TAILING TEST PLOTS ANNUAL REPORT
REPORT-NO. 1

PHELPS DODGE TYRONE INC.
AND
CHINO MINES COMPANY

Submitted to:

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2 Copies – Golder Associates Inc.

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1.0 INTRODUCTION

Phelps Dodge Tyrone Inc. (Tyrone) and Chino Mines Company (Chino) operate copper mining facilities near Silver City, New Mexico (Figure 1). Tyrone and Chino are evaluating reclamation options with respect to meeting pertinent applicable requirements of the New Mexico Water Quality Control Act (WQA), the Water Quality Control Commission (WQCC) Regulations, and the New Mexico Mining Act (NMMA). The New Mexico Mining and Minerals Division (MMD) regulate Tyrone (Permit No. GR010RE) and Chino (Permit No. GR009RE) as existing mines. The New Mexico Environment Department (NMED) issued Discharge Permit 1341 (DP-1341) to Tyrone and DP-1340 to Chino to regulate closure related issues. Conditions for the tailing test plot program were also negotiated in association with the DP-27 Settlement Agreement at the Tyrone Mine.

Condition 76 (DP-1341) and Condition 82 (DP-1340) require the development and interpretation of cover, erosion, and revegetation test plots. The purpose of the test plots is to "evaluate: net infiltration [drainage] through the store and release cover with differing cover thicknesses; feasibility of construction and construction techniques required during cover placement; erosion rates of covered and uncovered slopes; vegetation success; and the potential for upward migration of acidic solutions from the Tailing Impoundments, Waste Rock Piles and Leach Ore Stockpiles."

Because of broad similarities in operations, climate, vegetation, and materials, the NMED and MMD agreed to combine the Chino and Tyrone tailing pond test plot studies at the Tyrone Mine.

1.1 Background

Cover design is an important component of the reclamation plans for the Tyrone and Chino tailing facilities. Tyrone and Chino identified the need for cover design studies in the development of their respective closure/closeout plans (DBS&A, 1997a and 1997b). Through meetings and discussions with the NMED and the MMD during the spring of 1998, Tyrone and Chino prepared and submitted cover design work plans for regulatory review. Based upon agency comments, a revised work plan was submitted on October 23, 1998 and work was initiated on the cover design studies in early November 1998.

Implementation of the initial work plan and subsequent work led to the development of the Cover Design Study Status Reports (CDSSR) for Chino (DBS&A 1999a) and Tyrone (DBS&A, 1999b). The CDSSR presented the results of the materials characterization, soil water balance simulations, and technical reviews of various types of cover systems. Based on this work and subsequent interactions with the

NMED and MMD, a capacitive type cover (water storage cover) was selected as the most appropriate for use in this region.

In May 2003, Chino submitted a test plot study work plan to address the requirements of DP-1340 Condition 82 (TTEMI, 2003a). Subsequently, the Chino work plan was amended in October 2003 and submitted for Agency review (TTEMI, 2003b). In December 2003, separate but nearly identical work plans were submitted by Tyrone to address the tailing impoundment test pots for Condition 76 (DP-1341) and Condition 29 (DP-27) (TTEMI, 2003c and 2003d). These work plans were ultimately approved by the NMED in May 2004. The MMD granted final approval for the Tyrone test plot work plans related to Condition 9.L.1 (Permit GR010RE) in February 2006.

1.2 Goals and Objectives

Condition 76 (DP-1341) and Condition 82 (DP-1340) require submission of an annual report for the test plots. Condition L.1.d of Permits GR010RE (Tyrone) and GR009RE (Chino) require that annual reports be submitted beginning in year 2 of the study. This document represents the first annual report detailing the status of the test plots. Section 2 of this document contains responses to comments from the MMD and NMED concerning the *As-Built Report-Cover, Erosion, and Revegetation Test Plot Study-Tailing Test Plots* that was submitted in September 2006.

The primary objective of this report is to provide an overview of the status of the tailing test plots (Section 3). Data acquisition is ongoing but substantive results are not yet available. The preliminary results will be presented in the second annual report in accordance with the reporting schedule provided in the approved test plot work plans.

Section 4 identifies outstanding issues and presents a schedule for the completion of additional work associated with the test plots. Section 5 presents a summary of issues encountered at the test plots and recommendations for improving the test plot program.

2.0 RESPONSES TO COMMENTS ON AS-BUILT REPORT

In a November 8, 2007 letter, the MMD and the NMED provided comments on the report titled, *"As-Built Report-Cover, Erosion, and Revegetation Test Plot Study-Tailing Test Plots."* The MMD and NMED conditionally approved the report pending satisfactory responses to the conditions listed below. This section details responses to the Agencies comments.

Agency Comment #1

PDTI shall clarify the text in Section 2.1.1 and Table 4 with respect to the percentage of rock fragments. It is unclear whether the weight percent cited in Table 4 representative of the entire sample or after excluding greater than 75 millimeter fraction.

Phelps Dodge Response to Comment #1

The values listed in Table 4 are representative of the rock fragments (> 2mm) contained in the sample as measured by the laboratory. These data are reported on a weight or mass basis. The soil samples were collected in 1 gallon plastic bags and the fragments larger than about 75 mm (cobbles) were excluded, if they occurred in the soil profile. Field estimation of rock fragments volume and removal of oversize materials is a standard practice that is employed in sampling soils containing rock fragments.

Agency Comment #2

PDTI shall clarify the conversion of weight percent to volumetric percent, which would allow comparisons to be made more readily between Tables 3 and 4.

Phelps Dodge Response to Comment #2

The conversion from weight percent rock fragments to volume percent rock fragments was determined using the following formula and assumptions:

$$\text{Volume \%} = [(W\%/SG_r)/((W\%/SG_r)+((100-W\%)/BD_{<2mm}))]*100 \quad \text{where,}$$

W% = weight percent rock fragments retained on the No. 10 sieve,
SG_r = specific gravity of rock fragments (assume 2.65 g/cm^3),
$BD_{<2mm}$ = soil bulk density (assume 1.5 g/cm^3).

Agency Comment #3

PDTI must clarify the discrepancies between Figure 4, Figure 5, Figure 6 and Table 3 because the mean, highest, and lowest values do not agree.

Phelps Dodge Response to Comment #3

Figures 4, 5, and 6 illustrate the mean and 95% confidence intervals about the mean for the respective cover thickness and slope treatments. The thickness values in Table 3 represent the range of cover thicknesses measured at each site. The mean and 95% confidence intervals were calculated using the data in Table 3. Figures 4, 5, and 6 are not intended to illustrate the range of cover thickness measured on the test plots, which is represented by the data in Table 3.

Agency Comment #4

PDTI must include photographs of the test plots, preferably following the seeding of the test plots in the summer or fall of 2005 and following the installation of erosion monitoring locations in the fall of 2006.

Phelps Dodge Response to Comment #4

Photo documentation of various aspects of the test plot construction is included in Appendix A of this report.

Agency Comment #5

PDTI must include updated maps with the addition of erosion monitoring instrumentation (i.e., pin locations), the repaired area on the slope of the No. 3X Dam (TP#1), and the subsidence areas associated with any lysimeters.

Phelps Dodge Response to Comment #5

Figure 2 is an updated map showing the approximate location of the erosion transects, corrective action area on Dam 3X and approximate lysimeter subsidence zones.

Agency Comment #6

If there are subsequent erosion events and proposed repair work, PDTI must notify NMED and MMD personnel for both Chino and Tyrone permit leads as the tailing test plots serve a dual purpose. The approved work plan contingency language requires agency collaboration before implementing a corrective action plan at the test plots. Chino permit leads were not contacted for the No. 3X Dam (TP#1) cover repairs of September 2006 and were informed verbally after the work was complete.

