

GEOTECHNICAL ENGINEERING REPORT

IDAHO-MARYLAND MINE PROJECT – CENTENNIAL INDUSTRIAL SITE

10344 & 10350 CENTENNIAL DRIVE

APNs 009-550-032, 009-550-037, 009-550-038, 009-550-039, 009-550-040 & 009-560-036

GRASS VALLEY, CALIFORNIA 95945

DECEMBER 10, 2019

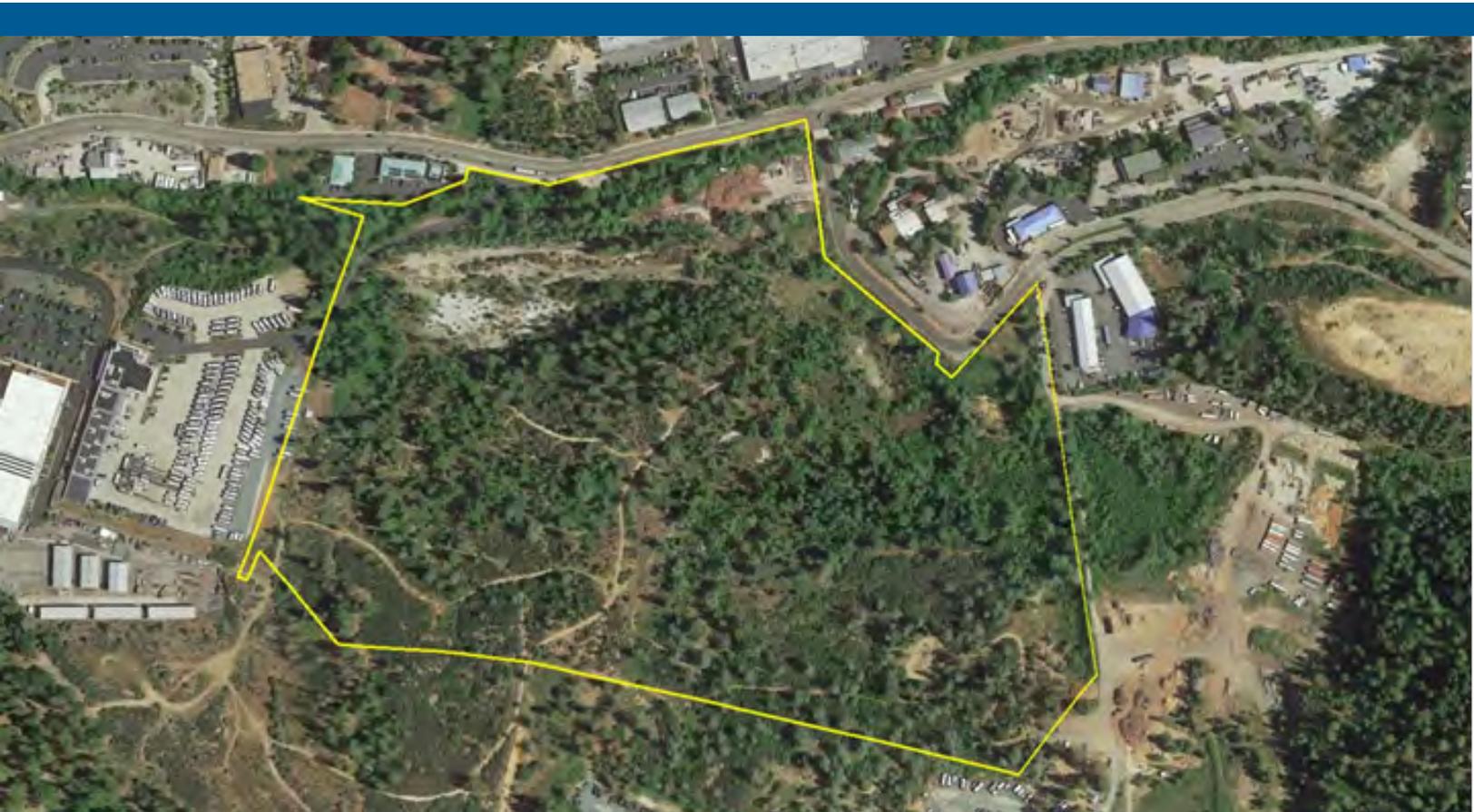
Prepared For:

RISE GRASS VALLEY, INC.

Ben Mossman, President

333 Crown Point Circle, Suite 215

Grass Valley, California 95945



N|V|5

792 Searls Avenue
Nevada City, CA 95959

PROJECT NO. 5279.02



Project No. 5279.02
December 10, 2019

Rise Grass Valley, Inc.
Ben Mossman, President
333 Crown Point Circle, Suite 215
Grass Valley, California 95945

Reference: Idaho-Maryland Mine Project – Centennial Industrial Site
10344 & 10350 Centennial Drive
APNs 009-550-032, 009-550-037, 009-550-038, 009-550-039, 009-550-040 & 009-560-036
Grass Valley, California 95945

Subject: Geotechnical Engineering Report

Dear Mr. Mossman:

This report presents the results of our geotechnical engineering investigation for the 56-acre Centennial Industrial Site located at 10344 and 10350 Centennial Drive in Grass Valley, California. As proposed, the project is to include the construction of an engineered fill to support future commercial and industrial site development.

The Site was historically used by the Idaho-Maryland Mine to deposit mine tailings. Because some of the historical tailings originated from other, more mineralized gold-quartz vein systems and contain elevated concentrations of heavy metals, Rise Grass Valley, Inc. is working with the California Department of Toxic Substances Control (DTSC) to develop a plan that consolidates and caps the mineralized mine tailings in a manner consistent with current state and federal regulations. The environmental cleanup work at the Centennial Industrial Site will be completed under the DTSC Voluntary Cleanup Program prior to the proposed industrial site development described herein.

The findings, conclusions and recommendations presented in this report are based on NV5's review of previous investigation findings; laboratory results; and published geological literature, surface reconnaissance, and experience with similar development projects and local geotechnical conditions. Our opinion is that the Site is suitable for the proposed improvements from a geotechnical engineering standpoint, provided that the recommendations presented in this report are incorporated into the proposed development plans.

Our primary concern, from a geotechnical standpoint, is the presence of undocumented fill that will require reworking prior to support of site improvements. Mining waste (tailings and waste rock) and other undocumented fill are present in approximately two-thirds of the Site (primarily the central and northern portions). The undocumented fill is typically less than 5 feet deep, but is greater than 20 feet deep at some locations. In general, existing undocumented fill should not be relied upon to support proposed improvements. Fill that does not meet current building code standards should be excavated, moisture conditioned, and recompacted pursuant to the grading recommendations presented in this report. Other methods of mitigating undocumented fill, such as surcharge loading or deep foundations, may also be effective and should be evaluated on a case-by-case basis.

Recommendations for mitigating the undocumented fill and other identified geotechnical Site conditions are presented in this report. During construction, we should be retained to observe and confirm site conditions and modify our recommendations, if necessary. This report should not be relied upon without review by NV5 if a period of 24 months elapses between the issuance report date shown above and the date when construction commences.

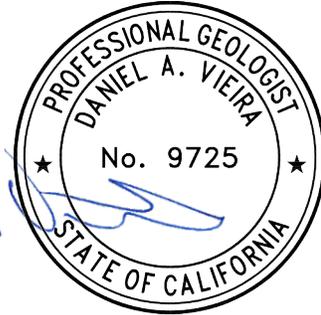
NV5 appreciates the opportunity to provide geotechnical engineering services for this important project. If you have questions or need additional information, please do not hesitate to contact the undersigned at 530-478-1305.

Sincerely,
NV5

Prepared by:



Daniel Vieira, P.G. 9725
Project Geologist



Reviewed by:



Chuck Kull, G.E. 2359
Principal



copies: PDF to Ben Mossman, ceo@risegoldcorp.com
PDF to Tessa Brinkman, tbrinkman.peng@gmail.com

F:\1 Projects\5279 Idaho-Maryland Mine\02 Geotechnical\02 Centennial Site\Report\5279.02, IMM Centennial_Geotech Report.docx

TABLE OF CONTENTS

TITLE SHEET.....	i
TRANSMITTAL LETTER WITH ENGINEER/GEOLOGIST’S SIGNATURE AND SEAL.....	ii
ACRONYMS	vi
1.0 INTRODUCTION.....	1
1.1 SITE DESCRIPTION.....	1
1.2 PROPOSED IMPROVEMENTS	1
1.3 PURPOSE.....	2
1.4 SCOPE OF SERVICES	2
2.0 SITE INVESTIGATION	2
2.1 LITERATURE REVIEW	2
2.1.1 Soil Survey	2
2.1.2 Geologic Setting	3
2.2 PREVIOUS SITE INVESTIGATIONS.....	3
2.2.1 Vector Engineering, Inc. (1990).....	3
2.2.2 Vector Engineering, Inc. (1993).....	3
2.2.3 Holdrege & Kull (2004).....	4
2.2.4 Engeo Incorporated (2007)	4
2.3 FIELD INVESTIGATION.....	6
2.3.1 Surface Conditions	6
2.3.2 Subsurface Soil Conditions.....	7
2.3.3 Groundwater and Surface Water Conditions.....	9
3.0 LABORATORY TESTING.....	10
4.0 CONCLUSIONS.....	10
5.0 RECOMMENDATIONS	12
5.1 GRADING.....	12
5.1.1 Import Fill	12
5.1.2 Clearing and Grubbing	13
5.1.3 Existing Fill.....	14
5.1.4 Cut Slope Grading	15
5.1.5 Native Soil Preparation for Engineered Fill Placement.....	15
5.1.6 Fill Placement.....	17
5.1.7 Differential Fill Depth/Cut-Fill Transitions	18
5.1.8 Rock Fill Placement	19
5.1.9 Fill Slope Grading	19
5.1.10 Erosion Controls.....	19
5.1.11 Underground Utility Trenches	20
5.1.12 Construction Dewatering.....	23
5.1.13 Soil Corrosion Potential.....	24
5.1.14 Surface Water Drainage.....	24
5.1.15 Grading Plan Review and Construction Monitoring	25

5.2	STRUCTURAL IMPROVEMENT DESIGN CRITERIA.....	25
5.2.1	Seismic Design Criteria.....	25
5.2.2	Foundations.....	26
5.2.3	Slab-on-Grade Floor Systems.....	28
5.2.4	Retaining Wall Design Criteria.....	30
5.2.5	Pavement Design.....	32
6.0	LIMITATIONS.....	33

LIST OF TABLES

Table 2.2-1, Summary of Soil Resistivity Test Results, Engeo (2007).....	5
Table 2.3.2-1, Summary of Subsurface Exploration.....	8
Table 5.1-1, Particle Size Gradation, Historical Sand Tailings.....	12
Table 5.1-2, Typical Blast Rock Composition.....	13
Table 5.1.6-1, Minimum Testing Frequencies.....	17
Table 5.1.6-1, Minimum Testing Frequencies for Non-Expansive Soil.....	18
Table 5.1.11-2, Minimum Testing Frequencies for Utility Trench Backfill.....	23
Table 5.2.1-1, Seismic Design Parameters.....	26
Table 5.2.4-1, Equivalent Fluid Unit Weights (1).....	31
Table 5.2.5-1, Recommended Pavement Sections.....	32

ATTACHMENTS

FIGURES

Figure 1	Site Location Map
Figure 2	Site Aerial Map

APPENDICES

Appendix A	Proposal
Appendix B	Important Information about Your Geotechnical Engineering Report (included with permission of GBA, Copyright 2016)
Appendix C	Previous Reports
Appendix D	Previous Laboratory Testing

ACRONYMS

AB	aggregate base
AC	asphalt concrete
ACI	American Concrete Institute
ADMP	Asbestos Dust Mitigation Plan
AMSL	above mean sea level
APN	Accessory's Parcel Number
ASCE	American Society of Civil Engineers
ASTM	ASTM International
ATCM	Asbestos Airborne Toxic Control Measure
bgs	below ground surface
CalEPA	California Environmental Protection Agency
CAT	Caterpillar
CARB	California Air Resources Board
CBC	California Building Code
CGS	California Geological Survey
CQA	Construction Quality Assurance
DWR	California Department of Water Resources
GBA	Geoprofessional Business Association
GIS	Geographical Information System
H:V	horizontal to vertical ratio
H&K	Holdrege & Kull
IBC	International Building Code
mybp	million years before present
NOA	naturally occurring asbestos
NSAQMD	Northern Sierra Air Quality Management District
OSHA	Occupational Safety and Hazards Administration
OSHPD	California Office of Statewide Health Planning and Development
PCA	Portland Cement Association
pcf	pounds per cubic foot
PEA	Preliminary Environmental Assessment
PI	plasticity index
psf	pounds per square foot
psf/ft	per square foot, per foot of depth
psi	pounds per square inch
SSD	saturated surface dry
TI	Traffic Index
USCS	Unified Soils Classification System
USGS	United States Geological Survey
WWM	welded wire mesh

1.0 INTRODUCTION

At the request of Rise Grass Valley, Inc., NV5 performed a geotechnical investigation of the 56.4-acre Centennial Industrial Site located at 10344 and 10350 Centennial Drive in Grass Valley, California. The geotechnical investigation was performed in general accordance with NV5's *Proposal for Geotechnical Engineering Services* dated August 30, 2019, a copy of which is included as Appendix A of this report. For your review, Appendix B contains a document prepared by Geoprofessional Business Association (GBA) entitled Important Information about Your Geotechnical Engineering Report, which summarizes the general limitations, responsibilities, and use of geotechnical reports.

1.1 SITE DESCRIPTION

The subject site (herein referred to as the "Site" or "subject site") comprises approximately 56.4 acres and is located on the eastern boarder of the City of Grass Valley in Nevada County, California. According to the Nevada County Geographical Information System (GIS) online database (<https://gis.nevcounty.net/MyNeighborhood/>) the Site is associated with assessor's parcel numbers (APNs) 009-550-032, 009-550-037, 009-550-038, 009-550-039, 009-550-040 and 009-560-036. The Site is accessible from the northwest via a gated road from Idaho Maryland Road and from the northeast near the intersection of Centennial Road and Whispering Pines Lane. Site access from East Bennett Road to the southeast is through adjacent private property. The Site is bordered by moderately developed mixed-use commercial properties to the east, Centennial Drive and Idaho-Maryland Road to the north, undeveloped land and minimally developed industrial properties to the south, and a commercial property to the west. Figure 1 shows the Site location.

The Site is historically associated with the Idaho Maryland Mine, a former underground hardrock (lode) gold mining operation. Mining and milling structures associated with the former mine were generally located to the east of the Site, and the Site was used primarily for storage of mine waste (tailings and waste rock). Remnant tailings associated with former tailings ponds are present in much of the central and northern portions of the Site. Two concrete towers, used for decanting of the former tailings ponds, are located in the northwestern portion of the Site.

The Site topography is irregular, with forested, moderate north-facing slopes in its southern portion and gentle, north-sloping surfaces at the former tailings pond areas. The Site generally drains north towards Wolf Creek, which flows from east to west along the northern site boundary. A remnant soil and rock berm is located at the northern boundary of the former tailings pond area above Wolf Creek. Elevations range from approximately 2,470 feet above mean sea level (AMSL) at Wolf Creek near the northwestern corner to approximately 2,580 feet AMSL in the southeastern corner of the Site.

1.2 PROPOSED IMPROVEMENTS

Proposed earthwork improvements are depicted on a grading plan (Sheet C-1) prepared by Nevada City Engineering, Inc. and an infrastructure plan (Sheet C101) prepared by Rise Grass Valley, Inc. (November 2019). The proposed improvements include placement of up to 40 vertical feet of engineered fill, much of which will originate from underground mine workings as blast rock and sand tailings. Particle size distribution of the proposed rock and sand fill, and general recommendations for blending of the materials prior to placement as engineered fill, are presented below in Section 5.1.1.

The engineered fill surface will cover most of the Site and is to be used as a building pad for future commercial and industrial development. Specific structural improvements (e.g., future buildings, roads and utilities) have not been determined and are not part of the current development project.

The proposed elevation of the finished fill surface is approximately 2,520 feet AMSL near the northwest corner of the Site and approximately 2,565 feet AMSL near the southeast corner of the Site. The finished fill surface is to slope to the west-northwest at an approximate gradient of 2.4%, and storm water runoff is to be collected in a proposed detention pond to be located in the northwest corner of the Site. The proposed fill slope gradients are generally 3:1, horizontal:vertical (H:V).

Appurtenant improvements include surface water and storm water conveyance beneath and adjacent to the fill. Surface water runoff entering the Site from a box culvert crossing the eastern Site boundary is to be routed beneath the fill to the northwest, and the culvert outfall is to be located at the northern toe of the fill near Centennial Drive. Storm water discharged from the culvert is to be routed overland to Wolf Creek.

1.3 PURPOSE

NV5 performed a site reconnaissance and reviewed development plans, previous investigation findings, laboratory results and published geological literature to develop geotechnical engineering recommendations and design criteria for the proposed industrial site development.

1.4 SCOPE OF SERVICES

To prepare this report, we performed the following scope of services:

- We performed a site investigation, including a site reconnaissance, literature review, and review of the results of previous subsurface investigation and laboratory testing.
- Based on our investigation findings and evaluation of previous investigation data, we provided geotechnical engineering recommendations and design criteria for earthwork and structural improvements.

Our scope of services did not include a groundwater flow analysis nor an evaluation of the Site for the presence of hazardous materials, mold, or radon gas. Therefore, the potential presence and mitigation of these conditions are not discussed in this report.

2.0 SITE INVESTIGATION

The site investigation included a literature review of published and unpublished geologic documents and maps, review of the results of previous subsurface investigation and laboratory test results, and surface reconnaissance. Each component of the site investigation is presented below.

2.1 LITERATURE REVIEW

We reviewed the following published maps and literature.

2.1.1 Soil Survey

According to the *Soil Survey of Nevada County Area, California* (United States Department of Agriculture Soil Conservation Service and Forest Service, 1975), soil conditions near the southern site boundary are mapped as Secca-Rock outcrop complex, which is described as moderately well-drained soils underlain by metabasic or basic rock. According to the soil survey, weathered rock is typically encountered at a depth of approximately four feet below the ground surface (bgs) in areas mapped as Secca-Rock outcrop complex, and rock outcrop typically comprises 10 to 40 percent of the mapped area. The Soil Survey maps the remainder of the Site as mined land, although the Soil Survey incorrectly maps the hardrock tailings as placer tailings.

2.1.2 Geologic Setting

The Property is located within a region underlain by a complex assemblage of igneous and metamorphic rocks in the western foothills of the Sierra Nevada. The regional structure of the foothills is characterized by the north-northwest trending Foothills Fault System, a feature formed during the Mesozoic era (between approximately 65 million and 248 million years ago) in a compressional tectonic environment. A change to an extensional tectonic environment during the late Cenozoic (approximately within the last 30 million years), resulted in normal faulting which has occurred coincident with some segments of the older faults near the Site.

According to Saucedo and Wagner (1981), the Site location is underlain by gabbro and ultramafic rocks associated with the Lake Combie complex. Tuminas (1983) depicts the western quarter of the Site location as being underlain by ultramafic rocks and the remainder of the Site location as underlain by gabbro.

Johnston (1939) depicts the historical Maryland Mine approximately 400 feet northeast of the Site, located on a gold-bearing quartz vein that dips beneath the Site at an angle of 50 to 70 degrees. The South Idaho shaft is depicted near the southwestern corner of the Site, located on a vein that dips away from the Site to the south at approximately 60 degrees. The Grass Valley Fault system is mapped to the southwest of the Site, and the Idaho Fault is mapped to the north of the Site. The Grass Valley Fault is not considered active.

We reviewed California Geological Survey Open File Report 96-08, Probabilistic Seismic Hazard Assessment for the State of California, and the 2002 update entitled California Fault Parameters. The documents indicate the property is located within the Foothills Fault System. The Foothills Fault System is designated as a Type C fault zone, with low seismicity and a low rate of recurrence. The 1997 edition of California Geological Survey Special Publication 42, Fault Rupture Hazard Zones in California, describes active faults and fault zones (activity within 11,000 years), as part of the Alquist-Priolo Earthquake Fault Zoning Act. The map and document indicate the Site is not located within an Alquist-Priolo active fault zone.

2.2 PREVIOUS SITE INVESTIGATIONS

NV5 reviewed the following previous geological/geotechnical investigations performed at the Site. The following summaries include findings and conclusions presented in these reports that are pertinent to the currently proposed development. The subsurface soil conditions described in the following reports are summarized in Section 2.3.2 below. The referenced reports are included in Appendix C.

2.2.1 Vector Engineering, Inc. (1990)

Vector Engineering, Inc. (Vector, 1990) performed a subsurface investigation and analytical testing for heavy metals. The investigation included soil sampling from four exploratory excavations (BH-1 through BH-4) located in the northwestern tailings area of the Site. Samples were obtained from depths up to approximately 15 feet bgs, and the depth of tailings were recorded. Vector reported that metals including arsenic, chromium, and lead were detected in samples from the test pits.

2.2.2 Vector Engineering, Inc. (1993)

Vector (1993) performed a subsurface investigation and analytical testing for heavy metals and cyanide in mine tailings. Vector (1993) excavated 19 exploratory trenches and contracted for analysis of 28 discrete samples of tailings, soil and bedrock. Samples were tested for pH and total concentrations of metals.

2.2.3 Holdrege & Kull (2004)

NV5, previously Holdrege & Kull (H&K, 2004), prepared a Preliminary Geotechnical Engineering Report for three Grass Valley properties including the subject Site. The scope of the preliminary investigation included review of pertinent geologic, soil survey and historical information, review of the findings of previous investigation, and site reconnaissance. No subsurface investigation or laboratory testing was performed.

2.2.4 Engeo Incorporated (2007)

Engeo Incorporated (Engeo, 2007) performed a geotechnical engineering investigation of the Idaho Maryland Mine Property, which included the subject site and property to the south and southeast, comprising a total of 138 acres. The purpose of the investigation was to support the design of surface facilities and improvements. The report presents the results of subsurface investigation, laboratory testing, and engineering analysis; geotechnical recommendations for design of formerly proposed structures and roads; and an opinion regarding the stability of an existing earth dam located on property immediately east of the Site.

Engeo (2007) advanced 19 hollow-stem auger borings, 11 of which were located on the Site, using CME 75 and CME 850 drill rigs. The maximum boring depth was approximately 50 feet bgs. Bulk soil samples were obtained from drill cuttings, and relatively undisturbed soil samples were obtained from the borings using a Modified California Sampler (3-inch outer diameter split spoon sampler with thin-walled metal liners). Standard Penetration Test (SPT) and Modified California Sampler blow counts were recorded for a 140-pound hammer and 30-inch free fall. Blow counts were typically recorded for the final 12 inches of the sample interval.

Engeo (2007) advanced 11 exploratory excavations at the Site using a Caterpillar 320C excavator with a 24-inch-wide bucket. The maximum excavation depth was approximately 13 feet bgs. Bulk soil samples were obtained from the exploratory excavations.

A slope stability analysis was performed on the berm at the eastern boundary of the Site. The analysis parameters included subsurface soil conditions encountered in borings B20 and B22 explored on top of the berm, and assumed conditions within the tailings pond on the east side of the berm. Static and pseudo-seismic stability analysis of the berm resulted in 1.6 and 1.4 factors of safety, respectively. The analysis did not assess water levels above the existing ground surface with the use of the berm as a dam.

Geotechnical laboratory tests included moisture content, dry density, unconfined compression, plasticity index, corrosion, direct shear, R-value, and grain size analysis. Engeo (2007) concluded that the Site was suitable for the proposed industrial development from a geotechnical engineering standpoint. Engeo (2007) provided geotechnical recommendations for the previously proposed development, which included but were not limited to the following topics:

- Existing undocumented fill,
- Expansive soil,
- Shallow bedrock and excavation,
- Differential fill thickness,
- Soil corrosion potential,
- Groundwater, and
- Future operations of the culvert tower structure.

Engeo's (2007) findings are summarized below.

Existing Undocumented Fill

Undocumented (non-engineered) fill is present across the majority of the Site (particularly the central and northern portions) and consists of mine tailings, lumber mill waste, and fill associated with previous site use. The undocumented fill is subject to settlement and cannot be relied upon from a structural standpoint.

Expansive Soil

Engeo (2007) encountered potentially expansive clay/silt layers within the mine tailings. The laboratory test results indicated that these soils exhibit low to moderate shrink/swell potential with variations in moisture content. Moderately to highly expansive soil layers were encountered in exploratory excavations TP3, TPI5, TP18 and TPI9, and may be encountered elsewhere at the Site.

According to the exploratory trench logs, the clay/silt layers encountered in exploratory excavations TP3, TPI5, TP18 and TPI9 were located at depths ranging from 0 to 3 feet bgs and were typically 1½ to 3½ feet thick. The clay/silt was typically encountered in the tailings fill or at the native soil/bedrock interface.

Shallow Bedrock and Excavation

Engeo (2007) encountered bedrock at depths as shallow as 1 foot bgs along the margins of the tailings fill. The upper five feet of the andesite and gabbro bedrock was typically weathered to a degree that it appeared excavatable with larger equipment, such as a Cat 235 or larger excavator.

Soil Corrosion Potential

Engeo (2007) contracted for the analysis of 15 soil samples for pH, electrical resistivity, sulfate, and chloride. Eight of the samples were obtained from the Site. Results for site samples are summarized below and are listed in the attached report.

Table 2.2-1, Summary of Soil Resistivity Test Results, Engeo (2007)

Parameter	Method	n	Min	Mean	Max
pH	CTM 643	8	6.77	7.38	8.15
Min. Resistivity	CTM 643	8	0.83	3.47	6.97
Chloride	CTM 422	8	4.20	8.24	14.20
Sulfate	CTM 417	8	5.90	65.74	206.2

Notes:

CTM = Caltrans Test Method

n = population (number of soil samples)

NL = address not listed

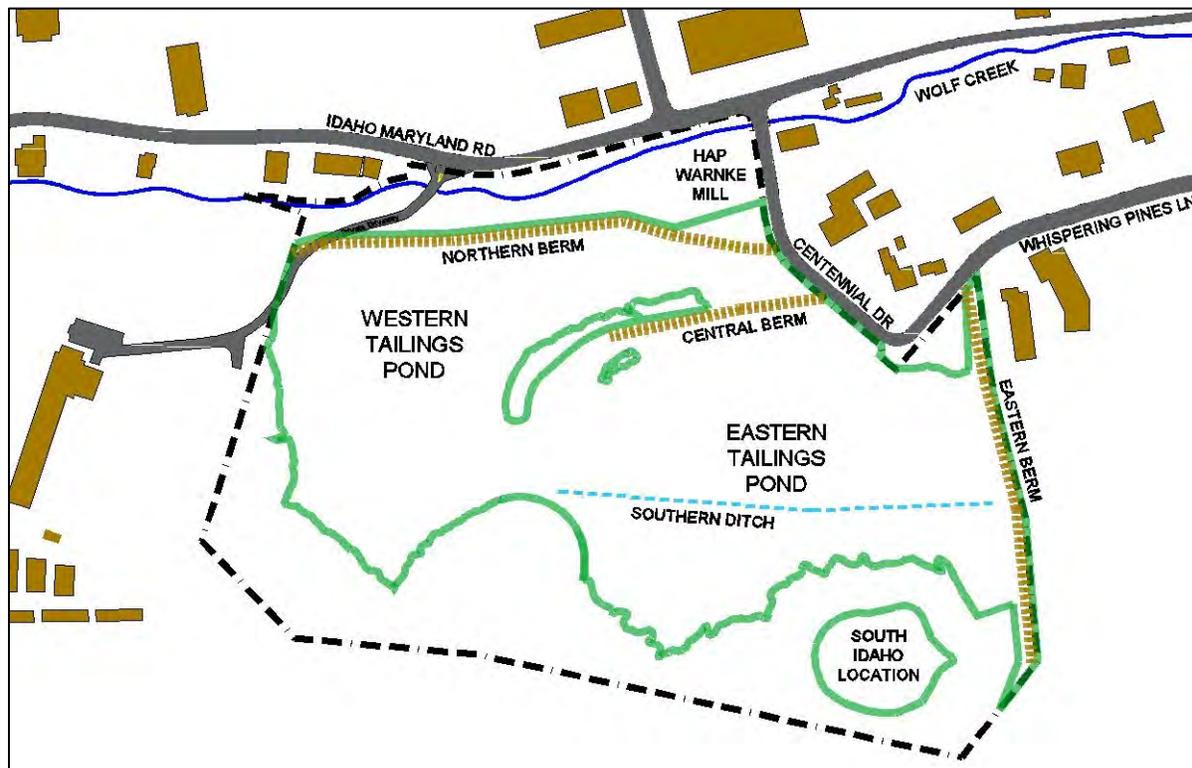
Engeo (2007) reported that the detected sulfate concentrations correspond to “negligible” sulfate exposure for concrete structures pursuant to the California Building Code. Soil samples TP3 at 5 feet and B8 at 3 feet (both located in the northeastern portion of the Site) had anomalously low resistivities (0.83 and 0.88 ohm/cm x 1000) and higher sulfate concentrations (113.4 and 206.2 ppm), indicating that they are very severely corrosive to buried metal.

2.3 FIELD INVESTIGATION

We performed a field investigation, which included a site reconnaissance and review of subsurface conditions identified during previous investigations. Our site reconnaissance was performed on November 1, 2019.

2.3.1 Surface Conditions

The 56-acre Site is generally described as rolling terrain with forested, moderate north-facing slopes in its southern portion and gentle, north-sloping surfaces at the former tailings pond areas in the remainder of the Site. Much of the original topography has been changed by the deposition and subsequent removal of tailings. The Site generally drains north towards Wolf Creek, which flows from east to west along the northern site boundary. Remnant soil/tailings/waste rock berms are located at the northern boundary of the former western tailings pond area above Wolf Creek and on the perimeter of the eastern tailings pond area. Surface features are described below.



Inset 2.3.1-1: Simplified Site Map

Tailings

Mine tailings overlie native soil and weathered rock across much of the central and northern portions of the Site. Based on subsurface investigations by Engeo (2007) and Vector (1993, 1990), as summarized below in Section 2.3.2, tailings depths are typically less than 5 feet bgs. Tailings depths range up to approximately 12 feet bgs in the northeastern corner of the eastern tailings pond (near Centennial Drive) and up to approximately 20 feet bgs on the northern edge of the western tailings pond.

Berms

Relic retention berms are present near the northern edge of the Site, centrally within the Site, and along the eastern boundary. The berms are generally comprised of waste rock, tailings and other undocumented fill. Angular rock and soil are generally exposed on the berm surfaces.

The northern berm creates the northern boundary of the former tailings pond. This northern berm is up to approximately 20 feet tall from its northern toe to the crest and up to approximately 15 feet tall from its southern toe to the crest. The crest is up to approximately 25 feet wide and narrows to the east. The side slopes of the berm are generally moderate, but the eastern segment of the berm contains slopes steeper than 2:1, H:V.

Discontinuous berm segments are also present in the central portion of this site, and are comprised of tailings, waste rock, and other undocumented fill.

A berm was historically constructed at the eastern Site boundary as a dam for a pond located immediately east of the Site. The western flank of this berm is located on the Site, and the eastern flank is located on adjacent property (the former location of the Lausman lumber mill). The berm is approximately 25 feet tall from the western toe to the crest. The crest is approximately 20 feet wide and supports a gravel road. Side slopes are up to approximately 1½:1, H:V. The lower portion of the western slope face is covered with rip-rap up to 12 inches in greatest dimension.

A 36-inch by 36-inch concrete box culvert extends through the base of the eastern berm near its midpoint and conveys water from the pond onto the Site. Engeo (2007) describes an approximately 36-foot-tall inlet tower within the pond on adjacent property. The inlet structure was not observed due to dense vegetation in the dry pond at the time of the Preliminary Environmental Assessment (PEA) reconnaissance.

Hap Warnke Mill

The Hap Warnke lumber mill operates intermittently in a three-acre area located in the northeast corner of the Site. The existing lumber mill is located to the north of the proposed engineered fill area and is not part of the proposed development project.

Roads and Utilities

A gravel road extends from the northern portion of the Site in the vicinity of Centennial Drive through adjacent property to the south to East Bennett Road. A private buried water line is reportedly located within this alignment. Several dirt access roads meander through the Site. Overhead power lines are located along the south side of Idaho Maryland Road. No utility survey was performed as part of this investigation, and other utilities may be present at the Site.

South Idaho Shaft

The historical South Idaho Shaft is mapped near the southeastern corner of the site. No records of physical shaft closure were available for review. Based on information provided by Rise Grass Valley, Inc., we understand the South Idaho workings are not connected to the Idaho-Maryland Mine workings.

2.3.2 Subsurface Soil Conditions

Exploratory borings and excavations performed by Engeo (2007) and Vector (1993, 1990) typically encountered mine tailings and waste rock fill overlying a thin native soil profile and underlying weathered bedrock.

Tailings depths are typically less than 5 feet bgs. Tailings depths range up to approximately 12 feet bgs in the northeastern corner of the eastern tailings pond (near Centennial Drive) and up to approximately 20 feet bgs on the northern edge of the western tailings pond (near the northern berm). Thicker deposits of tailings and waste rock are present in the northern berm, which extends up to approximately 20 feet above the ground surface and forms the northern boundary of the western tailings pond. The eastern berm extends up to approximately 25 feet above the ground surface and was historically constructed to retain water east of the Site. The berms are generally comprised of waste rock, tailings and other undocumented fill.

Engeo (2007) described the tailings as silt and sand with occasional gravel and clay. Bedrock underlying the tailings was typically described as weathered gabbro and diabase. In general, the gabbro was weak and highly weathered while the diabase was generally strong and moderately weathered. Engeo (2007) encountered approximately 30 feet of loose to medium dense “tailings fill” in exploratory boring B10, which was advanced through the northern waste rock berm.

Subsurface conditions reported by Engeo (2007) and Vector (1990, 1993) are summarized in Table 2.3.2-1 below.

