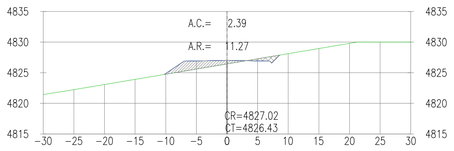
COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2018

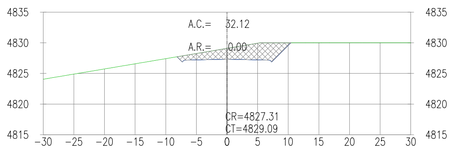
KM 4+520.00



KM 4+500.00



KM 4+480.00



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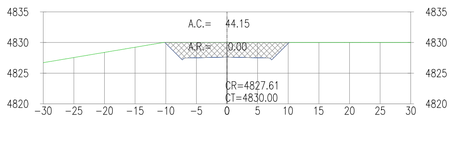
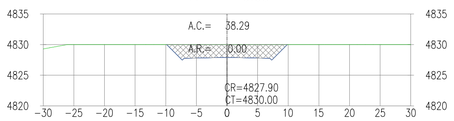


KM 4+440.00



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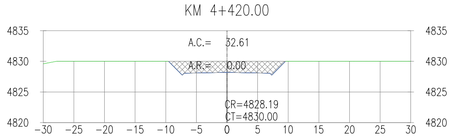

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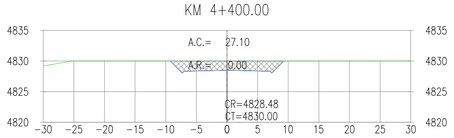

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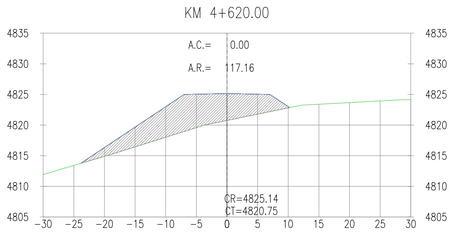
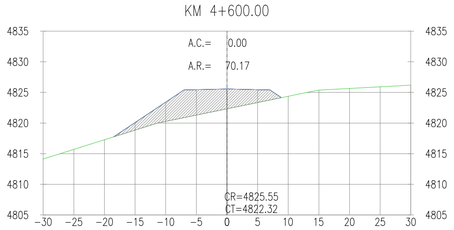
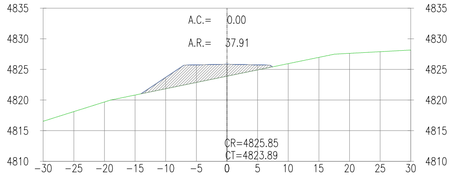


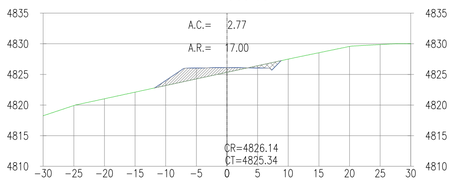
KM 4+600.00



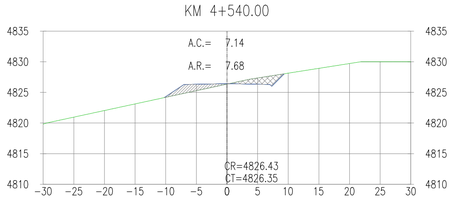
KM 4+580.00



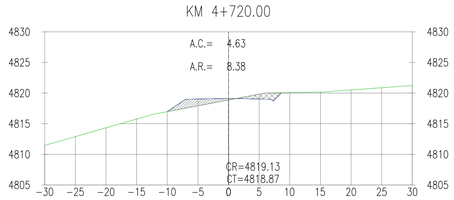
KM 4+560.00



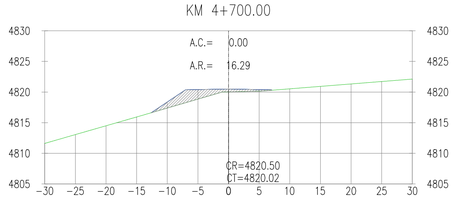
KM 4+540.00



KM 4+720.00



KM 4+700.00



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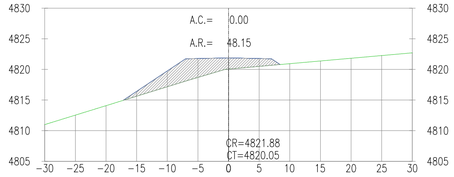

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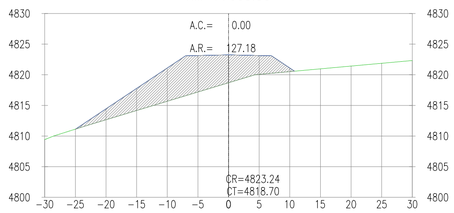

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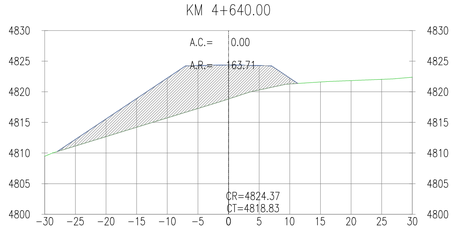
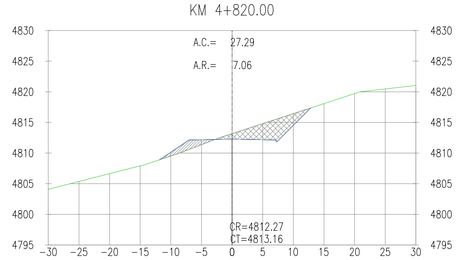


KM 4+820.00



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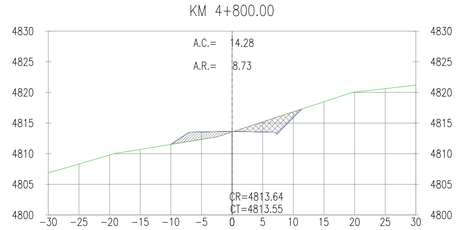

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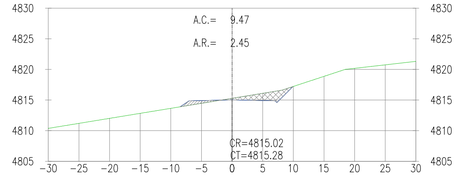

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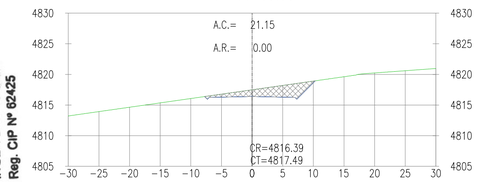
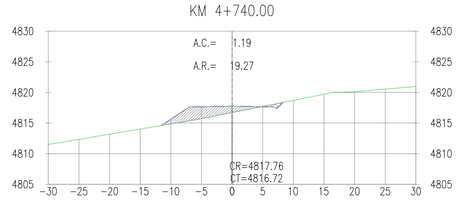


KM 4+740.00



MIGUEL ANGEL INFANTES OLIVARES
INGENIERO CIVIL
Reg. CIP Nº 82425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA			
DIBUJADO POR		FECHA APROB.	FIRMA
DISEÑADO POR		FECHA APROB.	FIRMA
REVISADO POR		FECHA APROB.	FIRMA
APROBADO POR		FECHA APROB.	FIRMA
USUARIO		FECHA APROB.	FIRMA

PROYECTO

CARRETERA TRAMO 1
4+400 – 4+820

PLANO

SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA:

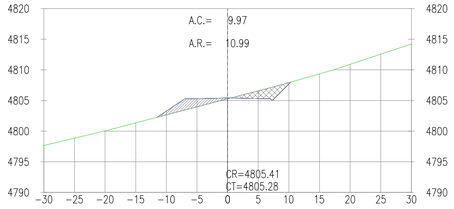
ESCALA METRICA 1:75 | 1:25 | 1:100 | 1:25 | 1:50

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

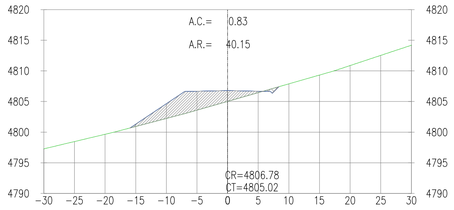
FORMATO OFICIAL A1

ARCHIVO:

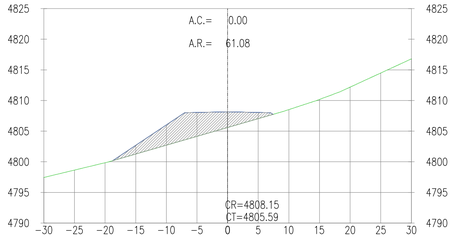
KM 4+920.00



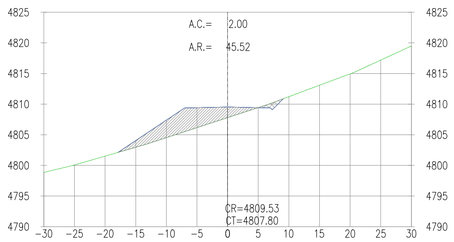
KM 4+900.00



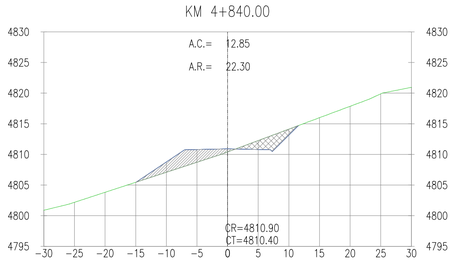
KM 4+880.00



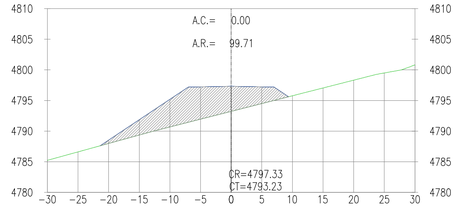
KM 4+860.00



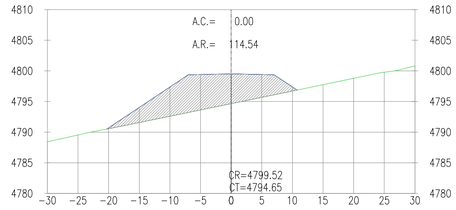
KM 4+840.00



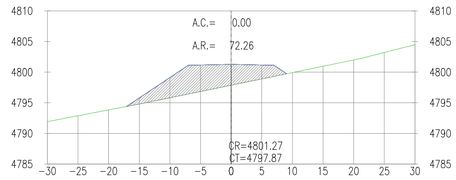
KM 5+020.00



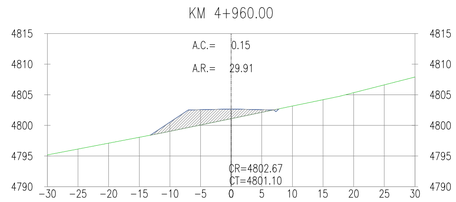
KM 5+000.00



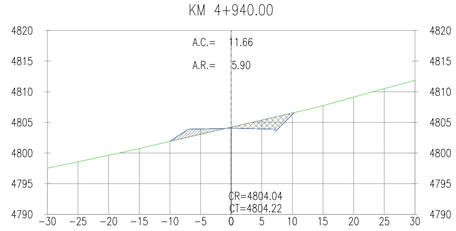
KM 4+980.00



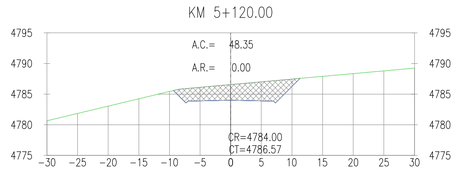
KM 4+960.00



KM 4+940.00



KM 5+120.00



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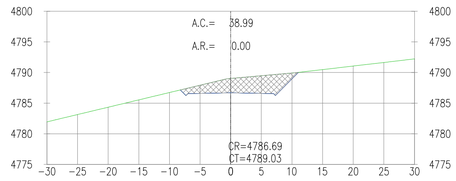
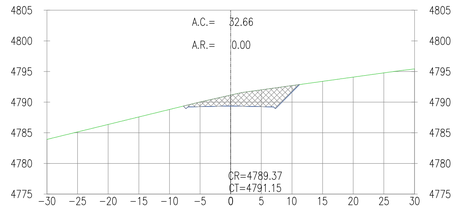
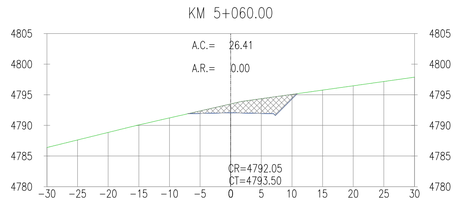


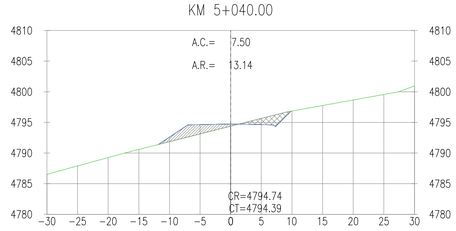
KM 5+080.00



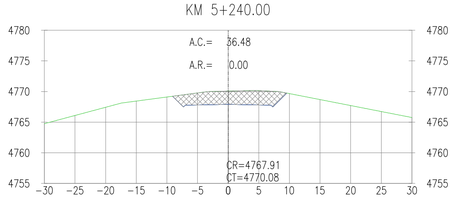
KM 5+060.00



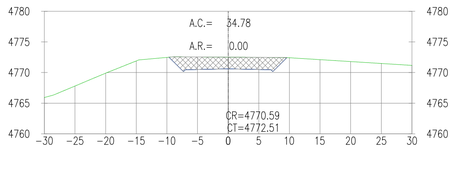
KM 5+040.00



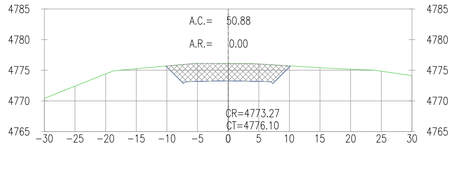
KM 5+240.00



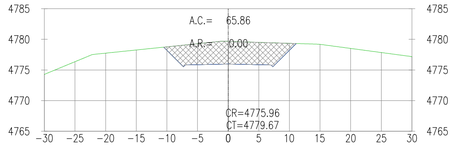
KM 5+220.00



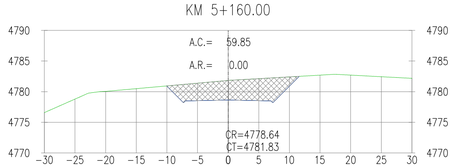
KM 5+200.00



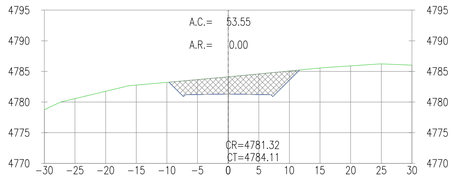
KM 5+180.00



KM 5+160.00



KM 5+140.00



MIGUEL ANGEL INFANTES OLIVARES
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Reg. CIP Nº 62425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

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RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO

CARRETERA TRAMO 1
4+840 – 5+240

PLANO

SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

ARCHIVO:

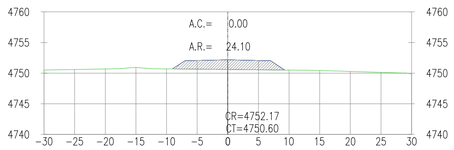
FECHA:

ESCALA METRICA 1:75

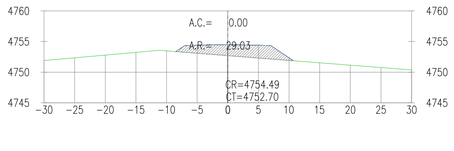
COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

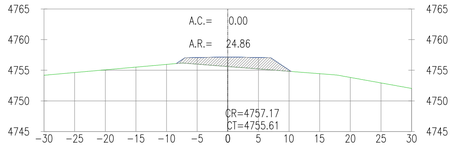
KM 5+360.00



KM 5+340.00



KM 5+320.00



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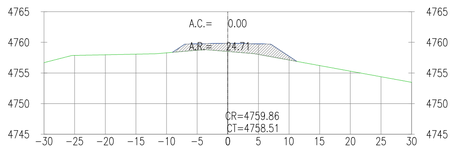
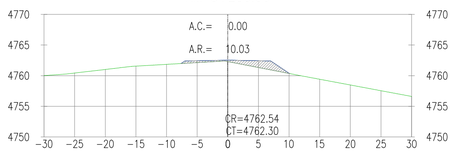
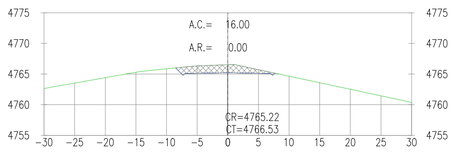


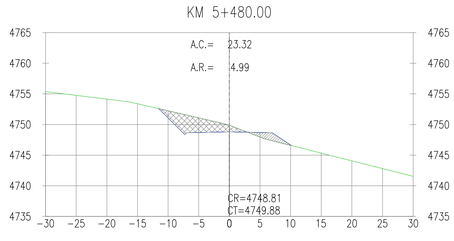
KM 5+280.00



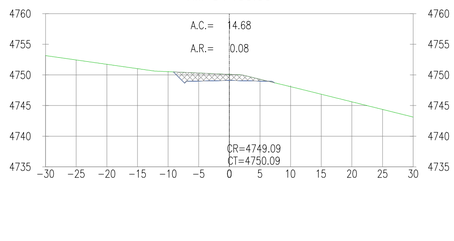
KM 5+260.00



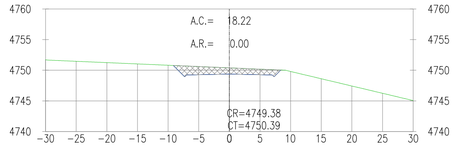
KM 5+480.00



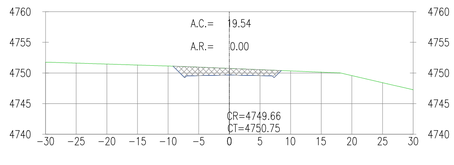
KM 5+460.00



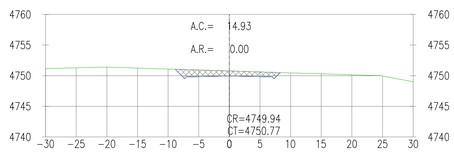
KM 5+440.00



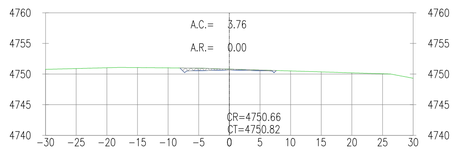
KM 5+420.00



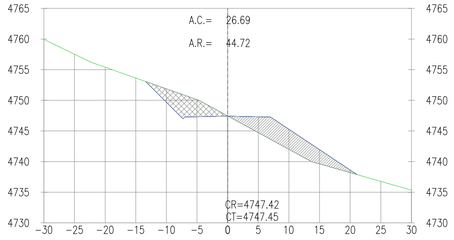
KM 5+400.00



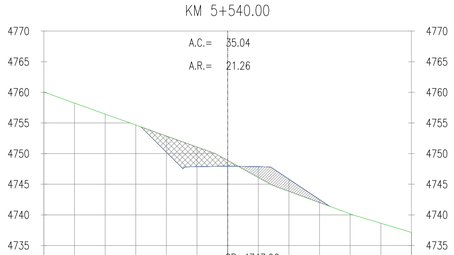
KM 5+380.00



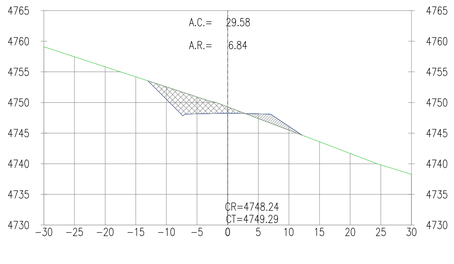
KM 5+560.00



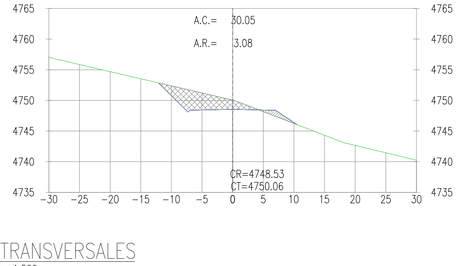
KM 5+540.00



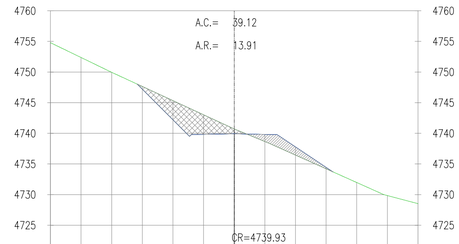
KM 5+520.00



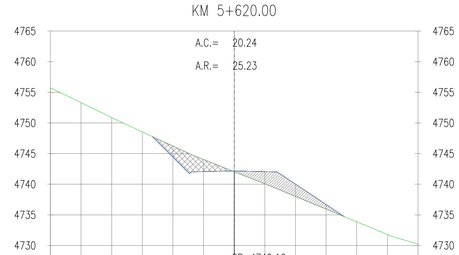
KM 5+500.00



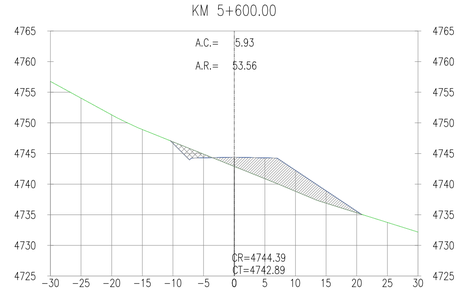
KM 5+640.00



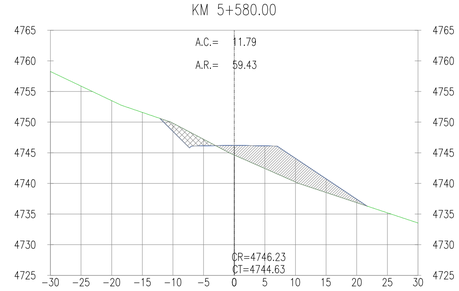
KM 5+620.00



KM 5+600.00



KM 5+580.00



MIGUEL ANGEL INFANTES OLIVANO
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Reg. CIP Nº 82425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

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RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1 5+260 – 5+640

PLANO: SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA:

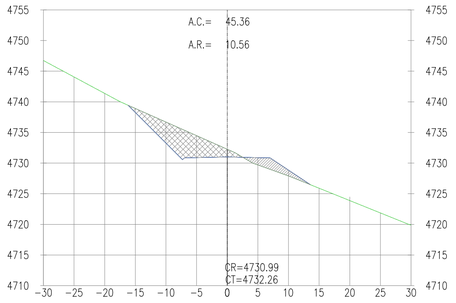
ARCHIVO:

ESCALA METRICA 1:25 1:100 1:75

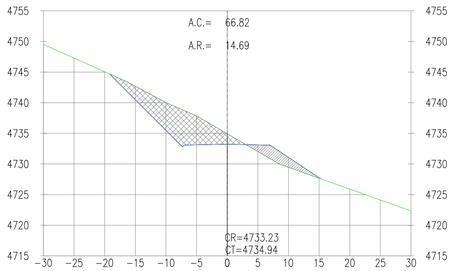
COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

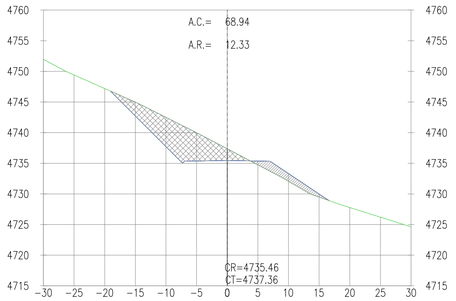
KM 5+720.00



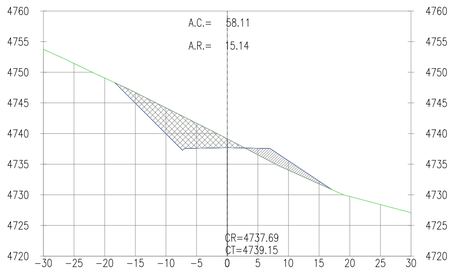
KM 5+700.00



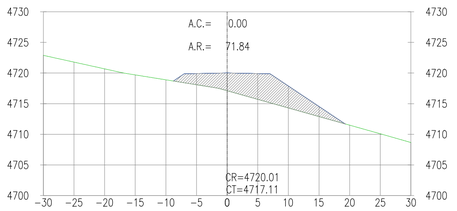
KM 5+680.00



KM 5+660.00



KM 5+820.00



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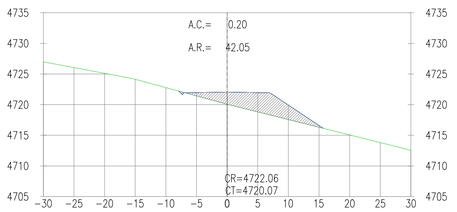
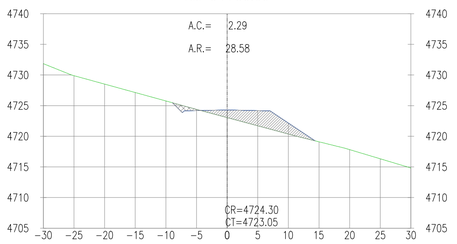