Phelps Dodge Response to Comment #6

Tyrone reported the erosion features on Dam 3X in accordance with the requirements of DP-1341 Condition 54 and Condition N.9 of Permit GR010RE. The erosion features were reported to the MMD and NMED in compliance with the general requirements for the Dam 3X reclamation unit. In the future, the Chino permit leads will be included in communications associated with erosion issues on the tailing test plots.

Agency Comment #7

PDTI should clarify the intended use of the soil hydraulic data relative to the loam samples. Table 6 values for soil hydraulic properties have two samples each of the soil types of sandy loam (SL), sandy clay loam (SCL), and loam (L). At the test plots, the loam samples represent 2 of the 70 samples. The loam soil hydraulic properties resulted in saturated hydraulic conductivity value two orders of magnitude lower than the SCL or SL type soils. Because the soil type appears to be an outlier relative to the test plot samples, NMED notes that it may be difficult to support using the loam values or even averaging the values with others for computer simulations. The values may have limited use for sensitivity analyses or possibly if the frequency of loams for cover materials are substantiated elsewhere.

Phelps Dodge Response to Comment #7

The soil hydraulic testing was conducted to allow an understanding of the range of cover conditions that may occur. Tyrone shares the Agencies' concern with the use of non-representative data and anticipates that the MMD and NMED will ultimately be involved in a review capacity in the selection of defensible soil hydraulic parameters. To date, Tyrone has made no determinations on the use of soil hydraulic data for the evaluation of the test plot data and has merely presented the data reported by the certified laboratory.

Agency Comment #8

Table 6 values only tested top surface samples. As indicated in Section 2.2.1 and Table 3, the cover has a higher rock fragment content on slopes than top surfaces. PDTI should clarify the rationale for testing only the top surface values instead of additional testing of some of the slope samples.

Phelps Dodge Response to Comment #8

The soil hydraulic analyses are performed on the fine earth fraction (< 2mm) of disturbed and repacked samples. These data are subsequently corrected to account for rock fragments representative of the whole soil. Thus, the sample locations were selected to characterize a representative range of materials that might occur on the test plots, with primary emphasis on the fine-earth fraction. In this context, the source of the samples is immaterial since the samples were collected from materials that were believed to be representative of test plot covers.

Agency Comment #9

Monitoring is mentioned in the as-built reports, and the tailing test plots require annual monitoring summaries. PDTI should clarify the reporting schedule when in the calendar year the annual summaries would be presented, which appears to be dictated by the Condition 29 for DP-27 Settlement Agreement as January of each year.

Phelps Dodge Response to Comment #9

Tyrone and Chino propose to provide an annual report for the tailing test plots at the end of January in subsequent years.

Agency Comment #10

In Section 3.2 and Plate 1, there is some indication that the sloped test plots were flatter and shorter in length than is defined in the permit language. PDTI must explain the causes for the change in grade from the proposed design and if these are due to construction limitations.

Phelps Dodge Response to Comment #10

The test plots were constructed as part of the overall reclamation of Dam 3X. The permits allows for slopes with gradients up to 3:1 on the tailing dams, however, the gradients on Dam 3X are generally shallower than 3:1 and it was not feasible to construct steeper slopes. The final reclamation designs for the test plots were approved by the MMD and NMED as part of the routine review process on Dam 3X.

The slope lengths on the test plots are generally shorter than originally proposed since the designs did not fully consider the slope length reductions associated with the construction of the v-ditches. Plate 1 provides additional cross-sections.

Agency Comment #11

As part of the annual summary report (progress report) for the test plots due on January 31, 2007, PDTI must submit responses to the above conditions as well as the five unfinished items in Section 4 Schedule of Future Work cited on page 16. The five items are installation of erosion monitoring points, fertilization of a section of top surface, neutron probe licensing, neutron probe calibration, cost summary.

Phelps Dodge Response to Comment #11

The status of the five unfinished items is detailed in Section 4 of this report.

3.0 RESULTS

The following sections present a summary of the first year of monitoring associated with the tailing test plot study. The status of the vadose zone and erosion monitoring programs are outlined in Sections 3.1 and 3.2, respectively. The preliminary assessment of the vegetation success is presented in Sections 3.3.

3.1 Vadose Zone Monitoring

The configuration of the test plots and instrumentation was detailed in the As-Built report (Golder, 2006). Stacked nests of heat dissipation sensors (HDS), frequency domain reflectometers (FDR), and electrical resistence sensors (ERS) were installed using a downhole emplacement and reconstruction method in each test plot. The installation method involved installing a 4-inch diameter, schedule 40, PVC pipe vertically in the tailing material following subgrade preparation. The pipe was installed so that the terminal depth was about 220 cm in a covered condition. Following cover placement and seeding operations, the individual sensors were lowered into the PVC pipe annulus to the target depths in a step wise manner; a section of the pipe was lifted out of the hole and the void space was backfilled with either tailing or cover as appropriate and the material was then compacted. At completion the entire length of pipe was removed and only the cables extended from the soil surface. This method resulted in the installation of sensors with minimal disturbance of the surrounding cover and waste material. The sensor cables were then routed through 1.5-inch diameter, schedule 40, PVC pipes to the tripods used to house the data loggers and solar panels. The pipes were then buried to protect them from solar degradation. The sensor cables were connected to data loggers that are powered by 86 amp-hour batteries and charged by 20W or 40W solar panels. Volumetric lysimeters were installed at 4 test plot locations. The vadose monitoring program is complemented by on-site meteorological measurements.

Data from the individual sensors are collected on an hourly basis and manually downloaded from the dataloggers on an approximate weekly basis. Comprehensive database files have been developed for the each vadose zone monitoring nest and are routinely updated as new data is downloaded. The quality of the raw data must be assessed prior to integration into the database. Protocols for data management are being evaluated. Once the quality of the data has been confirmed, it can be used to evaluate the soil water conditions.

A radio telemetry system was recently installed on Dam 3X, which allows continuous data transmission to a centralized server. However, manual downloads of the data are still being performed until a fully integrated electronic access system is established. The following sections provide a detailed description of the tailing test plot vadose zone monitoring program.

3.1.1 Heat Dissipation Sensors

Monitoring of the HDS network began in December 2005 for the Dam 3X nests and in June 2006 for the nest on Dam 3. The primary activities following installation included troubleshooting the primary and backup power systems, sensor cable and wiring installations, and data logger program optimization. Data from this initial monitoring period were evaluated to determine the approximate time when the moisture content of the backfill material in which the sensors were bedded came into equilibrium with the surrounding waste and cover material. Based on the analysis of the HDS data, the majority of the sensors appear to have reached equilibrium with the surrounding cover and waste material by about March 2006. In general, the data collected prior to this time is not considered reliable.

Individual database files have been developed for each vadose zone monitoring nest. The HDS files include the raw hourly data (i.e., initial soil temperature [T_0] and change in temperature [ΔT] following heating of the porous ceramic body of the HDS), associated HDS laboratory calibration information and, ambient temperature corrections (Flint et al., 2002). Once corrected the HDS data may then be used to estimate soil matric potentials (ψ). The database files are currently undergoing a thorough QA review.

3.1.2 Frequency Domain Reflectometers

A total of 16 individual FDR's were installed within four vadose zone monitoring nests. Monitoring and optimization of the FDR network began in December 2005. Database files have been developed for each FDR nest. The files include all hourly raw FDR data (i.e., voltage readings) and associated FDR laboratory calibration information. Soil water contents (θ) may be calculated from the FDR data. The database files are currently undergoing a thorough QA review.

3.1.3 Electrical Resistance Blocks

A total of 6 ERS were installed within six vadose zone monitoring nests. Individual database files have been developed for each ERS that include all hourly raw ERS data (i.e., water potentials in bars). These data will be used to evaluate the variability of soil matric potentials in the near-surface cover materials. The database files are currently undergoing a thorough QA review. Once the QA review is completed, soil matric potential data from the ERS will be combined with the soil matric potential data from the HDS to provide a complete profile of the matric potentials at each vadose zone monitoring nest.