Table 2.3.2-1, Summary of Subsurface Exploration

Exploratory Location	Reference	Location	Tailings Depth (ft bgs)	Total Exploration Depth (ft bgs)
SA-1	Vector (1993)	WTP	2.5	4.5
SA-2	Vector (1993)	WTP	2.0	5.0
SA-3	Vector (1993)	WTP	none	2.0
SA-4	Vector (1993)	WTP	6.0	10
SA-5	Vector (1993)	WTP-N	5.0	15
SA-6	Vector (1993)	WTP-N	>17	17
SA-7	Vector (1993)	WTP	7.0	12
SB-1	Vector (1993)	WTP-N	6.0 (WR)	9.0
SB-2	Vector (1993)	ETP	4.5 (WR)	7.0
SB-3	Vector (1993)	ETP-E	4.0 (WR)	7.0
SB-4	Vector (1993)	ETP-E	2.0	3.5
SB-5	Vector (1993)	ETP-E	2.0	6.0
SB-6	Vector (1993)	ETP	3.0	6.5
SB-7	Vector (1993)	ETP	3.0	6.0
SB-8	Vector (1993)	ETP-E	4.0	7.0
SB-9	Vector (1993)	ETP	4.0	6.0
SB-10	Vector (1993)	ETP	none	2.0
SB-11	Vector (1993)	ETP-E	3.0	5.0
SB-12	Vector (1993)	none	NR	NR
SB-13	Vector (1993)	SIL	NR	NR
HS-1	Vector (1990)	WTP-N	4.5 (WR)	6.0
HS-2	Vector (1990)	WTP-N	>12	12
HS-3	Vector (1990)	ETP-E	>11	11
B1	Engeo (2007)	WTP-N	2.5 (possible WR)	10.5

Table 2.3.2-1, Summary of Subsurface Exploration

TP2	Engeo (2007)	ETP	7.5	13.5
TP3	Engeo (2007)	ETP	3.5	11
B4	Engeo (2007)	WTP	6	20.5
B5	Engeo (2007)	WTP-N	none	11.5
B6	Engeo (2007)	HWLM	none	10
B7	Engeo (2007)	HWLM	none	10.5
B8	Engeo (2007)	ETP-E	10	15.5
B9	Engeo (2007)	WTP-N	10	15.5
B10	Engeo (2007)	Northern Berm	30 (WR/tailings berm)	30.5
TP11	Engeo (2007)	WTP	2.5	10
B12	Engeo (2007)	WTP-N	15	20.5
TP13	Engeo (2007)	WTP	1	5.5
TP14	Engeo (2007)	WTP	1	6.5
TP15	Engeo (2007)	WTP	1.5	5.5
TP16	Engeo (2007)	WTP	3.5	10
TP17	Engeo (2007)	ETP	1.5	10
TP18	Engeo (2007)	ETP	3.5	10
TP19	Engeo (2007)	ETP-E	6	11.5
B20	Engeo (2007)	Eastern Berm	20 (WR/tailings berm)	35.5
TP21	Engeo (2007)	ETP-E	4.5	11
B22	Engeo (2007)	Eastern Berm	25 (WR/tailings berm)	50.5

Notes:

- ETP = Eastern Tailings Pond
- ETP-E = Eastern Tailings Pond, Eastern (older, deeper portion)
- WTP = Western Tailings Pond
- WTP-N = Western Tailings Pond, Northern (older, deeper portion)
- HWLM = Hap Warnke lumber mill
- SIL = South Idaho location
- NR = not recorded
- WR = waste rock

2.3.3 Groundwater and Surface Water Conditions

An Aquatic Resources Delineation prepared by Matuzak (2019) identifies locations within the Site that are characterized as riparian, meadow and marsh. These areas and other locations within the site may be subject to seasonal seepage and standing water. The seasonal seepage and standing water are likely to be associated with near-surface conditions and are not likely representative of groundwater beneath the Site, which typically occurs in bedrock fractures.

Local groundwater well completion reports are available on the California Department of Water Resources (DWR) Well Completion Report Map Application (2019). The database reports that over 50 domestic and monitoring groundwater wells are on record within approximately 1 mile of the subject property. Reported well depths range from 11 to 550 feet bgs. Static groundwater depths are reported as shallow as 3 feet bgs in shallow wells completed in permeable soil, but typical depths to usable groundwater are greater than 60 feet bgs within fractured bedrock.

Engeo (2007) encountered groundwater at a depth of 50 feet in exploratory boring B22, which was terminated at a depth of 50.5 feet bgs in weathered bedrock (the boring extended approximately 11 feet into the weathered metavolcanic rock). This water was likely perched on the weathered rock rather than being representative of the actual groundwater surface, which is commonly encountered at greater depth in fractured bedrock. Perched groundwater was encountered in exploratory excavations TP2 and TP18 at depths of 9 and 3 feet bgs, respectively. Groundwater was not encountered in other exploratory borings or excavations during the Engeo (2007) investigation.

A dry pond associated with past lumber milling operations is located on adjacent property immediately to the east of the Site. The presence of cattails and other hydrophytic vegetation in this area suggests seasonal saturation of near-surface soil.

3.0 LABORATORY TESTING

Laboratory testing was not performed as part of the current investigation. The laboratory tests performed by others are presented in Appendix D and in their respective reports in Appendix C.

4.0 CONCLUSIONS

The following conclusions are based on our field observations, laboratory test results, and our experience in the area.

1. It is NV5's opinion that, from a geotechnical engineering standpoint, the Site is suitable to support the proposed improvements, provided that the geotechnical engineering design recommendations presented in this report are incorporated into the development plans.
2. The validity of the recommendations presented in this report is contingent upon our review of construction plans and our observation and testing during construction. Prior to the finalization of development plans, NV5 should be retained to review the plans in order to verify that our recommendations have been incorporated, and to provide additional recommendations if necessary. NV5 should be retained to observe and test during construction to verify that our recommendations are implemented, and to verify that subsurface conditions are as encountered in the exploratory locations.
3. Our primary concern, from a geotechnical standpoint, is the presence of undocumented fill that will require reworking prior to support of site improvements.
 - a. Mining waste (tailings and waste rock) and other undocumented fill are present in approximately two-thirds of the Site (primarily the central and northern portions). The undocumented fill is typically less than 5 feet deep, but is at least 12 feet deep in the northeastern corner of the eastern tailings pond (near Centennial Drive) and up to at least 20 feet deep on the northern edge of the western tailings pond. Deeper fill is present within former retention berms located in the north, central and eastern portions of the Site. The undocumented fill typically includes tailings, waste rock and soil that were not placed in accordance with the standards of geotechnical engineering practice.
 - b. In general, existing undocumented fill should not be relied upon to support proposed improvements. Fill that does not meet current building code standards should be excavated, moisture conditioned and recompacted pursuant to the grading recommendations presented in this report. General recommendations for mitigation of undocumented fill are presented in Section 5.1.3. Other methods of mitigating undocumented fill, such as surcharge loading or deep foundations, may also be effective and should be evaluated on a case-by-case basis.

4. NV5 understands that the proposed future underground mining operations will produce blast rock and sand tailings in approximately equal proportions. The rock and sand are to be transported to the ground surface and then blended prior to placement as engineered fill to support future industrial site development. Based on particle size data provided by Rise Grass Valley, Inc. (Section 5.1.1), NV5 anticipates that waste rock and tailings generated by the proposed mining operation will meet the geotechnical engineering criteria for structural fill presented in Section 5.1.6. General recommendations addressing rock fill placement are presented in Section 5.1.1 of this report.
5. The historical South Idaho Shaft is mapped in the southeastern portion of the Site near the upper, southern edge of the proposed engineered fill. No records of physical closure of the mine portal are known. Based on information provided by Rise Grass Valley, Inc., we understand the South Idaho workings are not connected to the Idaho-Maryland Mine workings. The abandoned mine feature may be unsuitable for support of future structural improvements and may present potential physical hazards. Because the historically mapped feature is located in an area of shallow fill that is proposed for future development, the portal should be located and physically closed in accordance with recommendations from a qualified geotechnical engineer under a building permit from the appropriate local agency.
6. Thin lenses of expansive clayey soil are present at some location at shallow depths. Expansive near-surface soils tend to shrink and swell with seasonal moisture variations and can result in damage to structural improvements such as foundations, slabs-on-grade and other flatwork. Based on the typical depth of fill as described in Section 1.2, we do not anticipate that future improvements will be located near the expansive soil layers. Expansive soil, when located in areas of proposed infrastructure improvements, can be mitigated by conventional earthwork procedures (e.g., removal of the potentially expansive clay or blending with granular material).
7. Based on our site observations, the geology of the region and our experience in the area, our opinion is that the risk of seismically induced hazards such as slope instability, liquefaction, and surface rupture are remote at the Site. We do not anticipate that the proposed project will result in the destruction, covering, or modification of any known unique geological and/or physical features.
8. Based on the typical depth of fill as described in Section 1.2, we do not anticipate that significant bedrock excavation will be required. However, if excavation is proposed for grading or utility installation below the weathered bedrock surface, areas of resistant rock may be encountered which may require ripping, splitting or hammering, to increase the rate of excavation.
 - a. If more detailed information regarding excavatability of the bedrock is required, a seismic refraction study should be performed or additional trenches/borings should be advanced to further define the type and size of equipment planned for construction.
 - b. Spoil resulting from rock excavation will likely consist of angular rock fragments that may be suitable for use as fill depending on the nominal size of the rock fragments, but will likely require specific recommendations for fill placement and observation to confirm compaction. General recommendations addressing rock fill placement are presented in Section 5.1.8 of this report.

9. Some locations within the Site are characterized by others as riparian, meadow and marsh. These areas and other locations within the Site may be subject to seasonal seepage and standing water. The seasonal seepage and standing water are likely to be associated with near-surface conditions and are not likely representative of groundwater beneath the Site, which typically occurs in bedrock fractures. We anticipate that areas of moist to saturated soil conditions and groundwater seepage will likely be encountered at these locations during grading if performed during the winter, spring or early summer. Recommendations addressing subsurface drainage, moisture conditioning, surface drainage, and fill placement are presented in Section 5.0 below.

5.0 RECOMMENDATIONS

The following geotechnical engineering recommendations are based on our understanding of the project as currently proposed, our field observations, results of laboratory testing by others, engineering analysis, and our experience in the area. Areas of the Site that are identified as containing historic mine tailings with elevated metals concentrations shall be subject to selective grading techniques and procedures provided by others in accordance with applicable jurisdictional regulations and constraints as part of the separate DTSC cleanup project.

5.1 GRADING

The following sections present our grading recommendations. The grading recommendations address import fill, clearing and grubbing, soil preparation, existing fill, cut slope grading, fill placement, fill slope grading, rock fill, erosion control, subsurface drainage, surface water drainage, construction dewatering, underground utility trenches, soil corrosion potential, plan review, and construction monitoring.

5.1.1 Import Fill

Proposed import soil fill and proposed import rock fill should meet the geotechnical engineering material properties described in Sections 5.1.6 and 5.1.8 of this report. This advisory represents the best practice for characterization of soil/rock prior to import for use as engineered fill. The project engineer should approve all proposed import fill for use in constructing engineered fills at the Site.

We understand that the sand tailings will likely have a gradation similar to the historical tailings gradation presented in the table below, and will typically have a large proportion of quartz.

Table 5.1-1, Particle Size Gradation, Historical Sand Tailings

Mesh Size	Particle Size (mm)	Particle Size (micron)	Percent Passing	Description
48	0.300	300	97.7	Medium Sand
65	0.212	212	87.5	Fine Sand
100	0.150	150	63.9	Fine Sand
200	0.075	75	32.3	Silt
325	0.044	44	12.1	Silt

Note: Particle size data provided by Rise Grass Valley, Inc.

We understand that the blast rock will typically be crushed underground to approximately 6 inches maximum dimension, and will generally consist of the following rock types.

Table 5.1-2, Typical Blast Rock Composition

Rock Type	Percent of Total
Meta-Andesite	96%
Altered Meta-Andesite	2%
Diabase	1%
Serpentinite	1%

Based on these general particle sizes we make the following recommendations:

1. The proposed use of 100 percent sand tailing for engineered fill is acceptable, provided the grading recommendations presented in this report are followed. Sand tailings should be tested and approved by NV5 prior to placement as engineered fill to confirm it meets the engineered fill criteria and allow for adjustments to gradation or placement and compaction procedures, if necessary.
2. Crushed blast rock with a maximum dimension of 6 inches may be blended into the sand tailings to produce engineered fill material at a ratio of up to 2 parts blast rock to 1 part sand tailings. A rock:sand ratio greater than a 2:1 ratio may be feasible but would not likely be testable using nuclear methods. When testing by nuclear density gauge is not possible, the development of a procedural test method is typically required, involving continuous observation to verify blending, placement and compaction effort.
3. To simplify future site development (e.g., construction of underground utilities and structure foundations), a maximum rock dimension of 2 inches is recommended within five vertical feet of the finished subgrade surface and within five horizontal feet from the face of proposed fill slopes.
4. Onsite blending of blast rock and sand tailings may be performed by earthwork equipment (e.g., windrowing and spreading the rock and sand together in thin lifts). Specific procedures for onsite blending should be developed in conjunction with an NV5 representative during initial fill placement.
5. Based on the particle size distribution and rock types provided (above) by Rise Grass Valley, Inc., we anticipate that the density of the engineered fill compacted to 90% of the ASTM D1557 maximum dry density may range from approximately 115 to 140 pounds per cubic foot (pcf) depending upon the percentage of rock blended into the fill. This rough estimate should be verified by laboratory testing of selective ratios of the blended materials.

5.1.2 Clearing and Grubbing

The areas to be graded should be cleared and grubbed to remove vegetation and other deleterious materials, as described below.

1. Strip and remove debris from clearing operations and the topsoil containing shallow vegetation, roots and other deleterious materials. The organic topsoil can be stockpiled onsite and used in landscape areas but is not suitable for use as fill. The project geotechnical engineer should approve any proposed use of the spoil generated from stripping prior to placement.
2. Overexcavate any relatively loose debris and soil that is encountered in our exploratory trenches or any other onsite excavations to underlying, competent material. Possible excavations include exploratory trenches excavated by others, mantles or soil test pits, holes resulting from tree stump or boulder removal, and mining relics.

3. Any loose, untested fill that is encountered during site development should be overexcavated to competent native soil or weathered rock, as determined by a representative of NV5, a minimum of 5 feet beyond the areas of proposed improvements.
4. Overexcavate any encountered leach lines, abandoned sewer, water, and fuel lines, and loose soil in abandoned subsurface utility line trenches within the proposed improvement areas to underlying competent soil, as determined by a representative of NV5.
5. Remove rocks greater than 8 inches in greatest dimension (oversized rock) from native soil by scarifying to a depth of 12 inches below finish grade in areas to support pavement, slabs-on-grade or other flatwork. Oversized rock may be used in landscape areas, rock landscape walls, or removed from the Site. Oversized rock can be stockpiled onsite and used to construct fills, but must be placed at or near the bottom of deep fills and must be placed in windrows to avoid nesting. No oversized rock should be placed in the upper 3 feet of any structural fill. Unless used as rip-rap, oversized rock placed in fill should not be located within 5 feet horizontally of the finished fill slope face. The project geotechnical engineer should approve the use of oversized rock prior to constructing fill.
6. Fine grained, potentially expansive soil, as determined by NV5, that is encountered during grading should be mixed with granular soil, or overexcavated and stockpiled for removal from the subject site or for later use in landscape areas. A typical mixing ratio for granular to expansive soil is 4 to 1. The actual mixing ratio should be determined by NV5.
7. Vegetation, deleterious materials, structural debris, and oversized rocks not used in landscape areas, drainage channels, or other non-structural uses should be removed from the Site.

5.1.3 Existing Fill

Existing untested fill, predominantly historic mine tailings, are present within the proposed improvement areas. Loose fill beneath footings may contribute to future differential settlement-induced distress. Existing fill that has not been tested and recorded should not be relied upon to support the proposed improvements without mitigation, as described in the following paragraphs.

In general, fill overexcavation and recompaction will likely be the most reliable approach to mitigating existing undocumented fill. The depth of the overexcavation should extend through all loose soil to competent native soil or rock. The fill should be moisture-conditioned and compacted in lifts (layers) pursuant to the recommendations presented in Section 5.1.6 (“Fill Placement”) of this report.

Options to mitigate undocumented fill without reworking include the use of deep foundations, mat foundations or surcharge loads. Mat slabs may be appropriate for buildings encompassing large footprints over undocumented fills, depending on the fill quality and structural loading of the building. Surcharging, if performed to appropriate pressures, can be an effective means of reducing future differential settlement. The feasibility of surcharge loading should be evaluated based on the results of consolidation analysis considering the thickness of the undocumented fill and the proposed surcharge loading. If surcharge loading is chosen as an alternative mitigation measure, some level of differential foundation movement should be anticipated. If requested, we can provide design recommendations and settlement analysis for surcharging or alternative foundation systems on a case-by-case basis.

5.1.4 Cut Slope Grading

Based on our understanding of the project at this time, we do not anticipate permanent cut slopes greater than approximately 10 feet in height will be created during grading of the proposed improvements. In general, permanent cut slopes should not be steeper than 2:1, H:V. Steeper cut slopes as steep as 1:1, H:V, may be feasible, depending on the soil/rock conditions encountered and

slope heights, and should be reviewed on a case-by-case basis. The upper two feet of all cut slopes should be graded to an approximate 2:1, H:V, slope to reduce sloughing and erosion of looser surface soil.

Temporary cut slopes may be constructed to facilitate construction of retaining walls and deep utilities. We anticipate that subsurface conditions will be favorable for construction of temporary cut slopes no steeper than ½:1, H:V, for a maximum height of approximately 6 feet. To reduce the likelihood of sloughing or failure, temporary cut slopes should not remain over the winter.

A representative of NV5 must observe temporary cut slopes steeper than 1.5:1, H:V, during grading to confirm the soil and rock conditions encountered. We recommend that personnel not be allowed between the cut slope and the proposed retaining structure, form work, grading equipment, or parked vehicles during construction, unless the stability of the slope has been reviewed by NV5 or the slope has been confirmed to meet OSHA excavation standards. All temporary excavations must comply with applicable local, state and federal safety regulations, including the current Occupational Safety and Hazards Administration (OSHA) excavation and trench safety standards. Construction site safety is the responsibility of the contractor, who is solely responsible for the means, methods and sequencing of construction operations.

5.1.5 Native Soil Preparation for Engineered Fill Placement

The exposed native soil should be prepared for placement and compaction of engineered fill as described below.

1. The native soil should be scarified to a minimum depth of 8 inches below the existing land surface, or stripped and grubbed surface, and then uniformly moisture conditioned. If the soil is classified as a coarse-grained soil by the USCS (i.e., GP, GW, GC, GM, SP, SW, SC or SM) then it should be moisture conditioned to within ± 3 percentage points of the ASTM D1557 optimum moisture content. If the soil is classified as a low plasticity fine-grained soil by the USCS (i.e., CL, ML), then it should be moisture conditioned to between 2 and 4 percentage points greater than the ASTM D1557 optimum moisture content. If soil is classified as a high plasticity fine-grained soil by the USCS (i.e., CH, MH), the soil should be removed from the building pad area or NV5 should be contacted for further recommendations.
2. The native soil should then be compacted to achieve a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry unit weight (density). The moisture content, density and relative percent compaction should be tested by the project engineer or his/her field representative to evaluate whether the compacted soil meets or exceeds the minimum percent compaction and moisture content requirements. The earthwork contractor shall assist the project engineer or his/her field representative by excavating test pads with the onsite earth moving equipment. Native soil preparation beneath concrete slab-on-grade structures (i.e., floors, sidewalks, patios, etc.) and asphalt concrete (AC) pavement should be prepared as specified in Section 5.2 (“Structural Improvements”).

3. Where fill placement is proposed on native slopes steeper than approximately 5:1, H:V, a base key and routine benches must be provided. Unless otherwise recommended by the project geotechnical engineer, the base key should be excavated at the toe of the fill a minimum of 3 feet into competent stratum, as determined by a representative of NV5 during construction observation. The bottom of the base key should be sloped slightly into the hillside at an approximate gradient of 5 percent or greater.
4. A subdrain should be installed at the rear of the keyway and where evidence of seepage is observed. The subdrain should consist of a 4-inch diameter (minimum) perforated plastic pipe embedded in drain rock material wrapped in woven geotextile filter fabric. The drain rock material should be at least 12 inches thick and extend at least 48 inches above the bottom of the keyway and/or 12 inches above and below the seepage zone. The depth and extent of subdrains should be determined by a representative of NV5 in the field during construction. In addition, subdrains should be installed at a minimum slope of 1 percent and should have cleanouts located at their ends and at turning points. Outlet and riser pipe fittings should not be perforated. A licensed land surveyor or civil engineer should provide “record drawings” depicting the locations of subdrains and cleanouts.

The fill must be benched into existing side slopes as fill placement progresses. Benching must extend through loose surface soil into firm material, and at intervals such that no loose surface soil is beneath the fill. As a minimum, a horizontal bench should be excavated every 5 vertical feet or as determined by a representative of NV5.

5. The prepared native soil surface should be proof-rolled with a fully-loaded 4,000-gallon-capacity water truck with the rear of the truck supported on a double-axle, tandem-wheel undercarriage or approved equivalent. The proof-rolled surface should be visually observed by the project engineer or his/her field representative to be firm, competent and relatively unyielding. The project engineer or his/her field representative may also evaluate the surface material by hand probing with a ¼-inch-diameter steel probe, however, this evaluation method should not be performed in place of proof rolling as described above.
6. Construction Quality Assurance (CQA) tests should be performed using the minimum testing frequencies presented in Table 5.1.6-1 or as modified by the project engineer to better suit the site conditions.

The native soil surface should be graded to minimize ponding of water and to drain surface water away from any future building foundations and associated structures. Where possible, surface water should be collected, conveyed and discharged into natural drainage courses, storm sewer inlet structures, permanent engineered storm water runoff percolation/evaporation basins or engineered infiltration subdrain systems.

Table 5.1.6-1, Minimum Testing Frequencies

ASTM No.	Test Description	Minimum Test Frequency ⁽¹⁾
D1557	Modified Proctor Compaction Curve	1 per 1,500 CY or Material Change ⁽²⁾
D6938	Nuclear Density and Nuclear Moisture Content	1 per 250 CY

Notes:

- (1) These are minimum testing frequencies that may be increased or decreased at the project engineer’s discretion on the basis of the site conditions encountered during grading.
 - (2) Whichever criteria provide the greatest number of tests.
- ASTM = ASTM International
CY = cubic yards
No. = number

5.1.6 Fill Placement

Construction of engineered fills with non-expansive soil should be performed as described below.

1. Non-expansive soil used as engineered fill should consist predominantly of materials less than ½-inch in greatest dimension and should not contain rocks greater than 6 inches in greatest dimension (oversized material). Non-expansive soil should have a plasticity index (PI) of less than or equal to 15, as determined by ASTM D4318 Atterberg Indices testing. Oversized materials should be spread apart to prevent clustering so that void spaces are not created. The project engineer or his/her field representative should approve the use of oversized materials for constructing engineered fills. Import material that is proposed for use onsite should be submitted to NV5 for approval and possible laboratory testing at least 72 hours prior to transport to the Site.
2. Non-expansive soil used to construct engineered fills should be uniformly moisture conditioned. If the soil is classified by the USCS as coarse grained (i.e., GP, GW, GC, GM, SP, SW, SC or SM), then it should be moisture conditioned to within ± 3 percentage points of the ASTM D1557 optimum moisture content. If the soil is classified by the USCS as fine grained (i.e., CL, ML), then it should be moisture conditioned to between 2 and 4 percentage points greater than the ASTM D1557 optimum moisture content.
3. Cohesive, predominantly fine-grained, or potentially expansive soil encountered during grading should be stockpiled for removal, mixed as directed by NV5, or used in landscape areas. As an option, cohesive fine-grained or potentially expansive soil can often be placed in the deeper portions of proposed fill (e.g., depths greater than 3 feet below subgrade in building footprints). However, this option would have to be evaluated on a case-by-case basis with consideration of the fill depth and proposed loading.
4. In areas where expansive soils are present, the upper 24 inches of fill beneath and within 5 feet of the building footprints and the upper 12 inches of fill beneath and within 3 feet of exterior slabs and/or pavement edges should be approved engineered fill.
5. Engineered fills should be constructed by placing uniformly moisture conditioned soil in maximum 12-inch-thick loose lifts (layers) prior to compacting.
6. The soil should then be compacted to achieve a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density.

7. The earthwork contractor should compact each loose soil lift with a tamping foot compactor such as a Caterpillar (CAT) 815 Compactor or equivalent as approved by NV5’s project engineer or his/her field representative. A smooth steel drum roller compactor should not be used to compact loose soil lifts for construction of engineered fills.
8. The field and laboratory CQA tests should be performed consistent with the testing frequencies presented in Table 5.1.6-1 or as modified by the project engineer to better suit the site conditions.

Table 5.1.6-1, Minimum Testing Frequencies for Non-Expansive Soil

ASTM No.	Test Description	Minimum Test Frequency ⁽¹⁾
D1557	Modified Proctor Compaction Curve	1 per 1,500 CY or Material Change ⁽²⁾
D6983	Nuclear Moisture and Density	1 per 250 CY

Notes:

- (1) These are minimum testing frequencies that may be increased or decreased at the project engineer’s discretion on the basis of the site conditions encountered during grading.
 - (2) Whichever criteria provide the greatest number of tests.
- ASTM = ASTM International
CY = cubic yards
No. = number

9. The moisture content, density and relative percent compaction of all engineered fills should be tested by the project engineer’s field representative during construction to evaluate whether the compacted soil meets or exceeds the minimum compaction and moisture content requirements. The earthwork contractor shall assist the project engineer’s field representative by excavating test pads with the onsite earth-moving equipment.
10. The prepared finished grade or finished subgrade soil surface should be proof-rolled, as mentioned above in Section 5.1.5, Paragraph 6.

5.1.7 Differential Fill Depth/Cut-Fill Transitions

The recommendations presented in this section are intended to reduce the magnitude of differential settlement-induced structural distress associated with variable fill depth beneath structures. Care should be taken when removing existing foundations and re-routing underground utilities so that large excavations are not opened which could inadvertently result in differing soil conditions between native soil and utility backfill that could be subject to differential settlement.

1. Site grading should be performed so that cut-fill transition lines do not occur directly beneath any structures. The cut portion of the cut-fill building pads, if proposed, should be scarified to a minimum depth of 8 inches, and recompacted to 95 percent relative compaction.
2. Differential fill depths beneath structures should not exceed 5 feet. For example, if the maximum fill depth is 8 feet across a building pad, the minimum fill depth beneath that pad should not be less than 3 feet. If a cut-fill building pad is used in this example, the cut portion would need to be overexcavated 3 feet and rebuilt with compacted fill.
3. If cut/fill transitions within any building footprint are greater than 5 feet are planned, or demolition requires deep and wide excavations, NV5 should be notified so that additional recommendations to properly construct the fill pad beneath the project location can be provided to ensure that a cut-fill transition is not constructed that may be subject to differential settlement in the future.

5.1.8 Rock Fill Placement

Based on our understanding of proposed import fill for the project, we anticipate that fill material generated from the subject site may contain significant rock fragments, and that compaction testing with conventional methods may be difficult or inappropriate. Typically, fill that consists primarily of soil can be tested for relative compaction by using a nuclear density gauge. Our opinion is that rock fill cannot be reliably tested using this method.

We recommend that quality assurance during rock fill placement be based on a procedural approach, or method specification, rather than a specified relative compaction. The procedural requirements will depend on the equipment used, as well as the nature of the fill material, and will need to be determined by the geotechnical engineering firm onsite. Typically, procedural recommendations are based on the measured relative compaction of a test fill constructed onsite.

Based on our experience in the area, we anticipate that the procedural specification will require a minimum of six passes (back and forth equaling one pass) with a Cat 563 or similar, self-propelled, vibratory compactor to compact a maximum 8-inch thick, loose lift. Processing or screening of the fill material will be needed to remove rocks larger than approximately 8 inches in maximum dimension. Continuous or nearly continuous observation by a representative of NV5 would be required during fill placement to confirm that procedural specifications have been met.

5.1.9 Fill Slope Grading

Based on our understanding of the project, we anticipate that fill slopes up to approximately 50 feet in height will be created as part of the proposed improvements. In general, permanent fill slopes created onsite should be no steeper than 2:1, H:V. Fills designed on native slopes steeper than 5:1, H:V, should be supported by a base shear keyway, as described in Section 5.1.5 (“Native Soil Preparation for Engineered Fill Placement”) of this report. Steeper fill slopes may be feasible based on the angularity and durability of the material to be placed or with the use of geotextile reinforcement and/or rock facing. All fill slopes greater than 30 feet in height should be terraced with surface drains that restrict surface runoff from traveling more than 30 feet continuously down the fill slope face. NV5 should review fill slope configurations greater than approximately 10 feet in height, if proposed, prior to fill placement. We can provide slope terracing and drainage recommendations or reinforced/buttressed fill slope design for the project, if requested.

Fill should be placed in horizontal lifts to the lines and grades shown on the project plans. Compaction and fill slope grading must be confirmed by NV5 in the field. Slopes should be constructed by overbuilding the slope face and then cutting it back to the design finished grade slope gradient. Fill slopes should not be constructed or extended horizontally by placing soil on an existing slope face and/or compacted by track walking. Where placement of oversized rock in deep fill is proposed, the oversized rock should be placed a minimum of 5 feet horizontally from the finished fill slope face.

5.1.10 Erosion Controls

Graded portions of the Site should be seeded as soon as possible to allow vegetation to become established prior to and during the rainy season. In addition, grading that results in greater than one acre of soil disturbance or in sensitive areas may require the preparation of a site-specific storm water pollution prevention plan. As a minimum, the following controls should be installed prior to and during grading to reduce erosion.

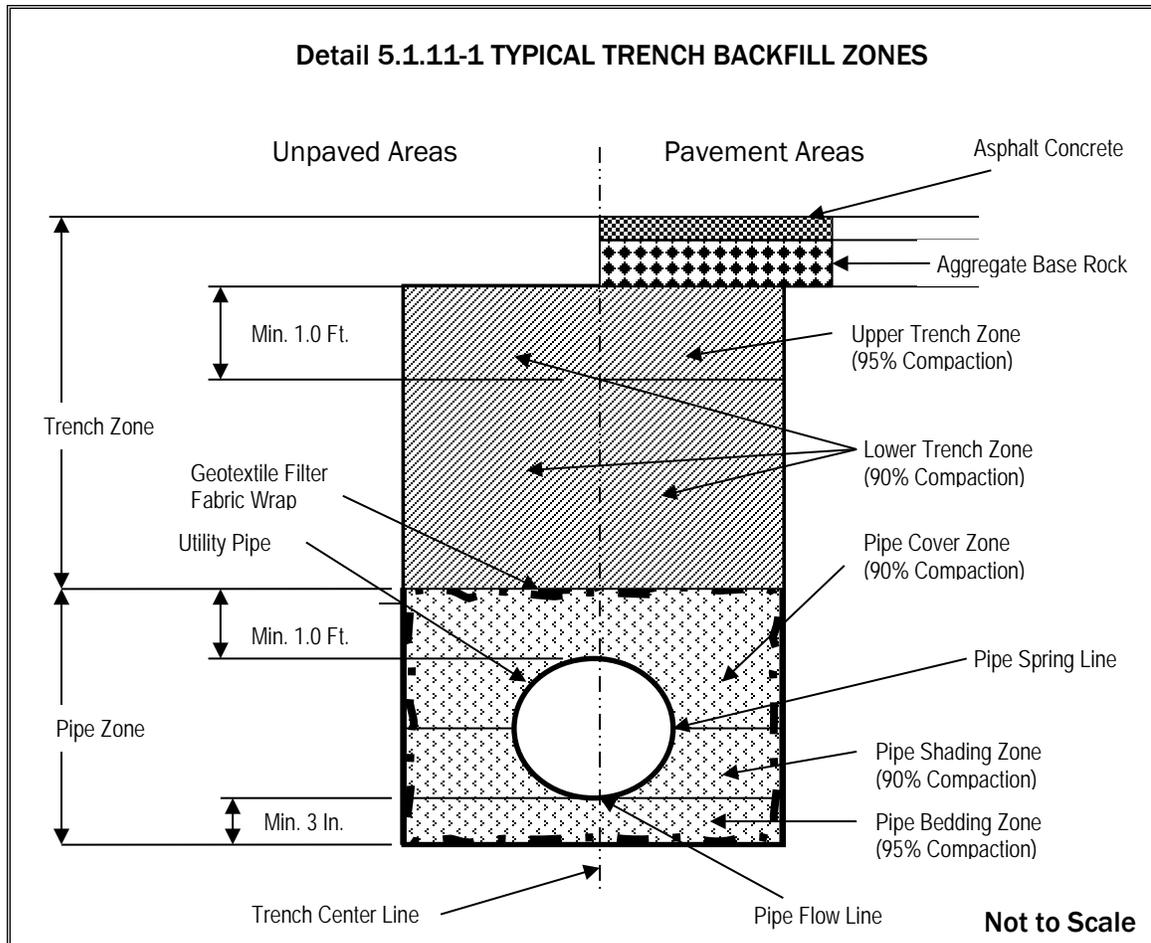
1. Prior to commencement of site work, fiber rolls should be installed down slope of the proposed area of disturbance to reduce migration of sediment from the Site. Fiber rolls on slopes are intended to reduce sediment discharge from disturbed areas, reduce the velocity of water flow, and aid in the overall revegetation of slopes. The fiber rolls should remain in place until construction activity is complete and vegetation becomes established.
2. All soil exposed in permanent slope faces should be hydroseeded or hand seeded/strawed with an appropriate seed mixture compatible with the soil and climate conditions of the Site as recommended by the local Resource Conservation District.
3. Following seeding, jute netting or erosion control blankets should be placed and secured over the slopes steeper than 2:1, H:V.
4. Surface water drainage ditches should be established as necessary to intercept and redirect concentrated surface water away from cut and fill slope faces. Under no circumstances should concentrated surface water be directed over slope faces. The intercepted water should be discharged into natural drainage courses or into other collection and disposal structures.
5. NV5 should be retained to review final grading plans for site improvements to confirm that appropriate slope drainage and erosion control measures have been included in the project design.

5.1.11 Underground Utility Trenches

Underground utility trenches should be excavated and backfilled as described below.

Underground utility trenches should be excavated and backfilled as described below for each trench zone shown in the figure below.