KM 5+780.00



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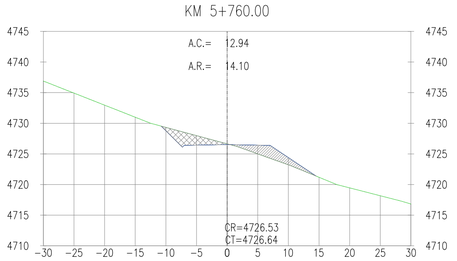

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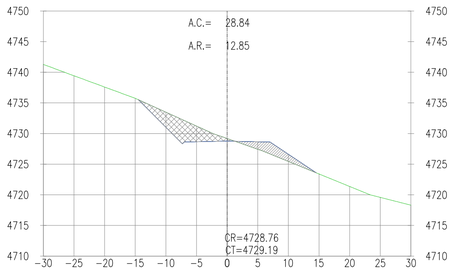

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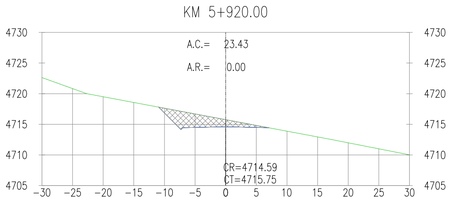

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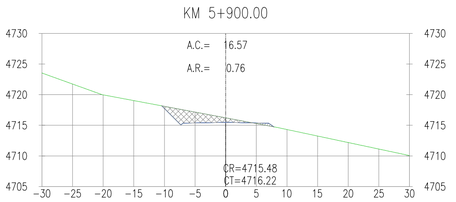

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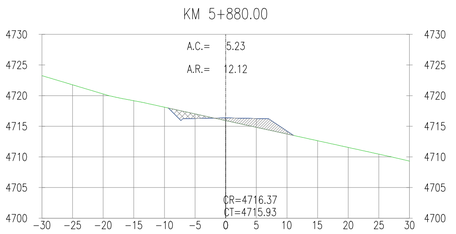

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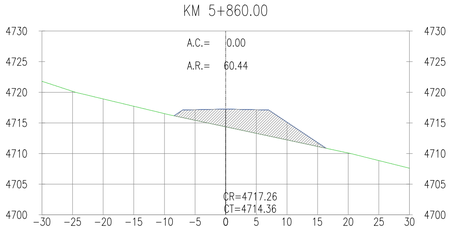

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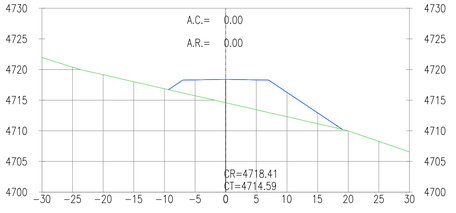
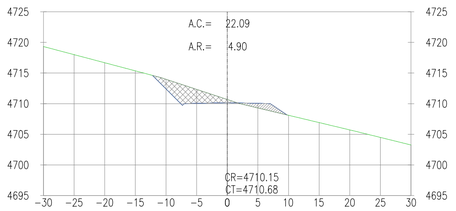
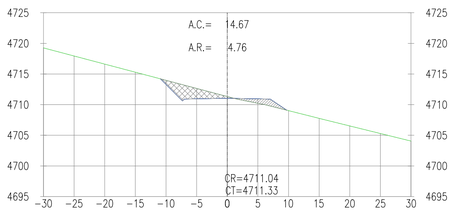


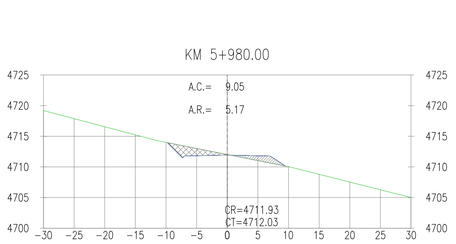
KM 6+020.00



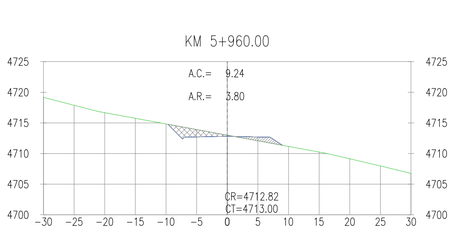
KM 6+000.00



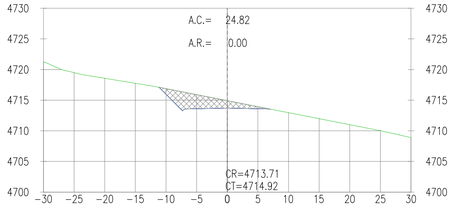
KM 5+980.00



KM 5+960.00



KM 5+940.00



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Reg. CIP Nº 82425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
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SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES

	FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS

PLANO NO.	REFERENCIA

EMISIONES

REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
			COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

	FECHA APROB.	FIRMA
DIBUJADO POR		
DISEÑADO POR		
REVISADO POR		
APROBADO POR		
USUARIO		

PROYECTO: CARRETERA TRAMO 1 5+660 – 6+020

PLANO: SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA:

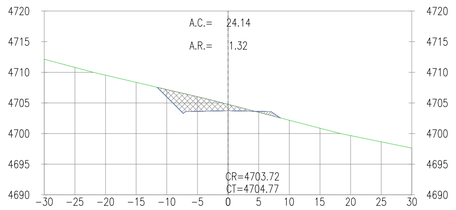
ARCHIVO:

ESCALA METRICA 1:25 1:50 1:75 1:100 1:20

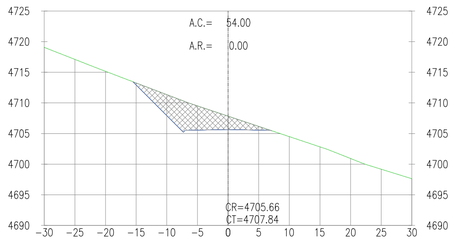
COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

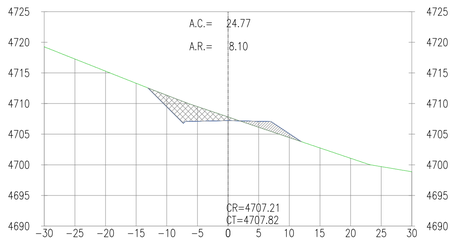
KM 6+120.00



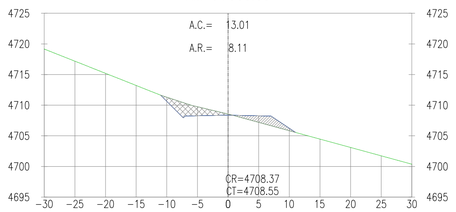
KM 6+100.00



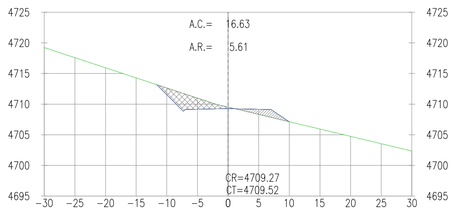
KM 6+080.00



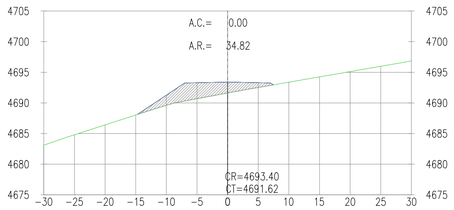
KM 6+060.00



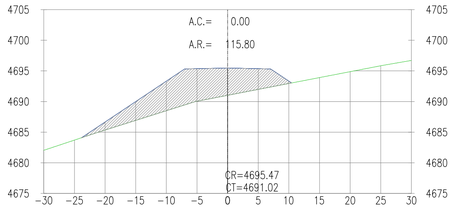
KM 6+040.00



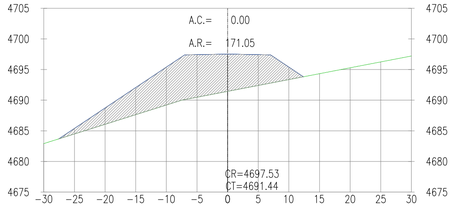
KM 6+220.00



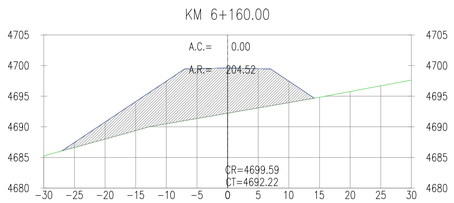
KM 6+200.00



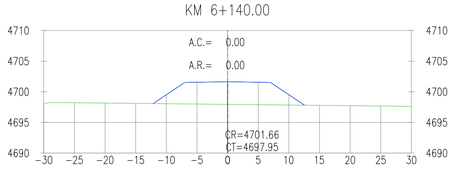
KM 6+180.00



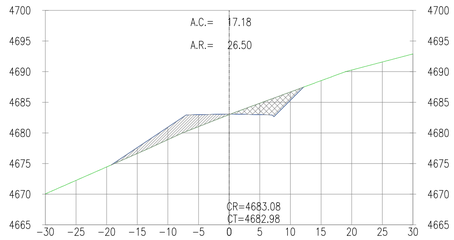
KM 6+160.00



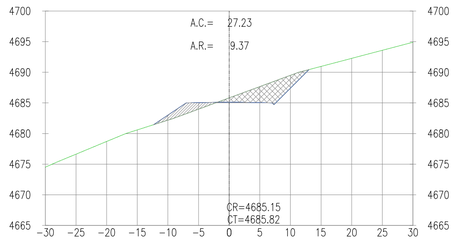
KM 6+140.00



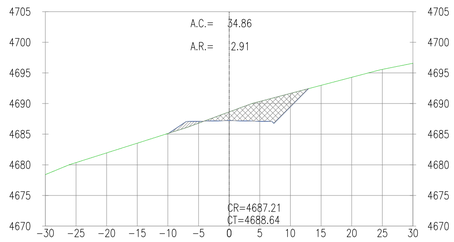
KM 6+320.00



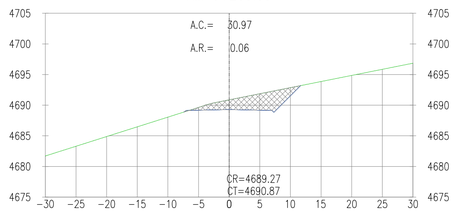
KM 6+300.00



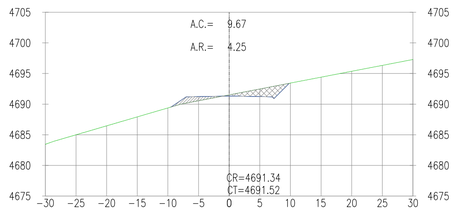
KM 6+280.00



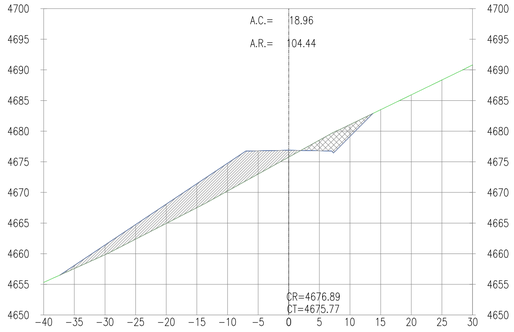
KM 6+260.00



KM 6+240.00



KM 6+380.00



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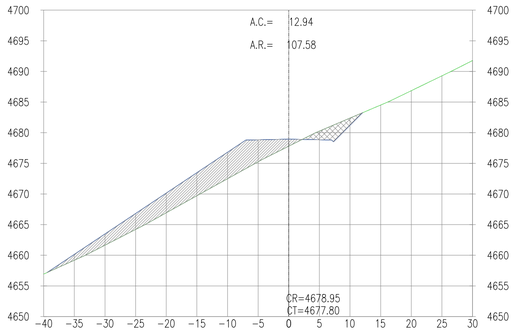
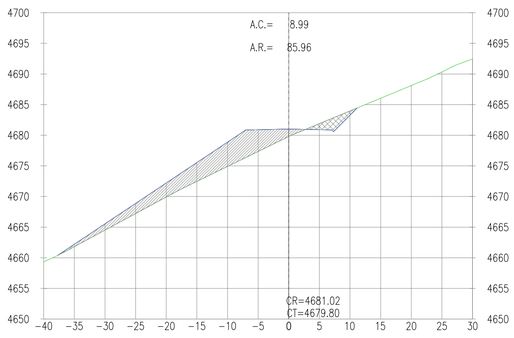


KM 6+340.00



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CARMEN ROCIO VALENZUELA CACHAY
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SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA		
DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO

CARRETERA TRAMO 1
6+040 – 6+380

PLANO

SECCIONES
TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA:

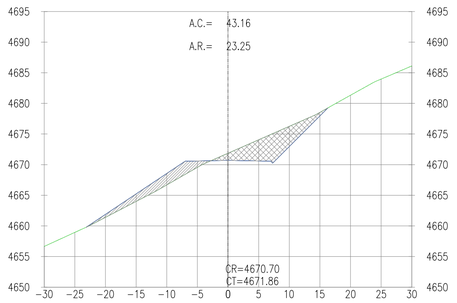
ESCALA METRICA 1:75 | 1:100 | 1:25 | 1:50

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

ARCHIVO:

KM 6+440.00



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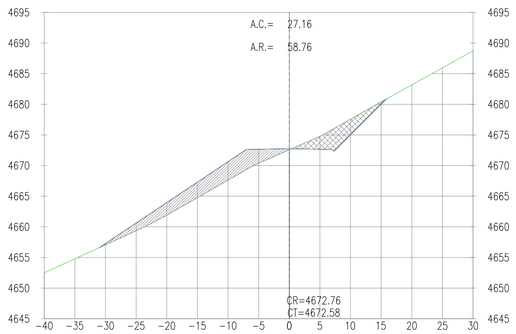
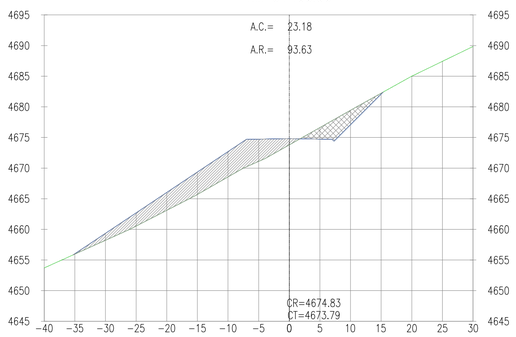
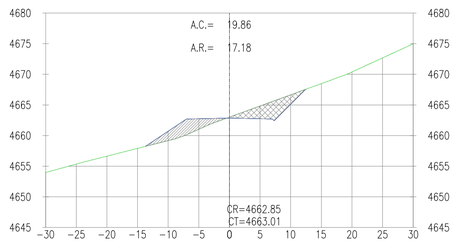


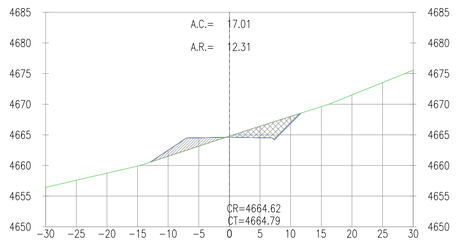
KM 6+400.00



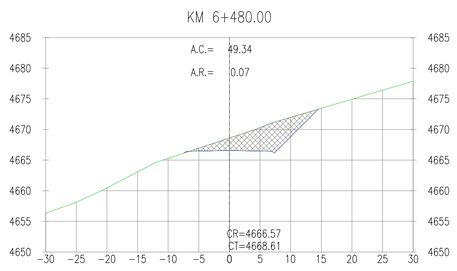
KM 6+520.00



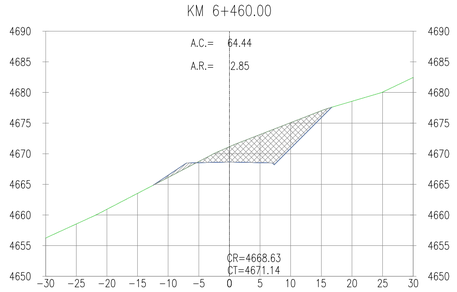
KM 6+500.00



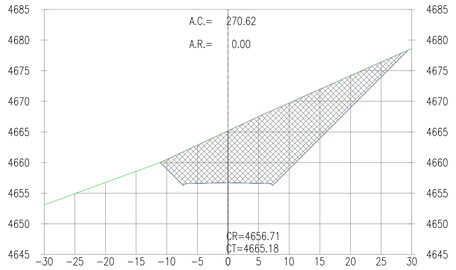
KM 6+480.00



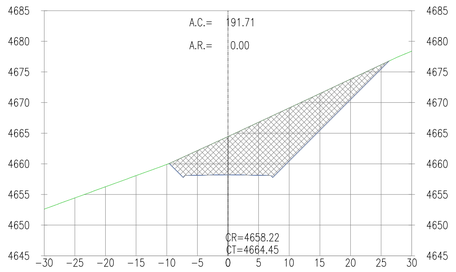
KM 6+460.00



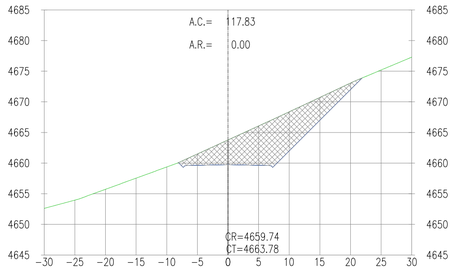
KM 6+600.00



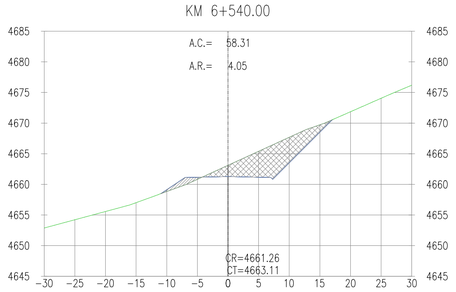
KM 6+580.00



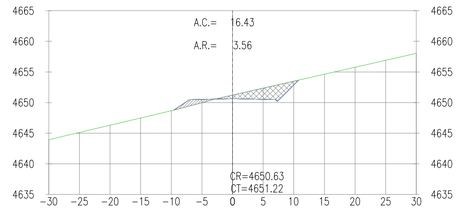
KM 6+560.00



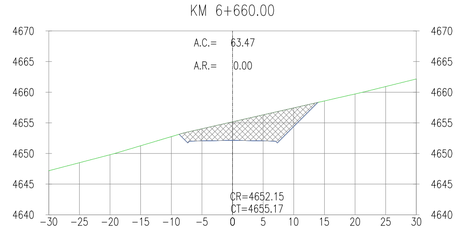
KM 6+540.00



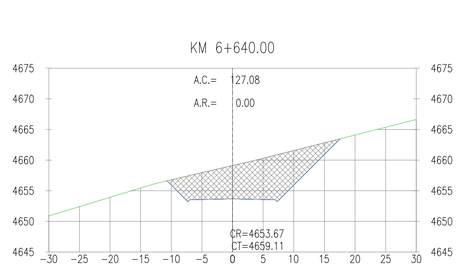
KM 6+680.00



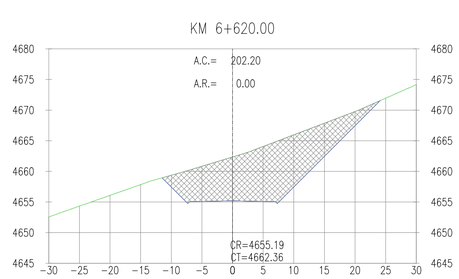
KM 6+660.00



KM 6+640.00



KM 6+620.00



MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 82425

CARMEN ROCIO
VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP N°92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES

	FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS

PLANO NO.	REFERENCIA

EMISIONES

REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS	

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1 6+40 – 6+680

PLANO: SECCIONES TRANSVERSALES

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

CHINALCO

ESCALA METRICA 1:25 1:100 1:25

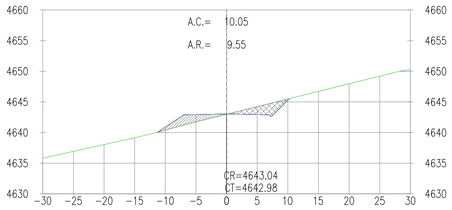
COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

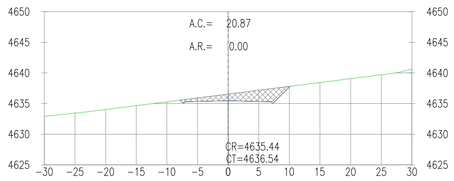
ARCHIVO:

FECHA:

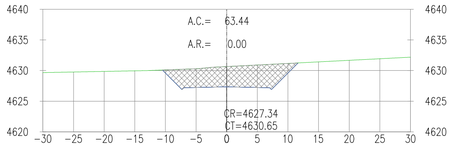
KM 6+780.00



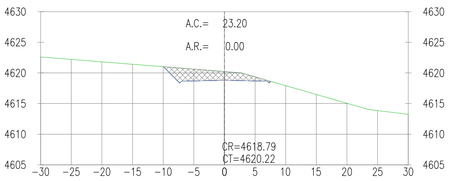
KM 6+880.00



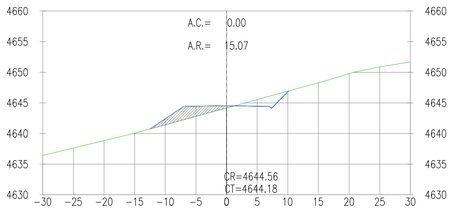
KM 6+980.00



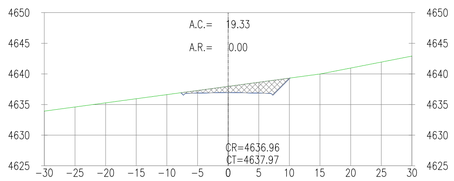
KM 7+080.00



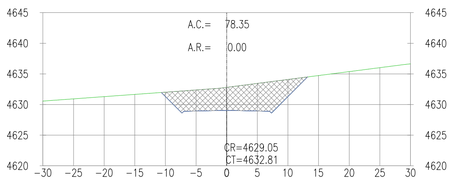
KM 6+760.00



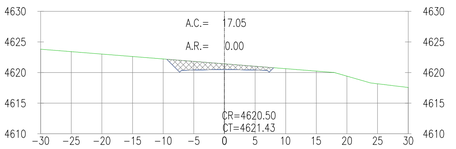
KM 6+860.00



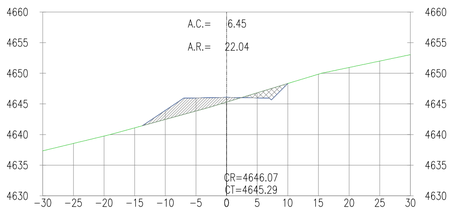
KM 6+960.00



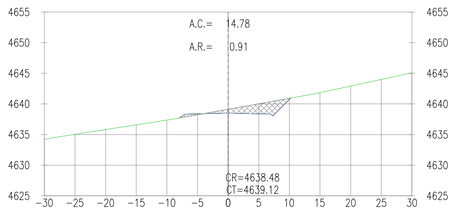
KM 7+060.00



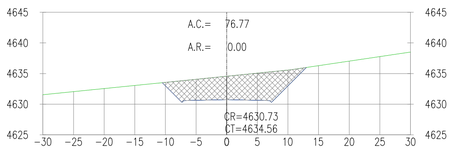
KM 6+740.00



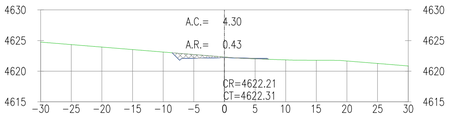
KM 6+840.00



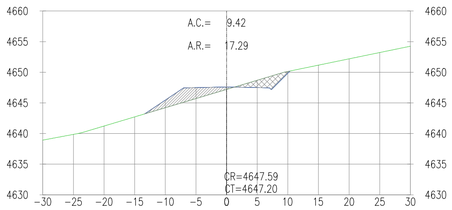
KM 6+940.00



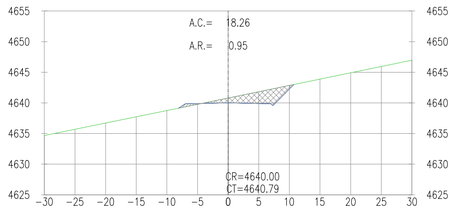
KM 7+040.00



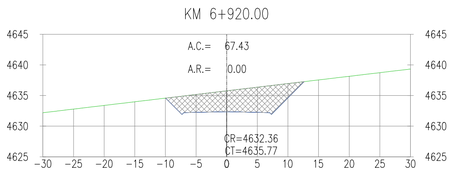
KM 6+720.00



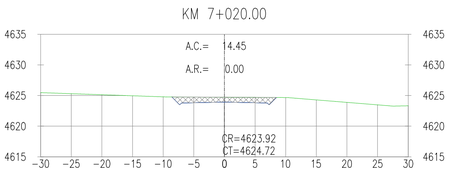
KM 6+820.00



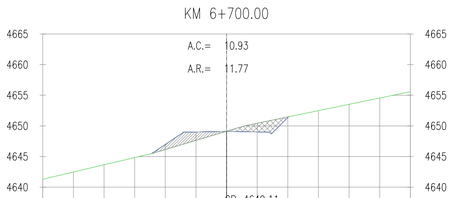
KM 6+920.00



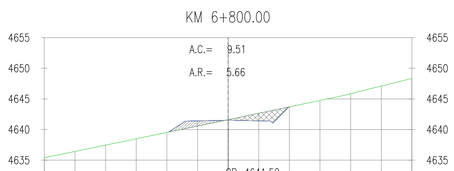
KM 7+020.00



KM 6+700.00



KM 6+800.00



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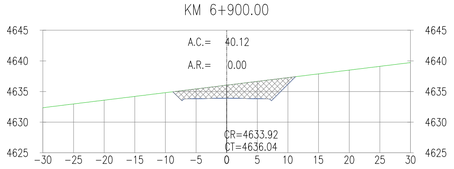
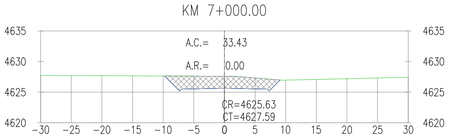