3.1.4 Volumetric Lysimeters

Four volumetric lysimeters were installed to evaluate cumulative drainage below the base of the covers (Golder, 2006). The lysimeters consist of polyethylene cone bottom tanks (84-inch diameter and 48-inch height) with a 2-inch diameter Schedule 80 HDPE discharge pipe connected to the bottom of the tank. The discharge pipe is connected to a 55-gallon closed-top polyethylene drum that acts as a reservoir for drainage water. Fluid levels have been measured in the gauging tubes with Druck model CS-420 pressure transducers on an hourly basis since December 2005. Water that accumulates in the gauging tubes or reservoirs is purged with a pump during the routine data downloads. Water quality monitoring of accumulated fluids is also conducted as part of the purging process. The monitoring consists of field measurements of the pH, electrical conductivity, and temperature.

Individual database files have been developed for each lysimeter. The files include all hourly reservoir water level data from the pressure transducers, manual purge volumes, and field water quality data. The database files are currently undergoing a thorough QA review.

3.1.5 Neutron Probe

Special licensing, operator training, handling, shipping, and storage procedures are required because of the potential radiation safety hazards associated with neutron probes. Golder has completed the Radioactive Materials License application. Pending approval by the Radiation Control Bureau of the NMED, calibration of the neutron probe and routine monitoring of the individual neutron access tubes at the tailing test plots will be conducted. Calibration should be completed within 60 days of issuance of the Radioactive Materials License by the NMED.

3.1.6 Meteorological Stations

Fully automated meteorological (met) stations were assembled and installed at Dam 3X and near Pond 7 at Chino. The met stations consist of a tipping bucket rain gage (Texas Electronic model TE525); relative humidity/air temperature probe (Vaisala model HMP45AC); wind speed and direction sensor (R.M. Young model 05103); and silicon pyranometer for measuring solar radiation (Kipp & Zonen SP-LITE). The sensors are mounted on a 10-foot tripod anchored in place. The sensors and gauges are connected to Campbell Scientific, Inc. data loggers (CR-23X at Dam 3X and CR-1000 at Chino) that are powered by 86 amp-hour batteries and charged by 20W solar panels. Initial monitoring and optimization of the meteorological stations began in January 2006 for Dam 3X and in June 2006 for the Chino station. This phase of monitoring included troubleshooting primary power and backup power systems, sensor cable wiring, and data logger program optimization. Average hourly values for relative humidity, air temperature, solar radiation, wind speed and wind direction; and hourly total rainfall measurements are currently being recorded with the data loggers.

3.3 Erosion Monitoring

The location of the erosion transects was modified from the original proposal (August 2006) with intent of better capturing spatial variability both within and between thickness treatments. The changes were approved by the NMED and MMD in November 2006. Figure 2 shows the approximate location of the erosion transects. Erosion transects have been established in all the tailing test plots and erosionometer stations have been designated along each transect. At each station, pins that will hold the erosionometer have been installed in small post-hole excavations where concrete is to be poured to secure the pins. Due to the recent winter weather, concrete has been poured at only one transect. Completion of the transects is scheduled for February 2007 as ground conditions permit.

3.4 Vegetation Success

Vegetation establishment is considered satisfactory on the Dam 3X test plots based on qualitative assessments of cover, density, and diversity. Canopy cover is relatively low, but is consistent with the levels expected for the early establishment phases of reclamation in this region. Plant density generally exceeds about 1 plant/square foot, which is considered appropriate for this stage in the reclamation. The seeding operation resulted in the initial establishment of shrubs, forbs, and warm and cool season grasses. With the exception of mountain mahogany (*Cercocarpus montanus*), all the seeded species are expressed in the test plots on Dam 3X. Because of the nearly complete failure of mountain mahogany to establish on the Dam 3X test plots and elsewhere, it was been replaced by four-wing saltbush (*Atriplex canescens*) in subsequent seeding operations after consultation with the Agencies. Colonization of the site by native species is evident through the occurrence of non-seeded species. While some weedy annuals are present in the test plots, they are not widespread. Because of the deferred seeding date, the vegetation response of the 1.5 foot test plot on Dam 3 is lagging behind the Dam 3X test plots. Quantitative vegetation monitoring will be conducted in accordance with the approved work plan.

4.0 STATUS AND SCHEDULE FOR FUTURE WORK

The tailing test plots were constructed and seeded by the summer of 2005 according to the approved schedule. Subsequent work involved the installation of the vadose zone monitoring instruments. This section provides an update of the outstanding items identified in the As-Built report (Golder, 2006).

4.1 Installation of Erosion Monitoring Points

The erosion transect locations were originally approved in mid-August 2006, with subsequent changes approved in November 2006. These points will be finalized in February 2007 when ground conditions are acceptable to avoid undo disturbance of the test plots.

4.2 Fertilization of Top Surface Plots

As indicated in the work plan, nitrogen fertilizer will be applied to the top surface test plots at a rate of 10 lbs N/acre. Ammonium nitrate fertilizer will be evenly broadcast in the treatment area shown on Plate 1. The schedule for fertilization has not changed and it will be completed in the early spring prior to the on-set of plant growth.

4.3 Acquisition of Neutron Probe License and Calibration

Golder has applied for a radioactive materials license with the New Mexico Radiation Control Bureau to use, transport, and store the neutron probe. Golder anticipates that the operating license will be granted within 60 days, at which time the probe can be used in the field. In the interim, Golder intends to install the access tubes in Test Plots #1, #2, #5 and #6 and obtain a CPN 530DR Hydroprobe from CPN International, Inc. Once the operating license is granted, the instrument will be calibrated to field conditions. Field calibration of the neutron probe is expected to take approximately 60 days.

4.4 Test Plot Cost Summary

The NMED and MMD requested that Chino and Tyrone summarize the costs associated with the establishment of the test plots. Because the tailing test plots were constructed concurrently with the reclamation of the Dams 3 and 3X, the construction management, equipment operation, and earthwork costs were not itemized for the test plots. Table 1 presents a summary of the itemized costs that were assigned to the tailing test plots based on information supplied by the Phelps Dodge Accounting Department. The costs were grouped into two major categories as described below.

<u>Design, Oversight, and Permitting</u>: The design and oversight category included consulting costs associated with the design and evaluation of the construction activities related to meeting the scientific requirements of the test plots, and incidental permitting requirements (e.g., meetings and agency correspondence). These costs would not normally be associated with routine reclamation activities.

<u>Vadose Zone and Erosion Monitoring Instrumentation</u>: This category includes costs associated with the design, acquisition, calibration, and installation of the vadose zone and erosion monitoring equipment. Monitoring, maintenance, repair, and replacement costs incurred since the installation of the monitoring equipment are also included in the values shown in Table 1.

Table 1
Summary of Costs Accounted for During the Tailing Test Plot Construction

Cost Category	Dollars Incurred
Design, Oversight, and Permitting	**45,045**
Vadose Zone Instrumentation	**312,830**
Total Cost	**$ 357,875**

Tyrone and Chino do not consider the costs attributed to the test plots as summarized in Table 1 to reflect the costs that can be expected for routine reclamation of the stockpiles. Nonetheless, these values represent the best available current records for the test plots.

5.0 PERTINENT RECOMMENDATIONS

The reclamation at Dam 3X represents the first major closure project at Tyrone. The construction and reclamation practices used at Dam 3X and the tailing test plots are generally considered successful. Experience gained from this area has resulted in design changes and improvements in techniques applied at other facilities. Overall the vadose zone and meteorological monitoring systems test plot monitoring systems are performing well. The intent of this section is to outline some of the problems with the test plots and identify potential solutions that can be integrated into unfinished test plots at Chino and Tyrone.