1. Trench Excavation Equipment: NV5 anticipates that the contractor will be able to excavate relatively shallow (up to 5 ft bgs) underground utility trenches with a Case 580 Backhoe or equivalent. Highly resistant rock, not described in our investigation, may be encountered in deeper trench excavations or in areas of existing or proposed cuts.
2. Trench Shoring: All utility trenches that are excavated deeper than 4 feet bgs are required by California OSHA to be shored with bracing equipment or sloped back to an appropriate slope gradient prior to being entered by any individuals.
3. Trench Dewatering: NV5 does not anticipate that the proposed underground utility trenches will encounter shallow groundwater. However, if the utility trenches are excavated during the winter rainy season, then shallow or perched groundwater may be encountered. The earthwork contractor may need to employ de-watering methods as discussed in Section 5.1.12 in order to excavate, place and compact the trench backfill materials.
4. Pipe Zone Backfill Type and Compaction Requirements: The backfill material type and compaction requirements for the pipe zone, which includes the bedding zone, the shading zone and the cover zone, are described in Detail 5.1.11-1 below. It is possible that waste rock/sand from the mine processing would be feasible for use as trench backfill and bedding. If proposed, select backfill material should be approved by NV5 prior to use.



- a. **Pipe Zone Backfill Material Type:** Trench backfill used within the pipe zone, which includes the bedding zone, the shading zone and the cover zone, should consist of $\frac{3}{4}$ -inch-minus, washed, crushed rock. The crushed rock particle size gradation should meet the following requirements (percentages are expressed as dry weights using ASTM D422 test method): 100 percent passing the $\frac{3}{4}$ -inch sieve, 80 to 100 percent passing the $\frac{1}{2}$ -inch sieve, 60 to 100 percent passing the $\frac{3}{8}$ -inch sieve, 0 to 30 percent passing the No. 4 sieve, 0 to 10 percent passing the No. 8 sieve, and 0 to 3 percent passing the No. 200 sieve.

If groundwater is encountered within the trench during construction, or if groundwater is expected to rise during the rainy season to an elevation that will infiltrate the pipe zone within the trench, then the pipe zone material should be wrapped with a minimum 6 ounce per square yard, non-woven geotextile filter fabric such as TenCate® Mirifi N140 or an approved equivalent. The geotextile seam should be located along the trench centerline and have a minimum 1-foot overlap. If the utility pipes are coated with a corrosion protection material, then the pipes should be wrapped with a minimum 6 ounce per square yard, non-woven, geotextile cushion fabric such as TenCate® Mirifi N140 or an approved equivalent. The geotextile cushion fabric should have a minimum 6-inch seam overlap. The geotextile cushion fabric will protect the pipe from being scratched by the crushed rock backfill material.

- b. **Pipe Bedding Zone Compaction:** Trench backfill soil placed in the pipe bedding zone (beneath the utilities) should be a minimum of 3 inches thick, moisture conditioned to within ± 3 percentage points of the ASTM D1557 optimum moisture content and compacted to achieve a minimum relative compaction of 95 percent of the ASTM D1557 maximum dry density. Crushed rock should be mechanically consolidated under the observation of NV5.
 - c. **Pipe Shading Zone Compaction:** Trench backfill soil placed within the pipe shading zone (above the bedding zone and to a height of one pipe radius above the pipe spring line) should be moisture conditioned to within ± 3 percentage points of the ASTM D1557 optimum moisture content and compacted to achieve a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density. Crushed rock should be mechanically consolidated under the observation of NV5. The pipe shading zone backfill material should be shovel-sliced to remove voids and to promote compaction.
 - d. **Pipe Cover Zone Compaction:** Trench backfill soil placed within the pipe cover zone (above the pipe shading zone to 1 foot over the pipe top surface) should be moisture conditioned to within ± 3 percentage points of the ASTM D1557 optimum moisture content and compacted to achieve a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density. Crushed rock should be mechanically consolidated under the observation of NV5.
5. **Trench Zone Backfill and Compaction Requirements:** The trench zone backfill materials consist of both lower and upper zones, as discussed below.
 - a. **Trench Zone Backfill Material Type:** Soil used as trench backfill within the lower and upper intermediate zones, as shown on the preceding figure, should consist of non-expansive soil with a PI of less than or equal to 15 (based on ASTM D4318) and should not contain rocks greater than 3 inches in greatest dimension.
 - b. **Lower Trench Zone Compaction:** Soil used to construct the lower trench zone backfills should be uniformly moisture conditioned to within 0 and 4 percentage points of the ASTM D1557 optimum moisture content, placed in maximum 12-inch-thick loose lifts prior to compacting and compacted to achieve a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density.
 - c. **Upper Trench Zone Compaction (Road and Parking Lot Areas):** Soil used to construct the upper trench zone backfills should be uniformly moisture conditioned to within 0 and 4 percentage points greater than the ASTM D1557 optimum moisture content, placed in maximum 8-inch-thick loose lifts (layers) prior to compacting and compacted to achieve a minimum relative compaction of 95 percent of the ASTM D1557 maximum dry density.
 - d. **Upper Trench Zone Compaction (Non-Road and Non-Parking Lot Areas):** Soil used to construct the upper trench zone backfills should be uniformly moisture conditioned to within 0 and 2 percentage points greater than the ASTM D1557 optimum moisture content, placed in maximum 6-inch-thick loose lifts (layers) prior to compacting and compacted to achieve a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density.
6. **CQA Testing and Observation Engineering Services:** The moisture content, dry density and relative percent compaction of all engineered utility trench backfills should be tested by the project engineer's field representative during construction to evaluate whether the compacted trench backfill materials meet or exceed the minimum compaction and moisture content requirements presented in this report. The earthwork contractor shall assist the project engineer's field representative by excavating test pads with the onsite earth moving equipment.

- a. **Compaction Testing Frequencies:** The field and laboratory CQA tests should be performed consistent with the testing frequencies presented in Table 5.1.11-2 or as modified by the project engineer to better suit the site conditions.

Table 5.1.11-2, Minimum Testing Frequencies for Utility Trench Backfill

ASTM No.	Test Description	Minimum Test Frequency ⁽¹⁾
D1557	Modified Proctor Compaction Curve	1 per 500 CY ⁽²⁾ Or Material Change
D6983	Nuclear Moisture and Density	1 per 100 LF per 24-Inch-Thick Compacted Backfill Layer ⁽²⁾ The maximum loose lift thickness shall not exceed 12-inches prior to compacting.

Notes:

- (1) These are minimum testing frequencies that may be increased or decreased at the project engineer’s discretion on the basis of the site conditions encountered during grading.
 - (2) Whichever criteria provide the greatest number of tests.
- ASTM = ASTM International
CY = cubic yards
LF = linear foot
No. = number

7. **Final Proof Rolling:** The prepared finished grade AB rock surface and/or finished subgrade soil surface of utility trench backfills should be proof-rolled, as mentioned above in Section 5.1.5, Paragraph 6.

5.1.12 Construction Dewatering

NV5 does not anticipate the need to perform de-watering of the Site during earthwork grading; however, the earthwork contractor should be prepared to de-water the utility trench excavations and any other excavations if perched water or the groundwater table is encountered during grading. NV5 recommends that the utility trench excavations be performed as late in the summer months as possible to allow the groundwater table to reach its lowest seasonal elevation. Perched groundwater may be encountered on low permeability soil or weathered rock layers even during the summer months.

The following recommendations are preliminary and are not based on performing a groundwater flow analysis. A detailed de-watering analysis was not a part of the proposed work scope. It should be understood that it is the earthwork contractor’s sole responsibility to select and employ a satisfactory de-watering method for each excavation.

1. NV5 anticipates that de-watering of utility trenches can be performed by constructing sumps to depths below the trench bottom and removing the water with sump pumps.
2. Additional sump excavations and pumps should be added as necessary to keep the excavation bottom free of standing water and relatively dry when placing and compacting the trench backfill materials.
3. If groundwater enters the trench faster than it can be removed by the de-watering system, thereby allowing the underlying compacted soil to become unstable while compacting successive soil lifts, then it may be necessary to remove the unstable soil and replace it with free-draining, granular drain rock. Native backfill soil can again be used after placing the granular rock to an elevation that is higher than the groundwater table.

4. If granular rock is used, it should be wrapped in a non-woven geotextile fabric, such as TenCate® Mirifi® N140 or an approved equivalent. The geotextile filter fabric should have minimum 1-foot overlapped seams. The granular rock should meet or exceed the following gradation specifications (all percentages are expressed as dry weights using ASTM D422 test method): 100 percent passing the 3/4-inch sieve, 80 to 100 percent passing the 1/2-inch sieve, 60 to 100 percent passing the 3/8-inch sieve, 0 to 30 percent passing the No. 4 sieve, 0 to 10 percent passing the No. 8 sieve, and 0 to 3 percent passing the No. 200 sieve.

If subsurface seepage or groundwater conditions are encountered which prevent or restrict fill placement or construction of the proposed improvements, subdrains may be necessary. If groundwater or saturated soil conditions are encountered during grading, we should be retained to observe the conditions and provide site-specific subsurface drainage recommendations.

5.1.13 Soil Corrosion Potential

Based on our review of soil survey information and previous laboratory testing by Engeo (2007), the onsite soils are generally not considered to be abnormally corrosive to buried metal and structures. However, soil samples TP3 at 5 feet and B8 at 3 feet (both located in the northeastern portion of the Site) had anomalously low resistivities (0.83 and 0.88 ohm/cm x 1000) and higher sulfate concentrations (113.4 and 206.2 ppm), indicating that they are very severely corrosive to buried metal.

Because these materials are to be placed as engineered fill near the base of the proposed deep engineered fill, it is unlikely that the potentially corrosive soil will be located near future structural improvements. However, if underground utilities (such as the culvert proposed for water conveyance from the eastern Site boundary through the development area) or infrastructure elements will be in contact with the potentially corrosive soil, they should be relocated or designed to resist the corrosive conditions.

To reduce the likelihood of corrosion problems, materials used for underground utilities, permanent subsurface drainage improvements, and foundation systems should be selected based on local experience and practice. If alternative or new construction methods or materials are being proposed, it may be appropriate to have the selected materials evaluated by a corrosion engineer for compatibility with the onsite soil conditions.

5.1.14 Surface Water Drainage

Proper surface water drainage is important to the successful development of the project. We recommend the following measures to help mitigate surface water drainage problems:

1. Slope final grades in structural areas so that surface water drains away from building pad finish subgrade at a minimum 2 percent slope for a minimum distance of 10 feet. For structures utilizing slab-on-grade interior floor systems we recommend increasing the slope to 4 percent.
2. To reduce surface water infiltration, compact and slope all soil placed adjacent to building foundations such that water is not allowed to pond. Backfill should be free of deleterious materials.
3. Direct downspouts to positive drainage or a closed collector pipe that discharges flow to positive drainage.

4. Construct V-ditches at the top of cut and fill slopes where necessary to reduce concentrated surface water flow over slope faces. Typically, V-ditches should be 3 feet wide and at least 6 inches deep. Surface water collected in V-ditches should be directed away and downslope from proposed building pads and driveways into a drainage channel.

5.1.15 Grading Plan Review and Construction Monitoring

Construction quality assurance includes review of plans and specifications and performing construction monitoring as described below.

1. NV5 should be retained to review the final grading plans prior to construction to confirm our understanding of the project at the time of our investigation, to determine whether our recommendations have been implemented, and to provide additional and/or modified recommendations, if necessary.
2. Prior to commencement of a new phases of development on the Property, NV5 should be retained to observe the soil/rock conditions within and surrounding the proposed improvements to confirm or modify our recommendations. A preconstruction meeting with the contractor and subcontractors involved should be held to discuss and review the applicable recommendations of this report as they apply to the proposed construction.
3. NV5 should be retained to perform construction quality assurance (CQA) monitoring of all earthwork grading performed by the contractor to determine whether our recommendations have been implemented, and if necessary, provide additional and/or modified recommendations.
4. NV5's experience, and that of the engineering profession, clearly indicates that during the construction phase of a project the risks of costly design, construction and maintenance problems can be significantly reduced by retaining a design geotechnical engineering firm to review the project plans and specifications and to provide geotechnical engineering observation and CQA testing services. Upon your request we will prepare a CQA geotechnical engineering services proposal that will present a work scope, a tentative schedule and a fee estimate for your consideration and authorization. If NV5 is not retained to provide geotechnical engineering CQA services during the construction phase of the project, then NV5 will not be responsible for geotechnical engineering CQA services provided by others nor any aspect of the project that fails to meet your or a third party's expectations in the future.

5.2 STRUCTURAL IMPROVEMENT DESIGN CRITERIA

The following sections present our structural improvement design criteria and recommendations. The recommendations address foundations, seismic parameters, concrete slabs-on-grade, retaining walls and pavement design.

5.2.1 Seismic Design Criteria

Our classification of onsite soil conditions is based on field observations and proposed improvements. We understand that proposed foundation structures will be constructed on import fill material that will primarily consists of medium dense granular soil composed of silty or clayey sand/gravel, with possible rock fill at depths. Based on the understanding that the proposed development will include improvements founded on compacted granular fill, we classified the onsite soil as stiff soil (Site Class D) for design purposes.

Table 5.2.1-1 below summarizes seismic design criteria based on ASCE 7-10, the 2019 California Building Code and the California Office of Statewide Health Planning and Development (OSHPD) Seismic Design Maps tool (available online at <https://seismicmaps.org/>).

Table 5.2.1-1, Seismic Design Parameters

Description	Value	Reference	Description	Value	Reference
Latitude Longitude	39.2213 -121.0422	1	Site Class	D	2
Site Coefficient, F_A	1.324	5	Site Coefficient, F_V	1.916	6
Short (0.2 sec) Spectral Response, S_S	0.595 g	3	Long (1.0 sec) Spectral Response, S_1	0.242 g	4
S_S modified for Site Class Effects, S_{MS}	0.788 g	7	S_1 modified for Site Class Effects, S_{M1}	0.464 g	8
Design Spectral Response Acceleration, Short Periods, S_{DS}	0.525 g	9	Design Spectral Response Acceleration, Long Periods, S_{D1}	0.309 g	10
References: 1) https://seismicmaps.org/ 2) ASCE 7-16 Table 20.3-1 3) ASCE 7-16 Figure 22-1 4) ASCE 7-16 Figure 22-2 5) ASCE 7-16 Table 11.4-1 6) ASCE 7-16 Table 11.4-2 7) ASCE 7-16 Equation 11.4-1 8) ASCE 7-16 Equation 11.4-2 9) ASCE 7-16 Equation 11.4-3 10) ASCE 7-16 Equation 11.4-4					

5.2.2 Foundations

Provided that the grading for the project is performed in accordance with the recommendations presented in this report, our opinion is that the Site will be suitable for the use of conventional perimeter foundations, isolated interior footings, and interior slabs-on-grade. Following are our recommendations for foundations constructed on compacted and tested fill or competent native soil:

1. In areas where expansive soils are present within 1½ feet of foundation elements, we recommend an 18-inch blanket of import granular fill be placed within and 5 feet beyond the building pad footprint.
2. Footings for single story structures should be a minimum of 12 inches wide and trenched through any loose surface material, potentially expansive soil, or untested fill, and a minimum of 12 inches into competent native soil, weathered rock or compacted fill. Footings for two-story structures, if proposed, should be a minimum of 15 inches wide and trenched a minimum of 18 inches into competent native soil, weathered rock or compacted fill. If clay is encountered at the base of footing excavations, the footing should be deepened through the clay into underlying granular material or weathered rock, as determined in the field by NV5.
3. The base of the footing excavation should be approximately level. On sloping sites, it will be necessary to step the base of the footing excavation as necessary to maintain a slope of less than 10 percent at the base of the footing.
4. Footing trenches should be cleaned of all loose soil and construction debris prior to placing concrete. A representative from NV5 should observe the footing excavations prior to concrete placement.

5. As a minimum, the footings should be designed with two No. 4 rebar reinforcement, one near the top of the footing and one near the bottom. A minimum of 3 inches of concrete coverage should surround the bars.
6. The concrete should have a minimum 2,500 pounds per square inch compressive break strength after 28 days of curing (unless specified by a structural engineer), have a water-to-cement ratio from 0.40 to 0.50, and should be placed with minimum and maximum slumps of 4 and 6 inches, respectively. Since water is often added to uncured concrete to increase workability, it is important that strict quality control measures be employed during placement of the foundation concrete to ensure that the water-to-cement ratio is not altered prior to or during placement.
7. Prior to placing concrete in any foundation excavation, the project geotechnical engineer or his/her field representative should observe the excavations to document that the following requirements have been achieved: minimum foundation dimensions, minimum reinforcement steel placement and dimensions, removal of all loose soil, rock, wood debris or other deleterious materials, and that firm and competent native or engineered fill soil is exposed along the entire foundation excavation bottom. Strict adherence to these requirements is paramount to the satisfactory behavior of a building foundation. Minor deviations from these requirements can cause the foundations to undergo minor to severe amounts of settlement which can result in cracks developing in the foundation and adjacent structural members, such as concrete slab-on-grade floors.
8. In general, structures constructed adjacent to descending slopes should employ a minimum setback of either $\frac{1}{3}$ the height of the slope, or 40 feet, whichever is less. The setback for ascending slopes is either $\frac{1}{2}$ the slope height or 15 feet, whichever is less. Where footings are proposed within these code-based setbacks, the project geotechnical engineer should review the proposed slope configuration and provide revised setback recommendations, if appropriate.
9. Footing excavations should be saturated prior to placing concrete to reduce the risk of problems caused by wicking of moisture from curing concrete. However, concrete should not be placed through standing water in the footing excavations.
10. In an effort to reduce the likelihood of settlement-induced distress to the proposed structures, we recommend that strip and isolated footings with a minimum embedment depth of 12 inches in competent soil be sized for an allowable bearing capacity of 3,000 pounds per square foot (psf) for dead plus live loads. This value can be increased by 300 psf for each additional foot of embedment up to a limiting value of 3,900 psf. Allowable bearing may be increased by 33 percent for additional transient loading, such as wind or seismic loads.
11. A triangularly-distributed lateral resistance (passive soil resistance) of $350d$ psf, where d is footing depth, may be used for footings. This value may be increased by 33 percent for wind and seismic. As an alternate to the passive soil resistance described above, a coefficient of friction for resistance to sliding of 0.40 may be used. The higher of the two values should be reduced by 50 percent if both resisting values are to be used.
12. Total settlement of individual foundations will vary depending on the plan dimensions of the foundation and actual structural loading. Based on anticipated foundation dimensions and loads, we estimate that total post-construction settlement of footings designed and constructed in accordance with our recommendations will be on the order of one-half inch. Differential settlement between similarly loaded, adjacent footings is expected to be less than one-quarter inch, provided footings are founded on similar materials (e.g., all on structural fill, native soil or rock). Differential settlement between adjacent footings founded on dissimilar materials

(e.g., one footing on soil and an adjacent footing on rock) may approach the maximum anticipated total settlement. Settlement of foundations is expected to occur rapidly and should be essentially complete shortly after initial application of loads.

13. Heavily loaded foundations should be evaluated on a case-by-case basis. We can provide Cast-in-drilled hole or mat foundations, if requested.

5.2.3 Slab-on-Grade Floor Systems

Our opinion is that interior concrete slab-on-grade floors may be used in conjunction with perimeter concrete foundations for the proposed improvements. The project structural engineer should design slabs-on-grade with regard to the anticipated loading. This section presents typical slab sections and reinforcement schedules used for residential construction in the region and presents construction recommendations. We can provide project specific slab-on-grade design for the proposed improvements once anticipated loading and serviceability criteria have been established.

The heavily loaded concrete slab on grade building floors and driveway areas should be evaluated by a California-licensed civil engineer for expected live and dead loads to determine if the minimum slab thickness and steel reinforcement recommendations presented in this report should be increased or redesigned.

NV5 recommends using the guideline procedures, methods and material properties that are presented in the following ASTM and ACI documents for construction of concrete slab on grade floors:

- ACI 302.1R 04, Guide for Concrete Floor and Slab Construction, reported by ACI Committee 302.
- ASTM E1643 98 (Reapproved 2005), Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- ASTM E1745 97 (Reapproved 2004), Standard Specifications for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- ASTM F710 5, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

The interior building concrete slab-on-grade floor and exterior shop, sidewalk and patio concrete slab-on-grade floor components are described below from top to bottom.

1. Minimum 4-Inch Thick Concrete Slab: The concrete slab should be installed with a minimum 3,000 pounds per square inch (psi) compressive strength after 28 days of curing. NV5 recommends that the concrete design use a water-to-cement ratio between 0.40 and 0.45 and should be placed with minimum and maximum slumps of 3 and 5 inches, respectively. The concrete mix design is the responsibility of the concrete supplier. If floor loads higher than 250 psf or intermittent live loads are anticipated, a structural engineer should determine the slab thickness and steel reinforcing schedule.
2. Steel Reinforcement: Reinforcement should be used to improve the load-carrying capacity, to reduce cracking caused by shrinkage during curing and from both differential and repeated loadings. It should be understood that it is nearly impossible to prevent all cracks from development in concrete slabs; in other words, it should be expected that some cracking will occur in all concrete slabs no matter how well they are reinforced. Concrete slabs that will be subjected to heavy loads should be designed with steel reinforcements by a California-licensed structural engineer.

3. Rebar: As a minimum, use No. 3 rebar (ASTM A615/A 615M 04 Grade 60), tied and placed with 18 inch centers in both directions (perpendicular) and supported on concrete “dobies” to position the rebar in the center of the slab during concrete pouring. NV5 does not recommend that the steel reinforcements of the concrete slab on grade floor be tied into the perimeter or interior continuous strip foundations or interior isolated column foundations. In other words, we recommend that the concrete slab on grade floors be constructed as independent structural members so that they can move (float) independently from the foundation structures. We do not recommend using rolls of welded wire mesh (WWM) because vertically centered placement of rolled mesh within the slab is difficult to achieve. All rebar and sheets of WWM should be placed in the center of the slab and supported on concrete "dobies". We do not recommend "hooking and pulling" of steel during concrete placement.
4. Underslab Vapor Moisture Retarder Membrane: The underslab retarder membrane should be placed in areas with moisture sensitive floor coverings as a floor component that will minimize transmission of both liquid water and water vapor transmission through the concrete slab on grade floor. NV5 recommends using at a minimum a Class A (ASTM E1745 97 [Reapproved 2004]), minimum 10 mil thick, plastic, vapor moisture, retarder membrane material such as Stego Wrap® underslab vapor retarder membranes or equivalents. Additionally, the following materials are recommended: Stego® Tape and Stego® Mastic or equivalents to seal membrane joints and any utility penetrations.

Regardless of the type of moisture vapor retarder membrane used, moisture can wick up through a concrete slab on grade floor. Excessive moisture transmission through a concrete slab floor can cause adhesion loss, warping and peeling of resilient floor coverings, deterioration of adhesive, seam separation, formation of air pockets, mineral deposition beneath flooring, odor and both fungi and mold growth. Slabs can be tested for water transmissivity in areas that are moisture sensitive. Commercial sealants, polymer additives to the concrete at the batch plant, entrained air, flyash, and a reduced water-to-content ratio can be incorporated into the concrete slab on grade floor mix design to reduce its permeability and water vapor transmissivity properties. A waterproofing consultant should be contacted to provide detailed recommendations if moisture sensitive flooring materials will be installed on the concrete slab on grade floors.

Prior to placing the vapor retarder and concrete, slab subgrade soil must be moisture conditioned to between 75 and 90 percent saturation to a depth of 24 inches. Moisture conditioning should be performed for a minimum of 24 hours prior to concrete placement. Clayey soil may take up to 72 hours to reach this required degree of saturation. If the soil is not moisture conditioned prior to placing concrete, moisture will be wicked out of the concrete possibly contributing to shrinkage cracks. Additionally, our opinion is that moisture conditioning the soil prior to placing concrete will reduce the likelihood of soil swell or heave following construction at locations where fine grained, potentially expansive soil is encountered. To facilitate slab-on-grade construction, we recommend that the slab subgrade soil be moisture conditioned following rock placement. Following moisture conditioning, the vapor retarder should be placed.

5. Minimum 4-Inch Thick Crushed Rock or Class II Aggregate Base Rock Layer: Interior floors should be underlain by clean crushed rock, while exterior floors should use either crushed rock or Class II AB rock. Crushed rock should be mechanically consolidated under the observation of NV5. AB rock layers should be placed and compacted to a minimum of 95 percent of the ASTM D1557 dry density with a moisture content of ± 3 percentage points of the ASTM D1557 optimum moisture content. The crushed rock should be washed to produce a particle size distribution of 100 percent (by dry weight) passing the $\frac{3}{4}$ inch sieve and 5 percent passing the No. 4 sieve and 0 to 3 percent

passing the No. 200 sieve. An alternative rock material for external slab-on-grade concrete surfaces would include AB rock meeting the specification of Caltrans Class II AB. Just prior to pouring the concrete slab, the rock layer should be moistened to a saturated surface dry (SSD) condition. This measure will reduce the potential for water to be withdrawn from the bottom of the concrete slab while it is curing and will help minimize the development of shrinkage cracks.

If the current property owner elects to eliminate the crushed rock or AB rock layer beneath the interior and exterior concrete slabs on grade for economic reasons, then there will be an inherent greater risk assumed by the developer for the development of both shrinkage and bearing-related cracks in the associated slabs.

6. Subgrade Soil Preparation: In general, the subgrade soil around the slabs-on-grade should be sloped away from the proposed slab subgrade a minimum of 4 percent for a distance of 10 feet as discussed in the Surface Water Drainage section of this report. NV5 recommends that subgrade elevations on which the concrete slab on grade floors are constructed be a minimum of 6 inches above the elevation of the surrounding parking lots, driveways and landscaped areas. Elevating the building will reduce the potential for subsurface water to enter beneath the concrete slab on grade floors and exterior surfaces and underground utility trenches. A representative from NV5 should observe pad and subgrade elevations prior to forming the slab footings.

The subgrade soil should be prepared and compacted consistent with the recommendations of Section 8.1. All deleterious material must be removed prior to placing concrete. The top 12 inches of the non-expansive soil should be compacted to a minimum of 90 percent of the ASTM D1557 dry density with relatively uniform moisture content within 3 percentage points of the ASTM D1557 optimum moisture content.

7. Crack Control Grooves: Crack control grooves should be installed during placement or saw cuts should be made in accordance with the ACI and Portland Cement Association (PCA) specifications. Generally, NV5 recommends that expansion joints be provided between the slab and perimeter footings, and that crack control grooves or saw cuts are installed no more than 10-foot centers in both directions (perpendicular).
8. Concrete slabs should be moisture cured for at least seven days after placement. Excessive curling of the slab may occur if moisture conditioning is not performed. This is especially critical for slabs that are cast during the warm summer months.
9. Concrete slabs impart a relatively small load on the subgrade (approximately 50 psf). Therefore, some vertical movement should be anticipated from possible expansion or differential loading.
10. Field Observations: Field observations of all concrete slab-on-grade surfaces and installed steel reinforcements should be made by an NV5 construction monitor prior to pouring concrete.

5.2.4 Retaining Wall Design Criteria

The following active and passive pressures are for retaining walls in the proposed granular import fill soil. If import fill soil is used, a representative from our firm should be retained to observe and test the soil to determine its strength properties. The pressures exerted against retaining walls may be assumed to be equal to a fluid of equivalent unit weight.

Table 5.2.4-1, Equivalent Fluid Unit Weights (1)

Loading Condition	Retained Cut or Compacted Fill (approximately horizontal backfill)	Retained Cut or Compacted Fill (retained slope up to 2:1, H:V)
Active Pressure (pcf)	30	45
Passive Pressure (pcf)	350	350
At-Rest Pressure (pcf)	50	60
Coefficient of Friction	0.40	0.40

Note: (1) The equivalent fluid unit weights presented are ultimate values and do not include a factor of safety. The passive pressures provided assume footings are founded in competent native soil or engineered fill.

Table 5.2.4-1 presents equivalent fluid unit weights for cut native soil and onsite fill compacted per the grading recommendations presented in this report. For approximately horizontal backfill we assume that the retained fill surface will be no steeper than 10% for a minimum distance of the wall height from the back of the retaining wall. If surcharge loads (such as adjacent building foundations) or live loads will be applied within a distance of the wall height from the back of the wall, we should be retained to review the loading conditions and revise our recommendations, if necessary.

The passive pressures provided assume footings are founded in competent native soil or engineered fill.

Please note that the use of the tabulated active pressure unit weight requires that the wall design accommodate sufficient deflection for mobilization of the retained soil to occur. Typically, a wall yield of less than 1 percent of the wall height is sufficient to mobilize active conditions in granular soil. However, if the walls are rigid or restrained to prevent rotation, at-rest conditions should be used for design.

Recommendations for design and construction of retaining walls are listed below:

1. Compaction equipment should not be used directly adjacent to retaining walls unless the wall is designed or braced to resist the additional lateral pressures.
2. If any surface loads are closer to the top of the retaining wall than its height, NV5 should review the loads and loading configuration. We should be retained to review wall details and plans for any wall over 12 feet in height.
3. All retaining walls must be well drained to reduce hydrostatic pressures. Walls should be provided with a drainage blanket to reduce additional lateral forces and minimize saturation of the backfill soil. Drainage blankets may consist of graded rock drains or geosynthetic blankets.
4. Rock drains should consist of a minimum 12-inch wide, Caltrans Class II, permeable drainage blanket, placed directly behind the wall; or crushed washed rock enveloped in a non-woven geotextile filter fabric such as Amoco 4546™ or equivalent. Drains should have a minimum 4-inch diameter, perforated, schedule 40, PVC pipe placed at the base of the wall, inside the drainrock, with the perforations placed down. The PVC pipe should be sloped so that water is directed away from the wall by gravity. A geosynthetic drainage blanket such as Enkadrain™ or equivalent may be substituted for the rock drain, provided the collected water is channeled away from the wall. If a geosynthetic blanket is used, backfill must be compacted carefully so that equipment or soil does not tear or crush the drainage blanket.

5. Adequate drainage and waterproofing for retaining walls associated with finished interior spaces are essential to reduce the likelihood of seepage and vapor transmission into the living space. We recommend that an appropriate waterproofing sealant be applied to the exterior surface of such retaining walls. A waterproofing consultant may be contacted to further review seepage and vapor transmission.
6. Additional lateral loading on retaining structures due to seismic accelerations may be considered at the designer's option. For an earthquake producing a design horizontal acceleration of 0.236g, we recommend that the resulting additional lateral force applied to unrestrained (cantilevered) retaining structures with drained level backfill onsite be estimated as $P_{ae}=4H^2$ pounds, where H is the height of the wall in feet. A value of $9H^2$ should be used for restrained walls. The additional seismic force may be assumed to be applied at a height of 0.3H above the base of the wall. This seismic loading is for a drained, level backfill condition only; NV5 should be consulted for values of seismic loading due to non-level or non-drained backfill conditions. The use of reduced factors of safety is often appropriate when reviewing overturning and sliding resistance during seismic events.

5.2.5 Pavement Design

The following recommended asphalt concrete flexible pavement sections are preliminary based on assumed design R-value of 35 for the proposed import granular engineered fill. Preliminary traffic indices (TIs) of 5-7 were selected based on anticipated light to heavy industrial activity at the Site. The TIs are being considered on a preliminary basis to facilitate planning of the proposed onsite and offsite roadways. Other TIs or specific R-values may need to be considered in design if heavy vehicle loads, truck traffic, or improvements deviate from the proposed development plan. Pavement design is presented in Table 5.2.5-1 below.

Table 5.2.5-1, Recommended Pavement Sections

R-Value	Traffic Index (TI)	Asphalt Concrete (inches)	Class 2 Baserock at 95% Compaction (inches)	Subgrade Soil at 95% Compaction (inches)
35	5	2.5	6.0	12
	6	2.5	8.5	12
	7	2.8	10.5	12

We make the following recommendations regarding paving at the Site.

1. Fill must be compacted to a minimum of 90 percent of the maximum dry density per ASTM D 1557, Modified Proctor. The upper 12 inches of subgrade in areas to be paved must be compacted to a minimum of 95 percent per ASTM D 1557. Baserock should be compacted to a minimum of 95 percent per ASTM D 1557. Moisture content, density and relative percent compaction should be verified by NV5. In addition to density testing, the subgrade must be proofrolled under the observation of a representative of NV5, prior to baserock placement.
2. Subgrade should be sloped to drain away from the proposed road alignment.
3. Import soil, if used, should be predominantly granular, non-expansive and free of deleterious material. Proposed import should be submitted to NV5 for testing prior to transport to the Site.

4. Steel reinforced concrete slabs should be considered for use in loading bays, service docks, garbage facilities, and other areas where frequent, heavy vehicle loads are anticipated. The project structural engineer should determine slab thickness and steel reinforcement.
5. Depending on the subsurface conditions encountered and the sources of fill, the actual subgrade material may vary significantly from that tested during this investigation. Representative subgrade samples should be obtained, and additional R-value tests performed, if appropriate, to confirm the recommendations in this report. If the results of confirmation testing vary significantly from those used in design, the recommended pavement sections may need to be revised.

6.0 LIMITATIONS

The following limitations apply to the findings, conclusions and recommendations presented in this report:

1. This report should not be relied upon without review by NV5 if a period of 24 months elapses between the issuance report date shown above and the date when construction commences.
2. Our professional services were performed consistent with the generally accepted geotechnical engineering principles and practices employed in northern California. No warranty is expressed or implied.
3. These services were performed consistent with our agreement with our client. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of our services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report. This report is solely for the use of our client unless noted otherwise. Any reliance on this report by a third party is at the party's sole risk.
4. If changes are made to the nature or design of the project as described in this report, then the conclusions and recommendations presented in this report should be considered invalid. Only our firm can determine the validity of the conclusions and recommendations presented in this report. Therefore, we should be retained to review all project changes and prepare written responses with regards to their impacts on our conclusions and recommendations. However, we may require additional fieldwork and laboratory testing to develop any modifications to our recommendations. Costs to review project changes and perform additional fieldwork and laboratory testing necessary to modify our recommendations are beyond the scope of services presented in this report. Any additional work will be performed only after receipt of an approved scope of services, budget, and written authorization to proceed.
5. The analyses, conclusions and recommendations presented in this report are based on site conditions as they existed at the time we performed our investigations. We have assumed that the subsurface soil and groundwater conditions encountered at the locations of exploratory trenches and borings are generally representative of the subsurface conditions throughout the entire subject site. However, the actual subsurface conditions at locations between and beyond exploratory trenches/borings may differ. Therefore, if the subsurface conditions encountered during construction are different than those described in this report, then we should be notified immediately so that we can review these differences and, if necessary, modify our recommendations.