KM 7+000.00



CARMEN ROCIO VALENZUELA CACHAY
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INGENIERO CIVIL
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SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

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RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1 6+700- 7+080

PLANO: SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA:

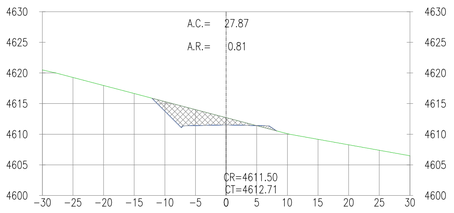
ARCHIVO:

ESCALA METRICA 1:75

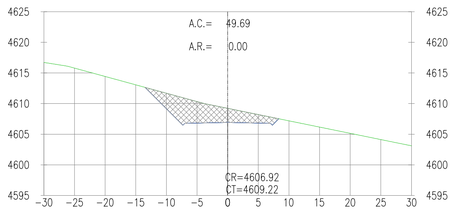
COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

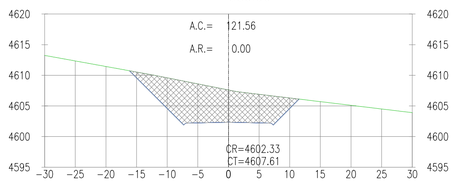
KM 7+180.00



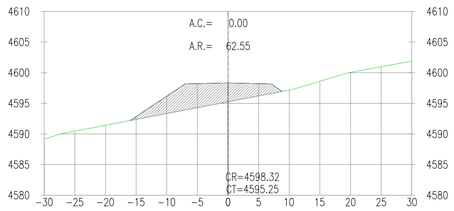
KM 7+280.00



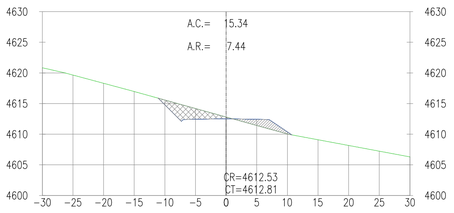
KM 7+380.00



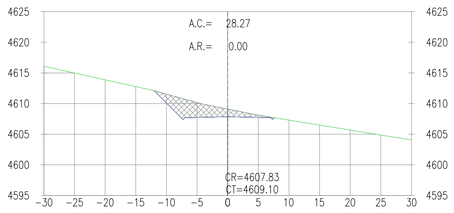
KM 7+480.00



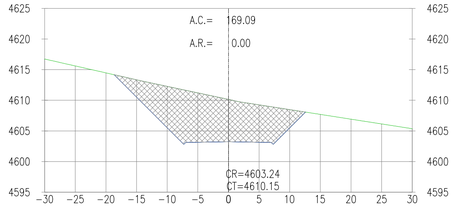
KM 7+160.00



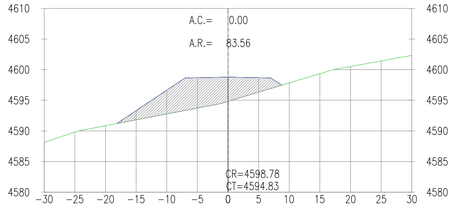
KM 7+260.00



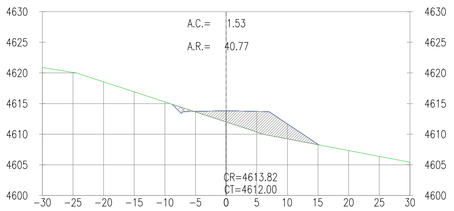
KM 7+360.00



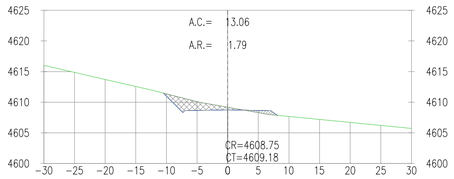
KM 7+460.00



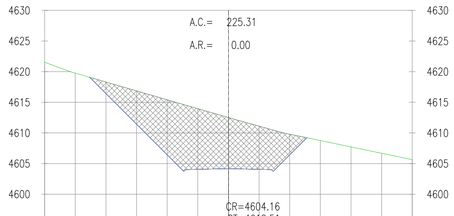
KM 7+140.00



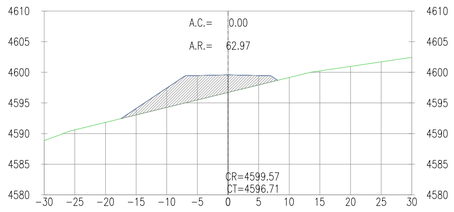
KM 7+240.00



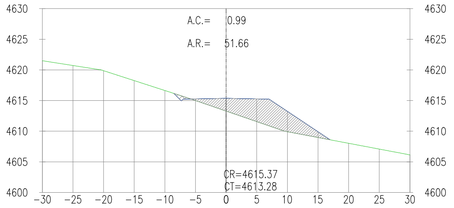
KM 7+340.00



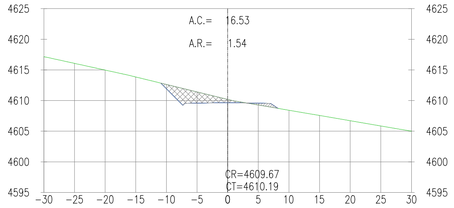
KM 7+440.00



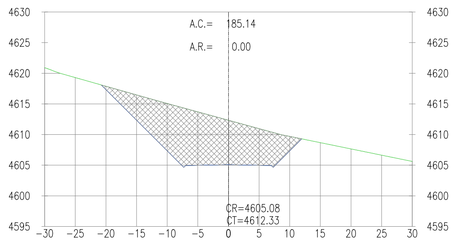
KM 7+120.00



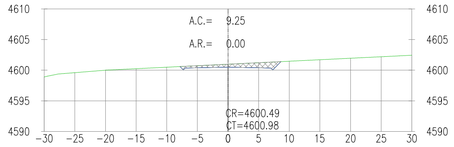
KM 7+220.00



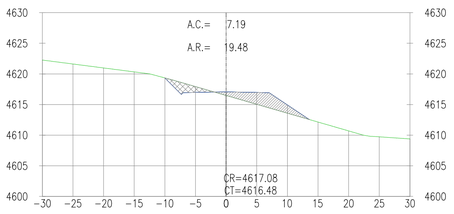
KM 7+320.00



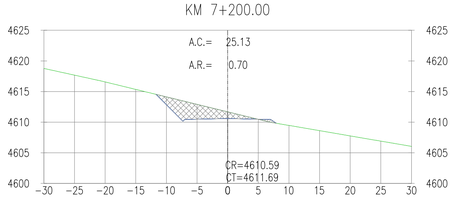
KM 7+420.00



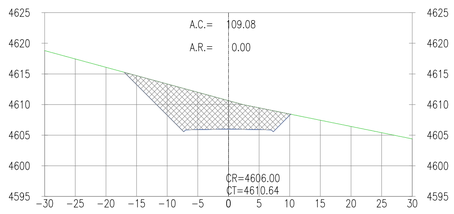
KM 7+100.00



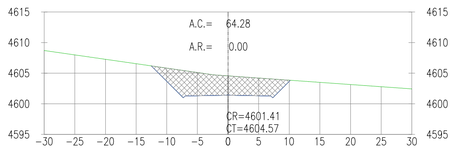
KM 7+200.00



KM 7+300.00



KM 7+400.00



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MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 82425

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA
SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO

CARRETERA TRAMO 1
7+100 – 7+480

PLANO

SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

ARCHIVO:

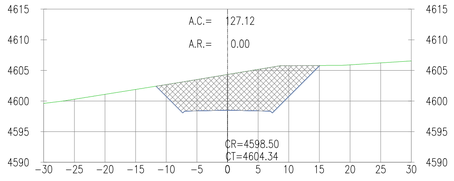
FECHA:

ESCALA METRICA 1:75

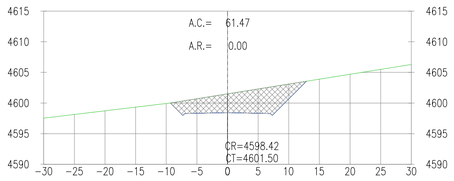
COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

KM 7+580.00



KM 7+560.00



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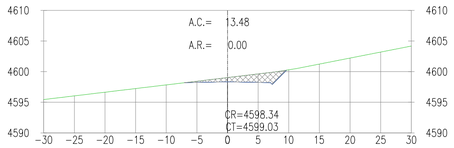

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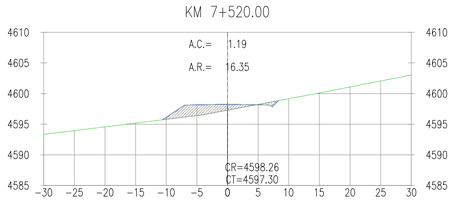
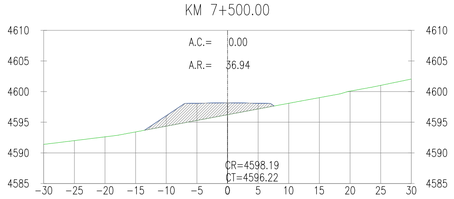


KM 7+500.00



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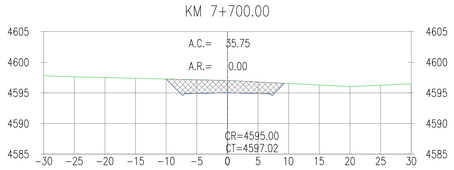

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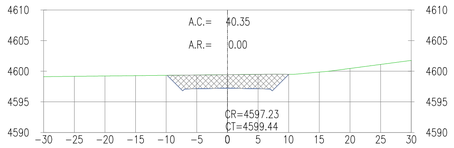
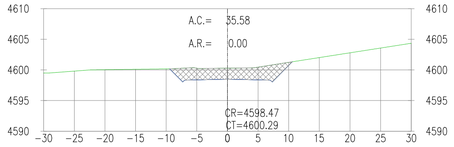


KM 7+660.00



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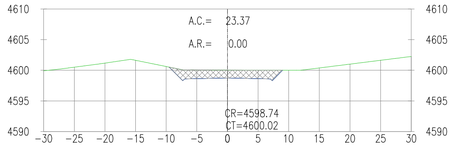

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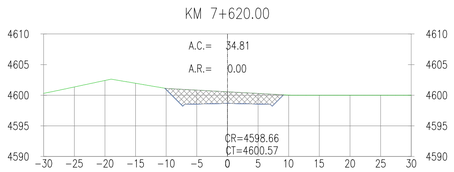

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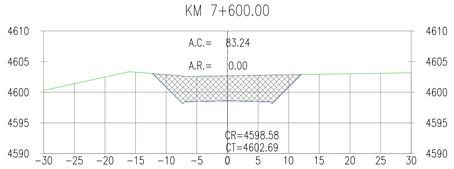

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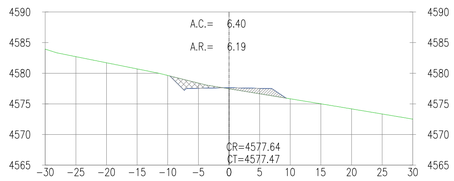

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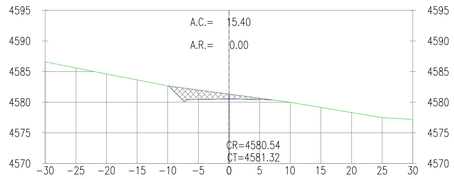

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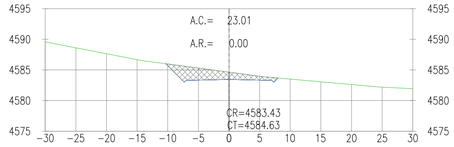

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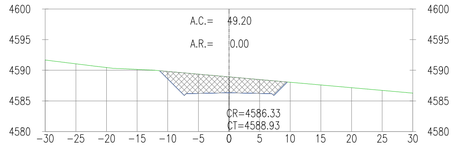
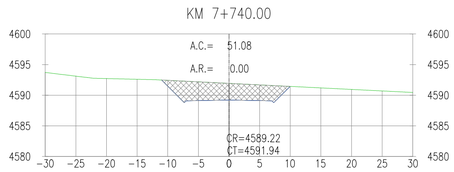
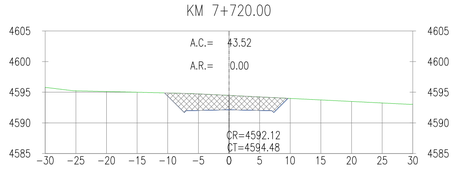


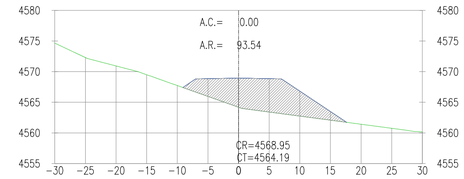
KM 7+740.00



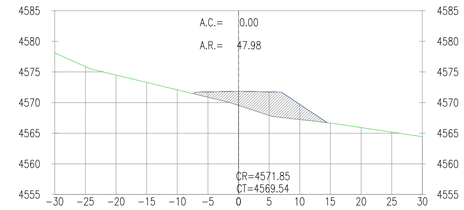
KM 7+720.00



KM 7+880.00



KM 7+860.00



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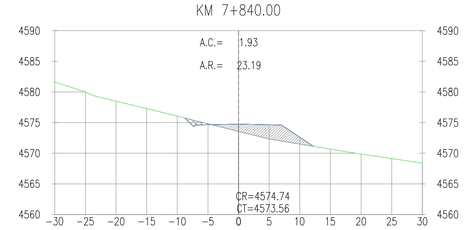

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Reg. CIP Nº 82425

CARMEN ROCIO
VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
					COPIAS	

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO

CARRETERA TRAMO 1
7+500 – 7+880

PLANO

SECCIONES
TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA:

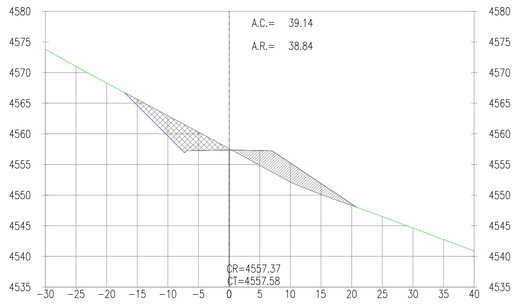
ARCHIVO:

ESCALA METRICA 1:75 1:100 1:25 1:50 1:25

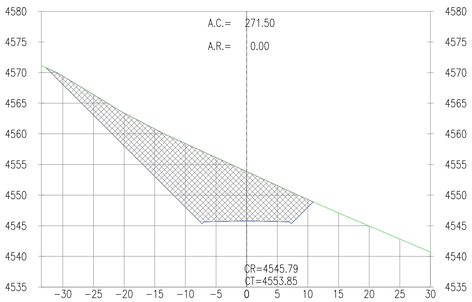
COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

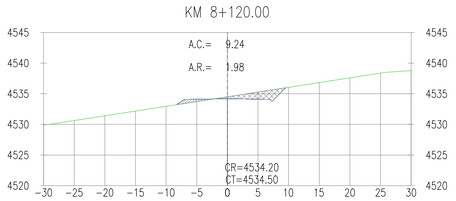
KM 7+960.00



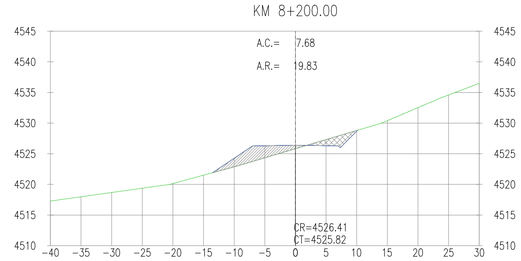
KM 8+040.00



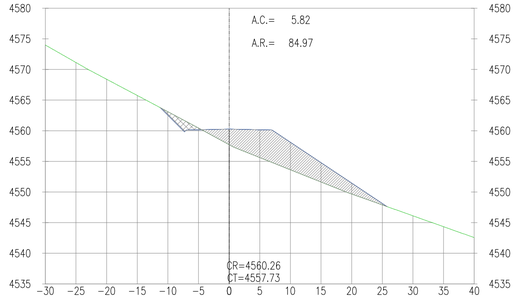
KM 8+120.00



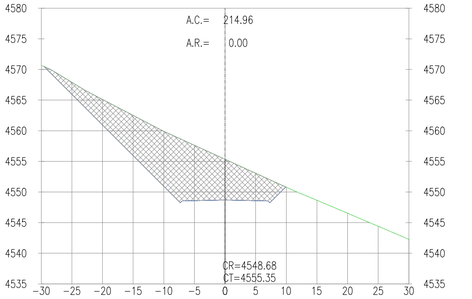
KM 8+200.00



KM 7+940.00



KM 8+020.00



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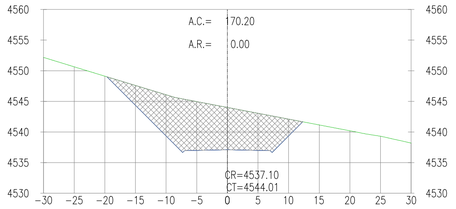

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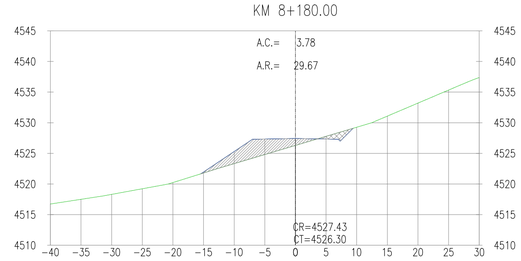
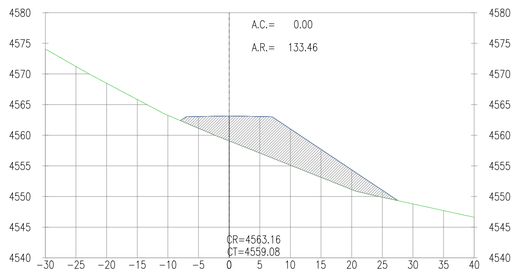
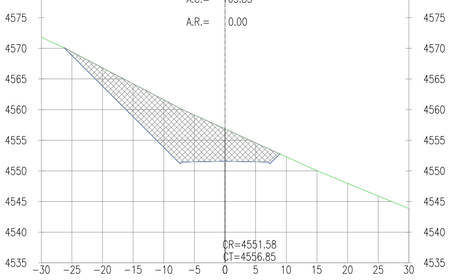


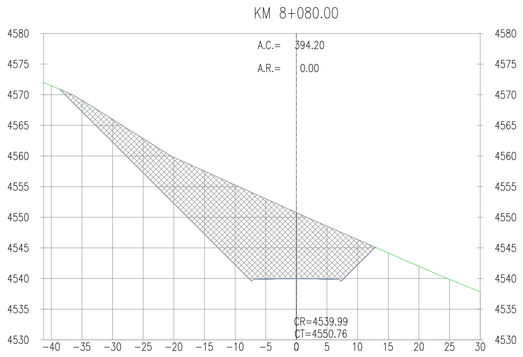
KM 7+920.00



KM 8+000.00



KM 8+080.00



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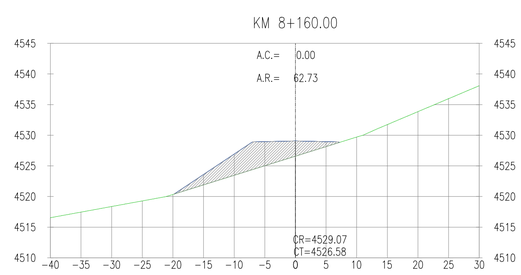
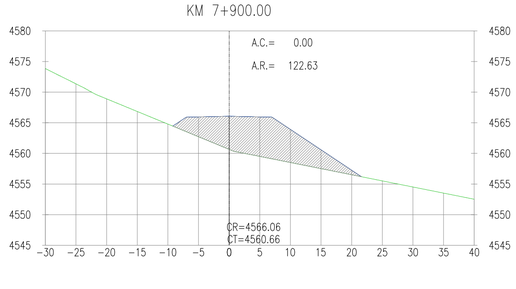


KM 7+900.00



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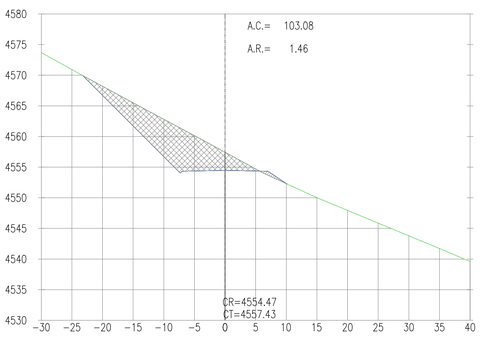
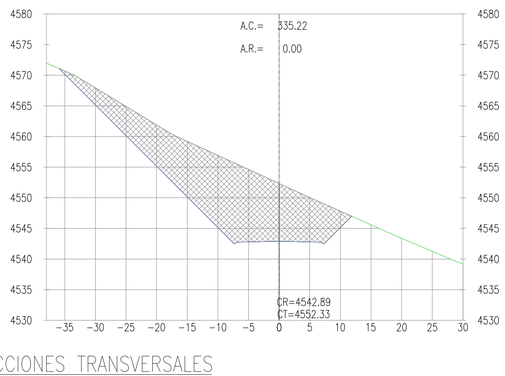
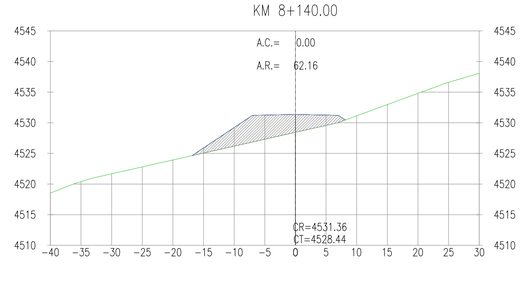