Several sensor cables (HDS, FDR, ERS, and pressure transducer) were severed in March 2006. The severed cables were located on the top surface plots in the immediate vicinity of the vadose zone monitoring nests. A short section of cable was exposed between the PVC pipe and soil entry point. The damage was either caused by wildlife or was an act of vandalism. The severed sensor cables were repaired in April and May 2006 and data collection was resumed. To avoid the future loss of data, all exposed sensor cables should be buried with cover material to the extent practicable or wrapped with a protective armor. All sensor cables in future test plot installations will be buried and installed in conduit pipe to minimize the potential for cable damage.

During a field inspection in August 2006, surface depressions were observed above both lysimeters on the top surface test plots (2-foot and 3-foot cover plots). Surface water from recent rainfall was observed in the depression above the 3-foot cover test plot. The surface depressions are believed to have been caused by settling of the tailing and/or cover material following the heavy summer rains. The subsidence appears to be centered along the axis of the discharge pipe from the lysimeter barrel to reservoir. The subsidence occurred despite efforts made to compact the tailing during installation of the lysimeters. Heavy equipment were generally routed away from the area immediately above the discharge pipe, which may have resulted in lower levels of compaction than the surrounding areas. Golder proposes to construct a small earthen berm upstream of the subsidence areas to prevent runon and ponding above the lysimeters.

The potential for lysimeter subsidence at future test plots may be reduced by increasing the degree of compaction of the substrate and/or slightly mounding the area immediately above the lysimeter. Both of the practices were recently implemented at the Chino Stockpiles test plots.

In general, there appears to be a lack of vegetation in the immediate vicinity (i.e., within a 2- to 3-foot radius) of the vadose zone monitoring nests on both the No. 1 Stockpile and Tailing test plots. The sensors are installed after seeding a mulching operation so that the cables are not damaged by the equipment. It is recommended that the area around each existing nest be seeded and mulched by hand following installation. For future test plot installations in other areas, it is recommended that the area around each new vadose zone monitoring nest also be seeded and mulched immediately following the sensor installations.

6.0 REFERENCES

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DBS&A. 1997b. Closure/Closeout plan, Tyrone Mine. Prepared for Phelps Dodge Tyrone Inc. Tyrone, NM.

DBS&A. 1999a. Cover design study status report, Chino Mine. Prepared for Chino Mines Company, Hurley, NM.

DBS&A. 1999b. Cover design study status report, Tyrone Mine. Prepared for Phelps Dodge Tyrone Inc., Tyrone, NM.

Flint, A.L., G.S. Campbell, K.M. Ellet, and C. Calissendorff. 2002. Calibration and temperature correction of heat dissipation matric potential sensors. Soil Sci. Soc. Am. J. 66:1439-1445.

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Tetra Tech. (TTEMI). 2003a. Cover, erosion, and revegetation test plot study work plan Condition 82, DP-1340. Prepared for Chino Mines Company. Hurley, NM. May 2003.

TTEMI. 2003b. Cover, erosion, and revegetation test plot study work plan Condition 82, DP-1340-Amended. Prepared for Chino Mines Company. Hurley, NM. October 23, 2003.

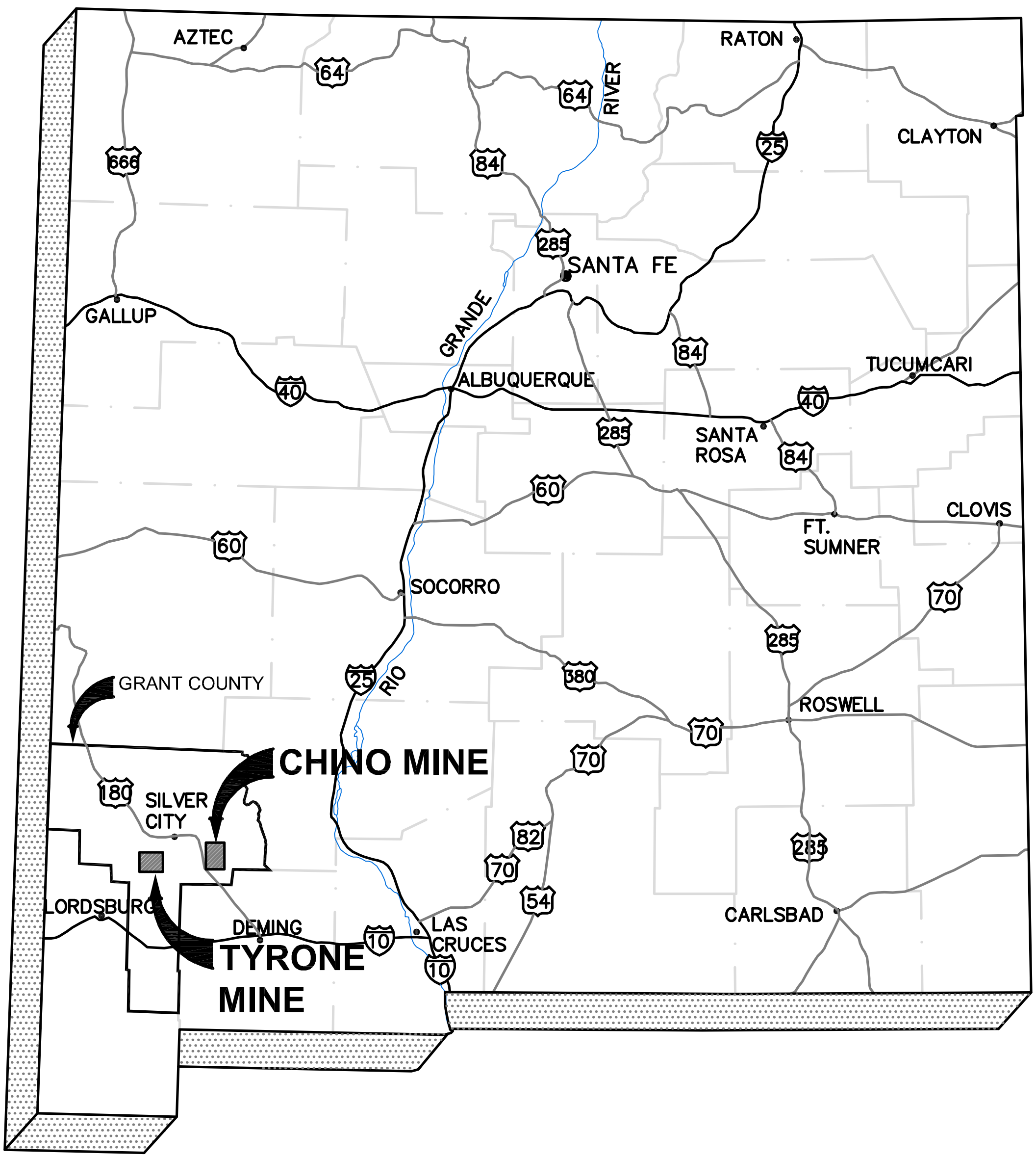
TTEMI. 2003c. Cover, erosion, and revegetation test plot study work plan Tyrone mine tailing impoundments. Condition 76, DP-1341. Prepared for Phelps Dodge Tyrone, Inc. Tyrone, NM. December 15, 2003.

TTEMI. 2003d. Cover, erosion, and revegetation test plot study work plan Tyrone mine tailing impoundments. Condition 29, DP-27. Prepared for Phelps Dodge Tyrone, Inc. Tyrone, NM. December 15, 2003.