6. The elevation or depth to the groundwater table underlying the subject site may differ with time and location; therefore, the depth to the groundwater table encountered in the exploratory trenches and borings is only representative of the specific time and location where it was observed.
7. Our geotechnical investigation scope of services did not include evaluating the subject site for the presence of historic mining surface features or hazardous materials. Although we did not observe evidence of historic mining activity or hazardous materials within the proposed building area at the time of our field investigation, all project personnel should be careful and take the necessary precautions should hazardous materials be encountered during construction. Possible historic mining excavation not detected during our investigation may impact the proposed improvements.
8. NV5's experience and that of the civil engineering profession clearly indicates that during the construction phase of a project the risks of costly design, construction and maintenance problems can be significantly reduced by retaining a design geotechnical engineering firm to review the project plans and specifications and to provide geotechnical engineering CQA observation and testing services. Upon your request, NV5 will prepare a CQA geotechnical engineering services proposal that will present a work scope, a tentative schedule and fee estimate for your consideration and authorization. If NV5 is not retained to provide geotechnical engineering CQA services during the construction phase of the project, then NV5 will not be responsible for geotechnical engineering CQA services provided by others nor any aspect of the project that fails to meet your or a third party's expectations in the future.
9. All temporary excavations must comply with applicable local, state and federal safety regulations, including the current Occupational Safety and Hazards Administration (OSHA) excavation and trench safety standards. Construction site safety is the responsibility of the contractor, who is solely responsible for the means, methods and sequencing of construction operations. Under no circumstances should the findings, conclusions and recommendations presented herein be inferred to mean that NV5 is assuming any responsibility for temporary excavations, or for the design, installation, maintenance and performance of any temporary shoring, bracing, underpinning or other similar systems.
10. The findings of this report are valid as of the present date. However, changes in the conditions of the property can occur with the passage of time. The changes may be due to natural processes or to the works of man, on the subject site or adjacent properties. In addition, changes in applicable or appropriate standards can occur, whether they result from legislation or the broadening of knowledge. Therefore, the recommendations presented in this report should not be relied upon after a period of two years from the issue date without our review.

FIGURES

Figure 1 Site Vicinity Map

Figure 2 Site Arial Map



BASE MAP FROM NEVADA COUNTY GEOGRAPHIC INFORMATION SYSTEM



LOCATION MAP
IDAHO-MARYLAND MINE PROJECT - CENTENNIAL INDUSTRIAL SITE
 GRASS VALLEY, CALIFORNIA

PREPARED BY: J. SMITH	FIGURE 1
REVIEWED BY: D. VIEIRA	
NV5 PROJECT: 5279.02	
DATE: NOVEMBER 2019	



BASE MAP FROM GOOGLE EARTH (ACCESSED NOVEMBER 2019)



SITE AERIAL MAP
IDAHO-MARYLAND MINE PROJECT - CENTENNIAL INDUSTRIAL SITE
 GRASS VALLEY, CALIFORNIA

PREPARED BY:	J. SMITH
REVIEWED BY:	D. VIEIRA
NV5 PROJECT:	5279.02
DATE:	NOVEMBER 2019

APPENDIX A

Proposal



Project No. 5279.02
August 30, 2019

Rise Gold Corporation
333 Crown Point Circle, Suite 215
Grass Valley, CA 95945

Attention: Benjamin Mossman, P.Eng.
President, CEO, and Director

Reference: Idaho-Maryland Gold Project
Grass Valley, California

Subject: Proposal for Geotechnical Engineering Services

Dear Mr. Mossman:

NV5 proposes to provide geotechnical engineering services in support of near-surface development planning and environmental review for the Idaho-Maryland Gold Project. The geotechnical investigation will include the Brunswick Industrial Site, Centennial Industrial Site, and locations of surface mine features on third-party owned properties. As described below, investigation tasks include:

1. Geotechnical engineering investigation and reports for the Brunswick Industrial Site and Centennial Industrial Site:
 - a. Subsurface investigation of Brunswick Industrial Site development area and dam;
 - b. Dam stability analysis and grading recommendations if mitigation is necessary;
 - c. Evaluation of an existing subsurface culvert at the Brunswick Industrial Site;
 - d. Surface reconnaissance of Centennial Industrial Site and document review;
 - e. Geotechnical engineering reports, including analysis, recommendations and design criteria for the Brunswick Industrial Site and Centennial Industrial Site:
 - i. Recommendations for subgrade preparation, drainage and grading;
 - ii. Stability analysis of proposed fill slope configurations;
 - iii. Foundation design criteria for proposed industrial development; and
 - iv. Design criteria for retaining walls, roads and utilities.
2. Geotechnical engineering review of near-surface mine features:
 - a. Surface reconnaissance, document review and/or subsurface investigation of surface features as identified by Rise Gold Corporation; and
 - b. Summary letter providing an opinion regarding geotechnical conditions associated with the surface features and, if necessary, recommendations for mitigation and/or monitoring.

SCOPE OF SERVICES

The scope of services described below includes a design-level geotechnical investigation and report for the two industrial sites, as well as geotechnical engineering review of surface features.

TASK 1 – DESIGN-LEVEL GEOTECHNICAL ENGINEERING INVESTIGATION

NV5 will perform a design-level geotechnical investigation of the Centennial Industrial Site and will review previous investigation findings for the Centennial Industrial Site. The investigation will be performed in general accordance with the 2016 California Building Code (CBC), and will focus on the currently proposed development.

Our design-level geotechnical engineering investigation will include map and document review, subsurface exploration and laboratory testing to determine soil engineering material properties, and data analysis to develop earthwork, paving and general foundation design criteria for the proposed development. We will also perform a stability analysis of the existing dam at the Brunswick Industrial Site and proposed fill slope configurations at both sites.

Plan and Document Review

NV5 will perform a map and literature review of published documents pertinent to the two sites including geologic maps, soil survey maps and previous known historical works on the sites.

Surface Reconnaissance

NV5 will perform a surface reconnaissance of both sites to identify surface conditions that may impact the proposed site development plans.

Subsurface Investigation

NV5 will perform a subsurface investigation at the Brunswick Industrial Site to characterize near-surface soil, rock and groundwater conditions, including:

- One day of drilling with truck-mounted auger drill rig to depths of approximately 20 to 30 feet below the ground surface (bgs), or until practical drilling refusal is met. The exploratory borings will focus on the dam to estimate the extent of weak materials identified during previous investigation. If time permits, we will advance borings at other locations in the development area where exploratory trenching is impractical (e.g., paved areas).
- One day of exploratory trenching to depths of approximately 10 feet bgs. The exploratory trenches will focus on the general development area.

Underground Utilities

NV5 will mark the site for Underground Service Alert (USA) prior to subsurface investigation. USA will notify public utility companies of the proposed investigation so that the utility companies can mark their utility locations. We will rely on the client to mark private utilities so that we can avoid them during subsurface exploration. NV5 will not be responsible for damage to subsurface utilities that were not marked or were improperly marked prior to our

investigation. To reduce the chance of damage to underground utilities, at your request we can retain a private utility locating service for an additional fee.

Exploratory Drilling

Exploratory boring locations will be determined based on access capabilities of the drill rig and location of existing onsite utilities (if any). Drill cuttings will remain at the boring locations unless Rise Gold Corporation requests their removal. If NV5 must remove excess drill cuttings, additional costs will be incurred based on our fee schedule. The borings will be backfilled with grout pursuant to local code requirements.

NV5's field engineer/geologist will record the subsurface conditions encountered in the exploratory borings. If groundwater is encountered, the depth to groundwater will be measured.

NV5 will collect both relatively undisturbed and disturbed soil samples. Relatively undisturbed soil samples will be collected with a standard penetration test (SPT) sampler and a 2.5-inch inside diameter split spoon barrel sampler equipped with brass liner tubes. The soil samples will be labeled, sealed, and transported to our laboratory facility where selected samples will be tested to determine their engineering material properties.

Generally, soil samples will be collected at depths of 0, 2, 5 and 10 feet bgs, and on five-foot intervals below that depth or at changes in subsurface conditions, until the boring is terminated. Sample intervals are subject to change depending upon the soil conditions encountered.

Exploratory Trenching

NV5 will excavate 6 to 10 exploratory trenches in the proposed development area to depths up to 10 feet bgs, or to refusal if encountered at shallower depths. Excavated soil will be placed back into the exploratory trenches but will not be compacted. Recomposition of the trenches should be performed during site development.

An NV5 engineer/geologist will record subsurface conditions and obtain soil samples using hand tools such as a drive sampler. The soil samples will be labeled, sealed, and transported to our laboratory where selected samples will be tested to determine their engineering material properties.

Laboratory Testing

Laboratory tests will be performed using ASTM International (ASTM) and Caltrans methods as guidelines. Depending on the subsurface conditions encountered, we anticipate that laboratory testing may include:

- D1140 200 Mesh Wash
- D2166 Unconfined Compressive Strength (rock and soil)
- D2216 Moisture Content
- D2487 Unified Soil Classification System
- D2844 Resistance Value
- D2937 Density

- D3080 Direct Shear Strength
- D4318 Atterberg Limits
- D4829 Expansion Index
- Caltrans Method 417 and 422, Sulfate and Chloride
- Caltrans Method 643, Resistivity

Data Analysis And Engineering

NV5 will evaluate slope stability and perform calculations to develop geotechnical engineering design criteria:

- Stability analysis will include the existing dam and proposed fill slope configurations.
- Evaluation of the existing culvert will include non-destructive testing of the culvert thickness at locations near the inlet and outlet, soil corrosivity analysis, and estimation of service life.
- The geotechnical engineering recommendations will include general procedures and geotechnical design parameters for earthwork and structural improvements.

Geotechnical Engineering Reports

Two design-level geotechnical reports will be prepared: one for the Brunswick Industrial Site and one for the Centennial Industrial Site.

The reports will summarize our investigation methods, summarize the results of previous investigation, provide an opinion regarding the geotechnical feasibility of the proposed developments, and present findings and geotechnical engineering design recommendations for the proposed earthwork and structural improvements. The geotechnical engineering design recommendations will address the following topics:

Earthwork Improvements

1. Site clearing and subgrade preparation.
2. Fill moisture conditioning, placement, and compaction.
3. Deep fill placement and rock slope protection.
4. Cut and fill slope grading.
5. Utility trench backfill placement and compaction.
6. Retaining wall backfill.
7. Retaining wall drainage.
8. Surface water drainage.
9. Expansive soil mitigation (if appropriate).
10. Temporary construction dewatering methods.
11. Subdrain recommendations (if appropriate).

Structural Improvements

1. Seismic design parameters (2016 CBC)
2. Foundation types and minimum embedment depths.
3. Allowable soil bearing capacity.
3. Foundation soil friction coefficients.

4. Lateral earth pressures for foundation and retaining wall design.
5. General construction recommendations for slabs-on-grade.
6. Retaining wall design criteria.
7. Typical pavement sections based on R-value results and typical traffic indices.

The reports will include a site plan showing the approximate locations of exploratory borings/trenches and prominent surface features. The report appendices will present the exploratory boring/trench logs and laboratory test data.

TASK 2 – GEOTECHNICAL ENGINEERING REVIEW OF SURFACE FEATURES

NV5 will perform a geotechnical engineering review of near-surface mine features identified by Rise Gold Corporation. We understand that Rise Gold Corporation will provide historical maps and data and will describe the features with respect to proposed underground mining operations.

The geotechnical engineering review will include surface reconnaissance and document review. Although we do not anticipate that subsurface investigation will generally be necessary, this may change depending upon the specific characteristics of each feature.

NV5 will prepare a summary letter providing an opinion regarding geotechnical conditions associated with the surface features and, if necessary, recommendations for mitigation and/or monitoring.

If mitigation measures include engineered physical closure, NV5 will provide an engineered closure plan and specifications. We will be able to provide engineering consultation and testing during physical closure construction and a to assist you and/or your contractor and summarize our visits in field reports. Upon completion of each closure, we will provide a summary letter documenting the closure work and including our field reports.

ADDITIONAL SERVICES

Review of Plans and Specifications

NV5 should be retained to review the plans and specifications for the development project, when available, to confirm that the findings of our geotechnical engineering investigation are incorporated into the project geotechnical design. Prior to securing a permit, the local building official may require this plan conformance review.

Construction Observation and Testing

The geotechnical engineering recommendations presented in our reports must be validated by NV5 during construction. The purpose of our construction observation and testing is to verify subsurface conditions and confirm that the project is constructed in accordance with the geotechnical engineering recommendations presented in our reports and in the project plans and specifications.

ASSUMPTIONS AND CLIENT RESPONSIBILITIES

This proposal is based on the following assumptions:

- The client will provide NV5 with authorization to access the site.

- NV5 will mark the Brunswick Site for USA prior to performing the subsurface investigation. The client will provide information regarding the location of existing onsite private utilities. Although reasonable care will be used during our investigation, the client understands that unmarked underground utilities may be damaged. NV5 will not be responsible for repair of utilities that were not marked or were improperly marked prior to the investigation. If requested, we can retain a private utility locating service for an additional fee.
- Upon completion of each task, a PDF digital copy of the reports or design sheets will be provided to the client and/or the client’s engineers and architects.
- Client meetings, report revisions and consultation services following report submittals are not included in the fee estimate but can be provided on a time and materials basis at the client's request.
- This proposal and our associated fee are based on the use of the attached terms and conditions.

FEES

Task 1 – Design-Level Geotechnical Engineering Investigation

NV5 will perform Task 1, Design-Level Geotechnical Engineering Investigation, on a lump sum basis as described below.

<u>Site</u>	<u>Fee</u>
Brunswick Industrial Site.....	\$
<u>Centennial Industrial Site</u>	<u>\$</u>
Total Fee	\$

Billing will be monthly on a percent complete basis and terms of payment are net 30 days. Full payment is due upon completion of the work and issuance of the report. The cost associated with this scope of service is valid for a period of 60 days from the date of this proposal.

We request a retainer in the amount of \$ that will be applied to the subcontracted exploration services. The remainder of the retainer will be applied to the final invoice upon project completion.

Task 2 – Geotechnical Engineering Review of Surface Features

NV5 will perform Task 2, Geotechnical Engineering Review Of Surface Features, on a time and expense basis according to the attached 2019 Fee Schedule. Our estimated fee for Task 2 is \$. Billing will be monthly according to the fee schedule.

SCHEDULE

We have tentatively scheduled the drill rig for October 4, 2019. We can typically provide verbal preliminary design recommendations within one to two weeks of our field investigation. We anticipate the geotechnical reports can be issued within six weeks of the field investigation.

If we encounter field conditions that may require additional investigation or otherwise impact our proposed schedule, we will contact you promptly to discuss.

AUTHORIZATION TO PROCEED

If this proposal is acceptable, please review and sign the attached agreement for engineering services and return one copy to our Nevada City office with a retainer of \$9,000 as our authorization to proceed.

Thank you for the opportunity to provide this proposal. If you have any questions, please contact our office.

Sincerely,

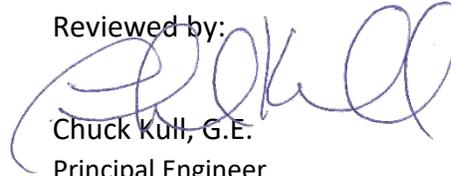
NV5

Prepared by:



Daniel Vieira, P.G.
Project Geologist

Reviewed by:



Chuck Kull, G.E.
Principal Engineer

Attached: Agreement for Geotechnical Engineering Services
2019 Fee Schedule

Copy: PDF to Rise Gold Corporation /Attn: Ben Mossman, ceo@risegoldcorp.com
PDF to Rise Gold Corporation /Attn: Tessa Brinkman, tbrinkman.peng@gmail.com

F:\1 Projects\5279 Idaho-Maryland Mine\02 Geotechnical\Proposal\5279.02 NV5 Proposal for Geotechnical Services, Idaho-Maryland Mine.docx

APPENDIX B

Important information about your Geotechnical engineering report
(Included with Permission of GBA, copyright 2016)

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be, and, in general, if you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying it.* A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may

perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old*.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration*. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists*.



Telephone: 301/565-2733

e-mail: info@geoprofessional.org www.geoprofessional.org

APPENDIX C

Previous Reports

RECEIVED
NOV 22 1993

ENVIRONMENTAL HEALTH

CONTAMINANT ASSESSMENT
of the
BOUMA-ERICKSON-TOMS PROPERTY
GRASS VALLEY, CALIFORNIA

prepared for:

MARY BOUMA, ERICA ERICKSON, and WILLIAM TOMS
P.O. Box 2403
Grass Valley, California 95945

prepared by:

VECTOR ENGINEERING, INC.
12438 Loma Rica Drive, Ste. C
Grass Valley, CA 95945

November 1993
Job. No. 901085.01

TABLE OF CONTENTS

INTRODUCTION	1
EXECUTIVE SUMMARY	1
SITE DESCRIPTIONS	2
Site Identification	2
Past and Current Site Activities	2
History of the Idaho-Maryland Mine	3
ENVIRONMENTAL SETTING	6
Topography of Site and Surrounding Areas	6
Geology and Soils	6
Hydrology and Hydrogeology	7
SAMPLING ACTIVITIES AND REQUIREMENTS	8
Previous Investigations	8
CURRENT INVESTIGATION	11
FIELD INVESTIGATION	12
SUBSURFACE CONDITIONS ENCOUNTERED	14
LABORATORY TESTING	15
Sample Collection	15
Analytical Testing	15
ANALYTICAL RESULTS	16
CONCLUSIONS	20
LIMITATIONS	21
REFERENCES	
APPENDICES	
PLATES	

INTRODUCTION

This report presents the results of our subsurface investigation and engineering analysis performed on the Bouma-Erickson-Toms (BET) property, part of the former Idaho-Maryland Mine holdings in Grass Valley, California. The owners of the property wish to split and sell the property; however, potential buyers have expressed concern over the potential for the presence of hazardous levels of heavy metals and cyanide in the areas previously used as tailings ponds. Vector Engineering, Inc., (Vector) was hired by the owners to sample and analyze the site soils for the constituents of concern, to provide conclusions regarding the potential for release of contaminants, and to provide recommendations for further work or closure, as appropriate. Our scope of services was limited to evaluation of potential contamination associated with the previous mining activities only, and did not include evaluation of any other potential sources of contamination which might affect this property.

EXECUTIVE SUMMARY

Field work consisting of 19 test pits provided a thorough view of the tailings materials present on the BET property. Laboratory analysis of 30 discreet samples provided an assessment of the metals concentrations both in the tailings materials and in the native soil and bedrock. Based on our field sampling and on the laboratory analyses, we believe that the bulk of the tailings materials pose no threat of release of hazardous materials. One sample at a depth of over 16 feet deep (SA 6.17) had total arsenic present at a level above its TTLC, but no soluble arsenic when analyzed by the WET procedure. It is our opinion that this one sample represents an isolated hazardous material which, because of its insoluble nature, limited extent, and considerable depth, is unlikely to pose a threat.

SITE DESCRIPTION AND HISTORY

Site Identification

The BET property occupies a portion of Section 26, T16N, R8E, Mount Diablo Baseline & Meridian and consists of 12 legal parcels comprising 124 acres. The property is approximately bounded by East Bennett Street (also shown on maps as Union Hill Road) on the south, Centennial Drive and an un-named unimproved road on the east, Idaho Maryland Road on the north, and the Grass Valley township line on the west. The property is zoned M-1, for light industrial uses, and is surrounded to the east, west, and north by similar zones. Plate 1 shows the site's location in relation to Grass Valley and nearby developments. An assessors parcel map, showing the 12 parcels included in the BET holdings is presented on Plate 2. Historical records and air photos indicate that of the 12 parcels comprising the BET property, only APN 09-550-17, which contains approximately 50 acres, was used for the deposition of tailings from the former mining activities. Our field investigation was concentrated in these tailings areas; the description of the environmental setting and past uses of the property includes all 12 parcels.

Past and Current Site Activities

Assessors Parcel Number (APN) 09-550-17 is the large interior parcel that contains the historic tailings areas. It currently is vacant land, except for the northeastern corner, which is occupied by Hap Warneke Mill, a lumber milling operation. This operation utilizes structures shown on historical maps and photos of the mine site, and uses the northern boundary of this parcel as a parking area for large equipment. The remainder of Parcel 17 is the subject of most of this report. Historical data available indicates that none of the remaining parcels were used for the deposition of tailings materials from the mine; thus the following parcels, though part of the BET holdings, were not included in our subsurface investigation.

APN 09-550-13 and -14 have been occupied by North Star Rock since 1979. This firm is actively mining the site for construction materials. Their access road traverses the northern portion of the former tailings area, generally following a branch of the former route of the Nevada County Narrow Gauge Railroad (NCNGRR). Historical maps and records indicate that these two parcels were part of the Morehouse Quartz Mine. The remains of some prospect pits and shafts are visible in the northern portion of these parcels.

APN 09-550-19, -20, -23, and 09-220-14 are narrow strips of vacant land lying between Wolf Creek on the south and Idaho-Maryland Road on the north. Historical maps do not indicate any structures or mining activities on these parcels.

APN 09-550-29 is a very small parcel of land east of Centennial Drive, which is currently paved and provides an entrance to two businesses. On historical maps this area is north of the cyanide plant and south of the main office building, and appears to have been part of the roadway or yard.

APN 09-560-02, and -08 are vacant land lying to the south of and uphill from the main tailings area, and are bordered on the north by a line through the center of Section 26. APN 09-560-05 and -10 lie directly to the south of these parcels. They are bounded on the north by the former path of the NCNGRR and on the south by Bennett Street. All four of these parcels are currently vacant land. Historical maps show several prospect pits on -02 and -08. The South Idaho Shaft was present in the southeast corner of -08. Several buildings are noted on -05 on historical maps, but their nature is not apparent. No structures or evidence of mining activity was noted on -10.

History of the Idaho-Maryland Mine

Plate 3 is a topographic map of the site, with current property boundaries superimposed. Historical photos and topographic maps define the locations of the two tailings areas fairly accurately; we have designated these as Area A and Area B. Area A covers the newer, cyanide-treated tailings, while Area B covers the older mercury-treated tailings area, parts of which have been reworked or removed. Both of these areas are shown

on Plate 3. Plate 4 is a copy of a historical photograph of the main operating area at the Idaho-Maryland Mine. This photo shows the locations of the main shaft, both mills and the tailings disposal areas.

According to historical records, the Idaho gold claim was patented in 1863. Exploration took place over the following 4 years, but actual mining did not start until 1867 under the ownership of the Idaho Quartz Mining Company. The main Idaho shaft was located near Wolf Creek on a parcel to the east of the BET property. In 1893 the Maryland mine purchased the Idaho workings, forming the Idaho-Maryland Mining Company which was active until about 1900. In 1915 the Idaho-Maryland, the Union Hill, the Brunswick, and several smaller mines were consolidated, and the Idaho-Maryland mine was reactivated. These mines operated underground, using blasting to loosen rock which was then trammed and hoisted to the surface for transportation to the mill for processing.

A twenty-stamp mill was erected near the main Idaho shaft shortly before 1920; this is the first reference to any milling and tailings production at the Idaho-Maryland site. Rock was crushed in the stamp mill and treated with mercury to recover the gold. The resulting gold-mercury amalgam was squeezed to recover as much free mercury as possible, and the gold concentrate was treated in a retort furnace to produce "pure" gold. The remaining slurry of treated waste sand was deposited in a north-draining gully along the eastern portion of Parcel 17 (Areas B1-B3 on Plate 3). Historical records indicate that from 1868 to 1926 about 106,000 tons of ore from the Idaho-Maryland were processed.

In 1936 a new ball mill was erected near the Idaho shaft. Rock was crushed in the ball mill and treated with cyanide to recover the gold. Most of the cyanide was recovered in a "scrubber" system and was reused. The gold concentrate was treated to produce "pure" gold and the slurry of treated waste sand was deposited in a pond downslope and to the west of the older waste pond (Area A on Plate 3). Tailings from the older pond were also hauled and/or pumped into the new mill and treated to obtain a greater recovery than was possible with the old mercury treatment. These reprocessed tailings were also placed in the new pond. Historical records indicate that from 1926 through 1942 about 1 million tons of ore

from the Idaho-Maryland were processed, much of it through the ball mill and cyanide plant.

The cyanide-treated waste sands, or tailings, were placed in an unlined pond with waste rock berms adjacent to Wolf Creek in the northeastern portion of Parcel 17. These berms ranged from 10 to 20 feet high, and the areal extent of the impounded tailings is estimated to be on the order of 575,000 square feet. A very rough estimate of 200,000 cubic yards of materials were originally deposited in the old mercury-treated tailings pond, most of which was then reprocessed and added to the younger pond. The pond was periodically breached and allowed to flow into Wolf Creek, so the total volume of milled tailings was greater than our estimate of the amount in storage. According to a former employee of the mine, State inspectors were on hand during the periodic breaching to inspect the waters of Wolf Creek. The quantity and fate of the material which was allowed to enter Wolf Creek is unknown.

The main Idaho shaft, both ball mills, the mercury plant and the cyanide plant were located to the east of the current BET property (Plate 4), on sites now occupied by industrial and office buildings. Mining and processing continued until World War II, when the War Act closed the majority of the mines in the area. Although the mine reopened briefly after the war, it was never successful and closed permanently in 1956. Following its closure in 1956, the Idaho-Maryland property was sold. William Ghidotti purchased the area formerly used for tailings disposal, along with the lands extending south to Union Hill Road. This property is currently owned by Mary Bouma, Ericka Erickson, and William Toms, who inherited it from Marion Ghidotti, William's widow.

From August 1988 through April 1989, the property owners leased a 5.28 acre portion of the more easterly tailings disposal area to Argo Associates. Argo excavated 7756.2 tons of tailings materials from this area and shipped them to Homestake Mining Company near Clear Lake. The tailings were run through the process mill there to extract more gold than was possible using the crude methods of the late 1800s and early 1900s.

ENVIRONMENTAL SETTING

Topography of Site and Surrounding Areas

The site is divided into quadrants by northwesterly and northerly trending ridges. Parcel 17 occupies the northeast and northwest quadrants, which slope gently to the north. Old maps indicate that several small north-draining gullies once dissected this area, but much of the original topography has been changed by the deposition and subsequent removal of mill tailings. A northerly trending ridge separates the northeast and northwest quadrants. A drainage ditch at the base of the ridge appears to channel water to the northwest. Centennial Drive, bordering the northeast quadrant, is at grade with the site adjacent to Hap Warneke's Mill, rising to about 20 feet above the site where Centennial intersects Whispering Pines Road. An east-west trending 20 foot high waste rock berm retains the former cyanide tailings on the northwestern quadrant of the site. Several 5 to 10 foot high earth berms are present in the northeastern quadrant, and appear to channel site drainage to the northwest.

Geology and Soils

The subject property is situated within the boundaries of the Sierra Nevada geomorphic province, in an area characterized by metamorphosed sedimentary, volcanic, and intrusive rock. The geologic map included in the Mineral Lands Classification of Western Nevada County shows that the western portion of Parcel 17 is underlain by pre-Tertiary serpentinized ultramafic rocks (serpentinite), while the eastern half is underlain by plutonic rocks, primarily gabbro, of Jurassic age. Northwest-striking quartz veins were common along fractures in the gabbro and serpentine. These veins contained traces of pyrite, galena,

chalcopyrite, arsenopyrite, and sphalerite as well as gold. No active faults are mapped within any of the BET property.

Based on the Soils Map of Nevada County, prepared by the USDA Soil Conservation Service, the northwest and south central portions of Parcel 17 are covered by Rock outcrop-Dubakella complex, composed of about 40 % ultrabasic rock outcrop and 50 % Dubakella gravelly loam. These soils are shallow and well-drained, with low permeability, high shrink-swell and runoff potential, and a pH of 5.6 to 7.3. The northeast quadrant is mapped as Placer Remains, waste rock and tailings. The underlying native soil is probably Sites loam or Sites very stony loam.

Hydrology and Hydrogeology

The Grass Valley area receives approximately 55 inches of precipitation yearly. Of this amount, about 90 percent occurs as rain from November through April. Runoff and shallow subsurface flow in the southern half of the site is to the south. Runoff in the northern half of the site is channeled to the western tailings area. Concrete overflow towers and riveted cast iron pipes installed in the tailings area during the mining era allow surface water to enter Wolf Creek. Some water infiltrates through the tailings sands into fractures in the underlying bedrock. Release of harmful levels of heavy metals or cyanide to Wolf Creek has not been studied. The berm at the northern end of the tailings area appears to separate the tailings area from the 500 year flood plain. The Federal Emergency Management Agency flood plain map for this area also indicates that a portion of the tailings area is in Zone C, with a minimal potential for flooding.

There is evidence of seasonal pooling of surface water in the central portion of the northeast quadrant. Cattails and reedy vegetation present in this area suggest that the soils are wet for long periods of time. Some of the pooled water may be seeping in from the east, where a former log pond is situated. This log pond partially fills with precipitation and runoff each winter, and air photos indicate a definite stream of water flowing from the log pond across the northeastern quadrant and into the northwestern tailings area.

Well logs from nearby single family domestic wells located east and southeast of the site indicate that ground water is present at elevations from 2400 to 2500 feet above sea level in fractured bedrock. These elevations are approximately 100 feet below the ground surface of the tailings impoundment area. The underground workings of the Idaho-Maryland Mine form an intricate network under the site and the surrounding area, and water is known to be present in the workings at an elevation of approximately 2500 feet above sea level. It is believed that the wells in the area encounter water located in fracture systems of the bedrock, and that the water levels in the wells may correlate with water levels encountered in the mine workings. No studies have been made in the area to verify interconnections between surface and subsurface water, or whether water levels in the wells of the area can be correlated. Sampling of the water present in the mine workings at the New Brunswick Shaft and from two discharges near the Idaho Shaft have shown that these waters do not have metals at levels above their Maximum Contaminant Levels (MCL's) for drinking water, with the exception of iron, manganese, and arsenic. Most of the wells in the area were drilled within the past 10 years and have met drinking water standards.

SAMPLING ACTIVITIES AND REQUIREMENTS

Previous Investigations

Anderson Geotechnical (now Anderson Consulting Group) performed a limited site investigation for a potential purchaser of the property in August 1989. We believe their investigation was a "fatal flaw" study, and that they sampled a limited number of locations in the northeastern portion of Parcel 17 that appeared to have the greatest potential for hazardous concentrations of heavy metals, based on surface appearance. No report was issued, but the property owners obtained a copy of an air photo with the sampling locations indicated on it, as well as copies of the analytical results. Anderson's sampling and analysis program revealed traces of cyanide and total concentrations of six heavy metals that ranged from 6 to 139 times their Soluble Threshold Concentration Limits (STLC). Their sampling locations are shown on Plate 6, and copies of their analytical results are included in the

Appendix A at the end of our report.

In June through August of 1990, Vector performed further investigation of the site in order to provide better definition of the extent of soils that contain potentially hazardous levels of heavy metals. Drilling and core sampling took place along the axis of the northwestern tailings impoundment mapped from recent and historic photos. Backhoe test pits were excavated more or less along the axis of the northeastern tailings area, near the area previously sampled by Anderson Geotechnical. The test pits, with total depths ranging between 6 and 12 feet, did not encounter any water. Selected soil samples were analyzed for total concentrations of the 17 CAM metals. No analyses for cyanide were performed. Sampling locations are shown on Plates 5 and 6, and copies of the analyses are included in Appendix B. The following table summarizes the results from previous sampling events.

TABLE 1
 SUMMARY OF ANALYTICAL RESULTS, TOTAL METALS CONCENTRATIONS
 (FROM ANDERSON AND FROM EARLIER VECTOR WORK)

Sample/Analyte	As	Cr	Cu	Hg	Ni	Pb	CN
HS 1 @ 4.5'	ND ¹	218 ²	47	ND	144	ND	NA ³
HS 2A @ 6'	292	349	69	3.8	281	115	NA
HS 2B @ 11.5'	ND	383	83	ND	222	ND	NA
HS 3 @ 10'	ND	119	170	ND	193	ND	NA
AG Comp. Ppt.	40.6	75.5	140	2.9	169	162	1.07
AG 2A-2B	132	387	158	2.35	324	91	2.01
AG 4B	254	166	1430	7.25	414	696	0.17
AG 5A-5B	128	166	639	3.85	302	364	0.45
AG 3A-3B/1A-1B	88	149	294	5.9	232	342	2.2
DH 1 @ 5.5'	16	40	14	ND	26	14	NA
DH 2 @ 15'	12	261	63	ND	205	ND	NA
DH 3 @ 6'	20	38	57	ND	49	24	NA
DH 4 @ 4'	ND	18	48	ND	23	ND	NA
DH 4 @ 11'	33	110	86	ND	269	15	NA
TTLC	500	2500	2500	20	2000	1000	NA

- Notes: 1. ND = Non Detectable
 2. All values in mg/kg
 3. NA = Not Applicable
 4. HS and DH samples obtained by Vector Engineering, AG samples by Anderson Geotechnical. Comp. Ppt. is a composite of the white precipitate found on the surface in the area of their study, exact locations unknown. Depths of Anderson's samples are also unknown.

CURRENT INVESTIGATION

Strategy and Objectives

The two tailings areas were chosen as the focus of our investigation because they were thought to potentially contain elevated levels of heavy metals and cyanide. The objective of this study was to evaluate the levels of cyanide and heavy metals present within the two former tailings areas, and assess if levels of metals and cyanide are significantly higher than in native materials. Our scope of work was intended to define the areas affected by elevated levels of heavy metals, as well as the concentrations within those areas.

A workplan outlining our scope of work, sampling objectives, and proposed analytical testing was provided to Mr. Tracy Gidel of the Nevada County Department of Environmental Health (NCDEH), who forwarded a copy to the California Department of Toxic Substance Control (DTSC), for their review as well. Per the request of DTSC and NCDEH, all samples were analyzed for pH and total concentrations of arsenic, chromium, copper, mercury, nickel, and lead, and five samples were analyzed for cyanide as well. In addition, a complete metal scan using EPA 3050 was performed on four samples from the cyanide-treated tailings (Area A) and on four samples from the mercury-treated tailings (Area B).

Actual field location of seven test pits on the site are different from those presented in the workplan, due to inaccessibility, grid intersection occurring on a steep hill side, in roads, or within undisturbed areas. One test pit in the southern portion of Area B was eliminated because of inaccessibility and the conviction that it was within undisturbed ground, and one test pit was added to Area A to more fully characterize the tailings.