KM 8+060.00



KM 8+140.00



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SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1 7+900 – 8+

PLANO: SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA: Jan 25 / 2019 / 4:34pm

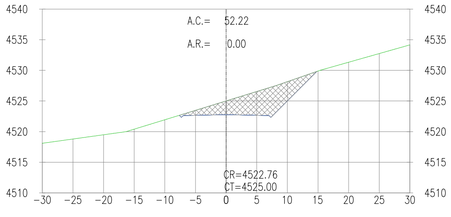
ESCALA METRICA 1:25 1:100 1:75 1:50 1:25 1:20

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

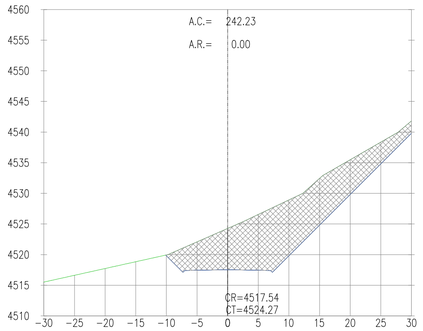
FORMATO OFICIAL A1

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2019.dwg

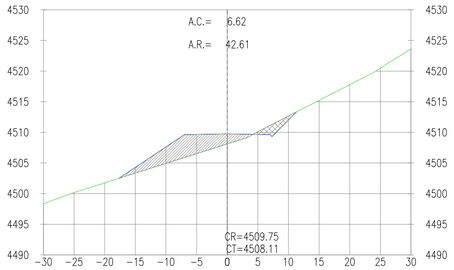
KM 8+280.00



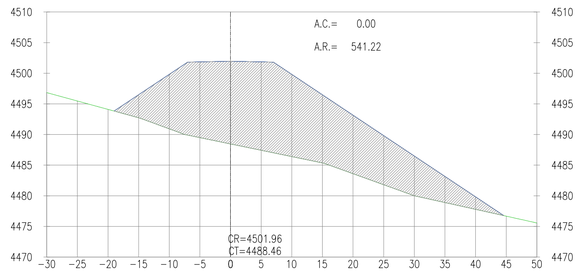
KM 8+360.00



KM 8+440.00



KM 8+520.00



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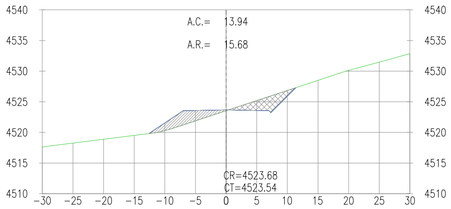

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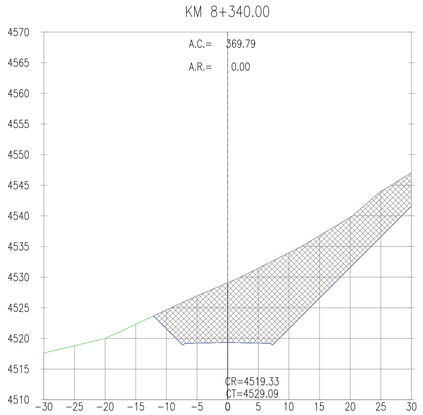
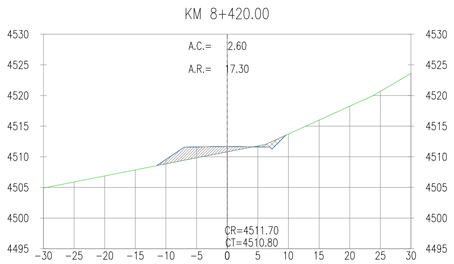
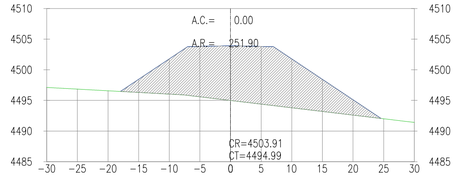


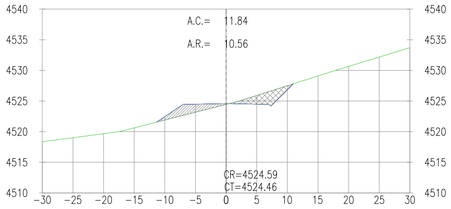
KM 8+420.00



KM 8+500.00



KM 8+240.00



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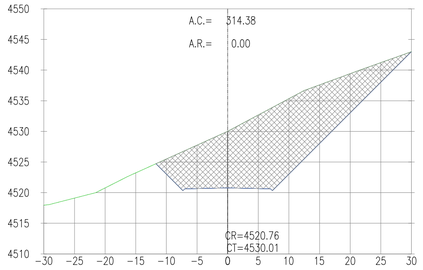
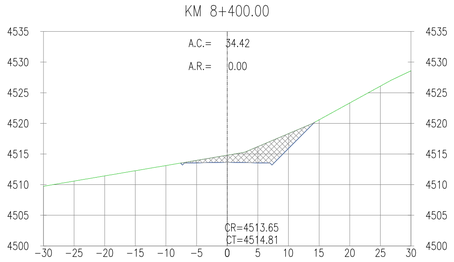
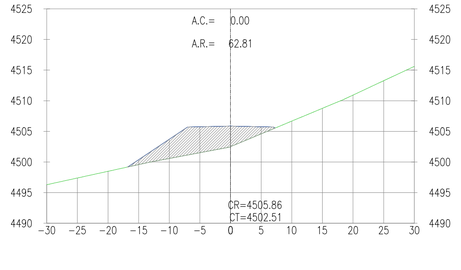


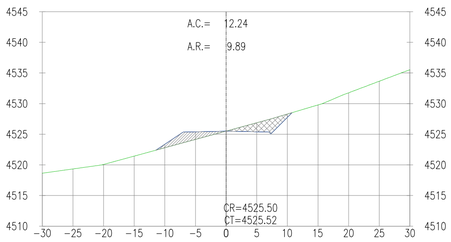
KM 8+400.00



KM 8+480.00



KM 8+220.00



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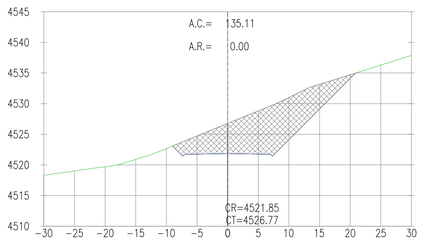

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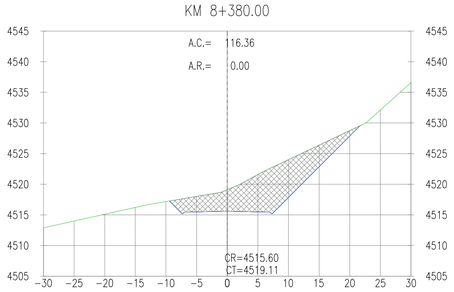

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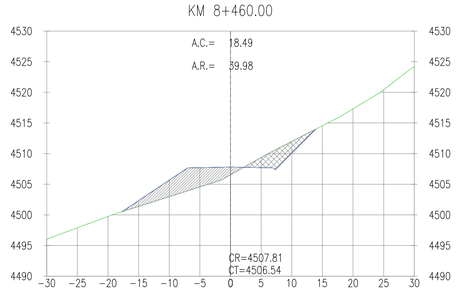

MIGUEL ANGEL INFANTES OHLIANO
INGENIERO CIVIL
Reg. CIP Nº 82425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA
SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1

PLANO: SECCIONES TRANSVERSALES

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

CHINALCO

FECHA: Jan 25 / 2019 / 4:34pm

ESCALA METRICA 1:25 1:100 1:75

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2019

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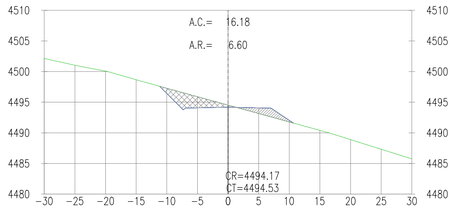

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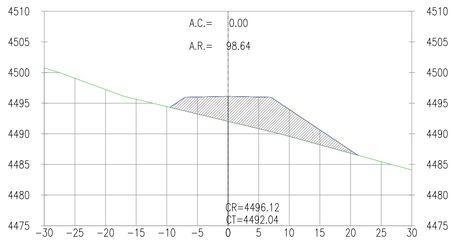

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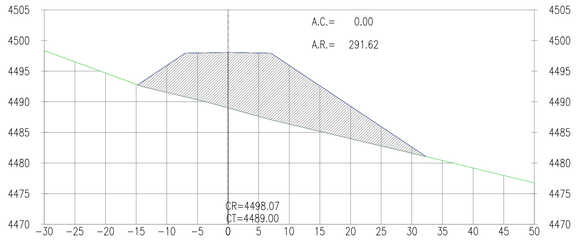

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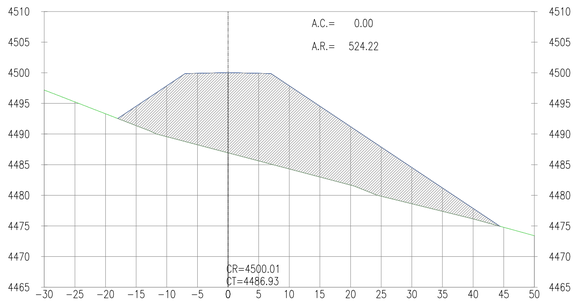

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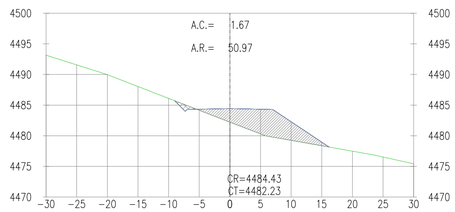

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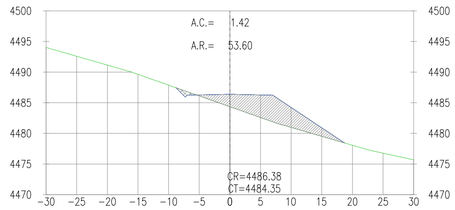

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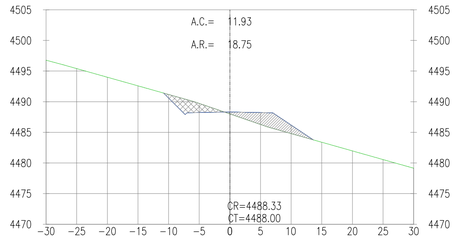

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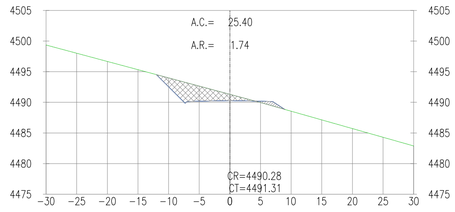

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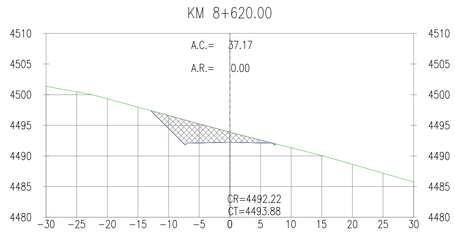

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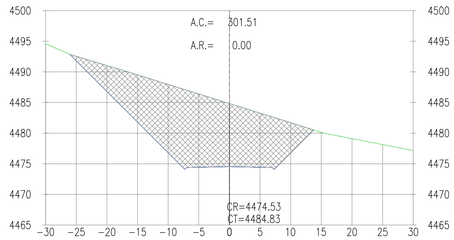

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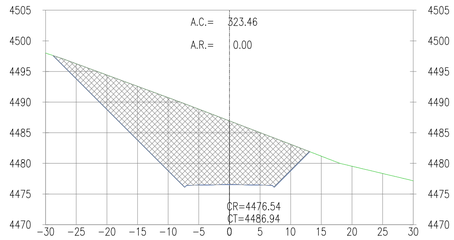

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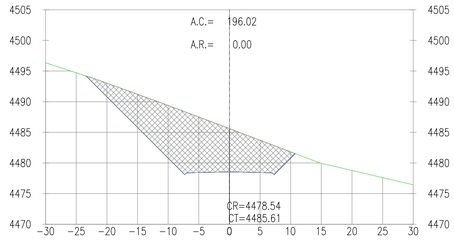

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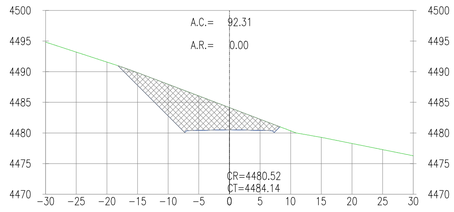

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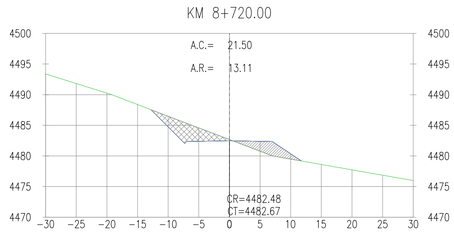

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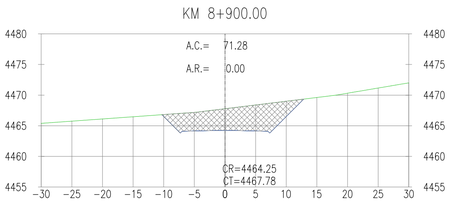

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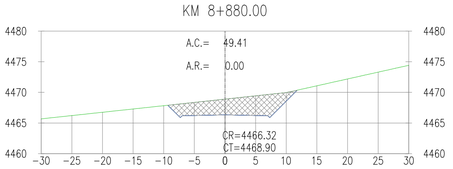

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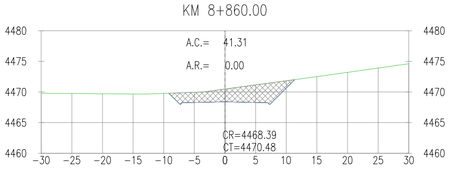

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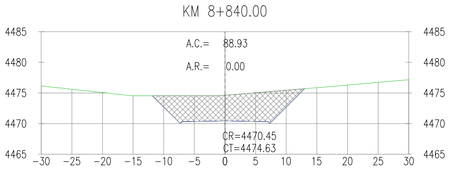

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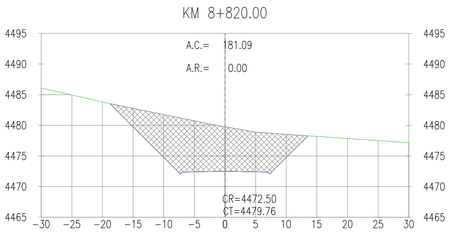

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Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES	FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA		
DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1

PLANO: SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA: Jan 25 / 2019 / 4:35pm

ESCALA METRICA 1:75

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2018

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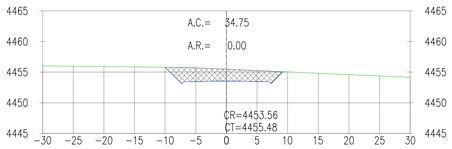

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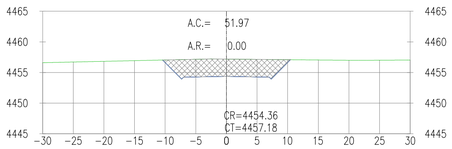

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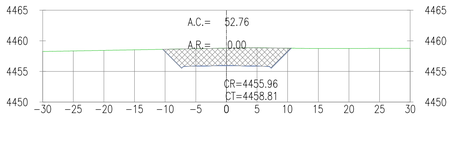

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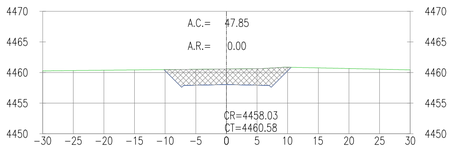

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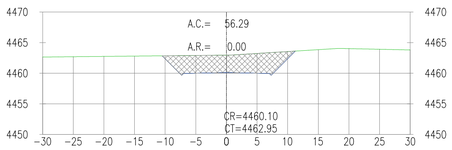

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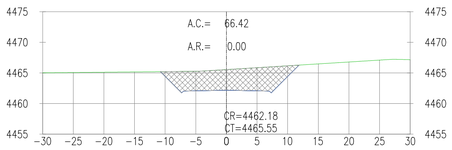

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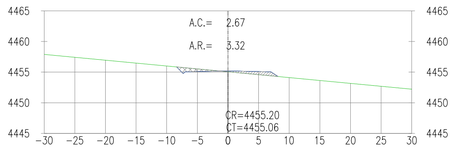

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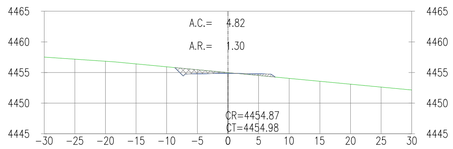

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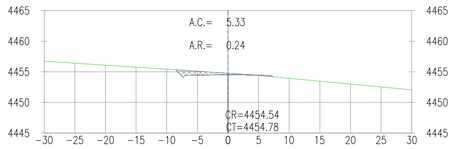
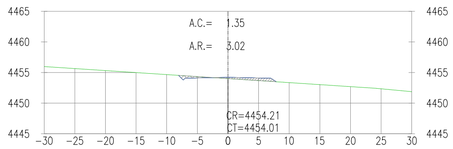


KM 9+080.00



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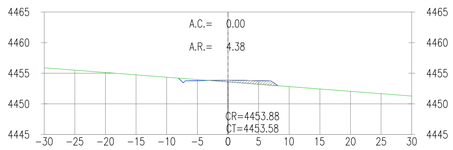

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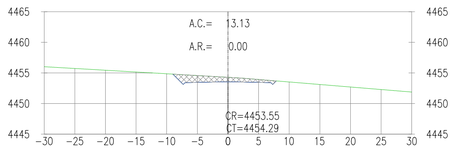

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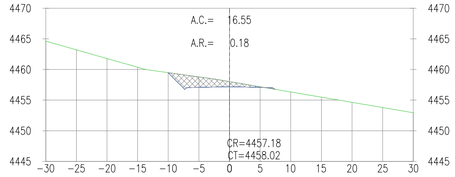

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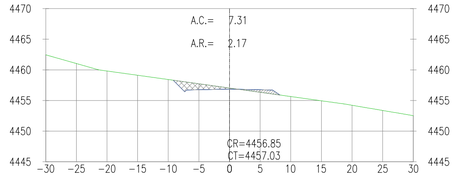

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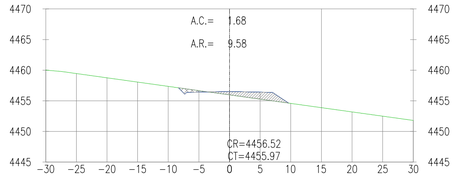

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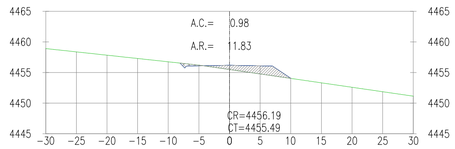

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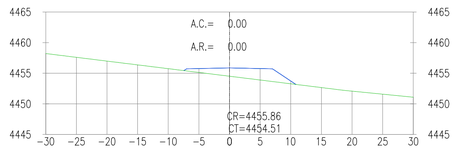

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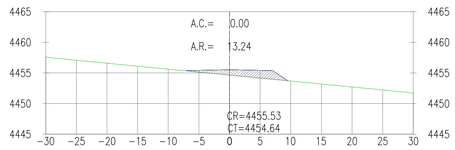

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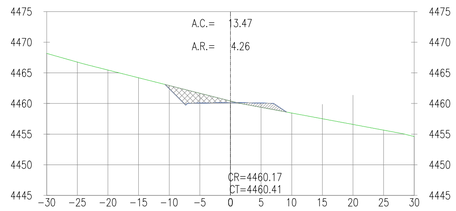

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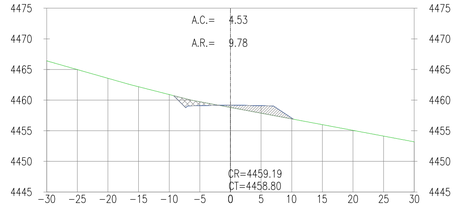

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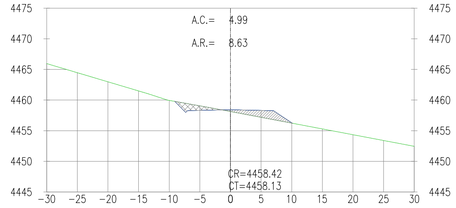

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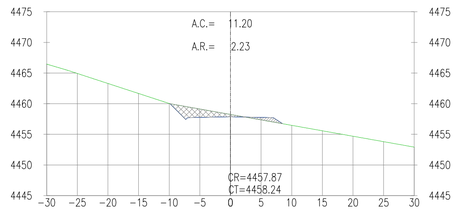

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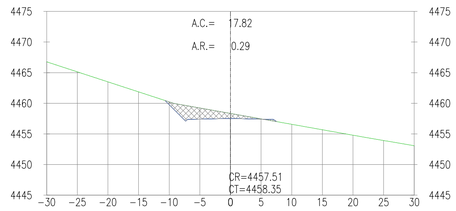

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MIGUEL ANGEL INFANTES OLIVANO
INGENIERO CIVIL
Reg. CIP Nº 82425

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT
						–		

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

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RECORD DE INGENIERÍA

DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1

PLANO: SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA: Jan 25 / 2019 / 4:36pm

ESCALA METRICA 1:75 1:100 1:125 1:50 1:20

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

xxx

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2018

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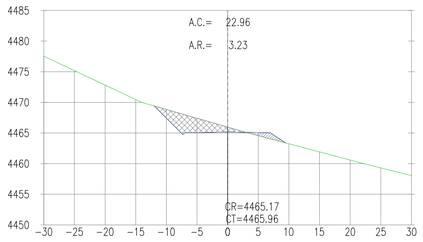

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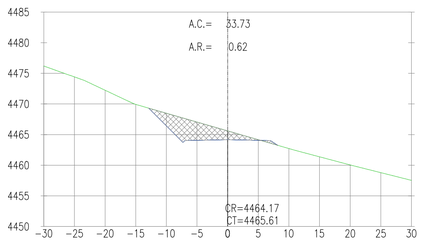

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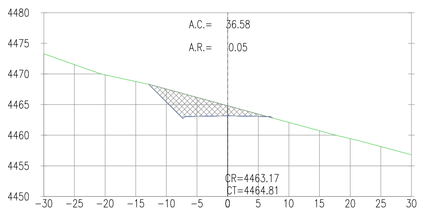

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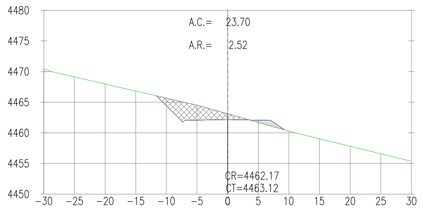

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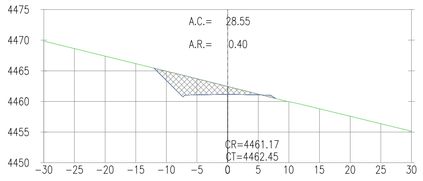

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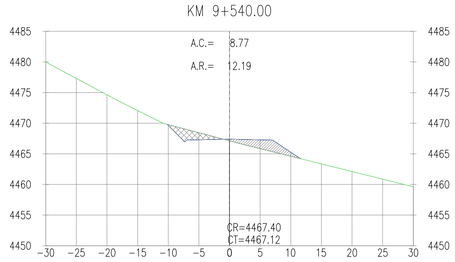

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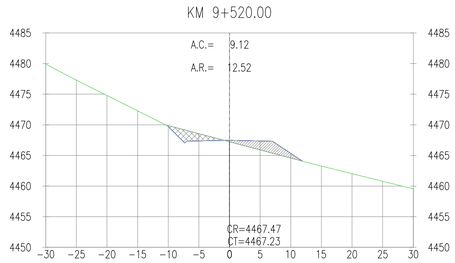

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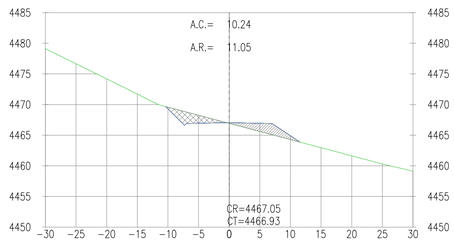