FIGURES

STATE OF NEW MEXICO

NOT TO SCALE



PROJECT

PHELPS DODGE TYRONE INC.
TAILING TEST PLOTS
GRANT COUNTY, NEW MEXICO

TITLE

GENERAL LOCATION OF TYRONE AND CHINO MINES

Golder Associates
Albuquerque, New Mexico

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REVIEW	LM	09/28/06		

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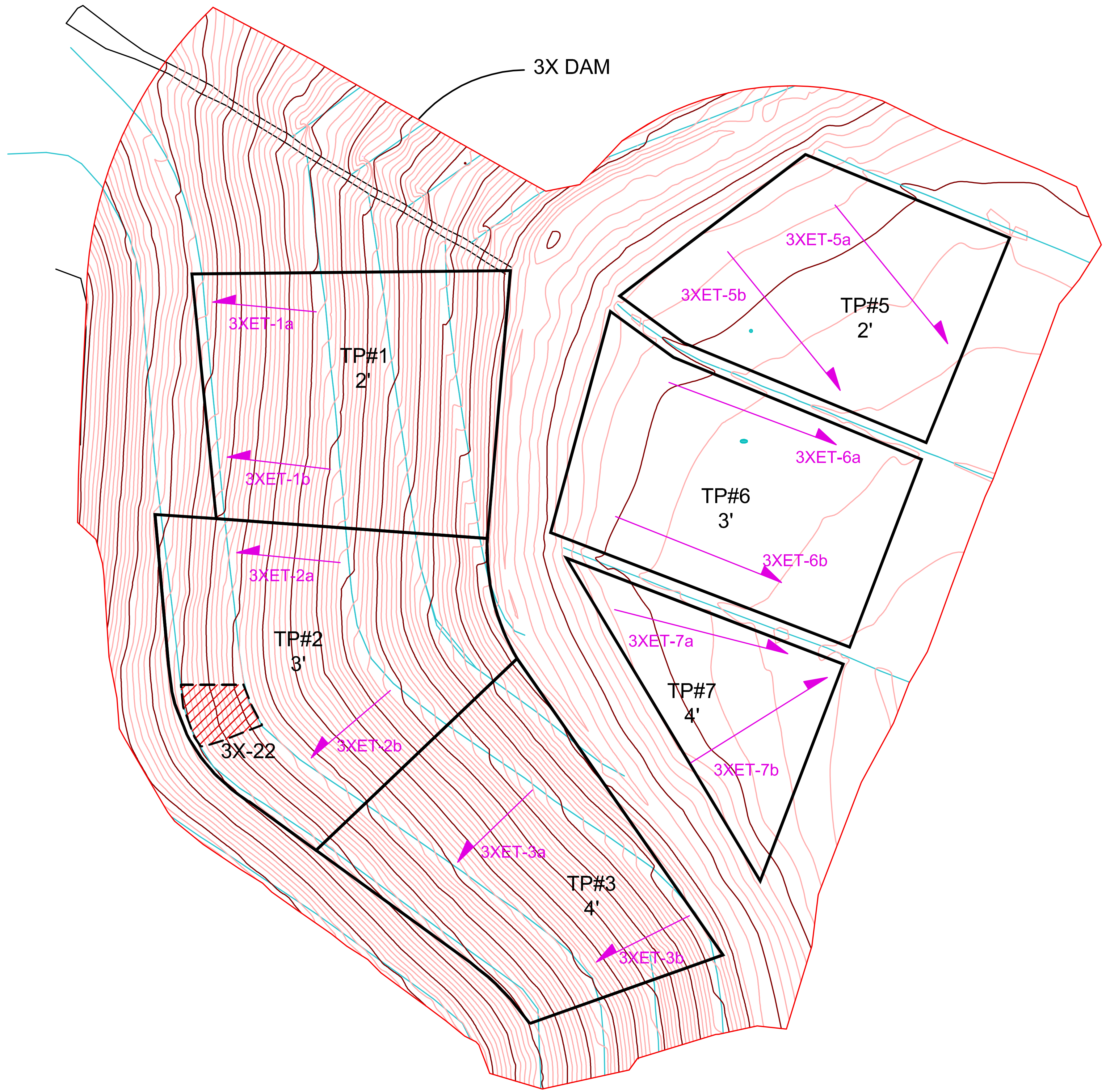