FIELD EXPLORATION

In order to systematically cover the area known or suspected to include mill tailings, we superimposed a grid system with a spacing of 600 feet along an east-west direction by 300 feet in a north-south direction in Area A and 400 feet along an east-west direction by 200 feet along a north-south direction in Area B. Test pits were located at the nodes. Test pit locations in Area A were laid out with a compass and tape, using the northeast property corner of Parcel 13 as a reference. Test pit locations in Area B used the southeast corner of Hap Warneke's mill building as a reference, and were laid out with a compass and either a tape or pacing. This procedure yielded 6 potential sample locations in Area A and 13 potential sample locations in Area B. In order to provide another test pit in the area of most surface disturbance a seventh test pit was excavated in Area A. One soil sample was also obtained at the outlet of the overflow pipe from tailings Area A to evaluate the quality of the sediments discharged into Wolf Creek. In addition, one soil sample was collected from an undisturbed part of the hillside located southwest of the tailings area to provide a baseline for natural background metals levels.

Area A

Using a backhoe with a maximum reach of 17 feet, seven test pits were excavated in Area A. These test pits, ranging in depth from 2 to 17 feet, were logged by our staff geologist, and samples were obtained from near-surface, mid-depth in the tailings unless the tailings were very thin, and in native soil, if encountered, in each. Locations of the seven test pits, SA-1 through SA-7, are shown on Plate 5, and their logs are presented as Plates 7 through 10.

Area B

Most of the mercury-treated tailings were removed from Area B, recycled through the cyanide circuit, and placed in Area A during the later years of operation of the Idaho Maryland. Those that remained were later sold for reprocessing at the

Homestake Mine. Limited soil analyses by Anderson and Vector indicated that potentially hazardous levels of heavy metals may be present in some locations in Area B.

Area B has been subdivided into three Sub-areas: B-1, the northernmost, which was the staging area for removal of most of the tailings; B-2, part of which has had tailings removed, and part of which still appears to have tailings present; and B-3, which appears to be native soil, perhaps formerly overlain by tailings. Areas B-1 and B-2 have been the subject of previous studies by both Anderson Geotechnical and Vector. Both studies indicated that elevated levels of heavy metals were still present after the removal of tailings for reprocessing.

Three test pits, SB-1 through -3, were excavated in Area B-1, which covers approximately 3.2 acres. These test pits ranged from 7 to 9 feet deep, and samples were taken at 3 to 4 feet below the surface in each, as well as at the base, where possible.

Area B-2 covers approximately 10 acres and had five sampling locations, Sb-4, -5, -6, -7, and -8. These test pits ranged in depth from 3.5 to 7 feet. Two samples, one near surface and one near the base, were obtained in each of these test pits.

Based on field observations, most of Area B-3 appears to have had all tailings removed during reprocessing of the mercury-treated tailings through the cyanide plant while the mine was in operation, or not to have had tailings deposited in it at all. Five sample locations had been planned for this area. The southwesternmost one (SB-12) was not excavated, primarily due to lack of access. The southeasternmost test pit (SB-13) encountered refusal on bedrock at less than six inches; no test pit log was prepared, nor was a sample obtained. The remaining three excavations (SB-9, -10, and -11) were shallow, with depths ranging from 2 to 6 feet. Soil samples from these three test pits were obtained from depths of 2 to 2.5 feet and 5 feet.

Thick brush and intervening drainage berms in the southern portion of Area B made location and access difficult, thus some test pits required relocation. Test pit locations in Area B are shown on Plate 6; logs of the eleven test pits are presented on Plates 11 through 16.

SUBSURFACE CONDITIONS ENCOUNTERED

Area A

Earlier investigation in a limited portion of Area A had indicated that the depth of the tailings varied from 10 to 14 feet. Our test pits encountered tailings depths of as little as 10 inches in Test Pit SA-2 to over 17 feet in SA-6, the maximum depth explored. The depths correlate fairly well with the original topography, forming an "L" shape with its long leg trending east-west and its short leg along a former north-trending gully. Also as expected, the tailings consisted of grey, thinly laminated clays, silts and sands. Native brown sandy silt or decomposed to hard serpentine bedrock was encountered below the tailings in five of the test pits. SA-6, located near the eastern end of the berm containing the tailings, encountered tailings through its entire depth of 17 feet. We estimate that, based on the height of the berm above the north access road, tailings probably extend another 3 feet in depth. The three test pits in the southern half of Area A, SA-1, -2, and -3, encountered bedrock at five feet or less.

Area B

In Area B-1 all three test pits encountered moderately weathered bedrock at depths of 7 to 9 feet. The overlying material appeared to be a mix of mine waste rock and finer tailings sands.

Test pit depths in Area B-2 ranged from 3.5 to 7 feet, all bottoming in decomposed serpentine. A thin layer, 1.5 to 3 feet thick, of tailings overlying native soil was encountered in each of the test pits. Although a few test pits in Area B-2 encountered wet soils near the bedrock interface no free water was observed; consequently no water samples were obtained.

Two of the four test pits in Area B-3, SB-9 and -11, appeared to have a very thin layer of grey mill tailings at the surface, encountering brown native soils at depths of 2.5 to 4 feet. SB-10 was excavated in an area of very shallow native soil overlying bedrock, and SB-13 encountered bedrock at six inches below the surface.

LABORATORY TESTING

Sample Collection

All personnel present on the site had received OSHA 40 Hour training, and a Site Safety Plan was prepared and submitted for NCDEH's approval prior to work on-site. Samples were collected by a staff level professional with over 2 years experience in environmental sampling. A stainless steel scoop was used to collect soil samples and place them in clean glass jars prepared and provided by the analytical laboratory. The scoop was cleaned between samples by using TSP and water, followed by two rinses, first with clear water and then with deionized water. Samples were stored and shipped in a chilled and insulated container, accompanied by appropriate chain-of-custody papers to Nevada Environmental Laboratories, California certification number 1707.

Analytical Testing

A total of 30 samples from the site were analyzed for pH and total metals. Following the receipt of the total metals results, seven of these samples with the highest values of metals were analyzed for their soluble metals content using the California Waste Extraction (WET) Test, using deionized water.

Three samples from Area A were analyzed for the CAM 17 metals, 10 for arsenic, chromium, copper, mercury, lead, and nickel, four for total cyanide, and 13 for pH. Five bedrock or native soil samples were held pending analytical results from overlying material. Two samples from Area B-1 were analyzed for the 17 CAM metals, and one for arsenic, chromium, copper, mercury, lead, and nickel. All three were analyzed for pH as well. Eight samples in B-2 were analyzed for pH, two were analyzed for the 17 CAM metals, and six were analyzed for the six metals listed previously. Three samples in B-3 were analyzed for pH, one sample was analyzed for the 17 CAM metals, and two for the six metals listed previously.

ANALYTICAL RESULTS

A summary of the analytical results for total metals and pH in Areas A and B are presented in Tables 2 and 3, respectively. Table 4 summarizes the results of the soluble metals content for the seven samples analyzed. Results of the total cyanide analyses are presented in Table 5; none of the five samples tested had detectable cyanide. Copies of all the analytical laboratory data are included in Appendix C.

TABLE 2
TAILINGS AREA A - SUMMARY OF RESULTS FOR TOTAL METALS ANALYSES

Analyte	Sample Number (SA-)															T ² T L C
	1.2 ¹	2.2	3.1	4.2	4.65	4.10	5.2	5.8	6.2	6.8	6.17	7.2	7.8	Sf-1	Sf-2	
Sb					5.0 ³		ND ⁴						ND			500
As	7.5	ND	10.0	ND	27.0	ND	6.5	136	168	79.5	648	ND	6.8	7.6	200	500
Ba					30.6		6.7						25.5			10,000
Be					1.0		.31						.44			75
Cd					ND		ND						.80			100
Cr	93.5	25.4	53.5	74	580	715	69.8	385	410	217	278	73	80.5	900	130	2,500
Co					59		14.2						16			8,000
Cu	56.5	67.5	31.4	23.2	78	59.5	35.4	32	224	14	168	19.7	31.4	45	230	2,500
Pb	17.7	ND	4.4	12.3	5.5	ND	4.6	13	172	ND	127	10	21.4	ND	ND	1,000
Hg	.69	.11	.11	.13	ND	ND	.25	1.2	12.4	.38	4.4	1.1	1.9	ND	2.6	20
Mo					4.2		3						6.2			3,500
Ni	56	144	26	33.8	400	255	43.2	249	352	176	292	33	40.2	2,100	440	2,000
Se					ND		ND						ND			100
Ag					ND		ND						ND			500
Th					33.1		5.8						ND			700
Vn					29.8		46.3						62.0			2,400
Zn					42.5		41.3						81.0			5,000
pH ⁵	8.5	7.6	8.6	8.2	7.1	7.7	8.1	8.2	7.9	8.3	8.4	8.3	8.0	7.4	7.6	

Handwritten notes on the right side of the table, including "1400", "215", "8,000", and "1000".

- Notes: 1) Sample Numbers assigned by test pit number and depth; e.g. 1.2 is the sample at 2 feet deep in test pit SA-1. SF-1 is the background sample, SF-2 is the Area A outfall sample.
 2) TTLC = Total Threshold Concentration Limit
 3) All metals values in mg/kg, equivalent to parts per million (ppm). Those marked in bold have total values greater than 10 x the STLC value.
 4) ND = Not Detected
 5) pH is unitless

TABLE 3
TAILINGS AREA B - SUMMARY OF RESULTS FOR TOTAL METALS ANALYSES

Analyte	Sample Number (SB-)															T ² T L C
	1.3 ¹	2.3	2.7	3.4	4.1	4.3	5.3	6.2	7.2.5	7.4.5	8.2.5	8.4.5	9.2.5	10.2	11.2.5	
Sb	ND ⁴	ND			ND						ND		ND			500 ³
As	6.0	ND	60	72.5	ND	ND	ND	7.6	ND	500						
Ba	6.0	38.4			10.9						5.4		6.2			10,000
Be	.32	.32			.36						.45		.41			75
Cd	ND	ND			ND						ND		ND			100
Cr	68.0	348	250	373	379	625	352	740	980	190	1160	254	735	282	740	2,500
Co	13.5	35			29						32.2		33.8			8,000
Cu	36.8	91	39	25.9	44.8	22.4	144	49.6	38.8	58	39	62	46.9	8.3	63	2,500
Pb	4.0	ND	ND	ND	20.4	ND	ND	30.8	19.6	ND	15.6	ND	34.4	ND	21	1,000
Hg	.21	.30	.17	.44	1.3	.13	ND	2.8	2.8	.16	2.8	.54	.26	ND	.12	20
Mo	2.6	4.1			5.9						6.6		16			3,500
Ni	40.2	126	102	241	296	120	112	466	535	58.5	687	186	575	69	429	2,000
Se	ND	ND			ND						ND		ND			100
Ag	ND	ND			2.4						2.0		3.0			500
Th	5.3	17			23.6						67		58.5			700
Vn	45.8	86			56						78.5		70			2,400
Zn	42.5	34.5			49.2						58		51.5			5,000
pH ⁵	7.4	5.9	6.6	7.6	7.8	6.4	5.3	7.9	8.6	7.7	7.8	7.3	7.3	7.4	8.3	

- tes: 1) Sample Numbers assigned by test pit number and depth; e.g. 1.3 is the sample at 3 feet deep in test pit SB-1.
2) TTLC = Total Threshold Concentration Limit
3) All metals values in mg/kg, equivalent to parts per million (ppm). Those marked in bold have total values greater than 10 x the STLC value.
4) ND = Not Detected
5) pH is unitless



**TABLE 4
SUMMARY OF RESULTS OF SOLUBLE METALS ANALYSES**

Analyte	Sample							STLC
	SA 4.1	SA 4.6.5	SA 5.8	SA 6.2	SA 6.17	SB 7.2.5	SB 8.2.5	
As			ND ²	ND	ND	ND		5.0 ¹
Cr	ND	ND		ND	ND	ND	ND	5
Cu				ND				25
Pb				ND	ND			5
Hg				0.0011	ND			0.2
Ni	ND	ND		ND	ND	ND	ND	20

- NOTES:1. All values in milligrams per liter (mg/l)
2. ND = not detected

**TABLE 5
RESULTS OF TOTAL CYANIDE ANALYSES**

Sample Number	Cyanide Concentration
SA 4.2	Not Detected
SA 5.8	Not Detected
SA 6.17	Not Detected
SA 7.8	Not Detected
SF 2	Not Detected

The total arsenic concentration in one sample at 17 feet deep in SA-6 was 648 mg/kg, which is above its TTLC of 500; the material at this depth is therefore hazardous. None of the remaining 29 samples submitted for analysis had total metal concentrations exceeding TTLC values. Total concentrations of arsenic, chromium, copper, lead, mercury, and nickel were above 10 times their STLCs in some samples, total thorium concentrations were up to 8 times the STLC value, and total vanadium concentrations were up to 3 times its STLC value in some samples. All other metals concentrations ranged from non-detectable to below STLC values.

Because total metals concentrations did not exceed TTLC values, the tailings are not classified as hazardous materials. Because their total metals exceeded STLC values, however, their solubility and potential to degrade ground water must be assessed. No metals exceeded their STLC values when analyzed with the WET procedure; all but one were below the detection limits for the test.

All but four of the samples had pH levels that were in the basic range (greater than 7.0). The four samples which had a pH below 7 were either native soil or bedrock samples. The net acid generating potential (NAGP) was determined for one tailings sample whose pH was the lowest of the seven samples chosen. This sample yielded a ratio of neutralization potential to acid generating potential of 5, indicating that the tailings materials are non-acid generating.

Native soils exhibited background levels of chromium and nickel as high as or higher than those from samples of the tailings.

CONCLUSIONS

Based on the field sampling and analytical results, it is our opinion that the mill tailings located on the BET property can be classified as non-hazardous. With the exception of arsenic in one deep sample, none of the constituents analyzed from the tailings materials were present at levels above their TTLC. The one sample in which arsenic exceeded its

TTLC had no detectable arsenic when analyzed by the WET procedure. Given the low potential for acid generation and the low to non-detectable levels of soluble metals, the potential for the tailings materials on this site to negatively impact surface or ground water is unlikely.

It is our opinion that the high level of arsenic in SA 6.17 is an isolated point. While we cannot say for certain that there are no other points in the tailings where such a high level may be found, we believe this to be unlikely based on our systematic grid of the area. We do not believe that any further work on this site is necessary, and hereby ask for a "No Further Action" status.

LIMITATIONS

This report was prepared in accordance with generally accepted engineering and geologic practices applicable at the time of preparation. The findings and conclusions presented in this report are based upon our field observations, results of limited selected sampling and laboratory analyses, and review of appropriate literature. They are specific for this site and for this client, and may not be expanded to include the greater areas beyond this site. Vector Engineering, Inc. makes no other warranties, expressed or implied, as to the professional advice provided in this report.

VECTOR ENGINEERING, INC.

The work described herein was performed under the direct Supervision of a State of California Registered Geologist and Environmental Assessor:


Peggy A. Smith, R.G., R.E.A.
Registered Geologist No. 5111

Date: 11/19/93

REFERENCES

Soil Survey of Nevada County, USDA/Soil Conservation Service, 1975

Monthly Normals of Temperature, Precipitation, and Heating and Cooling Degree Days
1951- 80, NOAA, 1982

Mines and Mineral Resources of Nevada County, Errol MacBoyle, California State Mining
Bureau, 1919, p. 166-167, 176-177, 185-191.

The Gold Quartz Veins of Grass Valley, California, W. D. Johnston, Jr., USGS Prof Paper
194, 1940, p. 94-96.

Jack Clark, former mine safety engineer and underground supervisor for the Idaho-Maryland
Mining Company, personal communication, newspaper articles, and historical photos.

Analytical data from Eureka Laboratories, courtesy of Anderson Consulting Group (no report
issued)

TTLIC/CAM METALS, EPA Method 6010

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 89-08-063
Hazardous Waste Testing
Certification: 108

CLIENT: ANDERSON GEO
CLIENT ID.: Comp 1A,1B,3A,3B-White PPT
SAMPLE LOCATION: -

PROJECT NO.: 2396-66
DATE RECEIVED: 08/08/89
DATE EXTRACTED: 08/09/89
DATE COMPLETED: 08/11/89

	<u>CONCENTRATION</u> <u>[mg/Kg (ppm)]</u>	<u>DETECTION LIMIT</u> <u>[mg/Kg (ppm)]</u>
Silver	1.1	1.0
Arsenic	40.6	3.0
Barium	3.4	0.2
Beryllium	<0.5	0.5
Cadmium	<2.0	2.0
Cobalt	50.2	2.0
Chromium	75.5	1.0
Copper	140	1.0
Molybdenum	9.7	2.0
Nickel	169	3.0
Lead	162	4.5
Antimony	<4.0	4.0
Selenium	8.3	5.0
Thallium	56.6	2.0
Vanadium	17.9	1.0
Zinc	3.14	1.0

(1) this D/L for soil is based on the dilution factor of 100.

Jean Hsu August 23, 1989
Chemist Date

TTL/CAM METALS, EPA Method 6010

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 89-08-063
Hazardous Waste Testing
Certification: 108

CLIENT: ANDERSON GEO
CLIENT ID.: Comp 1A,1B,3A,3B-White PPT
SAMPLE LOCATION: -

PROJECT NO.: 2396-66
DATE RECEIVED: 08/08/89
DATE EXTRACTED: 08/09/89
DATE COMPLETED: 08/11/89

	<u>CONCENTRATION</u> <u>[mg/Kg (ppm)]</u>	<u>DETECTION LIMIT</u> <u>[mg/Kg (ppm)]</u>
Silver	1.1	1.0
Arsenic	40.6	3.0
Barium	3.4	0.2
Beryllium	<0.5	0.5
Cadmium	<2.0	2.0
Cobalt	50.2	2.0
Chromium	75.5	1.0
Copper	140	1.0
Molybdenum	9.7	2.0
Nickel	169	3.0
Lead	162	4.5
Antimony	<4.0	4.0
Selenium	8.3	5.0
Thallium	56.6	2.0
Vanadium	17.9	1.0
Zinc	3.14	1.0

(1) this D/L for soil is based on the dilution factor of 100.

Jean Hsu August 23, 1989
Jean Hsu Date
Chemist

TTL/CAM METALS, EPA Method 6010

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 89-08-063
Hazardous Waste Testing
Certification: 108

CLIENT: ANDERSON GEO
CLIENT ID.: Comp 2A,2B
SAMPLE LOCATION: -

PROJECT NO.: 2396-66
DATE RECEIVED: 08/08/89
DATE EXTRACTED: 08/09/89
DATE COMPLETED: 08/11/89

	<u>CONCENTRATION</u> <u>[mg/Kg (ppm)]</u>	<u>DETECTION LIMIT</u> <u>[mg/Kg (ppm)]</u>
Silver	2.0	1.0
Arsenic	132	3.0
Barium	21.1	0.2
Beryllium	0.8	0.5
Cadmium	<2.0	2.0
Cobalt	47.6	2.0
Chromium	387	1.0
Copper	158	1.0
Molybdenum	8.3	2.0
Nickel	324	3.0
Lead	91.4	4.5
Antimony	5.5	4.0
Selenium	8.4	5.0
Thallium	164	2.0
Vanadium	80.9	1.0
Zinc	62.2	1.0

(1) this D/L for soil is based on the dilution factor of 100.

Jean Hsu August 23, 1989
Chemist Date

TTL/CAM METALS, EPA Method 6010

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 89-08-063
Hazardous Waste Testing
Certification: 108

CLIENT: ANDERSON GEO
CLIENT ID.: 4B
SAMPLE LOCATION: -

PROJECT NO.: 2396-66
DATE RECEIVED: 08/08/89
DATE EXTRACTED: 08/09/89
DATE COMPLETED: 08/11/89

	<u>CONCENTRATION</u> <u>[mg/Kg (ppm)]</u>	<u>DETECTION LIMIT</u> <u>[mg/Kg (ppm)]</u>
Silver	8.1	1.0
Arsenic	254	3.0
Barium	7.6	0.2
Beryllium	<0.5	0.5
Cadmium	<2.0	2.0
Cobalt	177	2.0
Chromium	166	1.0
Copper	1430	1.0
Molybdenum	18.5	2.0
Nickel	414	3.0
Lead	696	4.5
Antimony	14.5	4.0
Selenium	45.0	5.0
Thallium	650	2.0
Vanadium	49.2	1.0
Zinc	363	1.0

(1) this D/L for soil is based on the dilution factor of 100.

Jean Hsu August 23, 1989
Chemist Date

TTLIC/CAM METALS, EPA Method 6010

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

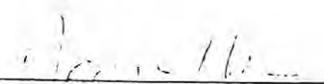
Order No: 89-08-063
Hazardous Waste Testing
Certification: 108

CLIENT: ANDERSON GEO
CLIENT ID.: Comp 5A, 5B
SAMPLE LOCATION: -

PROJECT NO.: 2396-66
DATE RECEIVED: 08/08/89
DATE EXTRACTED: 08/09/89
DATE COMPLETED: 08/11/89

	<u>CONCENTRATION</u> <u>[mg/Kg (ppm)]</u>	<u>DETECTION LIMIT</u> <u>[mg/Kg (ppm)]</u>
Silver	4.9	1.0
Arsenic	128	3.0
Barium	5.9	0.2
Beryllium	<0.5	0.5
Cadmium	<2.0	2.0
Cobalt	88.4	2.0
Chromium	166	1.0
Copper	639	1.0
Molybdenum	10.2	2.0
Nickel	302	3.0
Lead	364	4.5
Antimony	10.0	4.0
Selenium	25.1	5.0
Thallium	345	2.0
Vanadium	39.8	1.0
Zinc	173	1.0

(1) this D/L for soil is based on the dilution factor of 100.



Jean Hsu
Chemist

August 23, 1989

Date

TTL/CAM METALS, EPA Method 6010

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

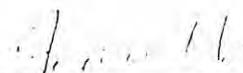
Order No: 89-08-063
Hazardous Waste Testing
Certification: 108

CLIENT: ANDERSON GEO
CLIENT ID.: Comp 1A,1B,3A,3B-Soil
SAMPLE LOCATION: -

PROJECT NO.: 2396-66
DATE RECEIVED: 08/08/89
DATE EXTRACTED: 08/09/89
DATE COMPLETED: 08/11/89

	<u>CONCENTRATION</u> <u>[mg/Kg (ppm)]</u>	<u>DETECTION LIMIT</u> <u>[mg/Kg (ppm)]</u>
Silver	2.9	1.0
Arsenic	88.3	3.0
Barium	5.6	0.2
Beryllium	<0.5	0.5
Cadmium	<2.0	2.0
Cobalt	60.6	2.0
Chromium	149	1.0
Copper	294	1.0
Molybdenum	11.8	2.0
Nickel	232	3.0
Lead	342	4.5
Antimony	4.5	4.0
Selenium	15.5	5.0
Thallium	210	2.0
Vanadium	36.0	1.0
Zinc	43.3	1.0

(1) this D/L for soil is based on the dilution factor of 100.



Jean Hsu
Chemist

August 23, 1989

Date

TTL/CAM METALS, EPA Method 6010

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 89-08-063
Hazardous Waste Testing
Certification: 108

CLIENT: ANDERSON GEO
CLIENT ID.: Method Blank
SAMPLE LOCATION: -

PROJECT NO.: 2396-66
DATE RECEIVED: 08/08/89
DATE EXTRACTED: 08/09/89
DATE COMPLETED: 08/11/89

	<u>CONCENTRATION</u> [mg/Kg (ppm)]	<u>DETECTION LIMIT</u> [mg/Kg (ppm)]
Silver	<1.0	1.0
Arsenic	<3.0	3.0
Barium	<0.2	0.2
Beryllium	<0.5	0.5
Cadmium	<2.0	2.0
Cobalt	<2.0	2.0
Chromium	<1.0	1.0
Copper	<1.0	1.0
Molybdenum	<2.0	2.0
Nickel	<3.0	3.0
Lead	<4.5	4.5
Antimony	<4.0	4.0
Selenium	<5.0	5.0
Thallium	<2.0	2.0
Vanadium	<1.0	1.0
Zinc	<1.0	1.0

Jean Hsu
Chemist

August 23, 1989
Date

TTL/CAM METALS, EPA Method 6010

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 89-08-063
Hazardous Waste Testing
Certification: 108

CLIENT: ANDERSON GEO
CLIENT ID: Matrix Spike Recovery

PROJECT NO.: 2396-66
DATE RECEIVED: 08/08/89
DATE EXTRACTED: 08/09/89
DATE COMPLETED: 08/11/89

SPIKE RECOVERY

Silver	105%
Arsenic	97%
Barium	92%
Beryllium	96%
Cadmium	90%
Cobalt	89%
Chromium	92%
Copper	95%
Molybdenum	86%
Nickel	88%
Lead	89%
Antimony	83%
Selenium	98%
Thallium	85%
Vanadium	92%
Zinc	86%

Jean Hsu
Chemist

August 23, 1989
Date

TTL/CAM METALS, EPA Method 6010

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 89-08-063
Hazardous Waste Testing
Certification: 108

CLIENT: ANDERSON GEO
CLIENT ID: Matrix Spike Recovery
Duplicate

PROJECT NO.: 2396-66
DATE RECEIVED: 08/08/89
DATE EXTRACTED: 08/09/89
DATE COMPLETED: 08/11/89

SPIKE RECOVERY

Silver	105%
Arsenic	97%
Barium	92%
Beryllium	96%
Cadmium	91%
Cobalt	89%
Chromium	92%
Copper	95%
Molybdenum	86%
Nickel	88%
Lead	89%
Antimony	83%
Selenium	99%
Thallium	86%
Vanadium	92%
Zinc	87%

Jean Hsu
Chemist

August 23, 1989
Date

CYANIDE
EPA METHOD 9010

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 89-08-063
Hazardous Waste Testing
Certification: 108

CLIENT: ANDERSON GEO
SAMPLE LOCATION: -

PROJECT NO.: 2396-66
DATE RECEIVED: 08/08/1989
DATE EXTRACTED: 08/15/1989
DATE COMPLETED: 08/16/1989

<u>SAMPLE ID.</u>	<u>CYANIDE [mg/Kg (ppm)]</u>
COMP 1A,1B,3A,3B-SOIL	2.20
COMP 1A,1B,3A,3B-WHITE PPT	1.07
COMP 2A,2B	2.01
COMP 5A,5B	0.45
4B	0.17
Method Blank	<0.01
Reagent Spike Recovery	92%
Reagent Spike Recovery Duplicate	87%

Detection Limit: 0.05 [mg/Kg (ppm)]

Scott M. Terry
Scott M. Terry August 23, 1989
Chemist Date

MERCURY
EPA METHOD 7471 (COLD VAPOR)

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 89-08-063
Hazardous Waste Testing
Certification: 108

CLIENT: ANDERSON GEO
SAMPLE LOCATION: -

PROJECT NO.: 2396-66
DATE RECEIVED: 08/08/1989
DATE EXTRACTED: 08/10/1989
DATE COMPLETED: 08/14/1989

<u>SAMPLE ID.</u>	<u>MERCURY COLD VAPOR [mg/Kg (ppm)]</u>
COMP 1A,1B,3A,3B-WHITE PPT	2.90
COMP 1A,1B,3A,3B-SOIL	5.90
COMP 2A,2B	2.35
COMP 5A,5B	3.85
4B	7.25
Method Blank	<0.05
4B Matrix Spike Recovery	86%
4B Matrix Spike Recovery	86%
Duplicate	

Detection Limit: 0.05 [mg/Kg (ppm)]

This DL is based on dilution factor of 50.

Josie Quiambao August 23, 1989
Josie Quiambao Date
Chemist



EUREKA LABORATORIES, INC.

6790 FLORIN PERKINS ROAD
SACRAMENTO, CA 95828
TEL: (916) 381-7953
FAX: (916) 381-4013

Air Pollution
Chemical Analysis,
Research & Testing
Environmental Studies
Robotics
Toxicology

August 23, 1989

Bill Welter
ANDERSON GEOTECHNICAL
631 Commerce
Roseville, CA 95678

Reference: Project No.: 2396-66
ELI Order No: 89-08-063

Dear Mr. Welter:

Eureka Laboratories, Inc. is pleased to submit a laboratory report for the subject project. This report presents analytical results for seven (7) soil samples for the following analyses:

<u>ANALYSIS</u>	<u>METHOD</u>	<u>SAMPLE ID.</u>
TTLIC/CAM Metals	EPA 6010	Composite 1A,1B,3A,3B-Soil; Composite 1A,1B,3A,3B-White PPT; Composite 2A,2B; 4B; Composite 5A,5B
Mercury	EPA 7471	Composite 1A,1B,3A,3B-Soil; Composite 1A,1B,3A,3B-White PPT; Composite 2A,2B; 4B; Composite 5A,5B
Cyanide	EPA 9010	Composite 1A,1B,3A,3B-Soil; Composite 1A,1B,3A,3B-White PPT; Composite 2A,2B; 4B; Composite 5A,5B
pH	EPA 9045	Composite 1A,1B,3A,3B-Soil; Composite 1A,1B,3A,3B-White PPT; Composite 2A,2B; 4B; Composite 5A,5B

Sincerely,
EUREKA LABORATORIES, INC.

By: Shao-Pin Yo
Shao-Pin Yo, Ph.D.
Laboratory Director

SPY/pv
Attachment



EUREKA LABORATORIES, INC.

6790 FLORIN PERKINS ROAD
SACRAMENTO, CA 95828
TEL: (916) 381-7953
FAX: (916) 381-4013

Air Pollution
Chemical Analysis,
Research & Testing
Environmental Studies
Robotics
Toxicology

August 23, 1989

Bill Welter
ANDERSON GEOTECHNICAL
631 Commerce
Roseville, CA 95678

Reference: Project No.: 2396-66
ELI Order No: 89-08-063

Dear Mr. Welter:

Eureka Laboratories, Inc. is pleased to submit a laboratory report for the subject project. This report presents analytical results for seven (7) soil samples for the following analyses:

<u>ANALYSIS</u>	<u>METHOD</u>	<u>SAMPLE ID.</u>
TTLIC/CAM Metals	EPA 6010	Composite 1A,1B,3A,3B-Soil; Composite 1A,1B,3A,3B-White PPT; Composite 2A,2B; 4B; Composite 5A,5B
Mercury	EPA 7471	Composite 1A,1B,3A,3B-Soil; Composite 1A,1B,3A,3B-White PPT; Composite 2A,2B; 4B; Composite 5A,5B
Cyanide	EPA 9010	Composite 1A,1B,3A,3B-Soil; Composite 1A,1B,3A,3B-White PPT; Composite 2A,2B; 4B; Composite 5A,5B
pH	EPA 9045	Composite 1A,1B,3A,3B-Soil; Composite 1A,1B,3A,3B-White PPT; Composite 2A,2B; 4B; Composite 5A,5B

Sincerely,
EUREKA LABORATORIES, INC.

By: Shao-Pin Yo
Shao-Pin Yo, Ph.D.
Laboratory Director

SPY/pv
Attachment



Alpha

Alpha Analytical Laboratories Inc.

860 Waugh Lane, H-1, Ukiah, California 95482

(707) 468-0401

CHEMICAL EXAMINATION REPORT

Vector Engineering, Inc.
12438 Loma Rica Drive, Suite C
Grass Valley, CA 95945
Attn: Ralph Phillips

Date Sampled: 06/14/90
Time Sampled:
Sampled By: Jeff Huggins
Date Received: 06/27/90 09:00
Sample Type: Soil

Page
1

Batch 90-0627-015 consisted of 6 Samples and 102 Tests

Sample 1 PJ# 90085 Idaho/Marylant Mine Tailings-
Brock BH - 1 10'-Composite

	Method	Results	Units	MDL
Antimony	7040	ND	mg/kg	100
Arsenic	7061	14	mg/kg	10
Barium	7080	ND	mg/kg	100
Beryllium	7090	ND	mg/kg	1
Cadmium	7130	ND	mg/kg	10
Chromium	7190	259	mg/kg	10
Cobalt	7200	ND	mg/kg	20
Copper	7210	58	mg/kg	10
Lead	7420	ND	mg/kg	10
Mercury	7471	ND	mg/kg	1
Molybdenum	7480	ND	mg/kg	50
Nickel	7520	164	mg/kg	10
Selenium	7741	ND	mg/kg	10
Silver	7760	ND	mg/kg	10
Thallium	7840	ND	mg/kg	100
Vanadium	7910	ND	mg/kg	100
Zinc	7950	46	mg/kg	10

MDL - Minimum Detection Limit

ND - None Detected

NOTES:

Bruce L. Gove
Laboratory Director

Bruce L. Gove
Date Printed: 07/18/90



alpha

Alpha Analytical Laboratories Inc.

860 Waugh Lane, H-1, Ukiah, California 95482

(707) 468-0401

CHEMICAL EXAMINATION REPORT

Vector Engineering, Inc.
12438 Loma Rica Drive, Suite C
Grass Valley, CA 95945
Attn: Ralph Phillips

Date Sampled: 06/14/90
Time Sampled:
Sampled By: Jeff Huggins
Date Received: 06/27/90 09:00
Sample Type: Soil

Batch 90-0627-015 consisted of 6 Samples and 102 Tests

Sample 2 PJ# 90085 Idaho/Marylant Mine Tailings-
Brock BH - 1 5.5' to 6.0'

Table with 5 columns: Element, Method, Results, Units, MDL. Lists elements like Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury, Molybdenum, Nickel, Selenium, Silver, Thallium, Vanadium, Zinc with their respective test results and MDL values.

MDL - Minimum Detection Limit

ND - None Detected

NOTES:

Bruce L. Gove
Laboratory Director

Signature of Bruce L. Gove
Date Printed: 07/18/90



Alpha

Alpha Analytical Laboratories Inc.

860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CHEMICAL EXAMINATION REPORT

Vector Engineering, Inc.
12438 Loma Rica Drive, Suite C
Grass Valley, CA 95945
Attn: Ralph Phillips

Date Sampled: 06/14/90
Time Sampled:
Sampled By: Jeff Huggins
Date Received: 06/27/90 09:00
Sample Type: Soil

Page
3

Batch 90-0627-015 consisted of 6 Samples and 102 Tests

Sample 3 PJ# 90085 Idaho/Marylant Mine Tailings-
Brock BH - 2 15.0' to 15.5'

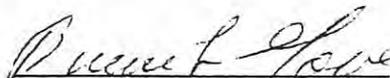
	Method	Results	Units	MDL
Antimony	7040	ND	mg/kg	100
Arsenic	7061	12	mg/kg	10
Barium	7080	ND	mg/kg	100
Beryllium	7090	ND	mg/kg	1
Cadmium	7130	ND	mg/kg	10
Chromium	7190	261	mg/kg	10
Cobalt	7200	20	mg/kg	20
Copper	7210	63	mg/kg	10
Lead	7420	ND	mg/kg	10
Mercury	7471	ND	mg/kg	1
Molybdenum	7480	ND	mg/kg	50
Nickel	7520	205	mg/kg	10
Selenium	7741	ND	mg/kg	10
Silver	7760	ND	mg/kg	10
Thallium	7840	ND	mg/kg	100
Vanadium	7910	ND	mg/kg	100
Zinc	7950	106	mg/kg	10

MDL - Minimum Detection Limit

ND - None Detected

NOTES:

Bruce L. Gove
Laboratory Director


Date Printed: 07/18/90



Alpha

Alpha Analytical Laboratories Inc.