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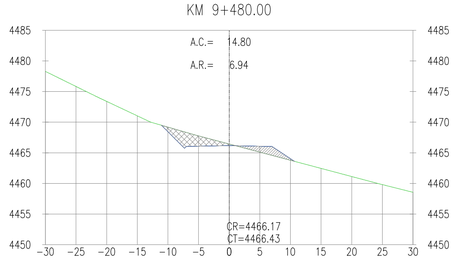

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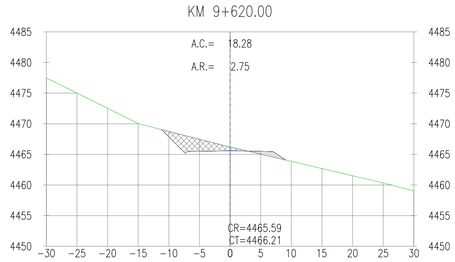

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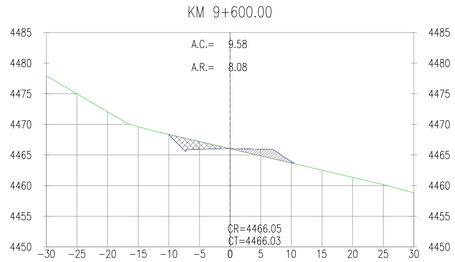

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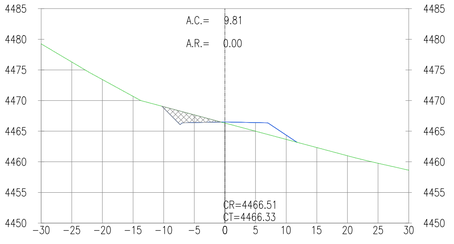

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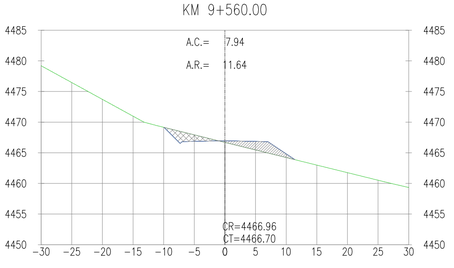

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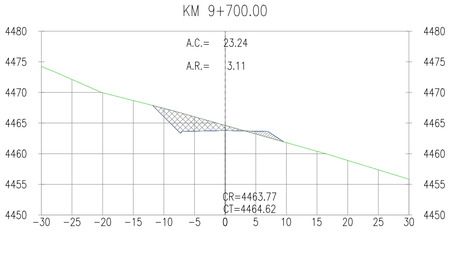

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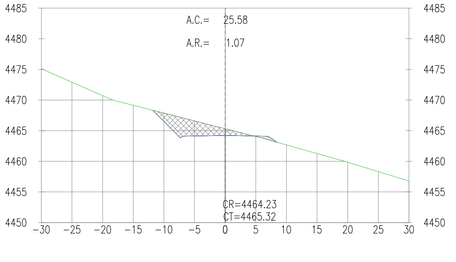

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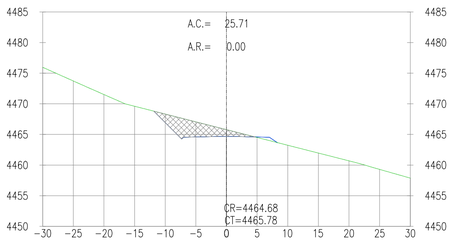

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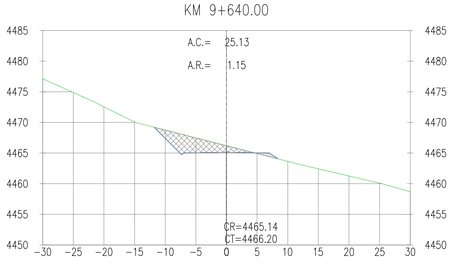

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Reg. CIP Nº 82425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA		
DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1

PLANO: SECCIONES TRANSVERSALES

CHINALCO

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

FECHA: Jan 25 / 2019 / 4:37pm

ESCALA METRICA 1:75 1:100 1:125 1:50 1:20

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

FORMATO OFICIAL A1

ARCHIVO: C:\Users\ZERO\Desktop\Planos y Metrados\Movimiento de Tierras\DWG\DISEÑO DE CARRETERA_01_2018

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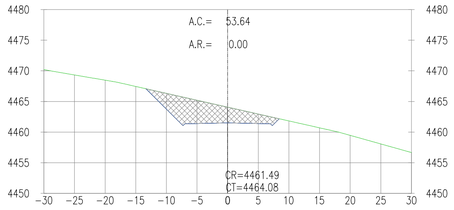

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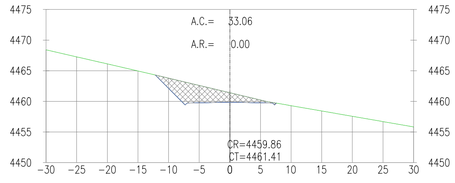

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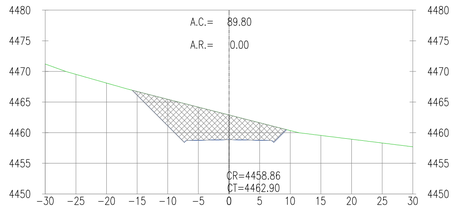

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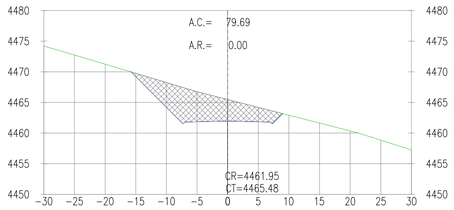

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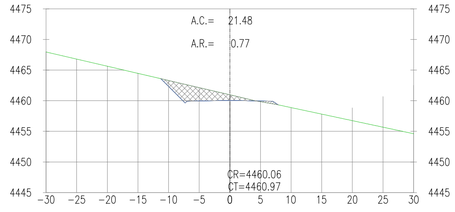

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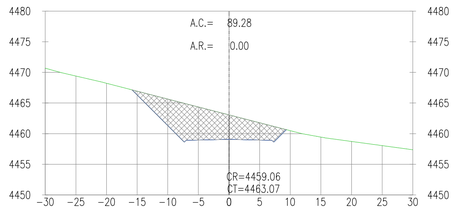

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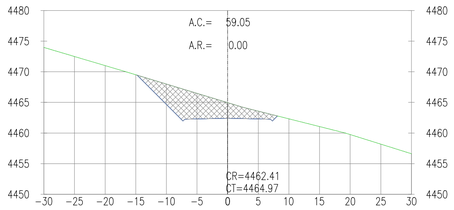

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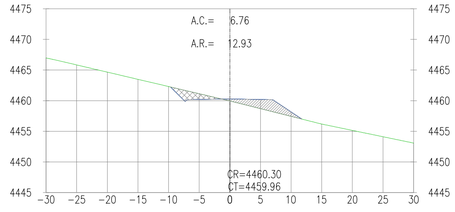

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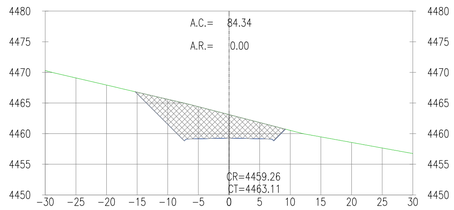

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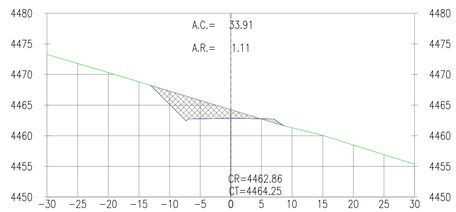

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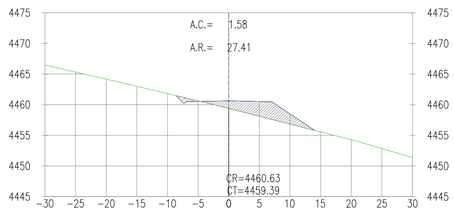

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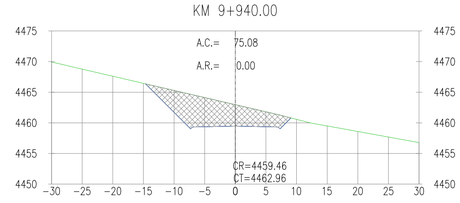

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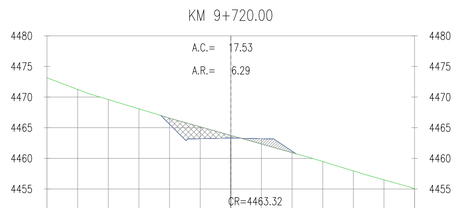

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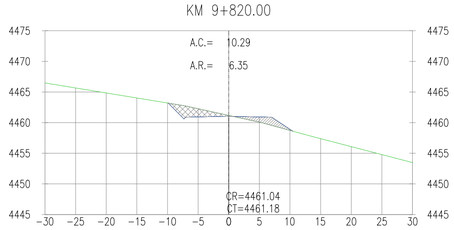

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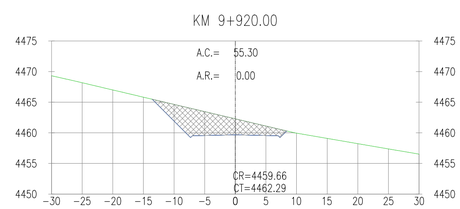

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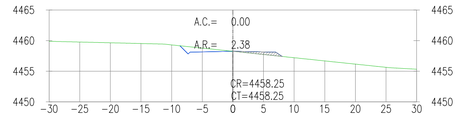

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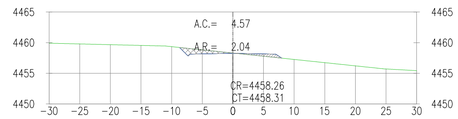

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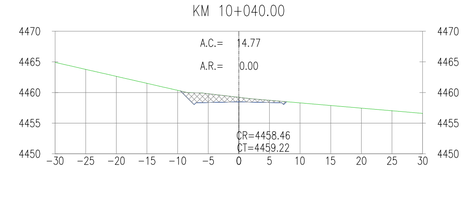

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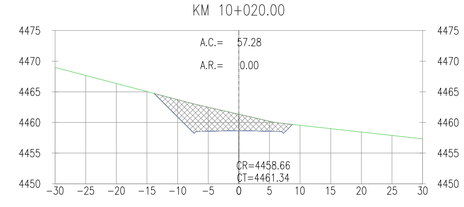

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INGENIERA CIVIL
Reg. CIP Nº92191

SECCIONES TRANSVERSALES

Esc. 1:500

REVISIONES		FECHA	DESCRIPCION	DIB.	DS.	JD	JP	CLT

REFERENCIAS	PLANO NO.	REFERENCIA

EMISIONES	REV. No.	No.	FECHA	CLTE.	OBRA	NOTAS
				COPIAS		

CONFIDENCIAL

ESTE PLANO Y LA INFORMACION CONTENIDA EN EL, SON PROPIEDAD UNIDAD MINERA SU USO Y REPRODUCCION SIN AUTORIZACION PREVIA, ESTAN PROHIBIDOS.

RECORD DE INGENIERÍA		
DIBUJADO POR	FECHA APROB.	FIRMA
DISEÑADO POR	FECHA APROB.	FIRMA
REVISADO POR	FECHA APROB.	FIRMA
APROBADO POR	FECHA APROB.	FIRMA
USUARIO	FECHA APROB.	FIRMA

PROYECTO: CARRETERA TRAMO 1

PLANO: SECCIONES TRANSVERSALES

ESCALA	NUMERO PLANO	REV.	COD PROYECTO
INDICADA			

CHINALCO

ESCALA METRICA 1:75

COMPARTAMOS LA SEGURIDAD: LA SEGURIDAD COMIENZA CONMIGO

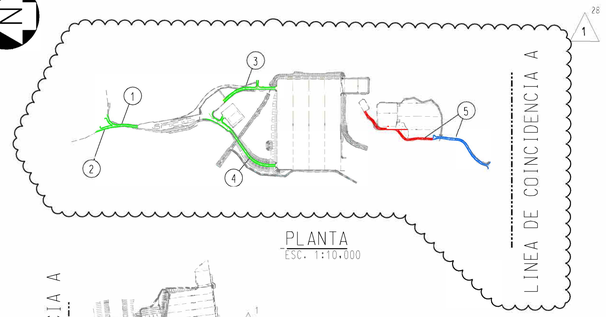
FORMATO OFICIAL A1

ARCHIVO:

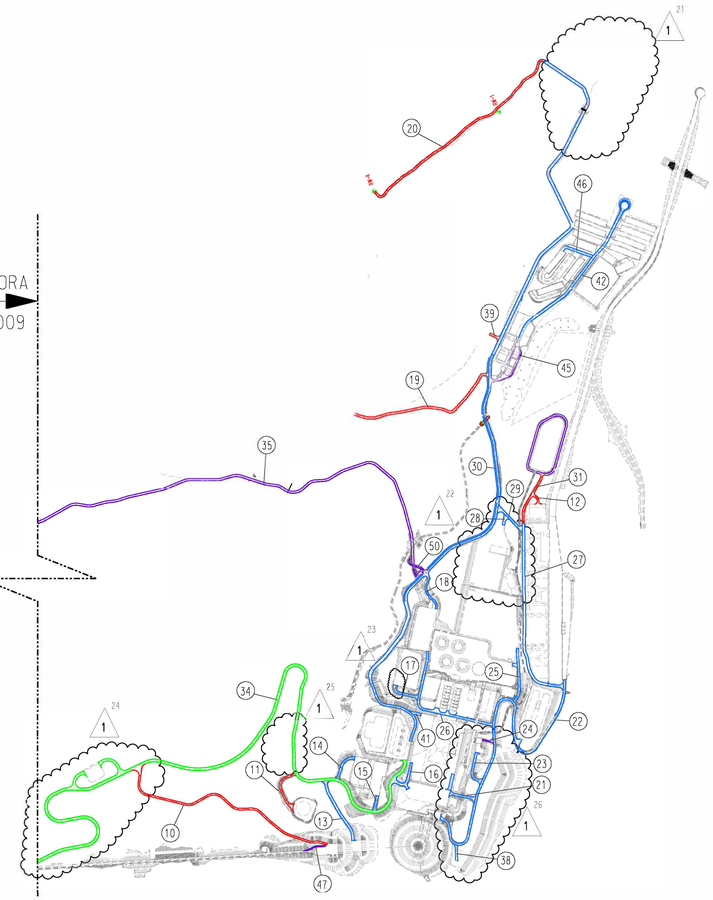
FECHA:

ANEXO 2-11
ACCESOS

DRAWING No. 400-DW-V-200



CORREDOR CINTA TRANSPORTADORA
PLANOS N°.200-DW-V-005 A 009



CAMINO N°.	PLANOS N°.	CAMINO TIPO	LARGO (m.)
1	140-DW-V-006	1	150.37
2	140-DW-V-006	1	114.57
3	140-DW-V-009	1	216.70
4	140-DW-V-010	VER NOTA 10	337.01
5	110-DW-V-001 Y 002 Y 004	VER NOTA 11	600.79
6	200-DW-V-011 A 013	1	2607.43
7	200-DW-V-032	3	188.97
8	200-DW-V-015	1	747.09
9	200-DW-V-011	3	308.48
10	200-DW-V-024	2	714.63
11	400-DW-V-226	3	140.30
12	400-DW-V-227	3	35.69
13	200-DW-V-024	2	192.18
14	400-DW-V-223	2	85.07
15	400-DW-V-223	2	42.72
16	400-DW-V-016	2	100.00
17	400-DW-V-225	2	84.07
18	400-DW-V-231	2	114.50
19	400-DW-V-230	3	433.84
20	400-DW-V-229	3	638.85
21	400-DW-V-214	VER NOTA 7	73.60
22	400-DW-V-214 A 216	VER NOTA 7	981.96
23	400-DW-V-217	2	102.00
24	400-DW-V-217	4	35.21
25	400-DW-V-225	2	153.66
26	400-DW-V-231	VER NOTA 12	375.95
27	400-DW-V-033	2	537.49
28	400-DW-V-045	2	27.70
29	400-DW-V-227	2	101.71
30	400-DW-V-219 Y 220	VER NOTA 2	4492.00
31	400-DW-V-227	3	153.45
34	400-DW-V-209 Y 210	1	2129.92
35	400-DW-V-201 A 208	VER NOTA 3	4594.00
36	200-DW-V-028	3	333.43
37	200-DW-V-028	3	214.59
38	400-DW-V-214	VER NOTA 7	53.66
39	400-DW-V-230	3	29.66
40	200-DW-V-034	3	116.15
41	400-DW-V-018	2	29.20
42	400-DW-V-221	2	632.31
43	200-DW-V-031	3	43.00
45	400-DW-V-222	4	133.10
46	400-DW-V-222	2	92.72
47	200-DW-V-039	4	54.00
50	400-DW-V-231	4	73.40

SIMBOLOGIA:

TIPO 1 — CAMINO ACCESO PRINCIPAL - DOBLE CALZADA, 3.50 m. C/U, BERMAS DE 1.0 m A CADA LAGO, TOTAL (1.0 + 3.5 + 3.5 + 1.0 = 9.0)

TIPO 2 — CAMINO SECUNDARIOS - DOBLE CALZADA, 3.00 m. C/U, BERMAS DE 0.50 m A CADA LAGO, TOTAL (0.5 + 3.0 + 3.0 + 0.5 = 7.0)

TIPO 3 — CAMINO DE CALZADA SIMPLE - 5.00 m., BERMAS DE 0.50 m A CADA LAGO, TOTAL (0.5 + 5.0 + 0.5 = 6.0)

TIPO 4 — CAMINO ESPECIAL DE MANTENCION Y MONTAJE 4.00 m.

NOTAS:

1.- VER SECCIONES DE CAMINO EN DET.1 DEL PLANO N°.000-ST-V-001.
2.- VER SECCION EN PLANO N°.400-DW-V-219.
3.- VER SECCION TIPICA EN PLANO N°. 400-DW-V-201.
4.- PARA CAMINOS 1 A 5 VER PLANO LLAVE EN PLANO N°.140-DW-V-001.

7.- VER SECCION PLANO NO. 400-DW-V-215.

10.- VER SECCION TIPICA PLANO NO.140-DW-V-001.
11.- VER SECCION TIPICA PLANO N°.110-DW-V-004.
12- VER SECCION 1 Y 2 EN PLANO 400-DW-V-231.

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

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DRAWING NOT VALID WITHOUT SIGN AND STAMP OF DOCUMENT CONTROL

QUALITY CONTROL
DISCIPLINE MANAG ENAME — SI GN
DOCI ME CONTROL
NAME — SI GN & STAMP

AkerSolutions

REFERENCES

DW GNO.	TITLE

REVISIONS

NO.	DE SCRIPTI ON	BY	CHE CK	APPROVE D	DATE
A	EMITIDO PARA COORDINACION INTERNA	MGJ	LG		06/21/10
B	EMITIDO PARA CONSTRUCCION	JMC	LG	LGM	AIH 06/28/10
A	REVISED AS NOTED.				

REVISIONS

NO.	DE SCRIPTI ON	BY	CHE CK	APPROVE D	DATE

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SCALE:	1:4000
DRAWN BY:	LMC
CHE CKE BY:	LG
APPROVE DBY:	LGM
AUTH OR IZE BY:	AIH
MOP APPROVE D:	

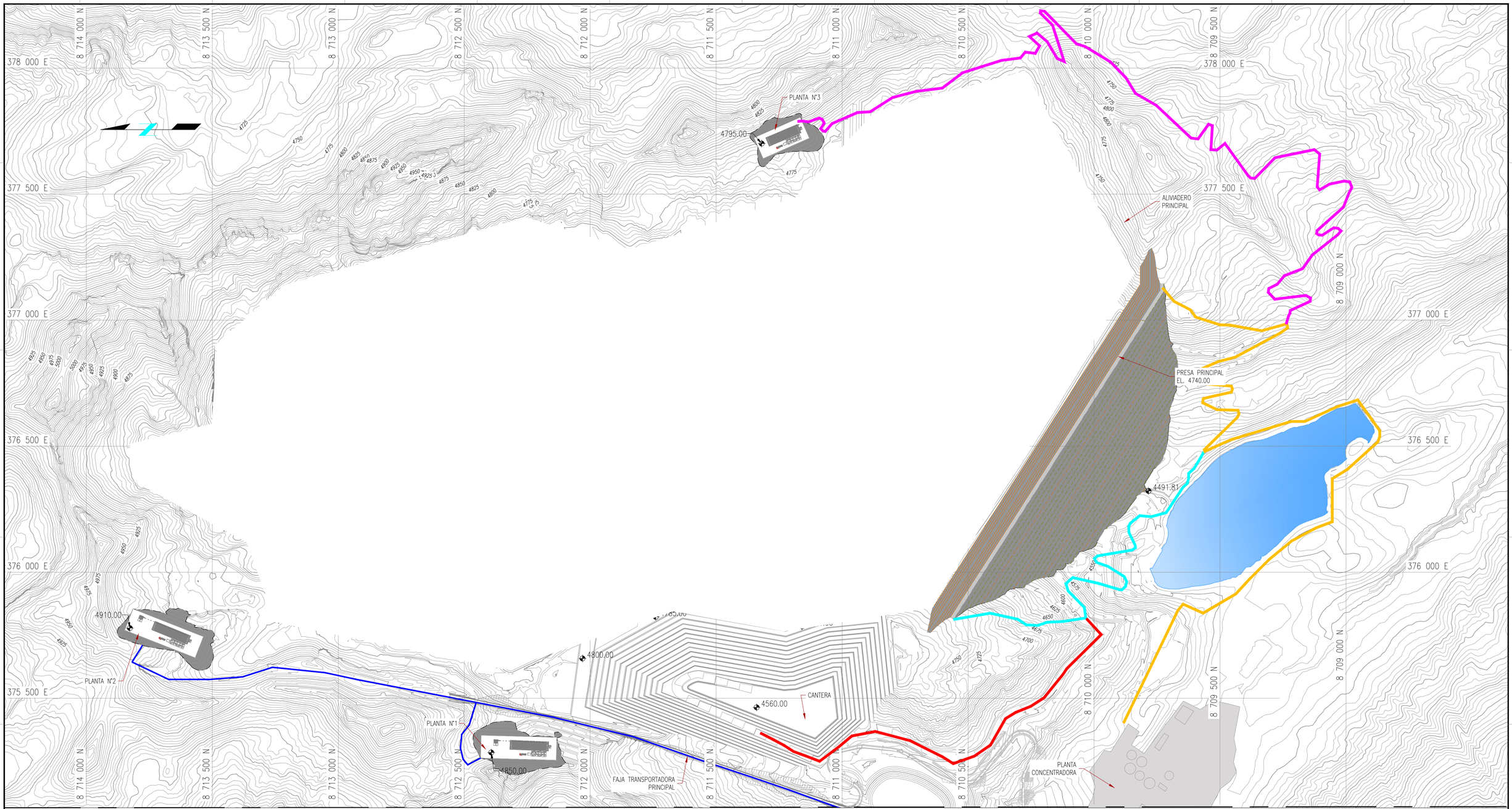
SHE E SI ZE A1

DATE: 06/28/10
DATE: 06/28/10
DATE: 06/28/10
DATE: 06/28/10
DATE :

CHINALCO
MINERA CHINALCO PERU S.A.

PROJE E TOROMOCHO PROJECT
AREA 400 - GENERAL - ON SITE FACILITIES
C-560
REVI SON
TITLE
CAMINOS
MOVIMIENTOS DE TIERRA
PLANO LLAVE
CAD NO. 560-400-DW-V-200.DGN
DW GNO. 400-DW-V-200
1/28

User: E1303020 7/26/2011 11:34:30 AM Q:\Shared\R0534200\02_Eng_Dwg\01_CIV\02_Int_App\560-400-DW-V-200_Ldgn



LEYENDA

- ACCESO PLANTA CONCENTRADORA
- ACCESO CANTERA
- ACCESO PLANTA 1 Y 2
- ACCESO PRESA DE RELAVES
- ACCESO PLANTA 3

PLANTA ARREGLO GENERAL

Esc. 1:7500

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

MINERA CHINALCO PERÚ S.A.