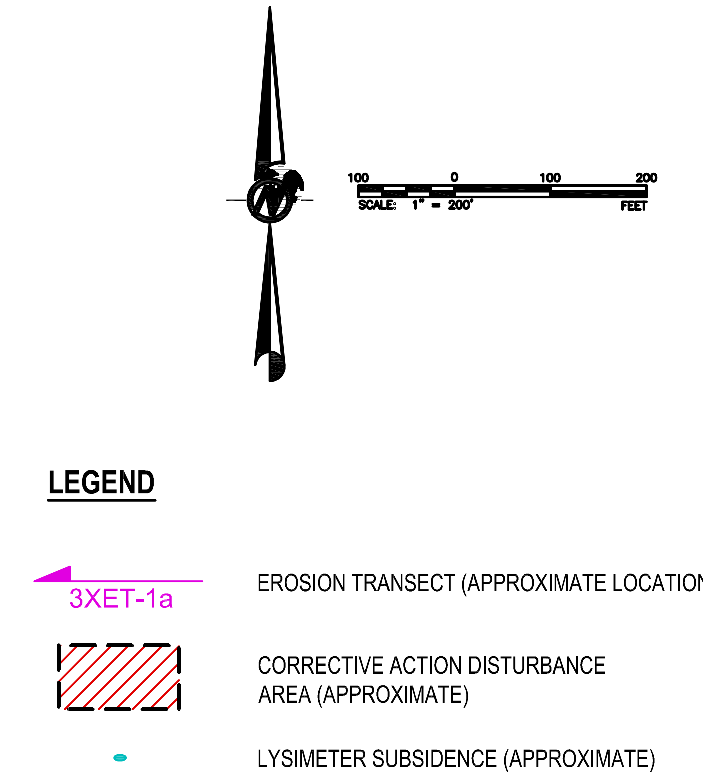

PROJECT
PHELPS DODGE TYRONE INC.
TAILING TEST PLOTS
GRANT COUNTY, NEW MEXICO

TITLE
APPROXIMATE LOCATIONS OF EROSION TRANSECTS, LYSIMETER SUBSIDENCE AND CORRECTIVE ACTION DISTURBANCE

Golder Associates
Albuquerque, New Mexico

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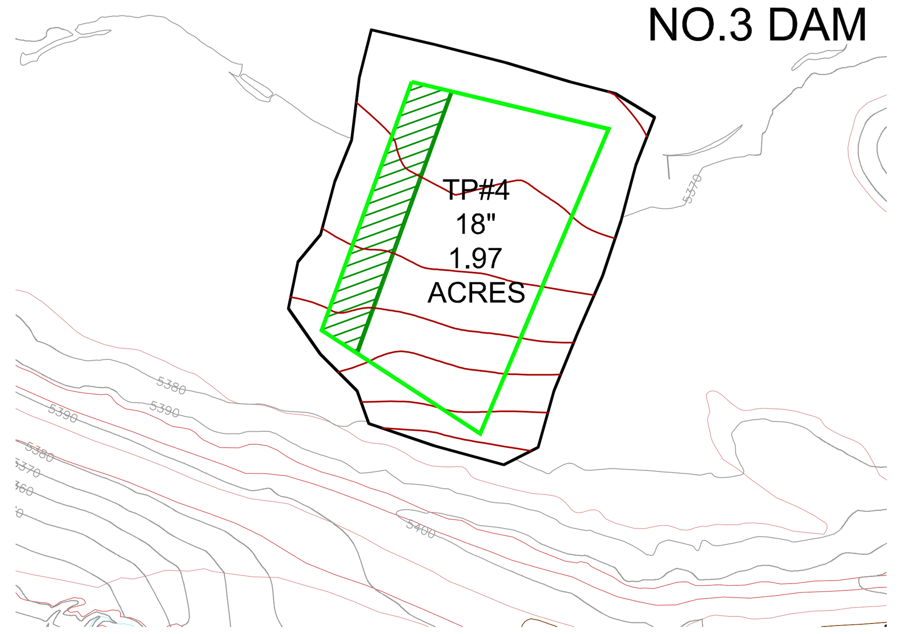
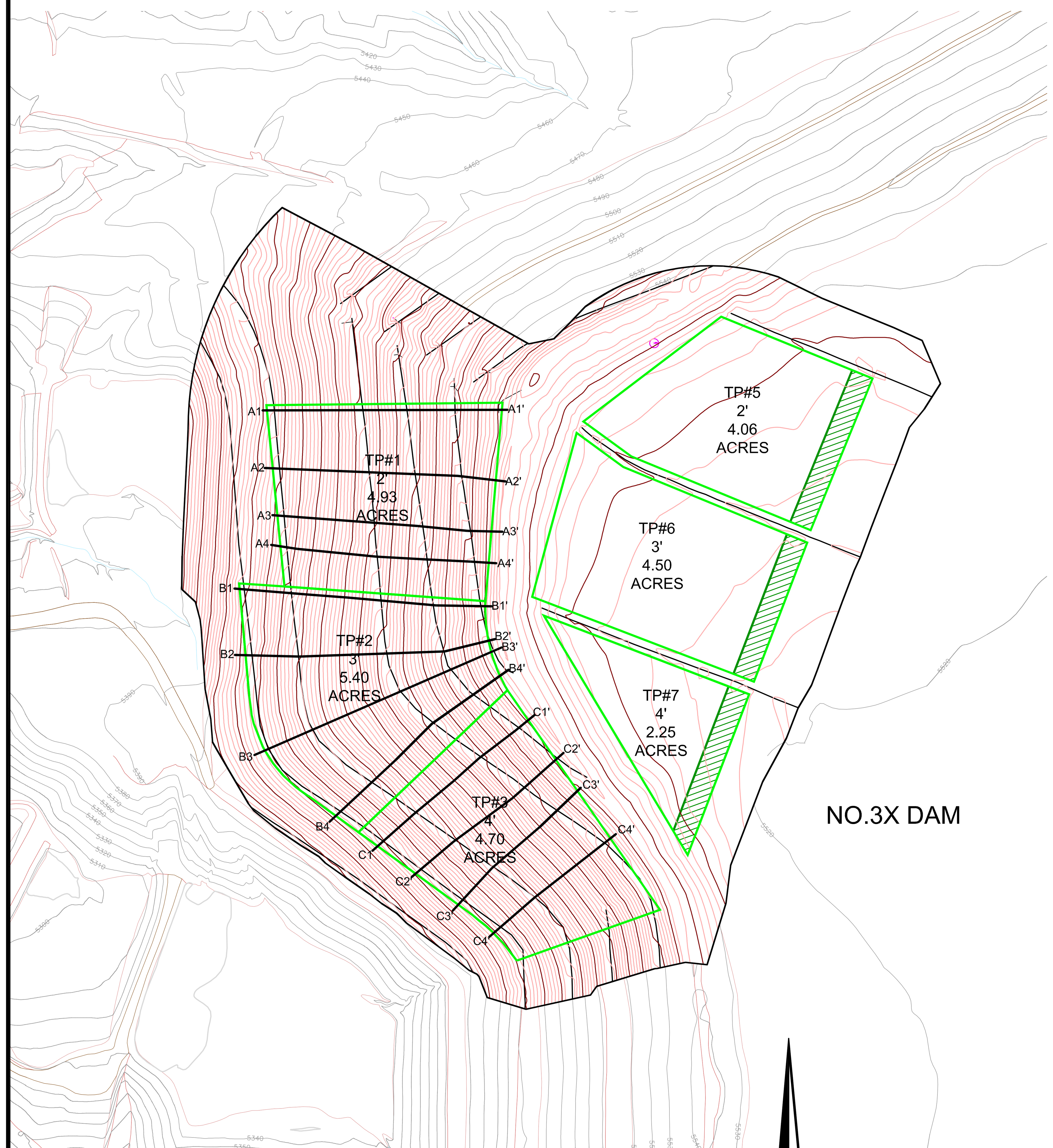
Drawing file: 3X TP PROP EROSION TRANS.dwg Jun 19, 2006 – 3:25pm

PLATE





NOTE: AS-BUILT TOPOGRAPHY FROM M3 ENGINEERING & TECHNOLOGY INC.

PLAN VIEW SCALE

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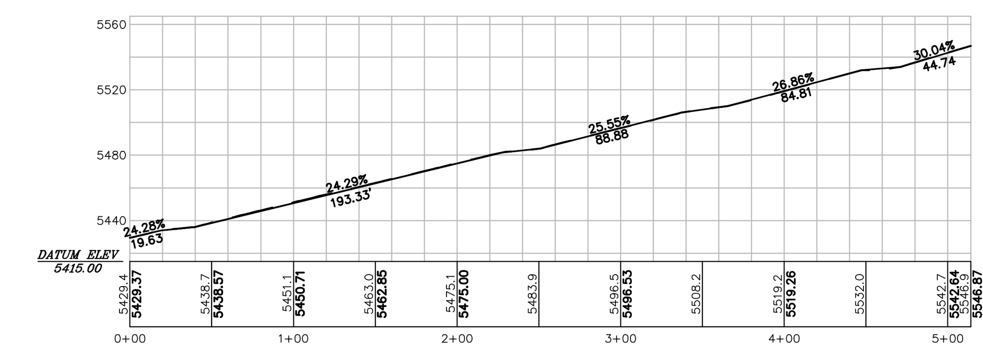
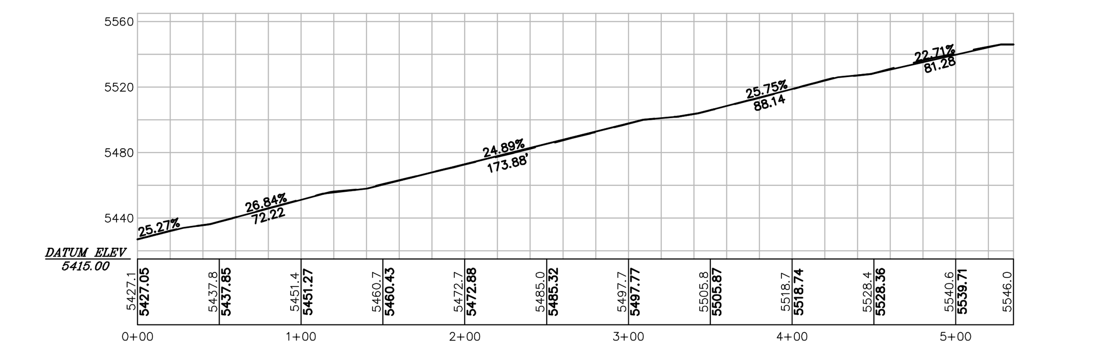
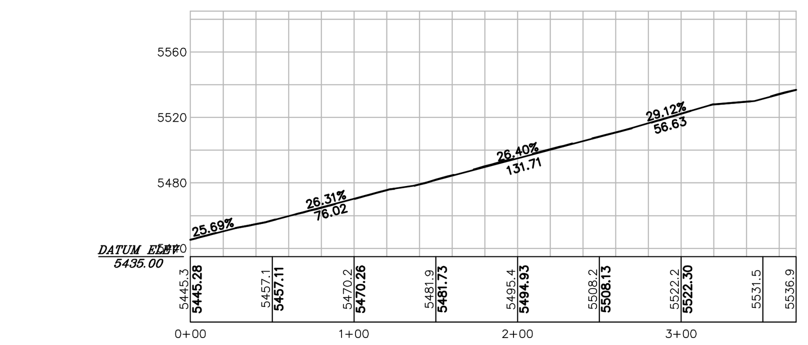
SCALE D SIZE: 1" = 200'
SCALE B SIZE: 1" = 400'