860 Waugh Lane, H-1, Ukiah, California 95482

(707) 468-0401

CHEMICAL EXAMINATION REPORT

Vector Engineering, Inc.
12438 Loma Rica Drive, Suite C
Grass Valley, CA 95945
Attn: Ralph Phillips

Date Sampled: 06/14/90
Time Sampled:
Sampled By: Jeff Huggins
Date Received: 06/27/90 09:00
Sample Type: Soil

Page 4

Batch 90-0627-015 consisted of 6 Samples and 102 Tests

Sample 4 PJ# 90085 Idaho/Marylant Mine Tailings-
Brock BH - 3 6.0' to 6.5'

	Method	Results	Units	MDL
Antimony	7040	ND	mg/kg	100
Arsenic	7061	20	mg/kg	10
Barium	7080	ND	mg/kg	100
Beryllium	7090	ND	mg/kg	1
Cadmium	7130	ND	mg/kg	10
Chromium	7190	38	mg/kg	10
Cobalt	7200	ND	mg/kg	20
Copper	7210	57	mg/kg	10
Lead	7420	24	mg/kg	10
Mercury	7471	ND	mg/kg	1
Molybdenum	7480	ND	mg/kg	50
Nickel	7520	49	mg/kg	10
Selenium	7741	ND	mg/kg	10
Silver	7760	ND	mg/kg	10
Thallium	7840	ND	mg/kg	100
Vanadium	7910	ND	mg/kg	100
Zinc	7950	92	mg/kg	10

MDL - Minimum Detection Limit

ND - None Detected

NOTES:

Bruce L. Gove
Laboratory Director

Date Printed: 07/18/90



Alpha

Alpha Analytical Laboratories Inc. • 860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CHEMICAL EXAMINATION REPORT

Vector Engineering, Inc.
12438 Loma Rica Drive, Suite C
Grass Valley, CA 95945
Attn: Ralph Phillips

Date Sampled: 06/14/90
Time Sampled:
Sampled By: Jeff Huggins
Date Received: 06/27/90 09:00
Sample Type: Soil

Page
5

Batch 90-0627-015 consisted of 6 Samples and 102 Tests

Sample 5 PJ# 90085 Idaho/Marylant Mine Tailings-
Brock BH - 4 5.5' to 6.0'

	Method	Results	Units	MDL
Antimony	7040	ND	mg/kg	100
Arsenic	7061	ND	mg/kg	10
Barium	7080	ND	mg/kg	100
Beryllium	7090	ND	mg/kg	1
Cadmium	7130	ND	mg/kg	10
Chromium	7190	18	mg/kg	10
Cobalt	7200	ND	mg/kg	20
Copper	7210	48	mg/kg	10
Lead	7420	ND	mg/kg	10
Mercury	7471	ND	mg/kg	1
Molybdenum	7480	ND	mg/kg	50
Nickel	7520	23	mg/kg	10
Selenium	7741	ND	mg/kg	10
Silver	7760	ND	mg/kg	10
Thallium	7840	ND	mg/kg	100
Vanadium	7910	ND	mg/kg	100
Zinc	7950	70	mg/kg	10

MDL - Minimum Detection Limit

ND - None Detected

NOTES:

Bruce L. Gove
Laboratory Director

Date Printed: 07/18/90



Alpha Analytical Laboratories Inc. • 860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CHEMICAL EXAMINATION REPORT

Vector Engineering, Inc.
12438 Loma Rica Drive, Suite C
Grass Valley, CA 95945
Attn: Ralph Phillips

Date Sampled: 06/14/90
Time Sampled:
Sampled By: Jeff Huggins
Date Received: 06/27/90 09:00
Sample Type: Soil

Page
6

atch 90-0627-015 consisted of 6 Samples and 102 Tests

Sample 6 PJ# 90085 Idaho/Marylant Mine Tailings-
Brock BH - 4 11.0' to 11.5'

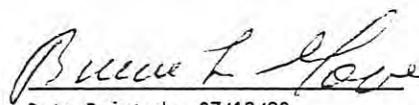
	Method	Results	Units	MDL
Antimony	7040	ND	mg/kg	100
Arsenic	7061	33	mg/kg	10
Barium	7080	ND	mg/kg	100
Beryllium	7090	ND	mg/kg	1
Cadmium	7130	ND	mg/kg	10
Chromium	7190	110	mg/kg	10
Cobalt	7200	67	mg/kg	20
Copper	7210	86	mg/kg	10
Lead	7420	15	mg/kg	10
Mercury	7471	ND	mg/kg	1
Molybdenum	7480	ND	mg/kg	50
Nickel	7520	269	mg/kg	10
Selenium	7741	ND	mg/kg	10
Silver	7760	ND	mg/kg	10
Thallium	7840	ND	mg/kg	100
Vanadium	7910	124	mg/kg	100
Zinc	7950	40	mg/kg	10

MDL - Minimum Detection Limit

ND - None Detected

NOTES:

Bruce L. Gove
Laboratory Director


Date Printed: 07/18/90

DUC-10-1
11-2-90

VECTOR ENGINEERING, INC.

12438 Loma Rica Dr., Suite C

Grass Valley, CA 95945

(916) 272-2448

SUBMITTED BY: R. PHILLIPS
 COMPANY: ALPHA ANALYTICAL LABS CONTACT: R. PHILLIPS

ADDRESS: 860 W. HUGH LANE H. 1 / K. 2 / CA PHONE: (916) 652-0145

PROJECT # 90085 PROJECT NAME IDAHO/MARSHALL MINE TAILINGS - BROCK
 ANALYSIS REQUESTED

LAB#	SAMPLE IDENTIFICATION (ID #, location, matrix)	DATE/TIME COLLECTED	# OF ITEMS	PRESERVE	EPA 6010 CUM METALS	READY FOR SOLD									
10-27-15-1	<u>BH-1 (2 1/2' BT) 10' COMPOSIT</u>	<u>6/14/90</u>	<u>1</u>		X										
10-27-15-2	<u>BH-1 5⁵ TO 6⁰</u>	<u>6/14/90</u>	<u>1</u>		X	X									
10-06-27-15-3	<u>BH-2 15⁰ TO 15⁵</u>	<u>6/14/90</u>	<u>1</u>		X	X									
10-27-15-4	<u>BH-3 6⁰ TO 6⁵</u>	<u>6/14/90</u>	<u>1</u>		X										
10-06-27-15-5	<u>BH-4 5⁵ TO 6⁰</u>	<u>6/14/90</u>	<u>1</u>		X										
10-27-15-6	<u>BH-4 11⁰ TO 11⁵</u>	<u>6/14/90</u>	<u>1</u>		X	X									

REMARKS:
IF TTLC LIMITS ARE EXCEEDED CALL TO CONFIRM W/LET TESTING
10 DAY TAT

SAMPLE RELINQUISHED BY:	DATE/TIME	RECEIVED BY:
<u>[Signature]</u>	<u>6-21-90 9:30</u>	<u>R Thomas</u>
<u>R Thomas</u>	<u>6-25-90 5:30 pm</u>	<u>[Signature] 6-27-90 0900 Alpha Labs via UPS</u>



Alpha

Alpha Analytical Laboratories Inc.

• 860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CLIENT Vector Engineering
ADDRESS 12438 Loma Rica Drive, Suite C
Grass Valley, CA 95945

DATE COLLECTED 8-13-90 / 0940
DATE IN LAB 8-16-90 / 1500
COLLECTED BY Ralph Phillips
SAMPLE TYPE Soil

ATTN: Ralph Phillips

LABORATORY NO.:
CLIENT I.D. :

90-0817-19-1
Idaho-Maryland Mine Waste-Brock
Sample HS - 1
CALIFORNIA TITLE 22 WASTE EXTRACTION TEST (TTLIC)

<u>Parameter</u>	<u>Method</u>	<u>Results</u> (mg/kg)	<u>MDL</u>	<u>Total Theshold Limit</u> <u>Concentration (TTLIC)</u> (mg/kg)
Antimony	7040	ND	50	500
Arsenic	7061	ND	10	500
Barium	7080	ND	100	10,000
Beryllium	7090	ND	1	75
Cadmium	7130	ND	10	100
Chromium	7190	218	10	2,500
Cobalt	7200	43	20	8,000
Copper	7210	47	10	2,500
Lead	7420	ND	10	1,000
Mercury	7471	ND	1	20
Molybdenum	7480	ND	50	3,500
Nickel	7520	144	10	2,000
Selenium	7741	ND	10	100
Silver	7760	ND	10	500
Thallium	7840	ND	40	700
Vanadium	7910	118	100	2,400
Zinc	7950	54	10	5,000

MDL = Minimum Detection Limit
ND = None detected

Alpha
Analytical Laboratories, Inc.

Bruce G. ... 8-31-90
LABORATORY DIRECTOR DATE



Alpha

Alpha Analytical Laboratories Inc.

860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CLIENT Vector Engineering
ADDRESS 12438 Loma Rica Drive, Suite C
Grass Valley, CA 95945

DATE COLLECTED 8-13-90 / 0955
DATE IN LAB 8-16-90 / 1500
COLLECTED BY Ralph Phillips
SAMPLE TYPE Soil

ATTN: Ralph Phillips

LABORATORY NO.:
CLIENT I.D. :

90-0817-19-2
Idaho-Maryland Mine Waste-Brock
Sample HS - 2A
CALIFORNIA TITLE 22 WASTE EXTRACTION TEST (TTL)

<u>Parameter</u>	<u>Method</u>	<u>Results</u> (mg/kg)	<u>MDL</u>	<u>Total Theshold Limit</u> <u>Concentration (TTL)</u> (mg/kg)
Antimony	7040	ND	50	500
Arsenic	7061	292	10	500
Barium	7080	ND	100	10,000
Beryllium	7090	ND	1	75
Cadmium	7130	ND	10	100
Chromium	7190	349	10	2,500
Cobalt	7200	30	20	8,000
Copper	7210	69	10	2,500
Lead	7420	115	10	1,000
Mercury	7471	3.8	1	20
Molybdenum	7480	ND	50	3,500
Nickel	7520	281	10	2,000
Selenium	7741	ND	10	100
Silver	7760	ND	10	500
Thallium	7840	ND	40	700
Vanadium	7910	ND	100	2,400
Zinc	7950	65	10	5,000

MDL = Minimum Detection Limit
ND = None detected

Alpha
Analytical Laboratories, Inc.

Ralph Phillips 8-31-90
LABORATORY DIRECTOR DATE
(J.F.)



Alpha

Alpha Analytical Laboratories Inc.

• 860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CLIENT Vector Engineering
ADDRESS 12438 Loma Rica Drive, Suite C
Grass Valley, CA 95945

DATE COLLECTED 8-13-90 / 1015
DATE IN LAB 8-16-90 / 1500
COLLECTED BY Ralph Phillips
SAMPLE TYPE Soil

ATTN: Ralph Phillips

LABORATORY NO.:
CLIENT I.D. :

90-0817-19-3

Idaho-Maryland Mine Waste-Brock

Sample HS - 2B

CALIFORNIA TITLE 22 WASTE EXTRACTION TEST (TTLIC)

<u>Parameter</u>	<u>Method</u>	<u>Results</u> (mg/kg)	<u>MDL</u>	<u>Total Theshold Limit Concentration (TTLIC)</u> (mg/kg)
Antimony	7040	ND	50	500
Arsenic	7061	ND	10	500
Barium	7080	ND	100	10,000
Beryllium	7090	ND	1	75
Cadmium	7130	ND	10	100
Chromium	7190	383	10	2,500
Cobalt	7200	25	20	8,000
Copper	7210	83	10	2,500
Lead	7420	ND	10	1,000
Mercury	7471	ND	1	20
Molybdenum	7480	ND	50	3,500
Nickel	7520	222	10	2,000
Selenium	7741	ND	10	100
Silver	7760	ND	10	500
Thallium	7840	ND	40	700
Vanadium	7910	ND	100	2,400
Zinc	7950	30	10	5,000

MDL = Minimum Detection Limit
ND = None detected

Alpha
Analytical Laboratories, Inc.

Russ Cove 8-31-90
LABORATORY DIRECTOR DATE
(S.F.)



Alpha

Alpha Analytical Laboratories Inc.

860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CLIENT Vector Engineering
ADDRESS 12438 Loma Rica Drive, Suite C
Grass Valley, CA 95945

DATE COLLECTED 8-13-90 / 1035
DATE IN LAB 8-16-90 / 1500
COLLECTED BY Ralph Phillips
SAMPLE TYPE Soil

ATTN: Ralph Phillips

LABORATORY NO.:
CLIENT I.D. :

90-0817-19-4

Idaho-Maryland Mine Waste-Brock

Sample HS - 3

CALIFORNIA TITLE 22 WASTE EXTRACTION TEST (TTLC)

<u>Parameter</u>	<u>Method</u>	<u>Results</u> (mg/kg)	<u>MDL</u>	<u>Total Theshold Limit</u> <u>Concentration (TTLC)</u> (mg/kg)
Antimony	7040	ND	50	500
Arsenic	7061	ND	10	500
Barium	7080	ND	100	10,000
Beryllium	7090	ND	1	75
Cadmium	7130	ND	10	100
Chromium	7190	119	10	2,500
Cobalt	7200	34	20	8,000
Copper	7210	170	10	2,500
Lead	7420	ND	10	1,000
Mercury	7471	ND	1	20
Molybdenum	7480	ND	50	3,500
Nickel	7520	193	10	2,000
Selenium	7741	ND	10	100
Silver	7760	ND	10	500
Thallium	7840	ND	40	700
Vanadium	7910	ND	100	2,400
Zinc	7950	43	10	5,000

MDL = Minimum Detection Limit
ND = None detected

Alpha
Analytical Laboratories, Inc.

Ralph Phillips 8-31-90
LABORATORY DIRECTOR DATE



Alpha

Alpha Analytical Laboratories Inc.

860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CALIFORNIA TITLE 22 TOTAL METALS ANALYSIS (TTLC)

<u>Analyte</u>	<u>California Title 22 Hazardous Waste Limit mg/kg</u>
Total Antimony	500
Total Arsenic	500
Total Barium	10,000
Total Beryllium	75
Total Cadmium	100
Total Chromium	2,500
Total Cobalt	8,000
Total Copper	2,500
Total Lead	1,000
Total Mercury	20
Total Molybdenum	3,500
Total Nickel	2,000
Total Selenium	100
Total Silver	500
Total Thallium	700
Total Vanadium	2,400
Total Zinc	5,000



Alpha

Alpha Analytical Laboratories Inc.

860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CHEMICAL EXAMINATION REPORT

Vector Engineering, Inc.
12438 Loma Rica Drive, Suite C
Grass Valley, CA 95945
Attn: Ralph Phillips

Date Sampled: 06/14/90
Time Sampled:
Sampled By: Jeff Huggins
Date Received: 06/27/90 09:00
Sample Type: Soil

Page
1

Batch 90-0627-015 consisted of 6 Samples and 102 Tests

Sample 1 PJ# 90085 Idaho/Marylant Mine Tailings-
Brock BH - 1 10'-Composite

	Method	Results	Units	MDL
Antimony	7040	ND	mg/kg	100
Arsenic	7061	14	mg/kg	10
Barium	7080	ND	mg/kg	100
Beryllium	7090	ND	mg/kg	1
Cadmium	7130	ND	mg/kg	10
Chromium	7190	259	mg/kg	10
Cobalt	7200	ND	mg/kg	20
Copper	7210	58	mg/kg	10
Lead	7420	ND	mg/kg	10
Mercury	7471	ND	mg/kg	1
Molybdenum	7480	ND	mg/kg	50
Nickel	7520	164	mg/kg	10
Selenium	7741	ND	mg/kg	10
Silver	7760	ND	mg/kg	10
Thallium	7840	ND	mg/kg	100
Vanadium	7910	ND	mg/kg	100
Zinc	7950	46	mg/kg	10

MDL - Minimum Detection Limit

ND - None Detected

NOTES:

Bruce L. Gove
Laboratory Director

Bruce L. Gove
Date Printed: 07/18/90



Alpha Analytical Laboratories Inc.

860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CHEMICAL EXAMINATION REPORT

Vector Engineering, Inc.
12438 Loma Rica Drive, Suite C
Grass Valley, CA 95945
Attn: Ralph Phillips

Date Sampled: 06/14/90
Time Sampled:
Sampled By: Jeff Huggins
Date Received: 06/27/90 09:00
Sample Type: Soil

Page
2

Batch 90-0627-015 consisted of 6 Samples and 102 Tests

Sample 2 PJ# 90085 Idaho/Marylant Mine Tailings-
Brock BH - 1 5.5' to 6.0'

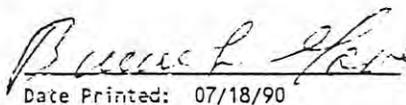
	Method	Results	Units	MDL
Antimony	7040	ND	mg/kg	100
Arsenic	7061	16	mg/kg	10
Barium	7080	ND	mg/kg	100
Beryllium	7090	ND	mg/kg	1
Cadmium	7130	ND	mg/kg	10
Chromium	7190	40	mg/kg	10
Cobalt	7200	ND	mg/kg	20
Copper	7210	14	mg/kg	10
Lead	7420	14	mg/kg	10
Mercury	7471	ND	mg/kg	1
Molybdenum	7480	ND	mg/kg	50
Nickel	7520	26	mg/kg	10
Selenium	7741	ND	mg/kg	10
Silver	7760	ND	mg/kg	10
Thallium	7840	ND	mg/kg	100
Vanadium	7910	ND	mg/kg	100
Zinc	7950	47	mg/kg	10

MDL - Minimum Detection Limit

ND - None Detected

NOTES:

Bruce L. Gove
Laboratory Director


Date Printed: 07/18/90



Alpha

Alpha Analytical Laboratories Inc.

860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CHEMICAL EXAMINATION REPORT

Vector Engineering, Inc.
12438 Loma Rica Drive, Suite C
Grass Valley, CA 95945
Attn: Ralph Phillips

Date Sampled: 06/14/90
Time Sampled:
Sampled By: Jeff Huggins
Date Received: 06/27/90 09:00
Sample Type: Soil

Page
3

Batch 90-0627-015 consisted of 6 Samples and 102 Tests

Sample 3 PJ# 90085 Idaho/Marylant Mine Tailings-
Brock BH - 2 15.0' to 15.5'

	Method	Results	Units	MDL
Antimony	7040	ND	mg/kg	100
Arsenic	7061	12	mg/kg	10
Barium	7080	ND	mg/kg	100
Beryllium	7090	ND	mg/kg	1
Cadmium	7130	ND	mg/kg	10
Chromium	7190	261	mg/kg	10
Cobalt	7200	20	mg/kg	20
Copper	7210	63	mg/kg	10
Lead	7420	ND	mg/kg	10
Mercury	7471	ND	mg/kg	1
Molybdenum	7480	ND	mg/kg	50
Nickel	7520	205	mg/kg	10
Selenium	7741	ND	mg/kg	10
Silver	7760	ND	mg/kg	10
Thallium	7840	ND	mg/kg	100
Vanadium	7910	ND	mg/kg	100
Zinc	7950	106	mg/kg	10

MDL - Minimum Detection Limit

ND - None Detected

NOTES:

Bruce L. Gove
Laboratory Director

Date Printed: 07/18/90



alpha

Alpha Analytical Laboratories Inc.

860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CHEMICAL EXAMINATION REPORT

Vector Engineering, Inc.
12438 Loma Rica Drive, Suite C
Grass Valley, CA 95945
Attn: Ralph Phillips

Date Sampled: 06/14/90
Time Sampled:
Sampled By: Jeff Huggins
Date Received: 06/27/90 09:00
Sample Type: Soil

Page
4

Batch 90-0627-015 consisted of 6 Samples and 102 Tests

Sample 4 PJ# 90085 Idaho/Marylant Mine Tailings-
Brock BH - 3 6.0' to 6.5'

	Method	Results	Units	MDL
Antimony	7040	ND	mg/kg	100
Arsenic	7061	20	mg/kg	10
Barium	7080	ND	mg/kg	100
Beryllium	7090	ND	mg/kg	1
Cadmium	7130	ND	mg/kg	10
Chromium	7190	38	mg/kg	10
Cobalt	7200	ND	mg/kg	20
Copper	7210	57	mg/kg	10
Lead	7420	24	mg/kg	10
Mercury	7471	ND	mg/kg	1
Molybdenum	7480	ND	mg/kg	50
Nickel	7520	49	mg/kg	10
Selenium	7741	ND	mg/kg	10
Silver	7760	ND	mg/kg	10
Thallium	7840	ND	mg/kg	100
Vanadium	7910	ND	mg/kg	100
Zinc	7950	92	mg/kg	10

MDL - Minimum Detection Limit

ND - None Detected

NOTES:

Bruce L. Gove
Laboratory Director

Date Printed: 07/18/90



Alpha

Alpha Analytical Laboratories Inc.

860 Waugh Lane, H-1, Ukiah, California 95482
(707) 468-0401

CHEMICAL EXAMINATION REPORT

Vector Engineering, Inc.
12438 Loma Rica Drive, Suite C
Grass Valley, CA 95945
Attn: Ralph Phillips

Date Sampled: 06/14/90
Time Sampled:
Sampled By: Jeff Huggins
Date Received: 06/27/90 09:00
Sample Type: Soil

Page
5

Batch 90-0627-015 consisted of 6 Samples and 102 Tests

Sample 5 PJ# 90085 Idaho/Marylant Mine Tailings-
Brock BH - 4 5.5' to 6.0'

	Method	Results	Units	MDL
Antimony	7040	ND	mg/kg	100
Arsenic	7061	ND	mg/kg	10
Barium	7080	ND	mg/kg	100
Beryllium	7090	ND	mg/kg	1
Cadmium	7130	ND	mg/kg	10
Chromium	7190	18	mg/kg	10
Cobalt	7200	ND	mg/kg	20
Copper	7210	48	mg/kg	10
Lead	7420	ND	mg/kg	10
Mercury	7471	ND	mg/kg	1
Molybdenum	7480	ND	mg/kg	50
Nickel	7520	23	mg/kg	10
Selenium	7741	ND	mg/kg	10
Silver	7760	ND	mg/kg	10
Thallium	7840	ND	mg/kg	100
Vanadium	7910	ND	mg/kg	100
Zinc	7950	70	mg/kg	10

MDL - Minimum Detection Limit

ND - None Detected

NOTES:

Bruce L. Gove
Laboratory Director

Bruce L. Gove
Date Printed: 07/18/90



Alpha

Alpha Analytical Laboratories Inc.

860 Waugh Lane, H-1, Ukiah, California 95482

(707) 468-0401

CHEMICAL EXAMINATION REPORT

Vector Engineering, Inc.
12438 Loma Rica Drive, Suite C
Grass Valley, CA 95945
Attn: Ralph Phillips

Date Sampled: 06/14/90
Time Sampled:
Sampled By: Jeff Huggins
Date Received: 06/27/90 09:00
Sample Type: Soil

Page
6

Batch 90-0627-015 consisted of 6 Samples and 102 Tests

Sample 6 PJ# 90085 Idaho/Marylant Mine Tailings-
Brock BH - 4 11.0' to 11.5'

	Method	Results	Units	MDL
Antimony	7040	ND	mg/kg	100
Arsenic	7061	33	mg/kg	10
Barium	7080	ND	mg/kg	100
Beryllium	7090	ND	mg/kg	1
Cadmium	7130	ND	mg/kg	10
Chromium	7190	110	mg/kg	10
Cobalt	7200	67	mg/kg	20
Copper	7210	86	mg/kg	10
Lead	7420	15	mg/kg	10
Mercury	7471	ND	mg/kg	1
Molybdenum	7480	ND	mg/kg	50
Nickel	7520	269	mg/kg	10
Selenium	7741	ND	mg/kg	10
Silver	7760	ND	mg/kg	10
Thallium	7840	ND	mg/kg	100
Vanadium	7910	124	mg/kg	100
Zinc	7950	40	mg/kg	10

MDL - Minimum Detection Limit

ND - None Detected

NOTES:

Bruce L. Gove
Laboratory Director

Date Printed: 07/18/90

Due to 7-12-90

VECTOR ENGINEERING, INC.

12438 Loma Rica Dr., Suite C
 Grass Valley, CA 95945
 (916) 272-2448

SUBMITTED BY: R. PHILLIPS
 COMPANY: ALPHA ANALYTICAL LABS CONTACT: R. PHILLIPS
 ADDRESS: 860 W. WASH. LANE H. 11 K. 24 CA PHONE: (916) 652-0145

LAB#	SAMPLE IDENTIFICATION (ID #, location, matrix)	DATE/TIME COLLECTED	# OF ITEMS	PRESERVE	ANALYSIS REQUESTED															
					EPA 6010 CATION METALS	ARMY FOR SOLD														
27-15-1	(2 1/2 BT) BH-1 10' COMPOSIT	6/14/90	1		X															
27-15-2	BH-1 5 ⁵ TO 6 ⁵	6/14/90	1		X		X													
27-15-3	BH-2 15 ² TO 15 ⁵	6/14/90	1		X		X													
27-15-4	BH-3 6 ² TO 6 ⁵	6/14/90	1		X															
27-15-5	BH-4 5 ⁵ TO 6 ⁰	6/14/90	1		X															
27-15-6	BH-4 11 ² TO 11 ⁵	6/14/90	1		X		X													

REMARKS:
 IF TLIC LIMITS ARE EXCEEDED CALL TO CONFIRM WET TESTING
 10 DAY TAT

SAMPLE RELINQUISHED BY:	DATE/TIME	RECEIVED BY:
<u>[Signature]</u>	6-21-90 9:30	<u>R. Thomas</u>
<u>R. Thomas</u>	6-25-90 5:05 PM	6-27-90 0900 <u>[Signature]</u> Alpha Labs V&E

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

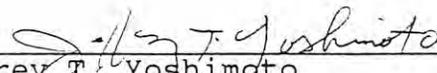
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 9, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-12
Sample ID Number: SA - 2.2

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	ND	5.00
Chromium	25.4	0.50
Copper	67.5	0.10
Lead	ND	3.8
Mercury*	0.11	0.10
Nickel	144	2.0

ND - Not Detected
* - EPA Method 245.5


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93
Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

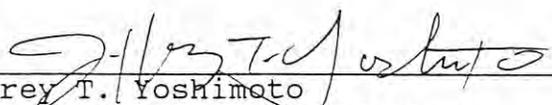
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 9, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-14
Sample ID Number: SA - 3.1

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	10.0***	5.00
Chromium	53.5	0.50
Copper	31.4	0.10
Lead	4.4	3.8
Mercury*	0.11	0.10
Nickel	26.0	2.0

ND - Not Detected
* - EPA Method 245.5
***- Re-Reported


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-27-93
Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

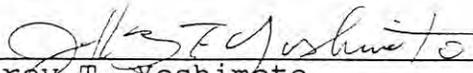
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 9, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-16
Sample ID Number: SA - 4.2

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	ND	5.00
Chromium	74.0	0.50
Copper	23.2	0.10
Lead	12.3	3.8
Mercury*	0.13	0.10
Nickel	33.8	2.0

ND - Not Detected
* - EPA Method 245.5


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93
Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

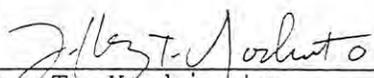
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 9, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993
**Re-ANALYZED: Sept. 24, 1993

Lab ID Number: VEC091193-17
Sample ID Number: SA - 4.6.5

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Antimony	5.0	2.50
Arsenic	27.0***	5.00
Barium	30.6	0.25
Beryllium	1.0	0.10
Cadmium	ND	0.50
Chromium	580	0.50
Cobalt	59.0	0.38
Copper	78.0	0.10
Lead	5.5	3.8
Mercury*	ND	0.10
Molybdenum	4.2	0.50
Nickel	400	2.0
Selenium	ND	5.0
Silver	ND	0.75
Thallium	33.1**	3.8
Vanadium	29.8	0.10
Zinc	42.5	0.50

ND - Not Detected
* - EPA Method 245.5
***- Re-Reported


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-27-93
Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

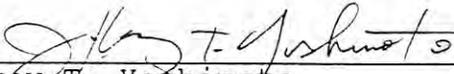
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 9, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-18
Sample ID Number: SA - 4.10

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	ND	5.00
Chromium	715	0.50
Copper	59.5	0.10
Lead	ND	3.8
Mercury*	ND	0.10
Nickel	255	2.0

ND - Not Detected
* - EPA Method 245.5



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93

Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1050 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533

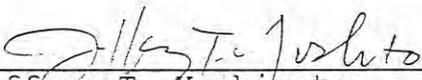
SAMPLED: September 9, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993
**Re-ANALYZED: Sept. 24, 1993

Lab ID Number: VEC091193-01
Sample ID Number: SA - 5.2

TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Antimony	ND	2.50
Arsenic	6.5	5.00
Barium	6.7	0.25
Beryllium	0.31	0.10
Cadmium	ND	0.50
Chromium	69.8	2.50
Cobalt	14.2	0.38
Copper	35.4	0.10
Lead	4.6	3.8
Mercury*	0.25	0.10
Molybdenum	3.0	0.50
Nickel	43.2	2.0
Selenium	ND	5.0
Silver	ND	0.75
Thallium	5.8**	3.8
Vanadium	46.3	0.10
Zinc	41.3	0.50

ND - Not Detected
* - EPA Method 245.5


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-27-93
Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1050 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533

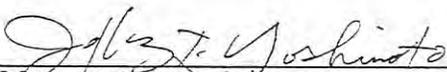
SAMPLED: September 9, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-02
Sample ID Number: SA - 5.8

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	136	5.00
Chromium	385	0.50
Copper	32.0	0.10
Lead	13.0	3.8
Mercury*	1.2	0.10
Nickel	249	2.0

ND - Not Detected
* - EPA Method 245.5


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93
Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

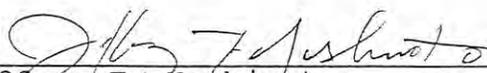
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 9, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-04
Sample ID Number: SA - 6.2

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	168	5.00
Chromium	410	0.50
Copper	224	0.10
Lead	172	3.8
Mercury*	12.4	0.10
Nickel	352	2.0

ND - Not Detected
* - EPA Method 245.5



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93

Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1050 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

ATTN: Peggy Smith PHONE #: (916) 272-2448

FAX #: (916) 272-8533

SAMPLED: September 9, 1993

DIGESTED: Sept. 14, 1993

ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-05

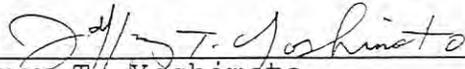
Sample ID Number: SA - 6.8

TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	79.5	5.00
Chromium	217	0.50
Copper	14.0	0.10
Lead	ND	3.8
Mercury*	0.38	0.10
Nickel	176	2.0

ND - Not Detected

* - EPA Method 245.5


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93
Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533

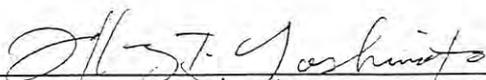
SAMPLED: September 9, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-06
Sample ID Number: SA - 6.17

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	648	10.0
Chromium	278	0.50
Copper	168	0.10
Lead	127	3.8
Mercury*	4.4	0.10
Nickel	292	2.0

ND - Not Detected
* - EPA Method 245.5



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93

Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533

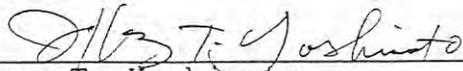
SAMPLED: September 9, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-07
Sample ID Number: SA - 7.2

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	ND	5.00
Chromium	73.0	0.50
Copper	19.7	0.10
Lead	10.0	3.8
Mercury*	1.1	0.10
Nickel	33.0	2.0

ND - Not Detected
* - EPA Method 245.5



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93

Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 548-2522 • Fax: (702) 548-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

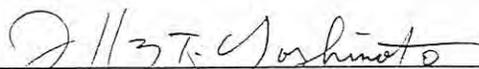
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 9, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-08
Sample ID Number: SA - 7.8

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Antimony	ND	2.50
Arsenic	6.8	5.00
Barium	25.5	0.25
Beryllium	0.44	0.10
Cadmium	0.80	0.50
Chromium	80.5	0.50
Cobalt	16.0	0.38
Copper	31.4	0.10
Lead	21.4	3.8
Mercury*	1.9	0.10
Molybdenum	6.2	0.50
Nickel	40.2	2.0
Selenium	ND	5.0
Silver	ND	0.75
Thallium	ND	3.8
Vanadium	62.0	0.10
Zinc	81.0	0.50

ND - Not Detected
* - EPA Method 245.5



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93

Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

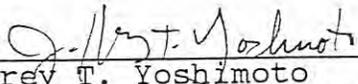
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 9, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993
**Re-ANALYZED: Sept. 24, 1993

Lab ID Number: VEC091193-19
Sample ID Number: SB - 1.3

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Antimony	ND	2.50
Arsenic	6.0***	5.00
Barium	6.0	0.25
Beryllium	0.32	0.10
Cadmium	ND	0.50
Chromium	68.0	0.50
Cobalt	13.5	0.38
Copper	36.8	0.10
Lead	4.0	3.8
Mercury*	0.21	0.10
Molybdenum	2.6	0.50
Nickel	40.2	2.0
Selenium	ND	5.0
Silver	ND	0.75
Thallium	5.3**	3.8
Vanadium	45.8	0.10
Zinc	42.5	0.50

ND - Not Detected
* - EPA Method 245.5
***- Re-Reported


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-27-93
Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

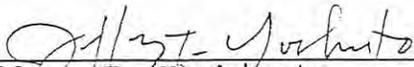
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 9, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993
**Re-ANALYZED: Sept. 24, 1993

Lab ID Number: VEC091193-21
Sample ID Number: SB - 2.3

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Antimony	ND	2.50
Arsenic	ND	5.00
Barium	38.4	0.25
Beryllium	0.32	0.10
Cadmium	ND	0.50
Chromium	348	0.50
Cobalt	35.0	0.38
Copper	91.0	0.10
Lead	ND	3.8
Mercury*	0.30	0.10
Molybdenum	4.1	0.50
Nickel	126	2.0
Selenium	ND	5.0
Silver	ND	0.75
Thallium	17.0**	3.8
Vanadium	86.0	0.10
Zinc	34.5	0.50