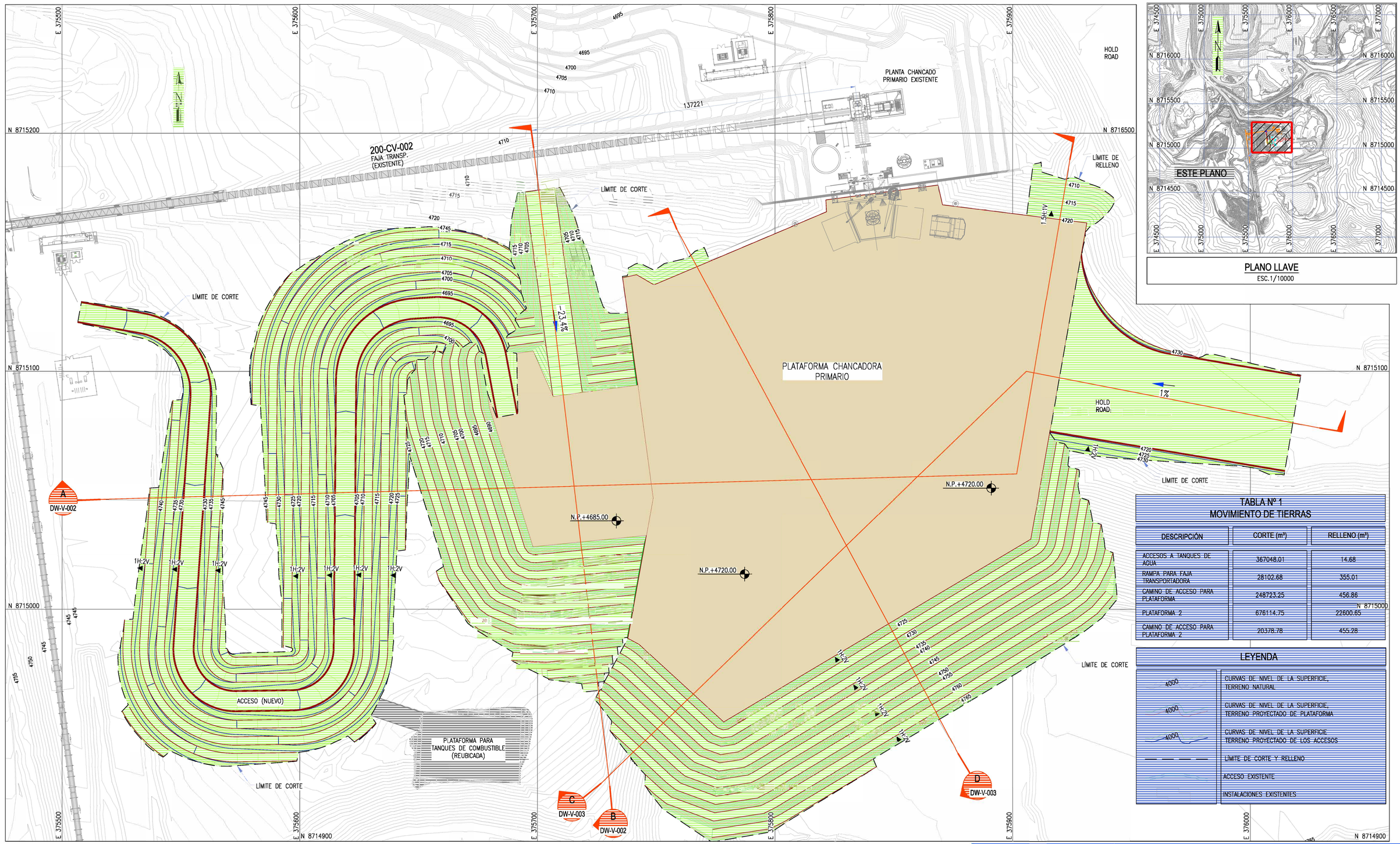
REFERENCIAS	
–	–
–	–
Nº DE PLANO/DOCUMENTO	TITULO

REVISIONES						
Nº	DESCRIPCION	DIB.	REV.	APR.	FECHA
0	EMITIDO PARA INFORMACIÓN	A.T.	E.L.	L.V.	09/06/20

NOTAS:

1. TODAS LAS ELEVACIONES Y NIVELES EN METROS.
2. EL SISTEMA DE COORDENADAS UTILIZADO ES UTM WGS 84 ZONA 18S.

ESCALA: INDICADA	FORMATO: A1	PROYECTO: ACCESOS PRESA DE RELAVES	
DIBUJO: A. TANTA	FECHA: 09.JUN.20	AREA: –	TIPO DE CONTRATO:
DISEÑO: E. LA TORRE	FECHA: 09.JUN.20	TITULO: PLANO DE ACCESOS	COD.PROYECTO Nº: –
REVISADO: E. LA TORRE	FECHA: 09.JUN.20		Nº DE PLANO: –
APROBADO: L. VALENTIN	FECHA: 09.JUN.20		0
COD. PROY. CONTRATISTA:	Nº DE PLANO CONTRATISTA:		



PLANO LLAVE
ESC.1/10000

PLANTA
PLATAFORMA Y ACCESOS
ESC.:1/750

TABLA Nº 1
MOVIMIENTO DE TIERRAS

DESCRIPCIÓN	CORTE (m³)	RELLENO (m³)
ACCESOS A TANQUES DE AGUA	367048.01	14.68
RAMPA PARA FAJA TRANSPORTADORA	28102.68	355.01
CAMINO DE ACCESO PARA PLATAFORMA	248723.25	456.86
PLATAFORMA 2	676114.75	22600.65
CAMINO DE ACCESO PARA PLATAFORMA 2	20378.78	455.28

LEYENDA

4000	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO NATURAL
4000	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO PROYECTADO DE PLATAFORMA
4000	CURVAS DE NIVEL DE LA SUPERFICIE TERRENO PROYECTADO DE LOS ACCESOS
	LÍMITE DE CORTE Y RELLENO
	ACCESO EXISTENTE
	INSTALACIONES EXISTENTES

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 82425

NOTAS:

1. ESTE PLANO ESTA PRESENTADO EN:
   –SISTEMA DE COORDENADAS: UTM WGS84.
   –SISTEMA DE UNIDADES DIMENSIONES (mm)
   ELEVACIONES (m)
2. EL DIMENSIONAMIENTO DE LOS EQUIPOS SON REFERENCIALES HASTA QUE SE TENGAN LOS PLANOS CERTIFICADOS DE LOS MISMOS.

REFERENCIAS

Nº DE PLANO/DOCUMENTO	TITULO
MTE13-OS91173-2010-DW-V-003	PLANTA DE CHANCADO PRIMARIO SECCIONES 2 DE 2
MTE13-OS91173-2010-DW-V-002	PLANTA DE CHANCADO PRIMARIO SECCIONES 1 DE 2

REVISIONES

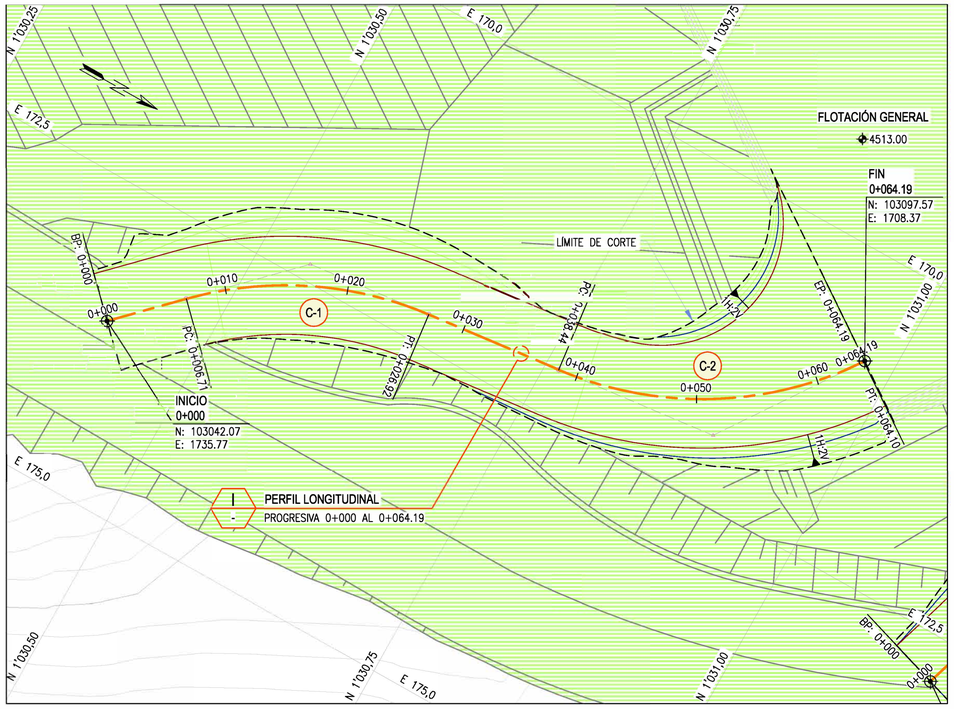
Nº	DESCRIPCION	DIB.	REV.	APR.	FECHA
C	RE EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	J.O.	G.CH.	P.M.	01/04/19
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	J.C	G.C.	P.M.	29/03/19
A	EMITIDO PARA COORDINACION INTERNA	J.C.	G.C.	P.M.	29/03/19

BISA INGENIERÍA DE PROYECTOS S.A.

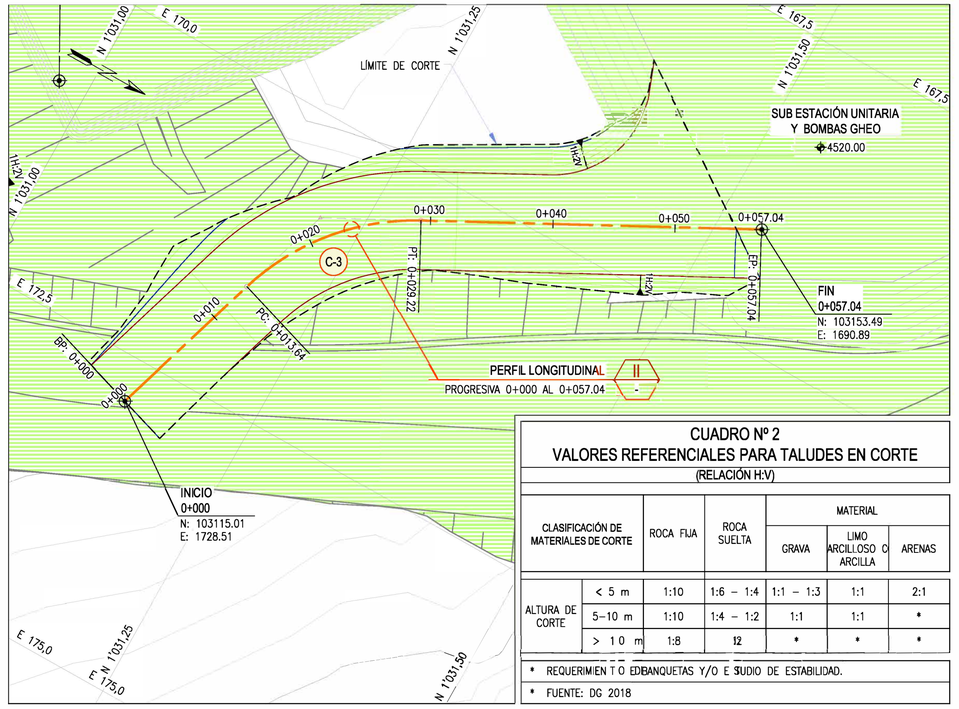
MINERA CHINALCO PERÚ S.A.

ESCALA: 1/750	FORMATO: A1	PROYECTO: AMPLIACIÓN PLANTA CONCENTRADORA TOROMOCHO A 170 KTPD	
DIBUJO: J.CAJAHUANCA	FECHA: 29/03/19		
DISEÑO: G.CHAPOÑAN	FECHA: 29/03/19	AREA: 2010 – CHANCADO PRIMARIO	TIPO DE CONTRATO: C
REVISADO: B.RODRIGUEZ	FECHA: 29/03/19	TITULO: PLANTA DE CHANCADO PRIMARIO PLATAFORMA Y ACCESOS PLANTA	COD.PROYECTO N°: OS91173
APROBADO: P. MARIN	FECHA: 29/03/19		N° DE PLANO: MTE13-OS91173-2010-DW-V-001
COD. PROY. CONTRATISTA: 395CM0066GB	N° DE PLANO CONTRATISTA:		

PVP_CONSTRUCCION\GERENCIA DE CONSTRUCCION\PT – PROJECT\02. Proy Internos MCP\01.– Proyectos



PLANTA
ACCESO A FLOTACIÓN GENERAL
ESC.:1/250



PLANTA
ACCESO A SUBESTACIÓN UNITARIA Y BOMBAS GHEO
ESC.:1/250

CUADRO Nº 2
VALORES REFERENCIALES PARA TALUDES EN CORTE
(RELACIÓN H:V)

CLASIFICACIÓN DE MATERIALES DE CORTE		ROCA FIJA	ROCA SUELTA	MATERIAL		
				GRAVA	LIMO ARCILLOSO O ARCILLA	ARENAS
ALTURA DE CORTE	< 5 m	1:10	1:6 – 1:4	1:1 – 1:3	1:1	2:1
	5–10 m	1:10	1:4 – 1:2	1:1	1:1	*
	> 10 m	1:8	1:2	*	*	*

* REQUERIMIENTO DE BANQUETAS Y/O ESTUDIO DE ESTABILIDAD.

* FUENTE: DG 2018

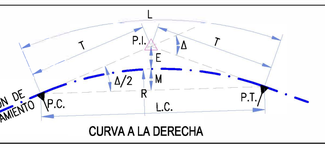
LEYENDA

4000	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO NATURAL
4000	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO PROYECTADO DE PLATAFORMA
4000	CURVAS DE NIVEL DE LA SUPERFICIE TERRENO PROYECTADO DE LOS ACCESOS
	LÍMITE DE CORTE Y RELLENO
	ACCESO EXISTENTE
	EJE DE ACCESO PROYECTADO
	INSTALACIONES EXISTENTES

CUADRO Nº 1
MOVIMIENTO DE TIERRAS - ACCESOS

DESCRIPCIÓN	CORTE (m³)	RELLENO (m³)
FLOTACIÓN GENERAL	1032.00	271.00
SUB ESTACIÓN UNITARIA	727.00	194.00

SIMBOLOGÍA DE CURVA CIRCULAR



CURVA A LA DERECHA

P.C. = PUNTO DE INICIO DE LA CURVA
P.I. = PUNTO DE INTERSECCIÓN
P.T. = PUNTO DE TANGENCIA
E = DISTANCIA EXTERNA (m)
M = DISTANCIA DE LA ORDENADA MEDIA (m)
R = LONGITUD DEL RADIO DE LA CURVA (m)
T = LONGITUD DE LA SUBTANGENTE (P.C. A P.I. A P.T.) (m)
L = LONGITUD DE LA CURVA (m)
L.C. = LONGITUD DE LA CUERDA (m)
Δ = ÁNGULO DE DEFLEXIÓN

T = R tan Δ/2
L.C. = 2R sen Δ/2
L = 2π R Δ/360
M = R [1–cos (Δ/2)]
E = R [sec (Δ/2) – 1]

COORDENADAS UTM

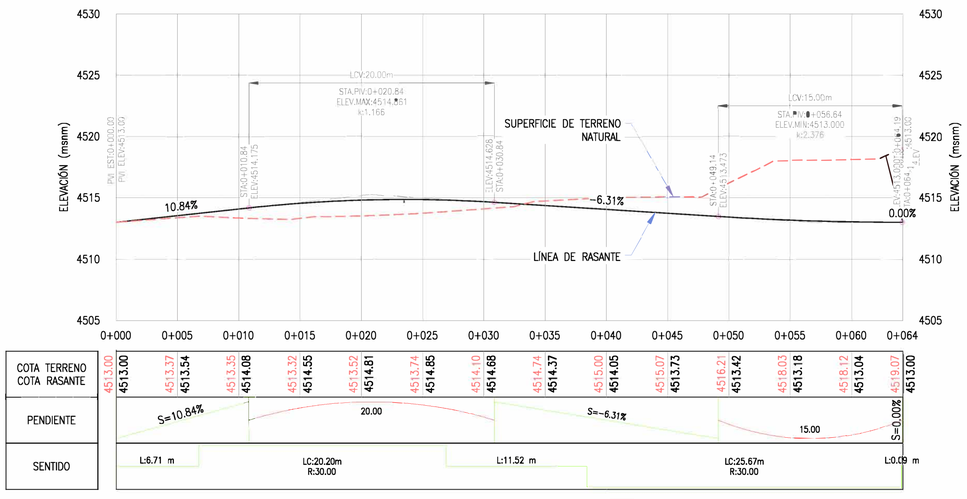
N°	N (PI)	E (PI)	N (PC)	E (PC)	N (PT)	E (PT)
C–1	103054.26	1723.62	103046.82	1731.03	103064.70	1722.46
C–2	103089.74	1719.69	103076.15	1721.20	103097.52	1708.44
C–3	103121.61	1707.68	103119.13	1715.51	103128.87	1703.85

ELEMENTOS DE CURVA

N°	C1 PROG	Δ	T	R	CL
C–1	Km 0+017.22	038°35'03"	10.50	30.00	19.82
C–2	Km 0+052.11	049°01'07"	13.68	30.00	24.89
C–3	Km 0+021.85	044°37'59"	8.21	20.00	15.19

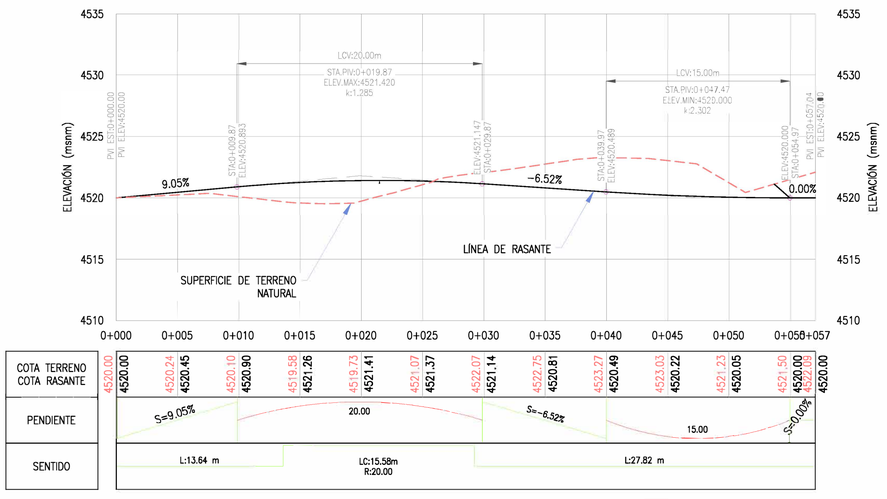
NOTAS:

1. TODOS LOS DATOS TOPOGRÁFICOS PARA EL REPLANTEO DEBERÁN SER APROBADOS POR EL SUPERVISOR EN CAMPO ANTES DE LA CONSTRUCCIÓN.
2. SI LA TOPOGRAFÍA DEL TERRENO DIFIERE DE LA MOSTRADA EN LOS PLANOS, EL SUPERVISOR DEBERÁ AJUSTAR EL DISEÑO A LAS CONDICIONES EXISTENTES.
3. EL RELLENO SERÁ CONFORMADO CON MATERIAL INDICADO EN LAS ESPECIFICACIONES TÉCNICAS DE MINERA CHINALCO PERÚ.
4. EL RELLENO ESTRUCTURAL COMPACTADO AL 95% DEL PROCTOR MODIFICADO, EN CAPAS DE 0.30M.
5. DEBIDO A QUE NO SE CUENTA CON ESTUDIOS DE SUELOS EN LA ZONA, EL TALUD DE CORTE ES REFERENCIAL, PUDIENDOSE UTILIZAR LOS TALUDES DE CORTE INDICADOS EN EL CUADRO N° 2 DE ACUERDO AL MATERIAL ENCONTRADO EN CAMPO.
6. OBLIGATORIAMENTE DEBERÁN CONSTRUIRSE LOS SISTEMAS DE DRENAJE AL NIVEL DE LA PLATAFORMA.
7. EL CONTRATISTA ES RESPONSABLE POR EL DRENAJE Y CONTROL DEL AGUA SUPERFICIAL Y SUBTERRÁNEA QUE PUDIERA IDENTIFICARSE DURANTE LAS EXCAVACIONES. EL ÁREA DE TRABAJO DEBE MANTENERSE SECO DURANTE LA CONSTRUCCIÓN.
8. DURANTE LA CONSTRUCCIÓN DEBERÁN MONITOREARSE LAS DEFORMACIONES QUE PUDIERA HABER TANTO EN LA LADERA SUPERIOR COMO LOS TALUDES DE CORTE. EL CONTRATISTA Y EL SUPERVISOR SERÁN RESPONSABLES DEL CUMPLIMIENTO DE ESTA ACTIVIDAD. LOS PUNTOS TOPOGRÁFICOS ESTÁN ADECUADAMENTE GEO–REFERENCIADOS.



COTA TERRENO / COTA RASANTE	4513.00 / 4513.00	4513.37 / 4513.54	4513.35 / 4514.08	4513.32 / 4514.55	4513.52 / 4514.81	4513.74 / 4514.85	4514.10 / 4514.68	4514.74 / 4514.37	4515.00 / 4514.05	4515.07 / 4513.73	4516.21 / 4513.42	4518.03 / 4513.18	4518.12 / 4513.04	4519.07 / 4513.00
PENDIENTE		S=10.84%		20.00		S=-6.31%			15.00			S=0.00%		
SENTIDO	L:6.71 m		LC:20.20m R:30.00		L:11.52 m		LC:25.67m R:30.00		L:0.09 m					

PERFIL LONGITUDINAL
ACCESO A FLOTACIÓN GENERAL
PROGRESIVA 0+000 AL 0+064.19



COTA TERRENO / COTA RASANTE	4520.00 / 4520.00	4520.24 / 4520.45	4520.10 / 4520.90	4519.58 / 4521.26	4519.73 / 4521.41	4521.07 / 4521.37	4522.07 / 4521.14	4522.75 / 4520.81	4523.27 / 4520.49	4523.03 / 4520.22	4521.23 / 4520.05	4521.50 / 4520.00	4522.09 / 4520.00
PENDIENTE		S=9.05%		20.00			S=-6.52%		15.00			S=0.00%	
SENTIDO	L:13.64 m		LC:15.58m R:20.00			L:27.82 m							

PERFIL LONGITUDINAL
ACCESO A SUBESTACIÓN UNITARIA Y BOMBAS GHEO
PROGRESIVA 0+000 AL 0+057.04

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

BISA INGENIERÍA DE PROYECTOS S.A.

MINERA CHINALCO PERÚ S.A.

REFERENCIAS

N° DE PLANO/DOCUMENTO	TITULO
MTE13-OS91173-2210-GA-V-001	DISPOSICIÓN GENERAL – PLANTA

REVISIONES

N°	DESCRIPCION	DIB.	REV.	APR.	FECHA
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	I.C.	G.CH.	P.M.	11/12/18
A	EMITIDO PARA COORDINACION INTERNA	I.C.	G.CH.	P.M.	05/12/18

NOTAS:

1. ESTE PLANO ESTA PRESENTADO EN:
   –SISTEMA DE COORDENADAS: LOCALES (PLANTA)
   –SISTEMA DE UNIDADES DIMENSIONES (mm)
   ELEVACIONES (m)
2. EL DIMENSIONAMIENTO DE LOS EQUIPOS SON REFERENCIALES HASTA QUE SE TENGAN LOS PLANOS CERTIFICADOS DE LOS MISMOS.
3. LA TOPOGRAFÍA FUE ENTREGADA POR MINERA CHINALCO PERÚ, NOVIEMBRE 2018.