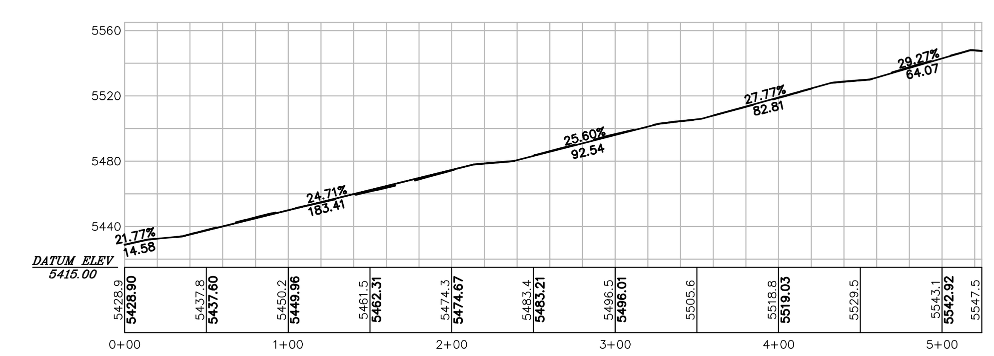
CROSS SECTION A4-A4'



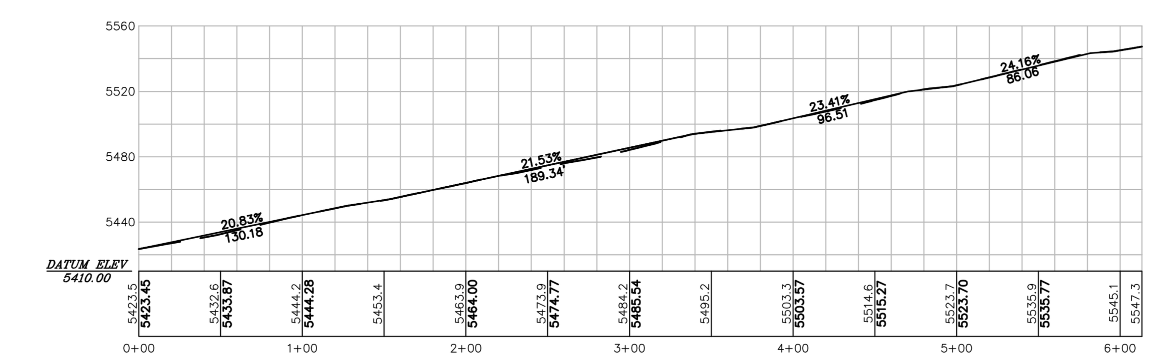
CROSS SECTION B4-B4'



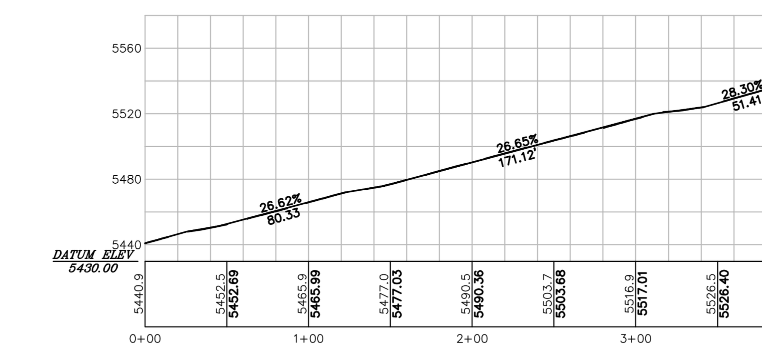
CROSS SECTION C4-C4'



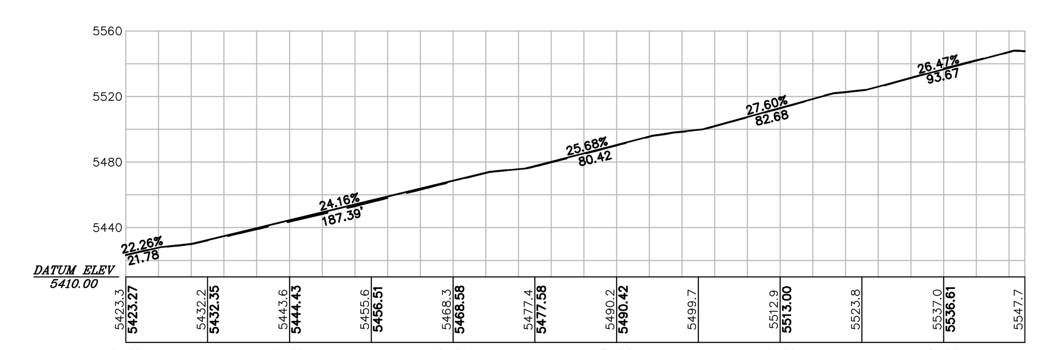
CROSS SECTION A3-A3'



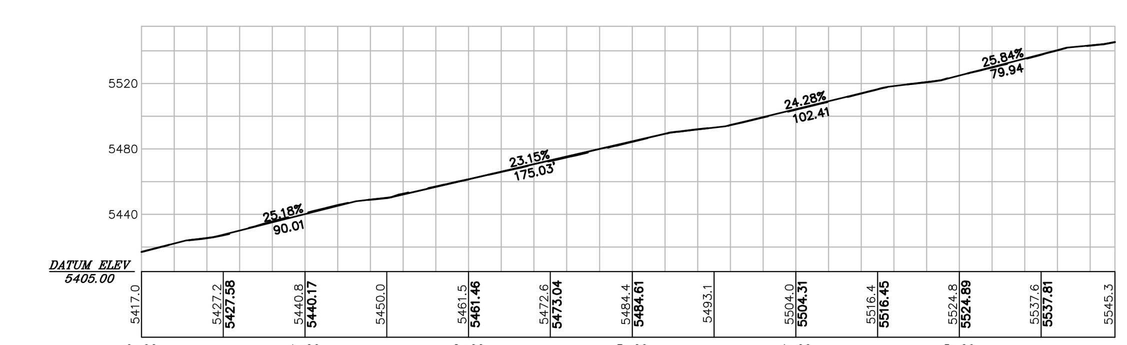
CROSS SECTION B3-B3'



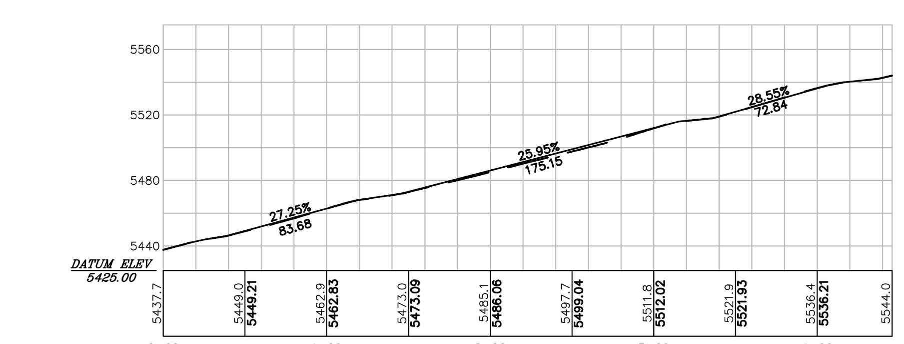
CROSS SECTION C3-C3'



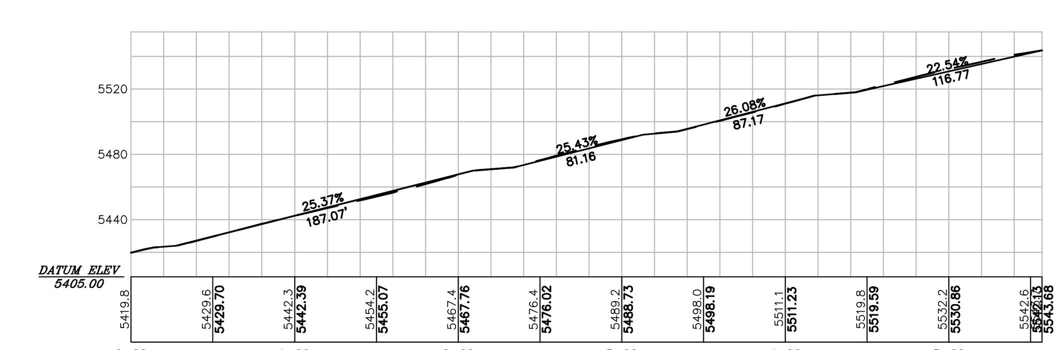
CROSS SECTION A2-A2'