ND - Not Detected
* - EPA Method 245.5


Jeffrey F. Yoshimoto
Metals Team Lead/Chemist II

9-27-93
Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

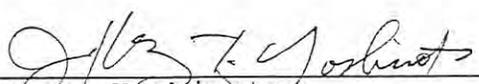
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 9, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-22
Sample ID Number: SB - 2.7

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	ND	5.00
Chromium	250	0.50
Copper	39.0	0.10
Lead	ND	3.8
Mercury*	0.17	0.10
Nickel	102	2.0

ND - Not Detected
* - EPA Method 245.5



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93

Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

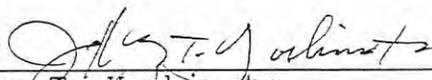
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 9, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-23
Sample ID Number: SB - 3.4

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	ND	5.00
Chromium	373	0.50
Copper	25.9	0.10
Lead	ND	3.8
Mercury*	0.44	0.10
Nickel	241	2.0

ND - Not Detected
* - EPA Method 245.5


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93
Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

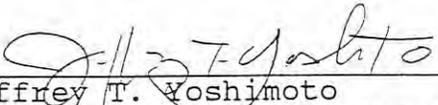
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 10, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993
**Re-ANALYZED: Sept. 28, 1993

Lab ID Number: VEC091193-24
Sample ID Number: SB - 4.1

TTLC TITLE 22 METALS
EPA METHOD 3050A/6010

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Antimony	ND	2.50
Arsenic	ND	5.00
Barium	10.9	0.25
Beryllium	0.36	0.10
Cadmium	ND	0.50
Chromium	379	0.50
Cobalt	29.0	0.38
Copper	44.8	0.10
Lead	20.4	3.8
Mercury*	1.3	0.10
Molybdenum	5.9	0.50
Nickel	296	2.0
Selenium	ND	5.0
Silver	2.4**	0.75
Thallium	23.6	3.8
Vanadium	56.0	0.10
Zinc	49.2	0.50

ND - Not Detected
* - EPA Method 245.5


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-28-93
Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

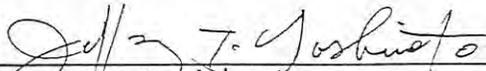
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 10, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-25
Sample ID Number: SB - 4.3

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	ND	5.00
Chromium	625	1.0
Copper	22.4	0.10
Lead	ND	3.8
Mercury*	0.13	0.10
Nickel	120	2.0

ND - Not Detected
* - EPA Method 245.5



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93

Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1050 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533

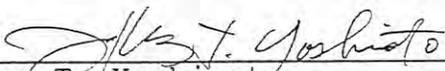
SAMPLED: September 10, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-26
Sample ID Number: SB - 5.3

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	ND	5.00
Chromium	352	0.50
Copper	144	0.10
Lead	ND	3.8
Mercury*	ND	0.10
Nickel	112	2.0

ND - Not Detected
* - EPA Method 245.5


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93
Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1050 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

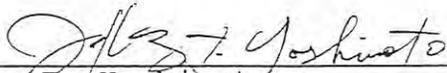
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 10, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-28
Sample ID Number: SB - 6.2

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	ND	5.00
Chromium	740	1.0
Copper	49.6	0.10
Lead	30.8	3.8
Mercury*	2.8	0.10
Nickel	466	2.0

ND - Not Detected
* - EPA Method 245.5



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93

Date

NEVADA ENVIRONMENTAL
LABORATORY

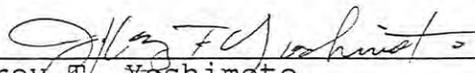
Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 10, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993
Lab ID Number: VEC091193-30
Sample ID Number: SB - 7.2.5

TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	60.0	10.0
Chromium	980	1.0
Copper	38.8	0.10
Lead	19.6	3.8
Mercury*	2.8	0.10
Nickel	535	2.0

ND - Not Detected
* - EPA Method 245.5


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93
Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

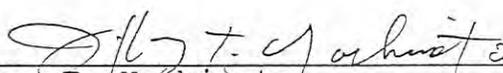
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 10, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-31
Sample ID Number: SB - 7.4.5

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	72.5	5.00
Chromium	190	0.50
Copper	58.0	0.10
Lead	ND	3.8
Mercury*	0.16	0.10
Nickel	58.5	2.0

ND - Not Detected
* - EPA Method 245.5


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93
Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 10, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993
**Re-ANALYZED: Sept. 28, 1993

Lab ID Number: VEC091193-32
Sample ID Number: SB - 8.2.5

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Antimony	ND	2.50
Arsenic	ND	5.00
Barium	5.4	0.25
Beryllium	0.45	0.10
Cadmium	ND	0.50
Chromium	1,160	1.0
Cobalt	32.2	0.38
Copper	39.0	0.10
Lead	15.6	3.8
Mercury*	2.8	0.10
Molybdenum	6.6	0.50
Nickel	687	2.0
Selenium	ND	5.0
Silver	2.0**	0.75
Thallium	67.0	3.8
Vanadium	78.5	0.10
Zinc	58.0	0.50

ND - Not Detected
* - EPA Method 245.5

Jeffrey T. Yoshimoto
Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-28-93
Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1050 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945

PROJECT: BET Property
JOB #: 904085.01

ATTN: Peggy Smith
PHONE #: (916) 272-2448
FAX #: (916) 272-8533

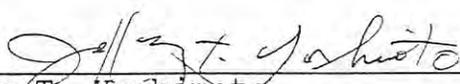
SAMPLED: September 10, 1993
DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-33
Sample ID Number: SB - 8.4.5

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	ND	5.00
Chromium	254	0.50
Copper	62.0	0.10
Lead	ND	3.8
Mercury*	0.54	0.10
Nickel	186	2.0

ND - Not Detected
* - EPA Method 245.5



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93

Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1050 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 10, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993
**Re-ANALYZED: Sept. 28, 1993

Lab ID Number: VEC091193-34
Sample ID Number: SB - 9.2.5

TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Antimony	ND	2.50
Arsenic	ND	5.00
Barium	6.2	0.25
Beryllium	0.41	0.10
Cadmium	ND	0.50
Chromium	735	1.0
Cobalt	33.8	0.38
Copper	46.9	0.10
Lead	34.4	3.8
Mercury*	0.26	0.10
Molybdenum	16.0	0.50
Nickel	575.0	4.0
Selenium	ND	5.0
Silver	3.0**	0.75
Thallium	58.5	3.8
Vanadium	70.0	0.10
Zinc	51.5	0.50

ND - Not Detected
* - EPA Method 245.5

Jeffrey T. Yoshimoto
Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-28-93
Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

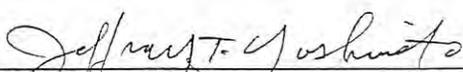
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 10, 1993 DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-36
Sample ID Number: SB - 10.2

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	7.6	5.00
Chromium	282	0.50
Copper	8.3	0.10
Lead	ND	3.8
Mercury*	ND	0.10
Nickel	69.0	2.0

ND - Not Detected
* - EPA Method 245.5



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93

Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945

PROJECT: BET Property
JOB #: 904085.01

ATTN: Peggy Smith

PHONE #: (916) 272-2448

SAMPLED: September 10, 1993

FAX #: (916) 272-8533

DIGESTED: Sept. 14, 1993

ANALYZED: Sept. 16, 1993

Lab ID Number: VEC091193-37

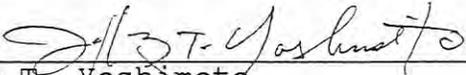
Sample ID Number: SB - 11.2.5

**TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010**

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	ND	5.00
Chromium	740	1.0
Copper	63.0	0.10
Lead	21.0	3.8
Mercury*	0.12	0.10
Nickel	429	2.0

ND - Not Detected

* - EPA Method 245.5



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93

Date

NEVADA ENVIRONMENTAL
LABORATORY

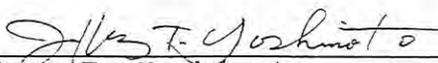
Reno Division
1050 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993
Lab ID Number: Method Blank

TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Antimony	ND	2.50
Arsenic	ND	5.00
Barium	ND	0.25
Beryllium	ND	0.10
Cadmium	ND	0.50
Chromium	ND	0.50
Cobalt	ND	0.38
Copper	0.35	0.10
Lead	ND	3.8
Mercury*	ND	0.10
Molybdenum	ND	0.50
Nickel	ND	2.0
Selenium	ND	5.0
Silver	ND	0.75
Thallium	ND	3.8
Vanadium	ND	0.10
Zinc	ND	0.50

ND - Not Detected
* - EPA Method 245.5


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93
Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1050 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

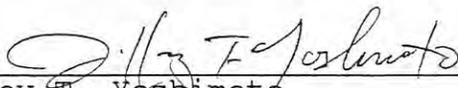
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
DIGESTED: Sept. 14, 1993
ANALYZED: Sept. 16, 1993

Lab ID Number: Method Blank

TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	ND	5.00
Chromium	ND	0.50
Copper	ND	0.10
Lead	ND	3.8
Mercury*	ND	0.10
Nickel	ND	2.0

ND - Not Detected
* - EPA Method 245.5



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93

Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945

PROJECT: BET Property
JOB #: 904085.01

ATTN: Peggy Smith

PHONE #: (916) 272-2448

SAMPLED: September 9, 1993

FAX #: (916) 272-8533

ANALYZED: Sept. 14, 1993

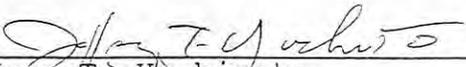
EPA Method: 9045A

Sample ID/ Lab ID	Parameter	Concentration
----------------------	-----------	---------------

SA - 5.2 VEC091193-01	pH**	8.1
SA - 5.8 VEC091193-02	pH**	8.2
SA - 5.15 VEC091193-03	pH*	7.0
SA - 6.2 VEC091193-04	pH**	7.9
SA - 6.8 VEC091193-05	pH**	8.3
SA - 6.17 VEC091193-06	pH**	8.4
SA - 7.2 VEC091193-07	pH**	8.3
SA - 7.8 VEC091193-08	pH**	8.0

* - Soil pH measured in DI water

** - Soil pH measured in 0.01M CaCl₂ Solution


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93
Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1050 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945

PROJECT: BET Property
JOB #: 904085.01

ATTN: Peggy Smith
PHONE #: (916) 272-2448
FAX #: (916) 272-8533

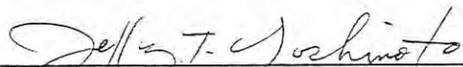
SAMPLED: September 10, 1993
ANALYZED: Sept. 14, 1993

EPA Method: 9045A

Sample ID/ Lab ID	Parameter	Concentration
SA - 7.12 VEC091193-09	pH**	7.6
SA - 1.2 VEC091193-10	pH**	8.5
SA - 1.4 VEC091193-11	pH**	8.0
SA - 2.2 VEC091193-12	pH**	7.6
SA - 2.5 VEC091193-13	pH**	8.2
SA - 3.1 VEC091193-14	pH**	8.6
SA - 3.2 VEC091193-15	pH**	8.1
SA - 4.2 VEC091193-16	pH**	8.2

* - Soil pH measured in DI water

** - Soil pH measured in 0.01M CaCl2 Solution


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93
Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1050 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945

PROJECT: BET Property
JOB #: 904085.01

ATTN: Peggy Smith

PHONE #: (916) 272-2448
FAX #: (916) 272-8533

SAMPLED: September 9,10, 1993

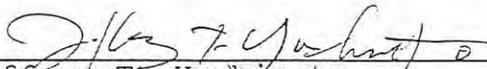
ANALYZED: Sept. 14, 1993

EPA Method: 9045A

Sample ID/ Lab ID	Parameter	Concentration
SA - 4.6.5 VEC091193-17	pH*	7.1
SA - 4.10 VEC091193-18	pH*	7.7
SB - 1.3 VEC091193-19	pH*	7.4
SB - 1.9 VEC091193-20	pH*	6.1
SB - 2.3 VEC091193-21	pH*	5.9
SB - 2.7 VEC091193-22	pH*	6.6
SB - 3.4 VEC091193-23	pH*	7.6
SB - 4.1 VEC091193-24	pH**	7.8

* - Soil pH measured in DI water

** - Soil pH measured in 0.01M CaCl₂ Solution


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93
Date

NEVADA ENVIRONMENTAL
LABORATORY

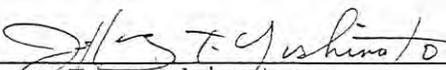
Reno Division
1050 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945
ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 10, 1993 ANALYZED: Sept. 14, 1993
EPA Method: 9045A

Sample ID/ Lab ID	Parameter	Concentration
----------------------	-----------	---------------

SB - 4.3 VEC091193-25	pH*	6.4
SB - 5.3 VEC091193-26	pH*	5.3
SB - 5.6 VEC091193-27	pH*	6.8
SB - 6.2 VEC091193-28	pH**	7.9
SB - 6.4 VEC091193-29	pH*	6.8
SB - 7.2.5 VEC091193-30	pH**	8.6
SB - 7.4.5 VEC091193-31	pH*	7.7
SB - 8.2.5 VEC091193-32	pH**	7.8

* - Soil pH measured in DI water
** - Soil pH measured in 0.01M CaCl2 Solution



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93

Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945

PROJECT: BET Property
JOB #: 904085.01

ATTN: Peggy Smith

PHONE #: (916) 272-2448
FAX #: (916) 272-8533

SAMPLED: September 10, 1993

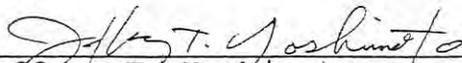
ANALYZED: Sept. 14, 1993

EPA Method: 9045A

Sample ID/ Lab ID	Parameter	Concentration
SB - 8.4.5 VEC091193-33	pH*	7.3
SB - 9.2.5 VEC091193-34	pH**	8.4
SB - 9.5 VEC091193-35	pH*	7.7
SB - 10.2 VEC091193-36	pH*	7.4
SB - 11.2.5 VEC091193-37	pH**	8.3
SB - 11.5 VEC091193-38	pH*	7.0

* - Soil pH measured in DI water

** - Soil pH measured in 0.01M CaCl₂ Solution



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

9-22-93

Date

NEVADA ENVIRONMENTAL
LABORATORY

RECEIVED
OCT 4 1993
Peggy

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

ATTN: Peggy Smith PHONE #: (916) 272-2448
FAX #: (916) 272-8533
SAMPLED: September 9, 1993 ANALYZED: Sept. 16, 1993

Method: EPA 335.2 Sample Type: Soil

Sample ID/ Lab ID	Parameter	Concentration	Detection Limit
SA - 5.8 VEC091193-02	Total Cyanide	ND	1.0 mg/kg
SA - 6.17 VEC091193-06	Total Cyanide	ND	1.0 mg/kg
SA - 7.8 VEC091193-08	Total Cyanide	ND	1.0 mg/kg
SA - 4.2 VEC091193-16	Total Cyanide	ND	1.0 mg/kg
Method Blank Non-distilled	Total Cyanide	ND	1.0 mg/kg
Method Blank Distilled	Total Cyanide	ND	1.0 mg/kg

ND - Not Detected

Approved by:

Eileen M. Ferguson
Eileen M. Ferguson, Ph.D.
Senior Staff Scientist

Date

Sept 23, 1993

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

RECEIVED
OCT 14 1993
Ans'd. Peggy S

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945

PROJECT: BET Property
JOB #: 904085.01

ATTN: Peggy Smith

PHONE #: (916) 272-2448
FAX #: (916) 272-8533
DIGESTED: Sept. 23, 1993
ANALYZED: Sept. 24, 1993

SAMPLED: September 22, 1993

Lab ID Number: VEC092393-01
Sample ID Number: SF - 1

TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic**	7.6	0.62
Chromium	900	2.50
Copper	45	0.10
Lead	ND	3.8
Mercury*	ND	0.10
Nickel	2,100	10.0

ND - Not Detected
* - EPA Method 245.5
** - EPA Method 206.2

Jeffrey P. Yoshimoto
Metals Team Lead/Chemist II

10-4-93
Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1050 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

RECEIVED

OCT 14 1993

Ans'd Peggy S

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945

PROJECT: BET Property
JOB #: 904085.01

ATTN: Peggy Smith

PHONE #: (916) 272-2448

FAX #: (916) 272-8533

SAMPLED: September 22, 1993

DIGESTED: Sept. 23, 1993

ANALYZED: Sept. 24, 1993

Lab ID Number: VEC092393-02

Sample ID Number: SF - 2

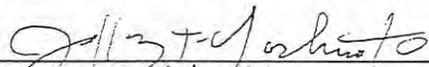
TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic**	200	31.0
Chromium	130	0.50
Copper	230	0.10
Lead	ND	3.8
Mercury*	2.6	0.12
Nickel	440	2.0

ND - Not Detected

* - EPA Method 245.5

** - EPA Method 206.2


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

60-4-93
Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

RECEIVED
OCT 14 1993
Ans'd. Peggy S

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945
ATTN: Peggy Smith

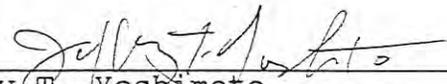
PROJECT: BET Property
JOB #: 904085.01
PHONE #: (916) 272-2448
FAX #: (916) 272-8533
DIGESTED: Sept. 23, 1993
ANALYZED: Sept. 24, 1993

Lab ID Number: Method Blank

TTLIC TITLE 22 METALS
EPA METHOD 3050A/6010

Parameter	Concentration (mg/kg)	Detection Limit (mg/kg)
Arsenic	ND	0.62
Chromium	ND	0.50
Copper	0.30	0.10
Lead	ND	3.8
Mercury*	ND	0.10
Nickel	ND	10.0

ND - Not Detected
* - EPA Method 245.5


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

40-4-93
Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

RECEIVED
OCT 14 1993
ASS. Peggy S.

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945

PROJECT: BET Property
JOB #: 904085.01

ATTN: Peggy Smith

PHONE #: (916) 272-2448

FAX #: (916) 272-8533

SAMPLED: September 22, 1993

ANALYZED: Sept. 24, 1993

Method: EPA 9045

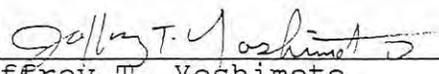
Sample ID/ Lab ID	Parameter	Concentration
----------------------	-----------	---------------

SF - 1 VEC092393-01	pH*	7.4
------------------------	-----	-----

SF - 2 VEC092393-02	pH**	7.6
------------------------	------	-----

* - Soil pH measured in DI water

** - Soil pH measured in CaCl2


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

10-4-93
Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

RECEIVED
OCT 14 1993
ms. Peggy S.

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945

PROJECT: BET Property
JOB #: 904085.01

ATTN: Peggy Smith

PHONE #: (916) 272-2448

FAX #: (916) 272-8533

SAMPLED: September 22, 1993

ANALYZED: Sept. 29, 1993

Method: EPA 335.2

Sample Type: Soil

Sample ID/ Lab ID	Parameter	Concentration	Detection Limit (mg/kg)
SF - 2 VEC092393-02	Total Cyanide	ND	1.0
Method Blank	Total Cyanide	ND	1.0

ND - Not Detected

Approved by: Eileen M. Ferguson
Eileen M. Ferguson, Ph.D.
Senior Staff Scientist

Oct. 4, 1993
Date

Sierra Environmental Monitoring, Inc.

47 Glen Carran Circle
Sparks, NV 89431
(702) 356-3868

Laboratory Analysis Report

Date : 10/08/93
Report : 9191
Client : NEL-942 PO#:
Taken by : Unknown
Name : NEVADA ENVIRONMENTAL LAB.
Address : 1030 MATLEY LANE
City/St/Zip: RENO NV 89502

Page: 1

Sample	Collected		NEUTRALIZA TION POT. TONS/1000T	ACID GEN. POTENTIAL TONS/1000T	ACID GENER. POTEN.SULFIDE TONS/1000T	PH-SATUR PASTE S.U.		
	Date	Time						
VEC091193-17	9/29/93	:	5	<1	<1	6.30		

Approved By: _____



This report is applicable only to the sample received by the laboratory. The liability of the laboratory is limited to the amount paid for this report. This report is for the exclusive use of the client to whom it is addressed and upon the condition that the client assumes all liability for the further distribution of the report or its contents.

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1050 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

ATTN: Peggy Smith PHONE #: (916) 272-2448

FAX #: (916) 272-8533

SAMPLED: September 9, 1993

ANALYZED: Oct. 7, 1993

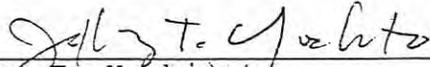
Lab ID Number: VEC091193-17

Sample ID Number: SA - 4.6.5

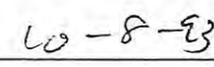
STLC-DI TITLE 22 METALS
EPA METHOD 6010

Parameter	Concentration (mg/L)	Detection Limit (mg/L)
Chromium	ND	0.010
Nickel	ND	0.040

ND - Not Detected



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II



Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945

PROJECT: BET Property
JOB #: 904085.01

ATTN: Peggy Smith

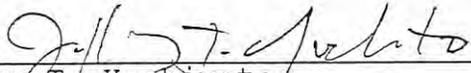
PHONE #: (916) 272-2448
FAX #: (916) 272-8533
ANALYZED: Oct. 7, 1993

SAMPLED: September 9, 1993
Lab ID Number: VEC091193-18
Sample ID Number: SA - 4.10

STLC-DI TITLE 22 METALS
EPA METHOD 6010

Parameter	Concentration (mg/L)	Detection Limit (mg/L)
Chromium	ND	0.010
Nickel	ND	0.040

ND - Not Detected



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

10-8-93

Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945

PROJECT: BET Property
JOB #: 904085.01

ATTN: Peggy Smith

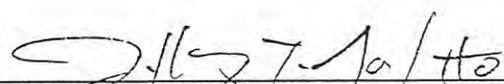
PHONE #: (916) 272-2448
FAX #: (916) 272-8533
ANALYZED: Oct. 7, 1993

SAMPLED: September 9, 1993
Lab ID Number: VEC091193-02
Sample ID Number: SA - 5.8

STLC-DI TITLE 22 METALS
EPA METHOD 6010

Parameter	Concentration (mg/L)	Detection Limit (mg/L)
Arsenic	ND	0.075

ND - Not Detected



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

10-8-93

Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945

PROJECT: BET Property
JOB #: 904085.01

ATTN: Peggy Smith

PHONE #: (916) 272-2448

FAX #: (916) 272-8533

SAMPLED: September 9, 1993
Lab ID Number: VEC091193-04
Sample ID Number: SA - 6.2

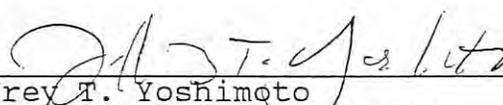
ANALYZED: Oct. 7, 1993

STLC-DI TITLE 22 METALS
EPA METHOD 6010

Parameter	Concentration (mg/L)	Detection Limit (mg/L)
Arsenic	ND	0.075
Chromium	ND	0.010
Copper	ND	0.002
Lead	ND	0.075
Mercury*	0.0011	0.0002
Nickel	ND	0.040

ND - Not Detected

* - EPA Method 245.1


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

Date

10-8-93

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945

PROJECT: BET Property
JOB #: 904085.01

ATTN: Peggy Smith

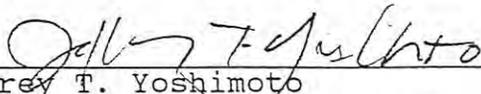
PHONE #: (916) 272-2448
FAX #: (916) 272-8533
ANALYZED: Oct. 7, 1993

SAMPLED: September 9, 1993
Lab ID Number: VEC091193-06
Sample ID Number: SA - 6.17

STLC-DI TITLE 22 METALS
EPA METHOD 6010

Parameter	Concentration (mg/L)	Detection Limit (mg/L)
Arsenic	ND	0.075
Chromium	ND	0.010
Lead	ND	0.075
Mercury*	ND	0.10
Nickel	ND	0.040

ND - Not Detected
* - EPA Method 245.1


Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

10-8-93
Date

**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945

PROJECT: BET Property
JOB #: 904085.01

ATTN: Peggy Smith

PHONE #: (916) 272-2448
FAX #: (916) 272-8533
ANALYZED: Oct. 7, 1993

SAMPLED: September 10, 1993
Lab ID Number: VEC091193-30
Sample ID Number: SB - 7.2.5

**STLC-DI TITLE 22 METALS
EPA METHOD 6010**

Parameter	Concentration (mg/L)	Detection Limit (mg/L)
Arsenic	ND	0.075
Chromium	ND	0.010
Nickel	ND	0.040

ND - Not Detected



Jeffrey T. Ypshimoto
Metals Team Lead/Chemist II

10-8-93

Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 548-2522 • Fax: (702) 548-2546
1-800-368-5221

CLIENT: Vector Engineering PROJECT: BET Property
12438 Loma Rica Drive Ste C JOB #: 904085.01
Grass Valley, CA 95945

ATTN: Peggy Smith PHONE #: (916) 272-2448

FAX #: (916) 272-8533

SAMPLED: September 10, 1993

ANALYZED: Oct. 7, 1993

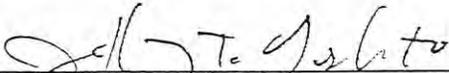
Lab ID Number: VEC091193-32

Sample ID Number: SB - 8.2.5

STLC-DI TITLE 22 METALS
EPA METHOD 6010

Parameter	Concentration (mg/L)	Detection Limit (mg/L)
Chromium	ND	0.010
Nickel	ND	0.040

ND - Not Detected



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II

10-8-93

Date

NEVADA ENVIRONMENTAL
LABORATORY

Reno Division
1030 Matley Lane · Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Vector Engineering
12438 Loma Rica Drive Ste C
Grass Valley, CA 95945

PROJECT: BET Property
JOB #: 904085.01

ATTN: Peggy Smith

PHONE #: (916) 272-2448
FAX #: (916) 272-8533
ANALYZED: Oct. 7, 1993

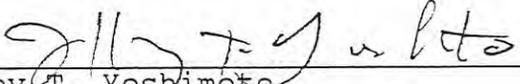
Lab ID Number: Method Blank

STLC-DI TITLE 22 METALS
EPA METHOD 6010

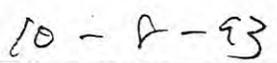
Parameter	Concentration (mg/L)	Detection Limit (mg/L)
Arsenic	ND	0.075
Chromium	ND	0.010
Copper	ND	0.002
Lead	ND	0.075
Mercury*	ND	0.0002
Nickel	ND	0.040

ND - Not Detected

* - EPA Method 245.1



Jeffrey T. Yoshimoto
Metals Team Lead/Chemist II



Date



**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division • 1030 Matley Lane • Reno, NV 89502
(702) 348-2522 • FAX: (702) 348-2546 • 1-800-368-5221

CHAIN OF CUSTODY

P 2 of 4

Company: VECTOR ENGINEERING
Address: 12438 LOMA RICA DR. STE. C
GRASS VALLEY, CA 95945
Phone No.: 916-272-2448 Fax No.: 272-8533
Attn: PEGGY SMITH
Requested Turnaround: 5 Day (Normal) 48 Hr. 24 Hr. Other
Expected Due Date: SEPT. 22nd OR 23rd

Project Name: BET PROPERTY Project No.: 904085.01
P.O. No.: _____ Sampled By: J. COLLINS

Analysis
of Containers and Type
CAM 17 METALS
P4H
TTLIC & STLC
CC, Cd, Hg, Ni, Pb
TOTAL CHLORIDE
WAD CYANIDE
Condition of Sample (Lab Use Only)
Preservative Code (Lab Use Only)

Date/Time	Sample Type	Sample ID	N.E.L. Identification												Remarks
9/9/93 11:30	S	SA-1.2	VEC091193-10	2	S	X	X								
" 11:45	S	SA-1.4	-11	2	S	X									Hold for TTLIC/STLC
" 12:10	S	SA-2.2	-12	2	S	X	X								
" 12:15	S	SA-2.5	-13	2	S	X									Hold for TTLIC/STLC
" 10:50	S	SA-3.1	-14	2	S	X	X								
" 10:52	S	SA-3.2	-15	2	S	X									Hold for TTLIC/STLC
" 10:10	S	SA-4.2	-16	2	S	X	X			X	X				
" 10:15	S	SA-4.6.5	-17	2	S	X	X								
" 10:25	S	SA-4.10	-18	2	S	X	X								

S (Soil), W (Water), O (Other)
This report is applicable only to the sample received by the laboratory. The liability of the laboratory is limited to the amount paid for this report. This report is for the exclusive use of the client to whom it is addressed and upon the condition that the client assumes all liability for the further distribution of the report or its contents.

Call Peggy Smith at Vector before running STLC's.

Relinquished (Signature)	Date / Time	Received (Signature)	Billing Information:	Mail Results To:
<u>J. Collins</u>	9/10/93 4:30	<u>Nick Savel NEL</u>		<u>5005</u>
	9/11/93 10:30			



**NEVADA ENVIRONMENTAL
LABORATORY**

Reno Division • 1030 Matley Lane • Reno, NV 89502
(702) 348-2522 • FAX: (702) 348-2546 • 1-800-368-5221

CHAIN OF CUSTODY

F 3 of 7

Company: VECTOR ENG.
Address: 12438 LOMA RICA DR. STE. C
GRASS VALLEY, CA. 95945
Phone No.: 916-272-5448 Fax No.: 272-8533
Attn.: PEGGY SMITH
Requested Turnaround: 5 Day (Normal) 48 Hr. 24 Hr. Other
Expected Due Date: SEPT. 22nd OR 23rd

Project Name: BET PROPERTY Project No.: 904085.01
P.O. No.: _____ Sampled By: J. COLLINS

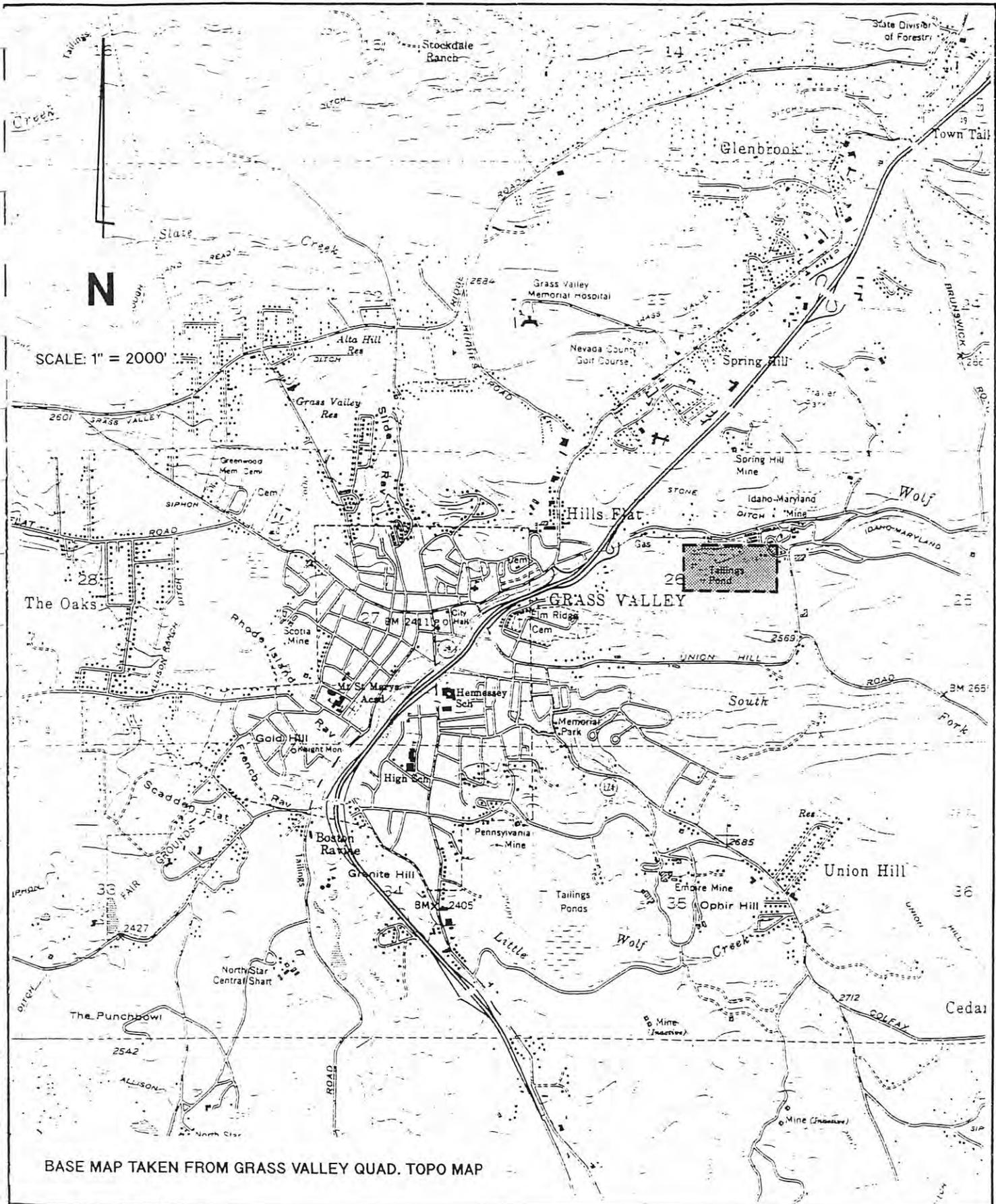
# of Containers and Type	Analysis										Condition of Sample (Lab Use Only) Preservative Code (Lab Use Only)
	<u>COM 17 METALS</u> <u>PH</u> <u>TTLIC + STLC FOR AS,</u> <u>CR, CU, HG, AL, PD.</u>										

Date/Time	Sample Type	Sample ID	N.E.L. Identification											Remarks	
9/9/93 2:35	S	SB-1.3	VEC 091193 - 19	2	S	X	X								
9/9/93 2:40	S	SB-1.9			2	S		X							Hold for TTLIC/STLC
9/9/93 3:45	S	SB-2.3			2	S	X	X							
9/9/93 4:00	S	SB-2.7			2	S		X	X						
9/9/93 4:55	S	SB-3.4			2	S		X	X						
9/10/93 10:05	S	SB-4.1			2	S	X	X							
11 9:50	S	SB-4.3			2	S		X	X						
11 9:05	S	SB-5.3			2	S		X	X						
11 9:20	S	SB-5.6			2	S		X							Hold for TTLIC/STLC

S (Soil), W (Water), O (Other)
This report is applicable only to the sample received by the laboratory. The liability of the laboratory is limited to the amount paid for this report. This report is for the exclusive use of the client to whom it is addressed and upon the condition that the client assumes all liability for the further distribution of the report or its contents.