ESCALA:	1/250
FORMATO:	A1
DIBUJO: I. CORDERO	FECHA: 05-12-18
DISEÑO: G. CHAPOÑAN	FECHA: 05-12-18
REVISADO: B. RODRIGUEZ	FECHA: 05-12-18
APROBADO: P. MARIN	FECHA: 05-12-18
COD. PROY. CONTRATISTA: 395CM0066GB	N° DE PLANO CONTRATISTA:

PROYECTO: AMPLIACIÓN PLANTA CONCENTRADORA TOROMOCHO A 170 KTPD

AREA: 2210 – FLOTACION GENERAL

TIPO DE CONTRATO:

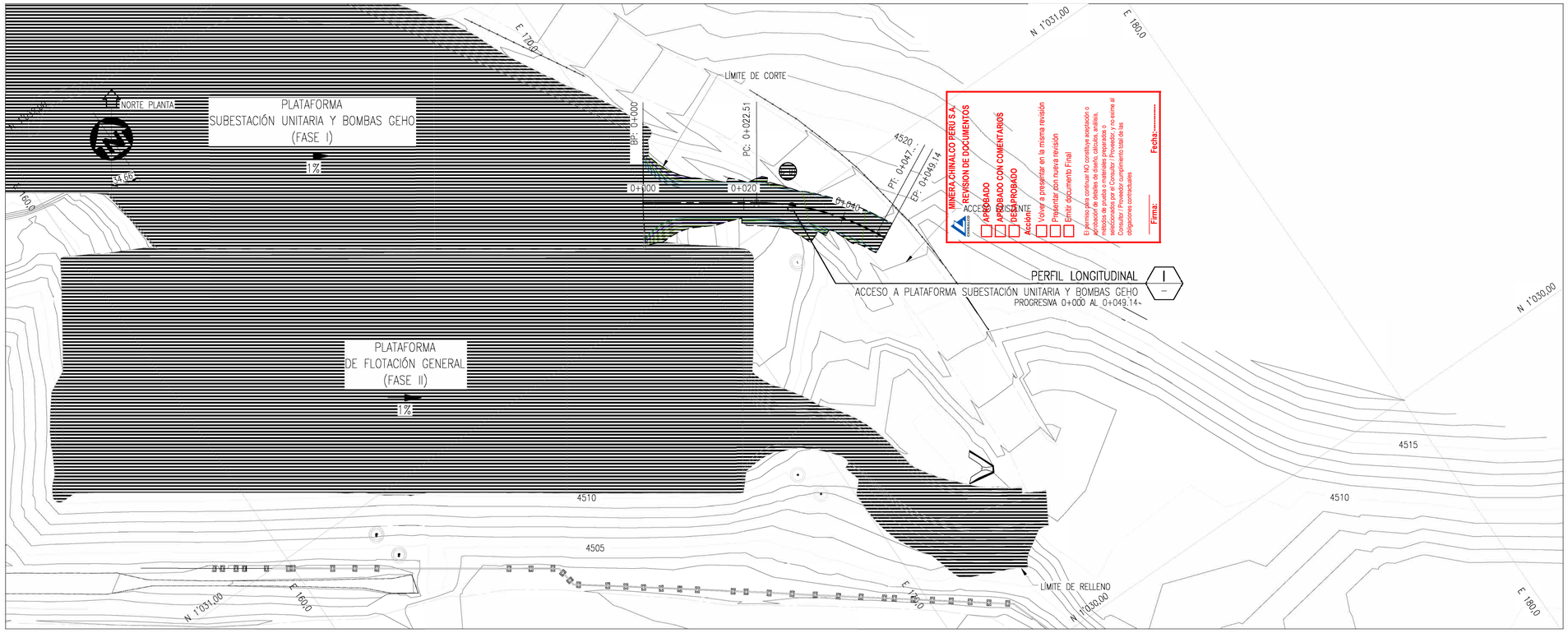
TITULO: ACCESOS PLANTA Y PERFIL

COD.PROYECTO N°: OS91173

N° DE PLANO: MTE13-OS91173-2210-DW-V-004

B

P:\VP_CONSTRUCCION\GERENCIA DE CONSTRUCCION\PT – PROJECT\02. Proy Internos MCP\01.– Proyectos



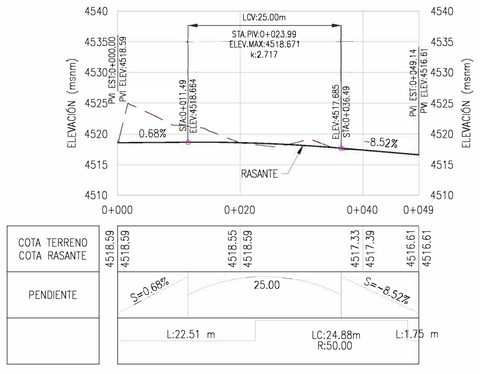
PERFIL LONGITUDINAL I

ACCESO A PLATAFORMA SUBESTACIÓN UNITARIA Y BOMBAS GEHO
PROGRESIVA 0+000 AL 0+049.14

ACCESO A PLATAFORMAS

0 10 15 20 30 50

ESC.: 1/500
(EN METROS)



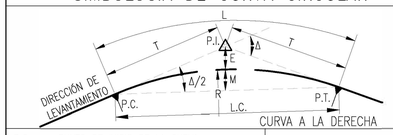
PERFIL LONGITUDINAL I

ACCESO A PLATAFORMA SUBESTACIÓN UNITARIA Y BOMBAS GEHO
PROGRESIVA 0+000 AL 0+049.14
ESC.:1/500

LEYENDA

4140	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO NATURAL
4135	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO PROYECTADO PLATAFORMA
	LÍMITE DE CORTE Y RELLENO
	EJE DE ACCESO
	SUPERFICIE DE TERRENO NATURAL
	LÍNEA DE RASANTE

SIMBOLOGÍA DE CURVA CIRCULAR



CURVA A LA DERECHA

P.C.	= PUNTO DE INICIO DE LA CURVA	T	= R tan Δ/2
P.I.	= PUNTO DE INTERSECCIÓN	L.C.	= 2R sen Δ/2
P.T.	= PUNTO DE TANGENCIA	L	= 2π R Δ/360
E	= DISTANCIA EXTERNA (m)	M	= R [1−cos (Δ/2)]
M	= DISTANCIA DE LA ORDENADA MEDIA (m)	E	= R [sec (Δ/2) − 1]
R	= LONGITUD DEL RADIO DE LA CURVA (m)		
T	= LONGITUD DE LA SUBTANGENTE (P.C. A P.I. A P.T.) (m)		
L	= LONGITUD DE LA CURVA (m)		
L.C.	= LONGITUD DE LA CUERDA (m)		
Δ	= ÁNGULO DE DEFLEXIÓN		

COORDENADAS UTM

N°	N (PI)	E (PI)	N (PC)	E (PC)	N (PT)	E (PT)
C−1	103097.80	1727.20	103105.03	1716.75	103086.47	1732.93

ELEMENTOS DE CURVA

N°	C1 PROG	Δ	T	R	CL
C−1	Km 0+035.22	028°30'45"	12.70	50.00	24.63

CUADRO N° 1
MOVIMIENTO DE TIERRAS − PLATAFORMAS

DESCRIPCION	CORTE (m3)	RELLENO (m3)
ACCESO A PLATAFORMA SUBESTACIÓN UNITARIA Y BOMBAS GEHO	620.00	46.00

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP N° 62425

BISA INGENIERIA DE PROYECTOS S.A.
PETER A. MARIN VELÁSQUEZ
JEFE DE PROYECTOS
Ing. Civil CIP:101374

NOTAS:

1. TODOS LOS DATOS PARA EL REPLANTEO DEBERÁN SER APROBADOS POR EL SUPERVISOR EN CAMPO ANTES DE LA CONSTRUCCIÓN. SI LA TOPOGRAFÍA DEL TERRENO DIFIERE DE LA MOSTRADA EN LOS PLANOS, EL SUPERVISOR DEBERÁ AJUSTAR EL DISEÑO A LAS CONDICIONES EXISTENTES.
2. LA LÍNEA DE RASANTE PODRÁ SER MODIFICADA DE ACUERDO A LAS CONDICIONES DEL TERRENO ENCONTRADAS Y DEBERÁ REEMPLAZARSE EL MATERIAL NO COMPETENTE, COMO LO INDIQUE EL INGENIERO DE CQA.
3. LOS TALUDES DE CORTE Y RELLENO SE MUESTRAN EN EL PLANO DE SECCIONES TÍPICAS MTE13−OS91173−2210−DW−V−015.
4. LOS TALUDES DE CORTE PODRÁN MODIFICARSE DE ACUERDO A LAS CONDICIONES DEL TERRENO ENCONTRADAS EN CAMPO PREVIA AUTORIZACIÓN DEL SUPERVISOR.
5. LA SUPERFICIE PROYECTADA SE HA DISEÑADO A NIVEL DE RASANTE, DEBAJO DEL CUAL SE COLOCARÁ UNA CAPA DE AFIRMADO MÍNIMO DE 0.20m.

REFERENCIAS

N° DE PLANO/DOCUMENTO	TITULO
MTE13−OS91173−2210−DW−V−014	ACCESOS A PLATAFORMAS − SECCIONES TRANSVERSALES

REVISIONES

N°	DESCRIPCION	DIB.	REV.	APR.	FECHA
0	EMITIDO PARA CONSTRUCCIÓN	V.C.	G.CH.	P.M.	11/02/19
C	RE EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	J.O.	G.CH.	P.M.	07/02/19
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	J.O.	G.CH.	P.M.	28/01/19
A	EMITIDO PARA REVISIÓN INTERNA	V.C.	G.CH.	P.M.	24/01/19

NOTAS GENERALES.−

1. TODAS LAS ELEVACIONES SE MOSTRARÁN EN METROS.
2. LAS UNIDADES DE LOS PLANOS SE ENCUENTRAN EN EL SISTEMA INTERNACIONAL, SALVO OTRA INDICACIÓN.
3. LAS ELEVACIONES ESTÁN REFERIDAS A ALTURAS ORTOMÉTRICAS (msnm).
4. BASE TOPOGRÁFICA PROPORCIONADO POR MINERA CHINALCO PERÚ S.A.
5. LA CUADRÍCULA ESTÁ REPRESENTADA EN EL SISTEMA DE COORDENADAS LOCALES.

BISA INGENIERÍA DE PROYECTOS S.A.

MINERA CHINALCO PERÚ S.A.

ESCALA:	INDICADA	FORMATO:	A1
DIBUJO:	V. CASAS	FECHA:	07/02/19
DISEÑO:	G. CHAPOÑAN	FECHA:	07/02/19
REVISADO:	B. RODRIGUEZ	FECHA:	07/02/19
APROBADO:	P. MARIN	FECHA:	07/02/19
COD. PROY. CONTRATISTA:	395CM0066GP	N° DE PLANO CONTRATISTA:	

PROYECTO: INGENIERÍA DE DETALLE PLATAFORMAS PARA BOMBAS GEHO Y CELDAS DE FLOTACIÓN

AREA: 2210 − FLOTACIÓN GENERAL

TIPO DE CONTRATO:

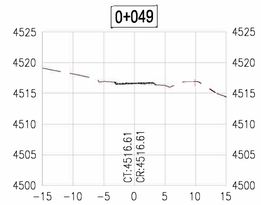
TITULO: ACCESOS A PLATAFORMAS
PLANTA Y PERFILES LONGITUDINALES

COD.PROYECTO N°: OS91173

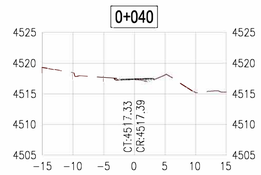
N° DE PLANO: MTE13−OS91173−2210−DW−V−013

0

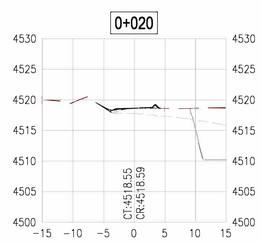
P:\PI CONSTRUCCION\GERENCIA DE CONSTRUCCION\PT − PROJECT\02. Proy Internos MCP\01.− Proyectos



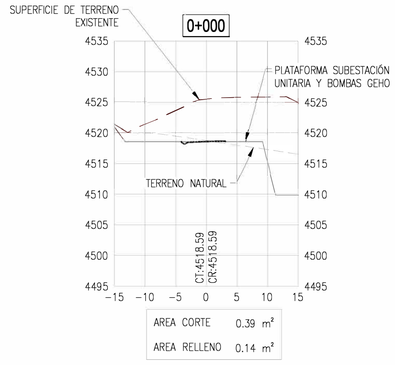
AREA CORTE	0.46 m²
AREA RELLENO	0.50 m²



AREA CORTE	0.33 m²
AREA RELLENO	0.86 m²



AREA CORTE	0.01 m²
AREA RELLENO	1.51 m²



AREA CORTE	0.39 m²
AREA RELLENO	0.14 m²

SECCIONES TRANSVERSALES

ACCESO A PLATAFORMA SUBESTACIÓN UNITARIA Y BOMBAS GEHO

Esc. 1:500

LEYENDA

	SUPERFICIE DE TERRENO EXISTENTE
	SUPERFICIE DE TERRENO NATURAL
	LÍNEA DE RASANTE
	CORTE
	RELLENO

CUADRO N° 1
MOVIMIENTO DE TIERRAS – PLATAFORMAS

DESCRIPCION	CORTE (m3)	RELLENO (m3)
ACCESO A PLATAFORMA SUBESTACIÓN UNITARIA Y BOMBAS GEHO	620.00	46.00

BISA INGENIERIA DE PROYECTOS S.A.
PETER A. MARIN VELÁSQUEZ
JEFE DE PROYECTOS
Ing. Civil CIP:101374

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 82425

NOTAS:

1. TODOS LOS DATOS PARA EL REPLANTEO DEBERÁN SER APROBADOS POR EL SUPERVISOR EN CAMPO ANTES DE LA CONSTRUCCIÓN. SI LA TOPOGRAFÍA DEL TERRENO DIFIERE DE LA MOSTRADA EN LOS PLANOS, EL SUPERVISOR DEBERÁ AJUSTAR EL DISEÑO A LAS CONDICIONES EXISTENTES.
2. LA LÍNEA DE RASANTE PODRÁ SER MODIFICADA DE ACUERDO A LAS CONDICIONES DEL TERRENO ENCONTRADAS Y DEBERÁ REEMPLAZARSE EL MATERIAL NO COMPETENTE, COMO LO INDIQUE EL INGENIERO DE CQA.
3. LOS TALUDES DE CORTE Y RELLENO SE MUESTRAN EN EL PLANO DE SECCIONES TÍPICAS MTE13-OS91173-2210-DW-V-015.
4. LOS TALUDES DE CORTE PODRÁN MODIFICARSE DE ACUERDO A LAS CONDICIONES DEL TERRENO ENCONTRADAS EN CAMPO PREVIA AUTORIZACIÓN DEL SUPERVISOR.
5. LA SUPERFICIE PROYECTADA SE HA DISEÑADO A NIVEL DE RASANTE, DEBAJO DEL CUAL SE COLOCARÁ UNA CAPA DE AFIRMADO MÍNIMO DE 0.20m.

REFERENCIAS	
MTE13-OS91173-2210-DW-V-015	ACCESOS A PLATAFORMAS – SECCIONES TÍPICAS
MTE13-OS91173-2210-DW-V-013	ACCESOS A PLATAFORMAS – PLANTA Y PERFILES LONGITUDINALES
N° DE PLANO/DOCUMENTO	TITULO

REVISIONES					
N°	DESCRIPCION	DIB.	REV.	APR.	FECHA
0	EMITIDO PARA CONSTRUCCIÓN	V.C.	G.CH.	P.M.	11/02/19
C	RE EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	V.C.	G.CH.	P.M.	07/02/19
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	V.C.	G.CH.	P.M.	28/01/19
A	EMITIDO PARA REVISIÓN INTERNA	V.C.	G.CH.	P.M.	24/01/19

NOTAS GENERALES.–

1. TODAS LAS ELEVACIONES SE MOSTRARÁN EN METROS.
2. LAS UNIDADES DE LOS PLANOS SE ENCUENTRAN EN EL SISTEMA INTERNACIONAL, SALVO OTRA INDICACIÓN.
3. LAS ELEVACIONES ESTÁN REFERIDAS A ALTURAS ORTOMÉTRICAS (msnm).
4. BASE TOPOGRÁFICA PROPORCIONADO POR MINERA CHINALCO PERÚ S.A.
5. LA CUADRÍCULA ESTÁ REPRESENTADA EN EL SISTEMA DE COORDENADAS LOCALES.

BISA INGENIERÍA DE PROYECTOS S.A.

MINERA CHINALCO PERÚ S.A.

ESCALA:	INDICADA	FORMATO:	A1
DIBUJO:	V. CASAS	FECHA:	07/02/19
DISEÑO:	G. CHAPOÑAN	FECHA:	07/02/19
REVISADO:	B. RODRIGUEZ	FECHA:	07/02/19
APROBADO:	P. MARIN	FECHA:	07/02/19
COD. PROY. CONTRATISTA:	395CM0066GP	N° DE PLANO CONTRATISTA:	

PROYECTO: INGENIERÍA DE DETALLE PLATAFORMAS PARA BOMBAS GEHO Y CELDAS DE FLOTACIÓN

AREA: 2210 – FLOTACIÓN GENERAL

TIPO DE CONTRATO:

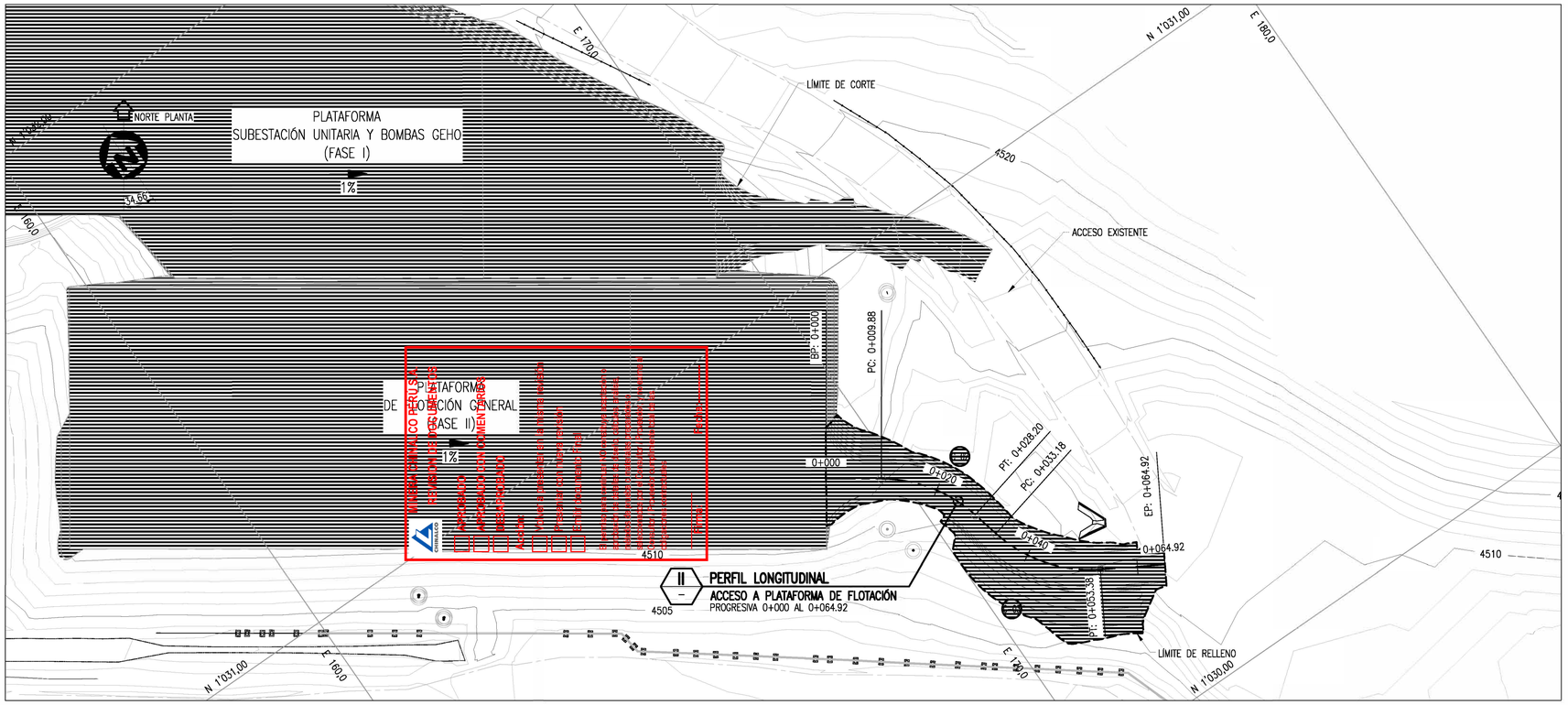
TITULO: ACCESOS A PLATAFORMAS SECCIONES TRANSVERSALES

COD.PROYECTO N°: OS91173

N° DE PLANO: MTE13-OS91173-2210-DW-V-014

0

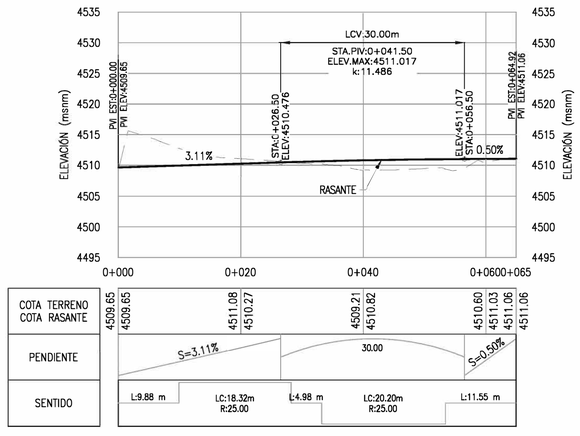
P:\VP CONSTRUCCION\GERENCIA DE CONSTRUCCION\PT – PROJECT\02. Proy Internos MCP\01.– Proyectos



ACCESO A PLATAFORMAS

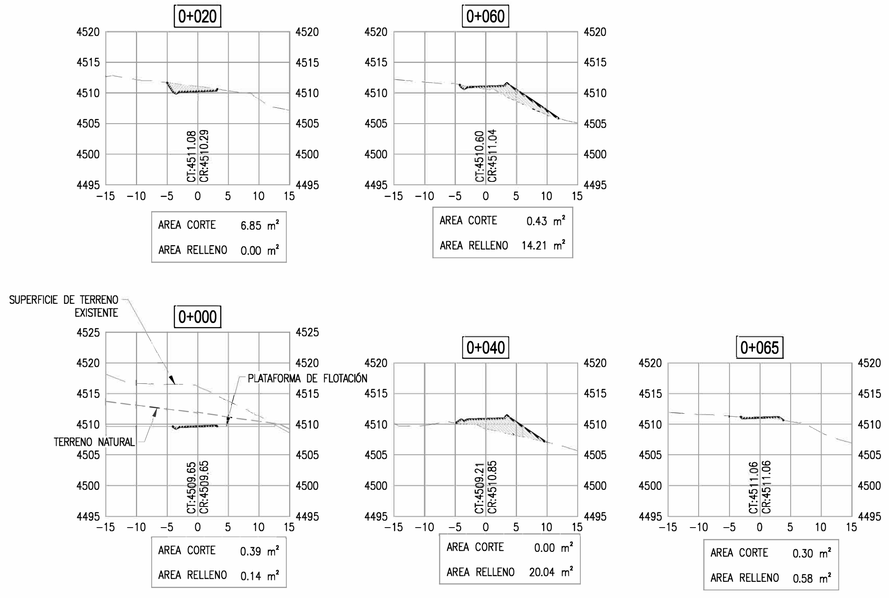
0 10 15 20 30 50

ESC.: 1/500
(EN METROS)



PERFIL LONGITUDINAL

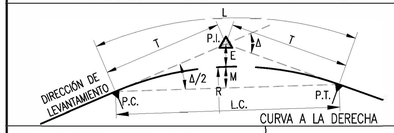
ACCESO A PLATAFORMA DE FLOTACIÓN
PROGRESIVA 0+000 AL 0+064.92
ESC.:1/500



LEYENDA

4140	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO NATURAL
4135	CURVAS DE NIVEL DE LA SUPERFICIE, TERRENO PROYECTADO PLATAFORMA
— — — —	LÍMITE DE CORTE Y RELLENO
——— — ———	EJE DE ACCESO
- - - - -	SUPERFICIE DE TERRENO NATURAL
———	LÍNEA DE RASANTE

SIMBOLOGÍA DE CURVA CIRCULAR



P.C.	= PUNTO DE INICIO DE LA CURVA	T	= R tan Δ/2
P.I.	= PUNTO DE INTERSECCIÓN	L.C.	= 2R sen Δ/2
P.T.	= PUNTO DE TANGENCIA	L	= 2π R Δ/360
E	= DISTANCIA EXTERNA (m)	M	= R [1−cos (Δ/2)]
M	= DISTANCIA DE LA ORDENADA MEDIA (m)	E	= R [sec (Δ/2) − 1]
R	= LONGITUD DEL RADIO DE LA CURVA (m)		
T	= LONGITUD DE LA SUBTANGENTE (P.C. A P.I. A P.T.) (m)		
L	= LONGITUD DE LA CURVA (m)		
L.C.	= LONGITUD DE LA CUERDA (m)		
Δ	= ÁNGULO DE DEFLEXIÓN		

COORDENADAS UTM

N°	N (PI)	E (PI)	N (PC)	E (PC)	N (PT)	E (PT)
C−2	103058.53	1704.93	103063.98	1697.04	103049.20	1707.14
C−3	103033.95	1710.76	103044.35	1708.29	103028.55	1719.98

ELEMENTOS DE CURVA

N°	C1 PROG	Δ	T	R	CL
C−2	Km 0+019.47	041°58'51"	9.59	25.00	17.91
C−3	Km 0+043.87	046°17'31"	10.69	25.00	19.65

CUADRO N° 1
MOVIMIENTO DE TIERRAS – PLATAFORMAS

DESCRIPCION	CORTE (m3)	RELLENO (m3)
ACCESO A APLATAFORMA DE FLOTACIÓN	714.00	707.00

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP N° 82425

BISA INGENIERIA DE PROYECTOS S.A.
PETER A. MARIN VELÁSQUEZ
JEFE DE PROYECTOS
Ing. Civil CIP:101374

NOTAS:

1. TODOS LOS DATOS PARA EL REPLANTEO DEBERÁN SER APROBADOS POR EL SUPERVISOR EN CAMPO ANTES DE LA CONSTRUCCIÓN. SI LA TOPOGRAFÍA DEL TERRENO DIFIERE DE LA MOSTRADA EN LOS PLANOS, EL SUPERVISOR DEBERÁ AJUSTAR EL DISEÑO A LAS CONDICIONES EXISTENTES.
2. LA LÍNEA DE RASANTE PODRÁ SER MODIFICADA DE ACUERDO A LAS CONDICIONES DEL TERRENO ENCONTRADAS Y DEBERÁ REEMPLAZARSE EL MATERIAL NO COMPETENTE, COMO LO INDIQUE EL INGENIERO DE CQA.
3. LOS TALUDES DE CORTE Y RELLENO SE MUESTRAN EN EL PLANO DE SECCIONES TÍPICAS MTE13−0S91173−2210−DW−V−015.
4. LOS TALUDES DE CORTE PODRÁN MODIFICARSE DE ACUERDO A LAS CONDICIONES DEL TERRENO ENCONTRADAS EN CAMPO PREVIA AUTORIZACIÓN DEL SUPERVISOR.
5. LA SUPERFICIE PROYECTADA SE HA DISEÑADO A NIVEL DE RASANTE, DEBAJO DEL CUAL SE COLOCARÁ UNA CAPA DE AFIRMADO MÍNIMO DE 0.20m.