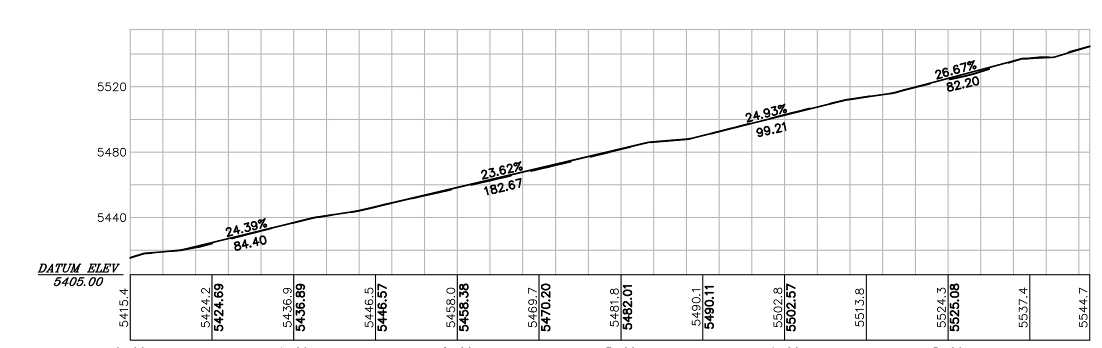
CROSS SECTION B2-B2'



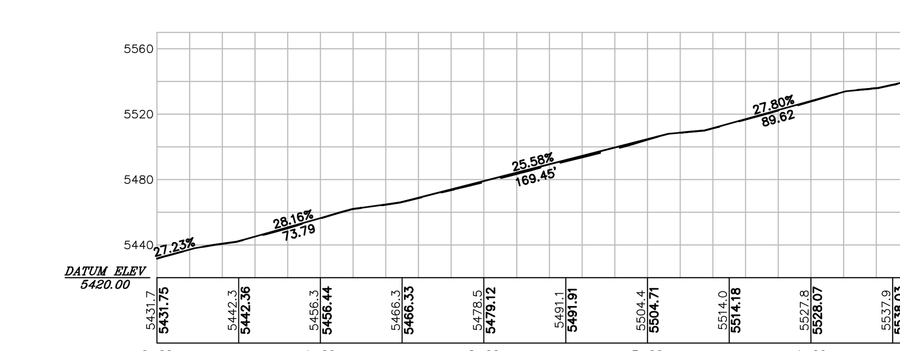
CROSS SECTION C2-C2'



CROSS SECTION A1-A1'



CROSS SECTION B1-B1'



CROSS SECTION C1-C1'

CROSS SECTION SCALE

100 0 100 200 FEET

SCALE D SIZE: 1" = 100'
SCALE B SIZE: 1" = 200'

LEGEND

- TEST PLOT BOUNDARY
- SLOPE GRADIENT & LENGTH
- FERTILIZER TREATMENT AREA

PROJECT	PHELPS DODGE TYRONE INC. TAILING TEST PLOTS GRANT COUNTY, NEW MEXICO			
TITLE	SLOPE PROFILES AND FERTILIZER TREATMENT AREAS			
Golder Associates Albuquerque, New Mexico	PROJECT No.	053-2365	FILE No.	3X TP ASBUILT CS
	DESIGN LM	01/15/07	SCALE AS SHOWN	REV. 0
	CADD CM	01/31/07	PLATE 1	
	CHECK DR	01/31/07		
	REVIEW LM	01/31/07		

APPENDIX A

TEST PLOT PHOTOS

General overview – Nov 04

Outslope regrading – Jan 04

Cover placement – May 05

Outslope cover prior to scarification - May 05

Golder Associates Albuquerque, New Mexico	TITLE 3X DAM TEST PLOT CONSTRUCTION		
CLIENT/PROJ PHELPS DODGE TYRONE, INC TAILING TEST PLOTS	DRAWN DR	DATE 01/31/07	JOB NO 053-2365
	CHECKED LM	SCALE NA	FIGURE A-1
	REVIEWED LM	FILE 3X PHOTOS	

Excavation of 5B Lysimeter

Tailing stratigraphy - 5B Lysimeter

Measuring in-situ density – 5B Lysimeter

Lysimeter 5B backfill compaction

Golder Associates — Albuquerque, New Mexico	TITLE: **LYSIMETER INSTALLATION**		
CLIENT/PROJ: **PHELPS DODGE TYRONE, INC TAILING TEST PLOTS**	DRAWN: DR	DATE: 01/31/07	JOB NO: 053-2365
	CHECKED: TS	SCALE: NA	**FIGURE A-2**
	REVIEWED: LM	FILE: 3X PHOTOS	

Scarified seedbed – June 05

Crimping mulch – June 05

Spreading mulch – June 05

Seeding complete – June 05

Golder Associates

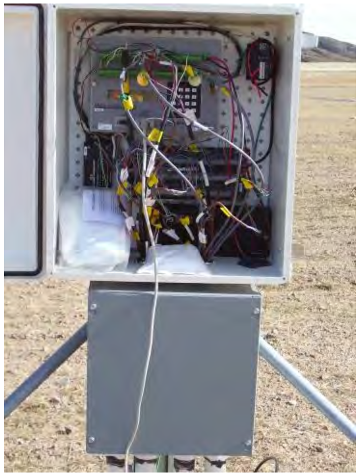
Albuquerque, New Mexico

TITLE

SEEDING OPERATIONS

CLIENT/PROJ **PHELPS DODGE TYRONE, INC** **TAILING TEST PLOTS**	DRAWN DR	DATE 01/31/07	JOB NO 053-2365
	CHECKED LM	SCALE NA	**FIGURE A-3**
	REVIEWED LM	FILE 3X PHOTOS	

Down-hole HDS installation



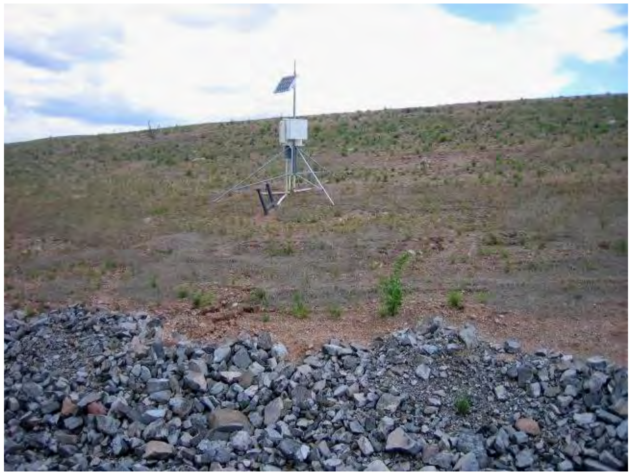
Data Logger

Erosionometer

Meteorological Station

Golder Associates — Albuquerque, New Mexico	TITLE **TEST PLOT INSTRUMENTATION**		
CLIENT/PROJ **PHELPS DODGE TYRONE, INC** **TAILING TEST PLOTS**	DRAWN DR	DATE 01/31/07	JOB NO 053-2365
	CHECKED LM	SCALE NA	**FIGURE A-4**
	REVIEWED LM	FILE 3X PHOTOS	

Vegetation TP#5 - Oct 06



Vegetation TP#1 – Aug 06

Overview TP#7 – Oct 06

Vegetation TP#1 – Oct 06

Golder Associates Albuquerque, New Mexico

TITLE

VEGETATION PERFORMANCE

CLIENT/PROJ

PHELPS DODGE TYRONE, INC
TAILING TEST PLOTS

DRAWN	DR	DATE	01/31/07	JOB NO	053-2365
CHECKED	TS	SCALE	NA	**FIGURE A-5**	
REVIEWED	LM	FILE	3X PHOTOS		