REFERENCIAS

N° DE PLANO/DOCUMENTO	TITULO

REVISIONES

N°	DESCRIPCION	DIB.	REV.	APR.	FECHA
0	EMITIDO PARA CONSTRUCCIÓN	V.C.	G.CH.	P.M.	13/02/19
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	V.C.	G.CH.	P.M.	12/02/19
A	EMITIDO PARA REVISIÓN INTERNA	V.C.	G.CH.	P.M.	11/02/19

NOTAS GENERALES.−

1. TODAS LAS ELEVACIONES SE MOSTRARÁN EN METROS.
2. LAS UNIDADES DE LOS PLANOS SE ENCUENTRAN EN EL SISTEMA INTERNACIONAL, SALVO OTRA INDICACIÓN.
3. LAS ELEVACIONES ESTÁN REFERIDAS A ALTURAS ORTOMÉTRICAS (msnm).
4. BASE TOPOGRÁFICA PROPORCIONADO POR MINERA CHINALCO PERÚ S.A.
5. LA CUADRÍCULA ESTÁ REPRESENTADA EN EL SISTEMA DE COORDENADAS LOCALES.

BISA INGENIERÍA DE PROYECTOS S.A.

MINERA CHINALCO PERÚ S.A.

ESCALA:	INDICADA	FORMATO:	A1
DIBUJO:	V. CASAS	FECHA:	13/02/19
DISEÑO:	G. CHAPOÑAN	FECHA:	13/02/19
REVISADO:	B. RODRIGUEZ	FECHA:	13/02/19
APROBADO:	P. MARIN	FECHA:	13/02/19
COD. PROY. CONTRATISTA:	395CM0066GP	N° DE PLANO CONTRATISTA:	

PROYECTO: INGENIERÍA DE DETALLE PLATAFORMAS PARA BOMBAS GEHO Y CELDAS DE FLOTACIÓN

AREA: 2210 – FLOTACIÓN GENERAL

TIPO DE CONTRATO:

TITULO: ACCESOS A PLATAFORMA DE FLOTACIÓN – FASE II
PLANTA Y PERFILES LONGITUDINALES Y SECCIONES TRANSVERSALES

COD.PROYECTO N°: OS91173

N° DE PLANO: MTE13−OS91173−2210−DW−V−022

0

P:\PI CONSTRUCCION\GERENCIA DE CONSTRUCCION\PT – PROJECT\02. Proy Internos MCP\01.– Proyectos

ANEXO 2-12
PLANOS ÁREA DE MINA

003031

8 718 000 N
8 717 000 N
8 716 000 N
8 718 000
8 717 000
8 716 000
8 715 000
373 000
373 999
374 999
376 000
377 000
377 999

LAGUNA CHURUCA
Carretera Central
MOROCOCHA ANTIGUA
RAISE BORER
PIQUE ALEJANDRIA
PIQUE GERTUDRIZ
PIQUE NATIVIDAD
PIQUE SAN FRANCISCO
PIQUE MARIA
TUNEL KINGSMILL
Pique Central
Canal de Concretro
Canal Norte DDMO
POZA S1
Capacidad Maxima Operativa: 26,500m3
Canal de Geomembrana
Dique Poza A
POZA A
Capacidad Maxima Operativa: 460,700 m3
Canal 2 Concreto
Alcantarilla B1
Deposito de desmonte Santa Rita
ACCESO SANTA RITA
BAHIA
Poza Sedimentadoras
Pared Norte
Pared Oeste
RAMPA CHAYCOCHA
Sistema de bombeo Poza C-Pique Central
FASE 3
RAMPA SAN FRANCISCO
RAMPA OESTE
TAJO
Alcantarilla Poza Contingencia - Poza C
Canal Morococha Geomenbrana
Garita Norte
BOMBA
POZA C
Capacidad Maxima Operativa: 399,300m3
Dique Poza C
Tuberia
Canal Polvorin Concreto
POLVORIN
POZA S2
Capacidad Maxima Operativa: 26,600m3
POZA CONTINGENCIA
Capacidad Maxima Operativa: 7,200m3
Canal C2 Concreto
Canal C1 Concreto
(Interior Mina) MANUELITA (M.YAULI)
San Florencio
DEPOSITO DE DESMONTE OESTE
Galeras
Ovalo
POZA COPAYCOCHA
Capacidad Maxima Operativa: 10,000m3
Desarrollo de acceso
ACCESO A CAJONCILLO
Alcantarilla B4
STOCK 04
AK-15
POZA BUENAVENTURA
Capacidad Maxima Operativa: 40,000m3
TRUCK SHOP
Canal de Geomembrana
Canal 6 Concreto
Alcantarilla B2
Nuevo Canal 11 Concreto
Stock Baden
Canal 10 Concreto
BUENAVENTURA
ACCESO BUENAVENTURA
BOTADERO ESTE CAJONCILLO
CAJONCILLO
CHANCADORA
STOCK 17
PIQUE BUENAVENTURA
DEPOSITO DE MINERAL DE BAJA LEY

LEYENDA

SIMBOLO	DESCRIPCIÓN
	PIQUE EXISTENTES
	TUNEL KINGSMILL
	CURVAS DE NIVEL DE TERRENO EXISTENTE ACTUAL
	CANALES CONCRETO
	CANAL GEOMENBRANA
	ALCANTARILLA

La Poza C cuenta con una bomba sumergida, marca Mody, modelo G1006T-SS, de acero inoxidable de 58 HP. Esta impulsa 50 L/s mediante una tubería HDPE hacien el Pique Central

PLANO GENERAL DE DRENAJE MINA

RUDDY JAVIER PALACIOS RODRIGUEZ
INGENIERO DE MINAS
Reg. CIP N° 165422

NOTAS :

1.- DIMENSIONES Y NIVELES EN METROS, SALVO INDICADO.
2.- SISTEMA DE COODENADAS UTM WGS-84

REFERENCIAS

Nº DE PLANO/DOCUMENTO	TITULO

REVISIONES

Nº	DESCRIPCION	DIB.	REV.	APR.	FECHA
B	EMITIDO PARA REVISION DEL USUARIO	---	---	---	---
A	EMITIDO PARA COORDINACION INTERNA	---	---	---	---

ESCALA: S/E	FORMATO: A1		
DIBUJO: GEOTECNIA	FECHA: 13.02.2020		
DISEÑO: GEOTECNIA	FECHA: 13.02.2020		
REVISADO: GEOTECNIA	FECHA: 13.02.2020		
APROBADO: GEOTECNIA	FECHA: 13.02.2020		
COD. PROY. CONTRATISTA:	Nº DE PLANO CONTRATISTA:		

CHINALCO
MINERA CHINALCO PERÚ S.A.

PROYECTO: D-1			
AREA: OPERACIONES MINA		TIPO DE CONTRATO:	B
TITULO: PLANO GENERAL DE DRENAJES		COD.PROYECTO Nº:	
		Nº DE PLANO: D-1	

372000 373000 374000 375000 376000 377000 378000

8718000 8717000 8716000 8715000 8714000

Lag. Huacracocha
Lag. Churuca
Lag. Huascacocha

Hacia Lima
Carretera Central
Hacia La Oroya
Carretera Central

Depósito de lodos de la PTATK
Planta de Tratamiento de Aguas Residuales Domésticas
Campamentos
Planta de Tratamiento de Agua Potable
Tajo
Poza S1
Poza A
Poza 3 (Aún no construida)
Mina a Tajo Abierto
Tanque de Agua Fresca (Mina)
Poza C
Camino de acceso Morococha a Tunshuruco
Poza S2
Polvorín
Nuevo Acceso Principal
Almacén de Explosivos
Depósito de Desmonte Oeste
Poza 2
Depósito de Desmonte Este
Sistema de Combustible
Infraestructura de Mantenimiento existente
Depósito de Mineral de Baja Ley Este
Poza 1
Edificio de Administración (Mina)
Depósito de Desmonte Oeste
Depósito de Desmonte Este
Chancadora Primaria
Depósito de Mineral de Baja Ley Oeste
Sistema de Faja Transportadora Principal
Nueva Chancadora Primaria
Almacén central de residuos sólidos
Infraestructura de Mantenimiento
Depósito de Mineral de Baja Ley Este
Depósito de Mineral de Baja Ley Oeste

Componentes Proyectados
Componentes Actuales de la UM Toromocho
Huella Final de la U.M. Toromocho

LEYENDA

Vía Asfaltada
Vía Afirmada
Quebrada
Curva Primaria
Curva Secundaria
Laguna

RUDY JAVIER PALACIOS RODRIGUEZ
INGENIERO DE MINAS
Reg. CIP N° 165422

MODIFICACIÓN DEL ESTUDIO DE IMPACTO AMBIENTAL PARA EL PROYECTO DE EXPANSIÓN DE LA UNIDAD MINERA TOROMOCHO A 170 000 TPD

TÍTULO :

COMPONENTES OPERACIONES MINA

DEPARTAMENTO:	PROVINCIA:	DISTRITO:
JUNIN	YAULI	YAULI, MOROCOCHA

ESCALA: 1:12,500
250 125 0 250 500 m
Datum: WGS84 UTM - Zona 18 Sur

CLIENTE: CHINALCO

ELABORADO POR:	PROYECTO:	FECHA:	MAPA:
Walsh Perú	MIN-1711	Junio, 2020	C-01

FUENTE: Instituto Nacional de Estadística e Informática (INEI), Instituto Geográfico Nacional (IGN) Ministerio de transportes y Comunicaciones (MTC)

ANEXO 2-13
ARREGLOS GENERALES

1.
Operaciones de mina

373000 374000 375000 376000 377000 378000 379000

8717000 8716000 8715000 8714000

Lag. Huacracocha
Lag. Churuca
Lag. Huascacocha
Carretera Central
Carretera Central
Tajo
Polvorín
Nuevo Acceso Principal
Deposito de Desmonte Oeste
Depósito de Mineral de Baja Ley Oeste
Nueva Chancadora Primaria
Depósito de Desmonte Este
Depósito de Mineral de Baja Ley Este

LEYENDA

- Vía Asfaltada
- Vía Afirmada
- Quebrada
- Laguna

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP N°92191

MODIFICACIÓN DEL ESTUDIO DE IMPACTO AMBIENTAL PARA EL PROYECTO DE EXPANSIÓN DE LA UNIDAD MINERA TOROMOCHO A 170 000 TPD

TÍTULO :

COMPONENTES OPERACIONES MINA

DEPARTAMENTO:	PROVINCIA:	DISTRITO:
JUNIN	YAULI	YAULI, MOROCOCHA

ESCALA: 1:12,500
250 125 0 250 500 m
Datum: WGS84 UTM - Zona 18 Sur

CLIENTE: CHINALCO

ELABORADO POR:	PROYECTO:	FECHA:	MAPA:
Walsh Perú	MIN-1711	Set, 2019	C-01

FUENTE: Instituto Nacional de Estadística e Informática (INEI), Instituto Geográfico Nacional (IGN)
Ministerio de transportes y Comunicaciones (MTC)

2.
Concentradora

003037

LEYENDA		
ITEM	DESCRIPCION	REF. PLANO
107	CHANCADO PEBBLES 2115-CR-701/702	2115-GA-M-001
112	BOMBA DE ALIMENTACIÓN CLEANER BULK 2211-TK-042/2211-PP-194@195	
113	CELDAS FLOTACIÓN LIMPIEZA BULK (07) 2212-FO-195@201	2210-GA-M-001
116	SISTEMA DE BOMBEO PARA RELAVES 2562-PP-455@460	2562-GA-M-001
126	TANQUE EQUALIZADOR 2562-TK-701	2562-GA-M-001
129	SUBESTACION UNITARIA	2562-GA-M-001
156	NUEVA TUBERÍA DE RELAVES ø24"	2563-GA-M-001
158	FLOTACION DE Cu - MOLINO VERTICAL 2215-ML-001	2215-GA-M-001
159	CELDAS DE FLOTACIÓN DE Cu SEGUNDA LIMPIEZA (06) 2214-FO-701@706	2210-GA-M-001
160	ESPESADOR DE CONCENTRADO Cu 2410-TK-001	2410-GA-M-001
161	PLANTA DE FILTRADO - FILTRO 2460-FL-705	2460-GA-M-001
163	ALMACÉN DE CONCENTRADO	2460-GA-M-004
164	TANQUE DE DISTRIBUCIÓN LECHADA DE CAL 2615-TK-701	2615-GA-M-001
165	TANQUE DE DISTRIBUCION LECHADA DE CAL 2615-TK-702	2615-GA-M-001
166	TANQUE DE DISTRIBUCION LECHADA DE CAL 2615-TK-703	2615-GA-M-001
167	SOPLADORES DE AIRE 2212-GB-701/702 Y 2213-GB-701	2210-GA-M-001
168	CELDAS FLOTACIÓN LIMPIEZA SCAVENGER 07) 2213-FO184@190	2210-GA-M-001
169	CELDAS DFR	220-GA-M-001
170	PLANTA DE NaHS	400-GA-M-001
171	SALA ELÉCTRICA ÁREA 2564	2564-GA-E-004

MTE13-OS91173-2564-GA-E-001

MTE13-OS91173-2562-GA-M-001

MTE13-OS91173-2115-GA-M-001

MTE13-OS91173-220-GA-M-002

MTE13-OS91173-2210-GA-M-001

MTE13-OS91173-2410-GA-M-001

MTE13-OS91173-2215-GA-M-001

MTE13-OS91173-2460-GA-M-001

MTE13-OS91173-400-GA-M-001

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 62425

LEYENDA	
SIMBOLO	DESCRIPCION
	AREA EXISTENTE
	AREA NUEVA

0 25 50 75 100 m
25000mm
1:1500

N 8710400 N 8710200 N 8710000 N 8709800 N 8709600 N 8709400
E 374600 E 374800 E 375000 E 375200 E 375400 E 375600

P:\VP CONSTRUCCION\GERENCIA DE CONSTRUCCION\PT - PROJECT\02. Proy Internos MCP\01.- Proyectos

REFERENCIAS

Nº DE PLANO/DOCUMENTO	TITULO

REVISIONES

Nº	DESCRIPCION	DIB.	REV.	APR.	FECHA
0	EMITIDO PARA CONSTRUCCIÓN	M.T.	V.V.	P.M.	13/12/18
C	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	J.M.	V.V.	P.M.	05/12/18
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	J.M.	V.V.	P.M.	22/11/18
A	EMITIDO PARA COORDINACION INTERNA	J.M.	V.V.	P.M.	14/11/18

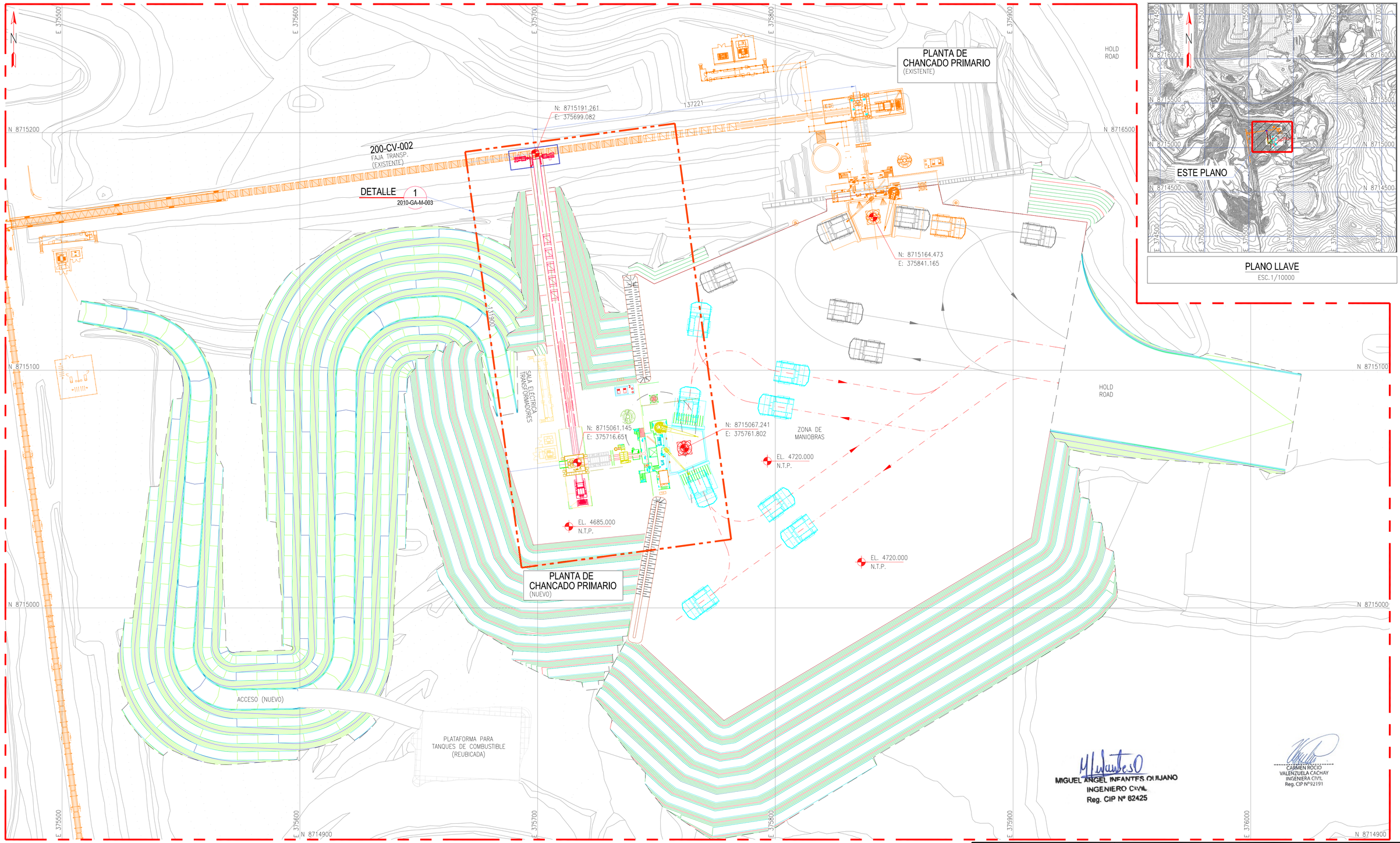
NOTAS:
1. ESTE PLANO ESTA PRESENTADO EN:
   -SISTEMA DE COORDENADAS: UTM WGS84.
   -SISTEMA DE UNIDADES DIMENSIONES (mm)
   ELEVACIONES (m)
2. EL DIMENSIONAMIENTO DE LOS EQUIPOS SON REFERENCIALES HASTA QUE SE TENGAN LOS PLANOS CERTIFICADOS DE LOS MISMOS.

BISA
BISA INGENIERIA DE PROYECTOS S.A.

ESCALA:	1/1500	FORMATO:	A1
DIBUJO:	J. MONCAYO	FECHA:	12/11/18
DISEÑO:	E. VASQUEZ	FECHA:	12/11/18
REVISADO:	V. VARGAS	FECHA:	12/11/18
APROBADO:	P. MARIN	FECHA:	12/11/18
COD. PROY. CONTRATISTA:	395CM0066GB	Nº DE PLANO CONTRATISTA:	

CHINALCO
MINERA CHINALCO PERÚ S.A.

PROYECTO:	AMPLIACIÓN DE LA PLANTA CONCENTRADORA TOROMOCHO A 170 KTPD		
AREA:	0010 - PLANTA DE PROCESOS	TIPO DE CONTRATO:	0
TITULO:	LAYOUT GENERAL PLANTA	COD.PROYECTO Nº:	OS91173
		Nº DE PLANO:	MTE13-OS91173-0010-GA-L-001



MIGUEL ANGEL INFANTES QUIJANO
INGENIERO CIVIL
Reg. CIP Nº 82425

CARMEN ROCIO VALENZUELA CACHAY
INGENIERA CIVIL
Reg. CIP Nº92191

BISA INGENIERÍA DE PROYECTOS S.A.

MINERA CHINALCO PERÚ S.A.

REFERENCIAS

Nº DE PLANO/DOCUMENTO	TITULO

REVISIONES

Nº	DESCRIPCION	DIB.	REV.	APR.	FECHA
0	EMITIDO PARA CONSTRUCCIÓN	P.Z.	V.V.	P.M.	12/12/18
C	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	P.Z.	V.V.	P.M.	07/12/18
B	EMITIDO PARA REVISIÓN Y APROBACIÓN DEL CLIENTE	P.Z.	V.V.	P.M.	22/11/18
A	EMITIDO PARA COORDINACION INTERNA	P.Z.	V.V.	P.M.	09/11/18

NOTAS:

1. ESTE PLANO ESTA PRESENTADO EN:
   - SISTEMA DE COORDENADAS: UTM WGS84.
   - SISTEMA DE UNIDADES: DIMENSIONES (mm), ELEVACIONES (m)
2. EL DIMENSIONAMIENTO DE LOS EQUIPOS SON REFERENCIALES HASTA QUE SE TENGAN LOS PLANOS CERTIFICADOS DE LOS MISMOS.

ESCALA: 1/200	FORMATO: A1	PROYECTO: AMPLIACIÓN PLANTA CONCENTRADORA TOROMOCHO A 170 KTPD	
DIBUJO: P. ZEGARRA	FECHA: 09-11-18		
DISEÑO: E. VASQUEZ	FECHA: 09-11-18	AREA: 2010 – CHANCADO PRIMARIO	TIPO DE CONTRATO:
REVISADO: V. VARGAS	FECHA: 09-11-18		0
APROBADO: P. MARIN	FECHA: 09-11-18	TITULO: PLANTA DE CHANCADO PRIMARIO ARREGLO VISTA DE PLANTA	COD.PROYECTO N°: OS91173
COD. PROY. CONTRATISTA: 395CM00666B	N° DE PLANO CONTRATISTA:		N° DE PLANO: MTE13-OS91173-2010-GA-M-002

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