Call Peggy Smith at Vector before running STLC's.

Relinquished (Signature) <u>JH Collins</u>	Date / Time <u>9/10/93 4:30</u>	Received (Signature) <u>Mike Sorce HFL</u>	Billing Information:	Mail Results To:
	<u>9/11/93 10:30</u>			



BASE MAP TAKEN FROM GRASS VALLEY QUAD. TOPO MAP

VECTOR
ENGINEERING, INC.

12438 Loma Rica Drive, Suite C, Grass Valley, CA 95945

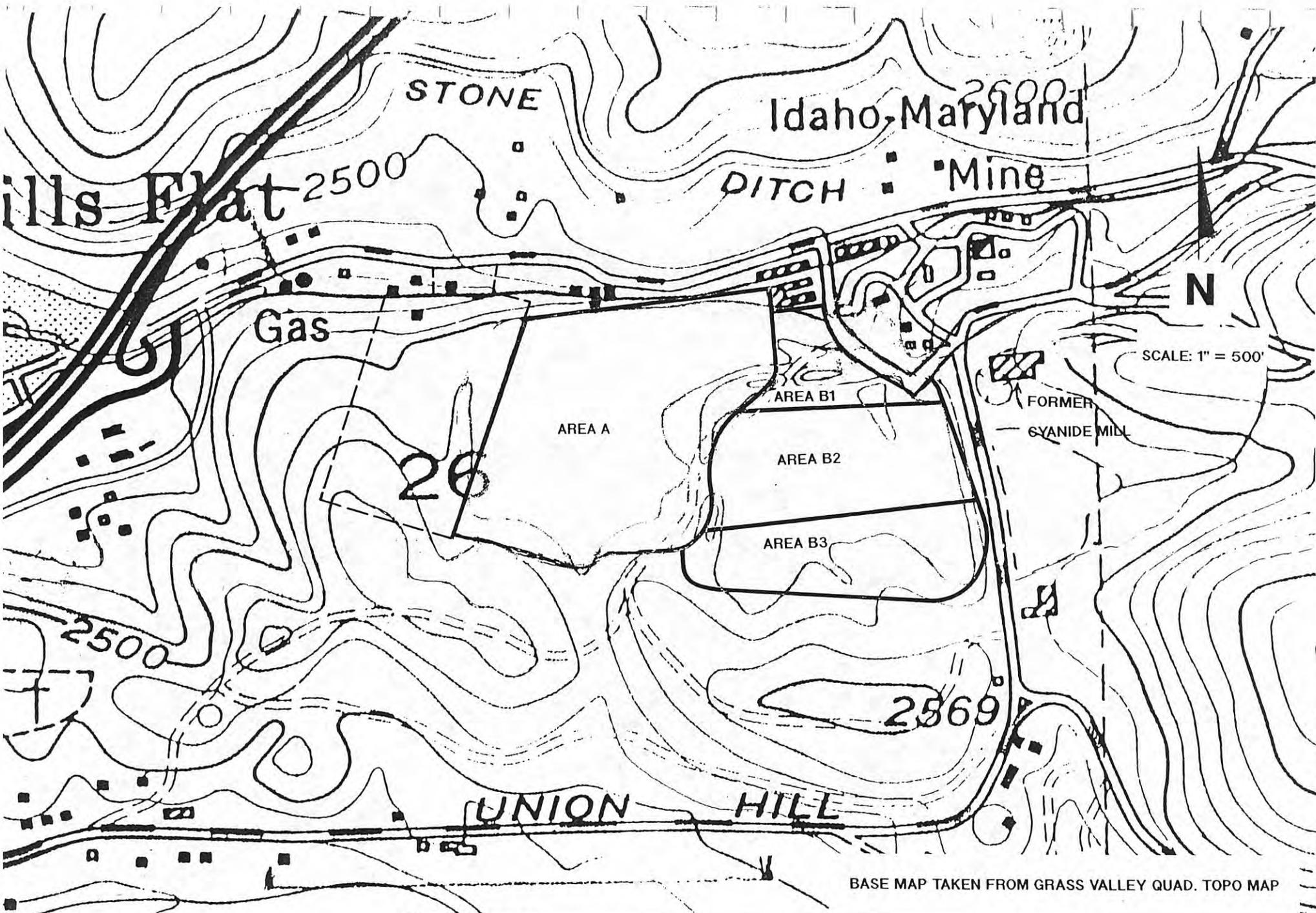
SITE VICINITY MAP

PLATE

BOUMA - ERICKSON - TOMS PROPERTY
GRASS VALLEY, CALIF.

1

JOB NO. 901085.01 APPR. *[Signature]* DATE 11/13/92



BASE MAP TAKEN FROM GRASS VALLEY QUAD. TOPO MAP

VECTOR
ENGINEERING, INC.

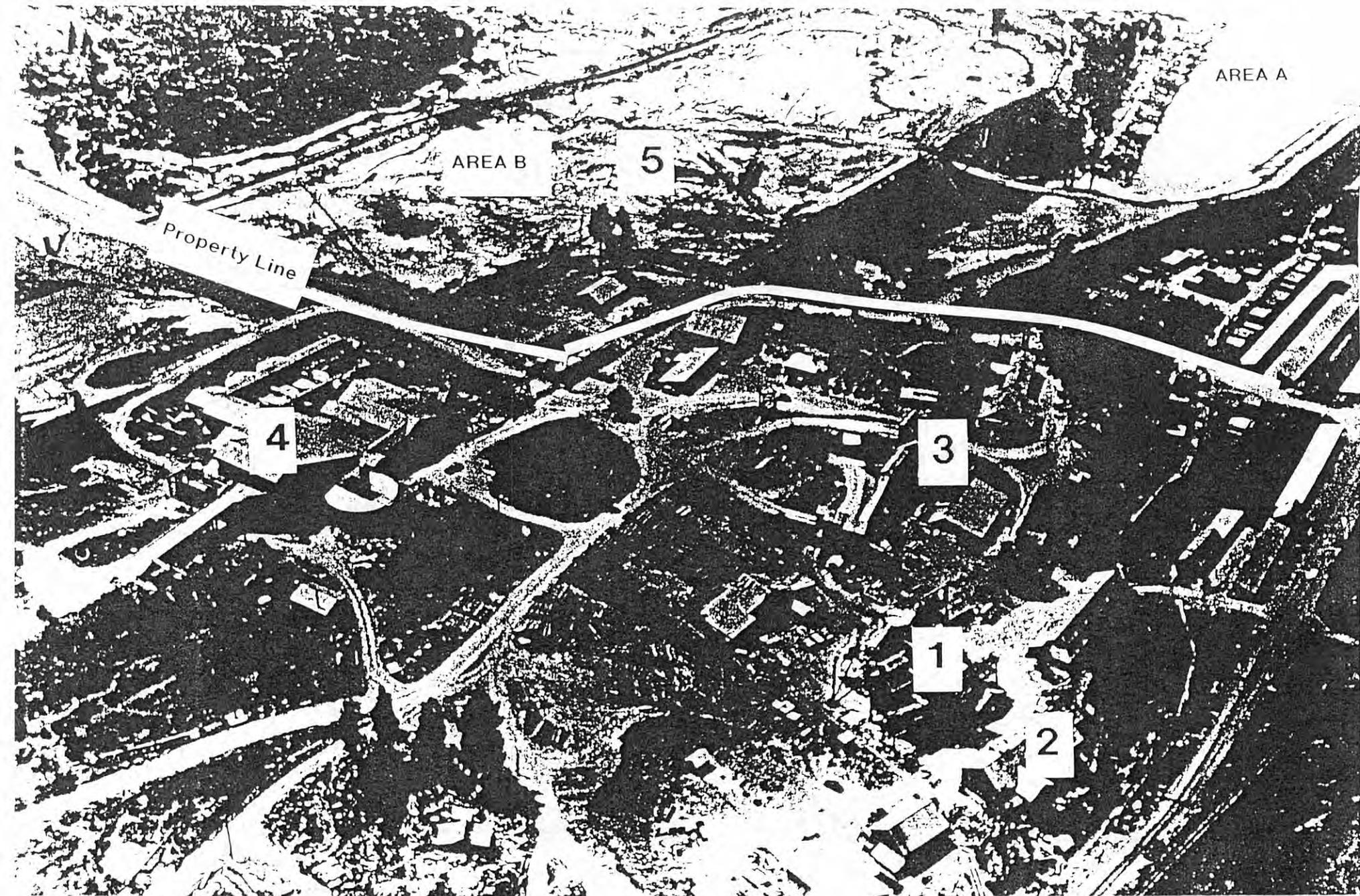
12438 Loma Rica Dr., Ste C, Grass Valley, CA 95945 (916) 272-2448

Job No. 901085.01 Appr. [Signature] Date: 11/13/92

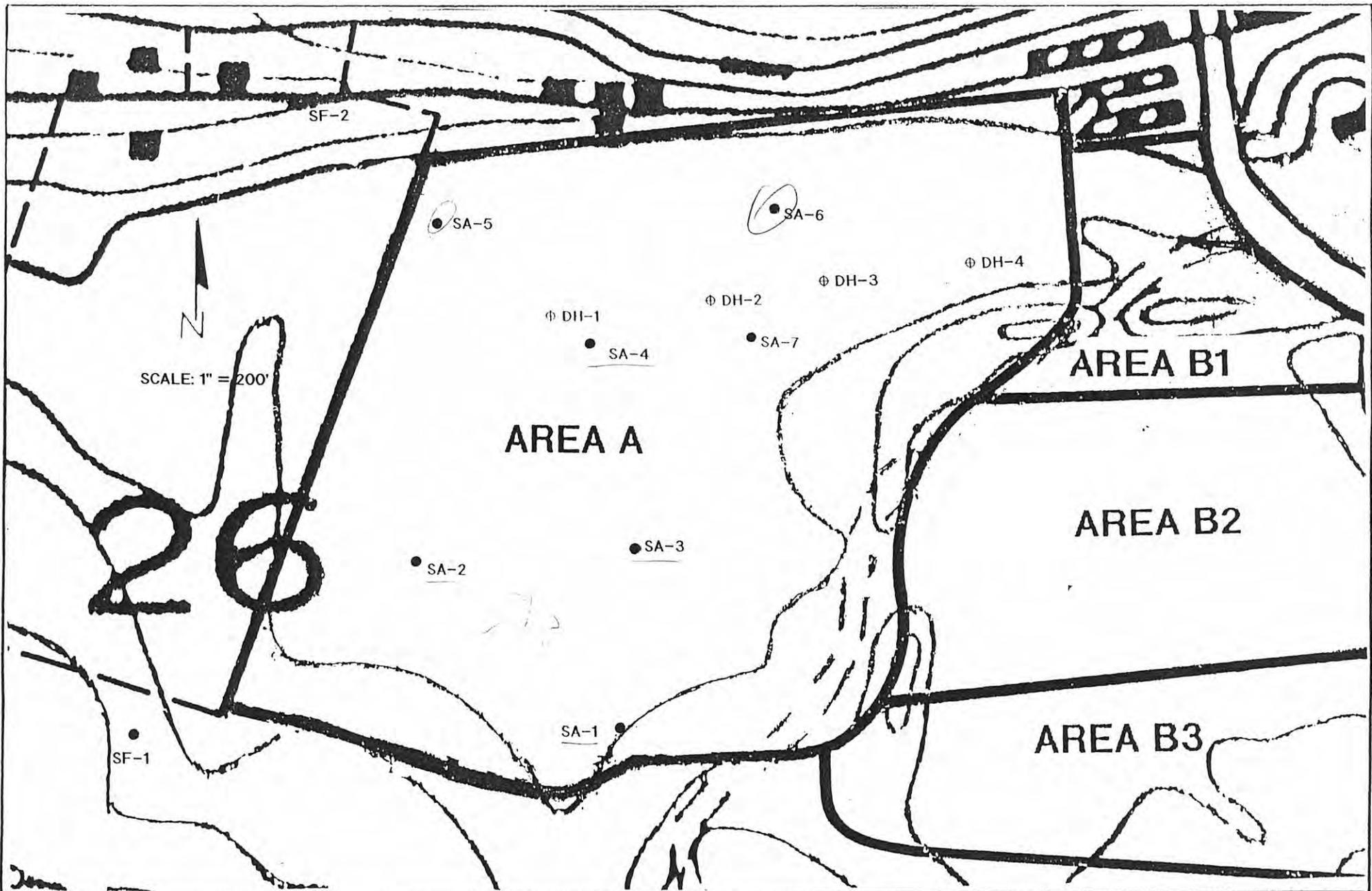
SITE MAP

BOUMA - ERICKSON - TOMS PROPERTY
GRASS VALLEY, CALIF.

PLATE
3



Aerial view of the Idaho-Maryland mine's main operating area at Grass Valley, plainly showing (1) the steel headframe and the Idaho shaft, (2) the hoist house, (3) the old 20-stamp mill and (4) the new mill and cyanide plant. The flat area to the right (5) of the new mill was the tailings disposal area. (W. H. French)



VECTOR
ENGINEERING, INC.

12430 LOMA RICA DR., SUITE C, GRASS VALLEY, CA 95946 (916) 272-2440

JOB NO. 901085.01

APPR. *PHS*

DATE: 11/12/93

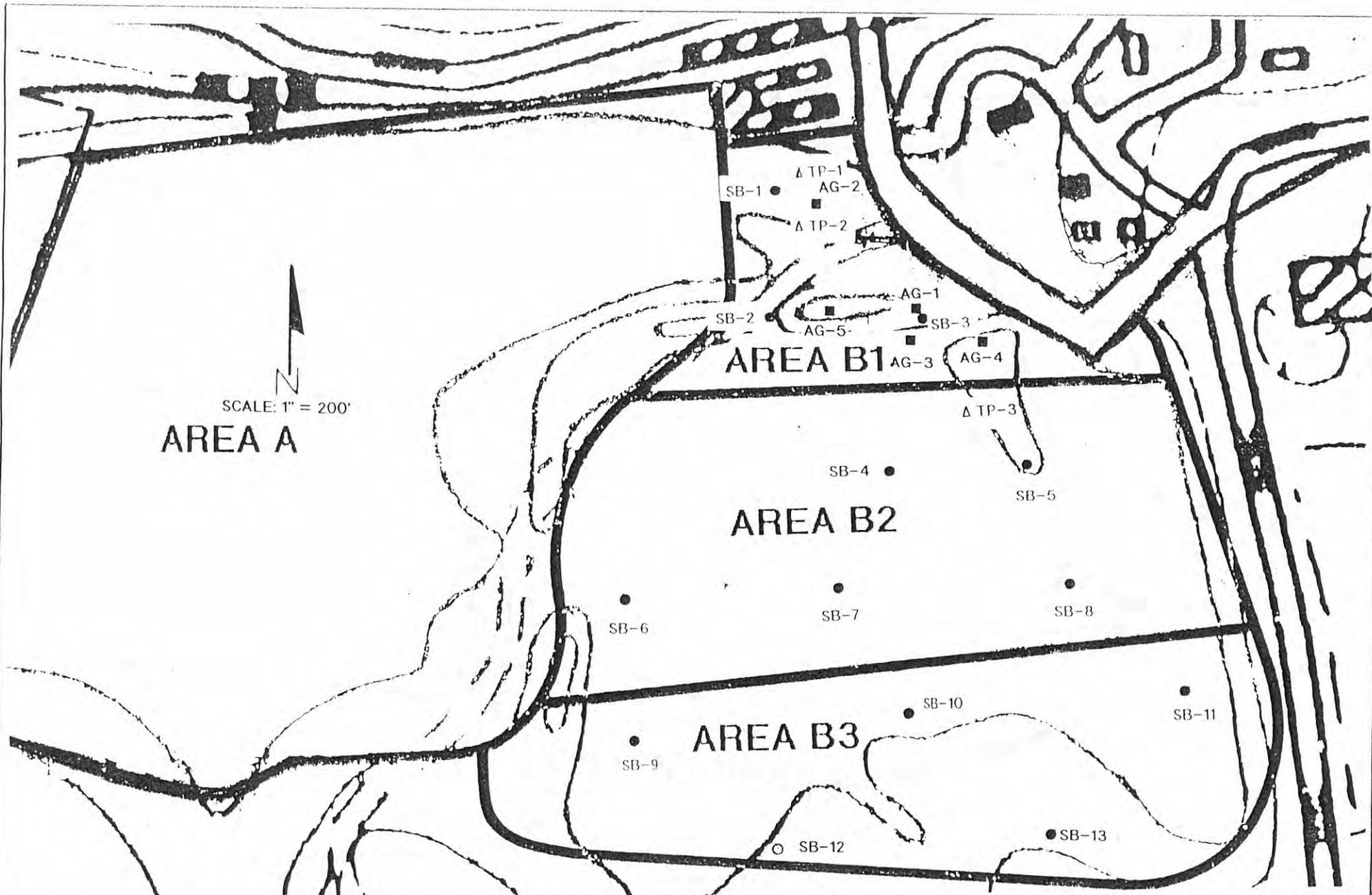
SAMPLE LOCATIONS - AREA A

BOUMA - ERICKSON - TOMS PROPERTY

GRASS VALLEY, CALIFORNIA

PLATE

5



VECTOR
ENGINEERING, INC.

12408 LOUA HICA DR., SUITE C, GRASS VALLEY, CA 95946 (916) 728-2400

JOB NO. 901085.01

ATTR. *JPK*

DATE: 11/12/93

SAMPLE LOCATIONS - AREA B

BOUMA - ERICKSON - TOMS PROPERTY

GRASS VALLEY, CALIFORNIA

PLATE

6

LOG OF SA-1

DATE EXCAVATED: 9-09-93

DEPTH IN FEET

DEPTH IN FEET	SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./FT.)
0 - 1.2	SA 1.2		
1.2 - 1.4	SA 1.4		
5 - 20			

SAMPLES

SYMBOLS

DESCRIPTION

☒	SP	SAND (SP), Grey with roots, dry, loose (Mill Tailings)
	ML	
☒	SP	SILT (ML), Light Grey, dry, stiff (Mill Tailings)
	ML	
☒	SP	SAND (SP), Gray, light, loose (Mill Tailings)
	ML	
		Sandy SILT (ML), Reddish Brown, dry stiff (Native Soil) grading to Greenish Brown near base
		TEST PIT TERMINATED AT 4.5 FEET No free water encountered

LOG OF SA-2

DATE EXCAVATED: 9-09-93

DEPTH IN FEET

DEPTH IN FEET	SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./FT.)
0 - 2.2	SA 2.2		
2.2 - 2.5	SA 2.5		
5 - 20			

SAMPLES

SYMBOLS

DESCRIPTION

☒	SW	SAND (SW), Brown to Gray, dry, loose with thin layers of gray Silt
	SRP	
☒	SRP	Light Gray decomposed SERPENTINITE (with remnant rock texture?), green semi-rectangular patches heavily rooted in upper 6", increasingly hard with depth
	SRP	
		TEST PIT TERMINATED AT 5 FEET (backhoe refusal) No free water encountered

VECTOR ENGINEERING, Inc.
12438 Loma Rica Drive, Ste C
Grass Valley, CA. 95945
(916) 272-2448

LOG OF TEST PITS SA-1 AND SA-2
B-E-T Property, Idaho-Maryland Rd.
Grass Valley, CA 95945
901085.01

**PLATE
7**

LOG OF SA-3

DATE EXCAVATED: 9-09-93

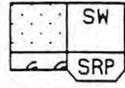
DEPTH IN FEET

SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./FT.)
SA 3.1		
SA 3.2		

SAMPLES

-
-

SYMBOLS



DESCRIPTION

SAND (SW), Grey-Brown, loose, dry (Native Soil)

Decomposed SERPENTENITE

TEST PIT TERMINATED AT 2 FEET
No free water encountered

LOG OF SA-4

DATE EXCAVATED: 9-09-93

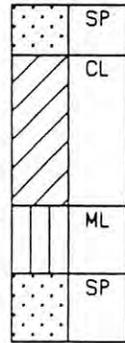
DEPTH IN FEET

SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./FT.)
SA 4.2		
SA 4.6.5		
SA 4.10		

SAMPLES

-
-
-

SYMBOLS



DESCRIPTION

Silty SAND (SP), Light Brown to Grey, loose to medium, dry (Mill Tailings)

Silty CLAY (CL), Grey, stiff, moist (Mill Tailings)

Sandy SILT (ML), Dark Brown, medium dense, moist (Native Soil)

Silty SAND (SP), Grey-Green, medium dense, moist

TEST PIT TERMINATED AT 10 FEET
No free water encountered

VECTOR ENGINEERING, Inc.
12438 Loma Rica Drive, Ste C
Grass Valley, CA. 95945
(916) 272-2448

LOG OF TEST PITS SA-3 AND SA-4
B-E-T Property, Idaho-Maryland Rd.
Grass Valley, CA 95945
901085.01

PLATE
8

LOG OF SA-5

DATE EXCAVATED: 9-09-93

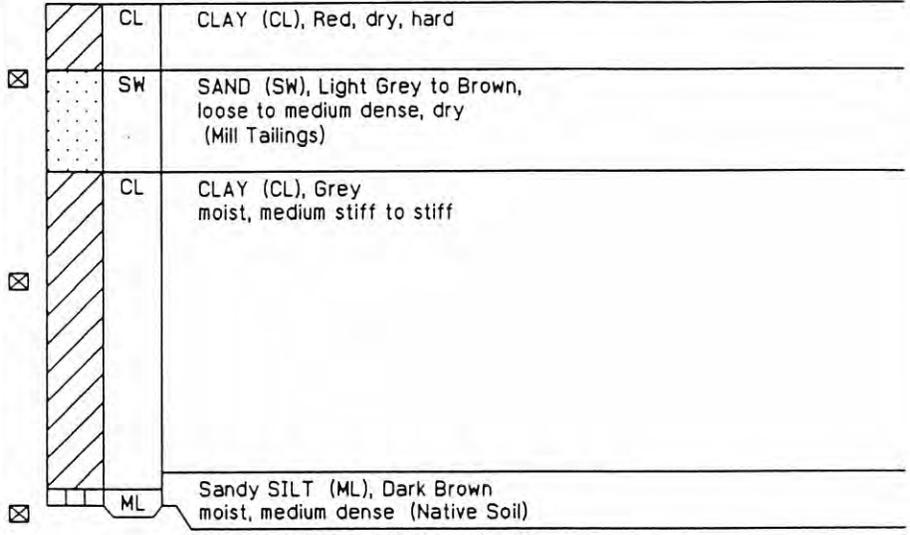
DEPTH IN FEET

SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./FT.)
SA 5.2		
SA 5.8		
SA 5.15		

SAMPLES

SYMBOLS

DESCRIPTION



Sandy SILT (ML), Dark Brown moist, medium dense (Native Soil)
TEST PIT TERMINATED AT 15 FEET
No free water encountered

LOG OF SA-6

DATE EXCAVATED: 9-09-93

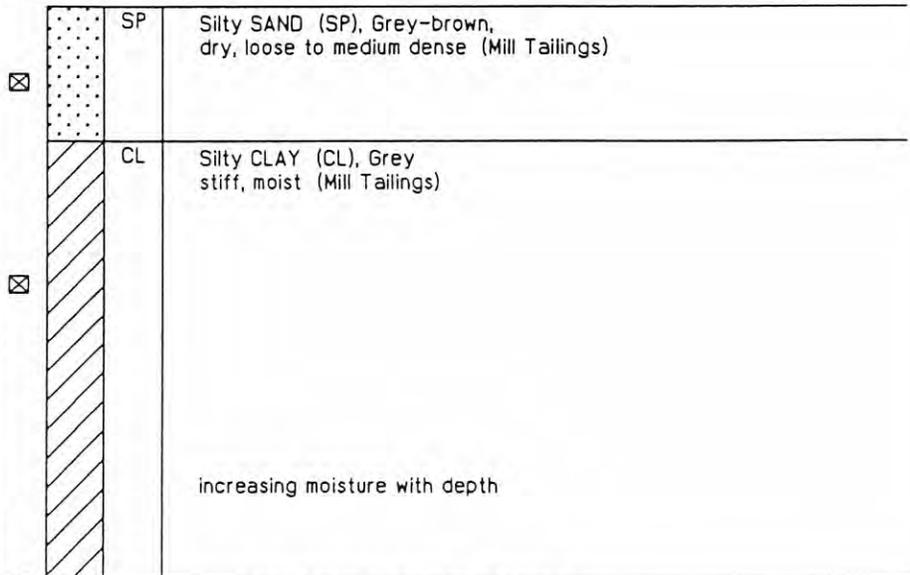
DEPTH IN FEET

SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./FT.)
SA 6.2		
SA 6.8		
SA 6.17		

SAMPLES

SYMBOLS

DESCRIPTION



increasing moisture with depth

TEST PIT TERMINATED AT 17 FEET
No free water encountered

VECTOR ENGINEERING, Inc.
 12438 Loma Rica Drive, Ste C
 Grass Valley, CA. 95945
 (916) 272-2448

LOG OF TEST PITS SA-5 AND SA-6
 B-E-T Property, Idaho-Maryland Rd.
 Grass Valley, CA 95945
 901085.01

PLATE
9

LOG OF SA-7

DATE EXCAVATED: 9-09-93

DEPTH IN FEET

SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./FT.)
SA 7.2		
SA 7.8		
SA 7.12		

SAMPLES

SYMBOLS

DESCRIPTION

☒	SP	SAND (SP), Light Brown to Grey, dry, loose with fine rootlets (Mill Tailings)
☒	CL	Silty CLAY (CL), Brown & Grey layering, moist, stiff, rootlets @ 6.5' (Mill Tailings)
☒	SP ML	SAND (SP), Light Brown to Grey, loose, dry (Mill Tailings) Sandy SILT (ML), Dark Brown, medium dense, moist (Native Soil)
☒	SRP	Decomposed SERPENTINITE, Green and White highly weathered

TEST PIT TERMINATED AT 12 FEET
No free water encountered

VECTOR
ENGINEERING, Inc.
12438 Loma Rica Drive, Ste C
Grass Valley, CA. 95945
(916) 272-2448

LOG OF TEST PIT SA-7
B-E-T Property, Idaho-Maryland Rd.
Grass Valley, CA 95945
901085.01

PLATE
10

LOG OF SB-1

DATE EXCAVATED: 9-09-93

DEPTH IN FEET

DEPTH IN FEET	SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./FT.)
5	SB 1.3		
10	SB 1.9		
15			
20			

SAMPLES	SYMBOLS	DESCRIPTION
	 GP	Sandy, Silty Boulders, Brown, loose to medium dense, dry (Waste Rock)
<input checked="" type="checkbox"/>		fine silt layer at 3.0 feet
	 GP	Sandy Silty Cobbles, Brown, dry, loose to medium dense (Waste Rock)
	 ML	Sandy SILT (ML) with cobbles, Dark Brown moist, medium dense
<input checked="" type="checkbox"/>	 SRP	Decomposed SERPENTINITE, angular cobbles, hard, light grey to green
		TEST PIT TERMINATED AT 9 FEET No free water encountered

LOG OF SB-2

DATE EXCAVATED: 9-09-93

DEPTH IN FEET

DEPTH IN FEET	SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./FT.)
5	SB 2.3		
10	SB 2.7		
15			
20			

SAMPLES	SYMBOLS	DESCRIPTION
	 GP	Silty Sandy Boulders, Light Brown, angular, dry, dense (Waste Rock)
<input checked="" type="checkbox"/>	 ML	Sandy SILT (ML) Brownish-Red, dry, dense (Mill Tailings?)
<input checked="" type="checkbox"/>	 SRP	Decomposed SERPENTINITE, Light Green, dense, dry, highly weathered
		TEST PIT TERMINATED AT 7 FEET No free water encountered

VECTOR ENGINEERING, Inc.
12438 Loma Rica Drive, Ste C
Grass Valley, CA. 95945
(916) 272-2448

LOG OF TEST PITS SB-1 AND SB-2
B-E-T Property, Idaho-Maryland Rd.
Grass Valley, CA 95945
901085.01

**PLATE
11**

LOG OF SB-3

DATE EXCAVATED: 9-09-93

DEPTH IN FEET

SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./FT.)
SB 3.4		

SAMPLES

SYMBOLS	DESCRIPTION
GP	Silty Sandy Boulders, Brownish-Red, dry, medium dense to dense (Waste Rock)
SP	SAND (SP), Brown to Red, dry, loose to medium dense (Native Soil)
Rx	GABBRO, Dark Brown, fractured, weathered

TEST PIT TERMINATED AT 7 FEET (backhoe refusal)
No free water encountered

LOG OF SB-4

DATE EXCAVATED: 9-09-93

DEPTH IN FEET

SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./FT.)
SB 4.1		
SB 4.3		

SAMPLES

SYMBOLS	DESCRIPTION
CL	Silty CLAY (CL), Black and Orange, dry to moist, medium stiff, fine roots (Mill Tailings)
SP	SAND (SP), Grey, medium dense, moist (Mill Tailings)
CL	SANDY CLAY (CL), Red, medium stiff, moist (Native Soil)
SRP	Decomposed SERPENTINITE, Green, moist, highly weathered

TEST PIT TERMINATED AT 3.5 FEET
No free water encountered

VECTOR ENGINEERING, Inc.
12438 Loma Rica Drive, Ste C
Grass Valley, CA. 95945
(916) 272-2448

LOG OF TEST PITS SB-3 AND SB-4
B-E-T Property, Idaho-Maryland Rd.
Grass Valley, CA 95945
901085.01

**PLATE
12**

LOG OF SB-5

DATE EXCAVATED: 9-09-93

DEPTH IN FEET

SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./FT.)
SB 5.3		
SB 5.8		

SAMPLES

SYMBOLS

DESCRIPTION

<input type="checkbox"/>		ML	Sandy SILT (ML), with Boulders, moist, medium dense (Mill Tailings)
<input type="checkbox"/>		SP	SAND (SP), Grey, moist, medium dense (Mill Tailings)
<input checked="" type="checkbox"/>		CL	Sandy CLAY (CL), Red, moist to wet, medium stiff (Native Soil)
<input checked="" type="checkbox"/>		SRP	Decomposed SERPENTINITE, Green, wet, highly weathered
<p>TEST PIT TERMINATED AT 6 FEET No free water encountered</p>			

LOG OF SB-6

DATE EXCAVATED: 9-10-93

DEPTH IN FEET

SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./FT.)
SB 6.2		
SB 6.4		

SAMPLES

SYMBOLS

DESCRIPTION

<input checked="" type="checkbox"/>		ML	Sandy SILT (ML), Grey, dry, medium dense to dense, rootlets to 1.5' (Mill Tailings)
<input checked="" type="checkbox"/>		ML	Sandy SILT with gravel (ML), dry to moist, medium dense to dense (Native Soil)
		SRP	Decomposed SERPENTINITE
<p>TEST PIT TERMINATED AT 6.5 FEET No free water encountered</p>			

VECTOR
ENGINEERING, Inc.
12438 Loma Rica Drive, Ste C
Grass Valley, CA. 95945
(916) 272-2448

LOG OF TEST PITS SB-5 AND SB-6
B-E-T Property, Idaho-Maryland Rd.
Grass Valley, CA 95945
901085.01

PLATE
13

LOG OF SB-7

DATE EXCAVATED: 9-10-93

DEPTH IN FEET

SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./FT.)
SB 7.2		
SB 7.4		

SAMPLES

SYMBOLS DESCRIPTION

<input checked="" type="checkbox"/>		ML	Sandy SILT (ML), Grey, dry to moist, medium dense to dense, rootlets in top 2.0' (Mill Tailings)
<input checked="" type="checkbox"/>		ML	Sandy SILT (ML), Red-Brown, dry to moist, dense with gravel (Native Soil)
<input checked="" type="checkbox"/>		SRP	Decomposed SERPENTINITE, Green, moist, stiff, highly weathered

TEST PIT TERMINATED AT 6 FEET
No free water encountered

LOG OF SB-8

DATE EXCAVATED: 9-10-93

DEPTH IN FEET

SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./FT.)
SB 8.2		
SB 8.4		

SAMPLES

SYMBOLS DESCRIPTION

<input checked="" type="checkbox"/>		ML	Sandy SILT (ML), Brown, moist, medium dense, fine rootlets (Native Soil)
<input checked="" type="checkbox"/>		CL	CLAY (CL), Grey, moist, medium stiff to stiff (Mill Tailings)
<input checked="" type="checkbox"/>		ML	Sandy SILT (ML), Brown, moist to wet, medium dense (Native Soil)
<input checked="" type="checkbox"/>		SRP	Decomposed SERPENTINITE, Green, wet, highly weathered

TEST PIT TERMINATED AT 7 FEET
No free water encountered

VECTOR ENGINEERING, Inc.
12438 Loma Rica Drive, Ste C
Grass Valley, CA. 95945
(916) 272-2448

LOG OF TEST PITS SB-7 AND SB-8
B-E-T Property, Idaho-Maryland Rd.
Grass Valley, CA 95945
901085.01

**PLATE
14**

LOG OF SB-9

DATE EXCAVATED: 9-10-93

DEPTH IN FEET

DEPTH IN FEET	SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./F.T.)
0-5	SB 9.2		
5-6	SB 9.5		
6-10			
10-15			
15-20			

SAMPLES

SYMBOLS

DESCRIPTION

SAMPLES	SYMBOLS	DESCRIPTION
<input checked="" type="checkbox"/>	ML	Sandy SILT (ML), Grey, dry, medium dense to dense, rootlets to 1.5' (Mill Tailings)
<input checked="" type="checkbox"/>	ML	Sandy SILT with gravel (ML), Red-brown, dry, dense (Native Soil)

TEST PIT TERMINATED AT 6 FEET
No free water encountered

LOG OF SB-10

DATE EXCAVATED: 9-10-93

DEPTH IN FEET

DEPTH IN FEET	SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./F.T.)
0-2	SB 10.2		
2-5			
5-10			
10-15			
15-20			

SAMPLES

SYMBOLS

DESCRIPTION

SAMPLES	SYMBOLS	DESCRIPTION
<input checked="" type="checkbox"/>	ML	Sandy SILT (ML), Light Brown, dry, loose to medium dense (Native Soil)
<input checked="" type="checkbox"/>	SRP	Decomposed SERPENTINITE, Green, dry, highly weathered

TEST PIT TERMINATED AT 2 FEET
No free water encountered

VECTOR ENGINEERING, Inc.
12438 Loma Rica Drive, Ste C
Grass Valley, CA. 95945
(916) 272-2448

LOG OF TEST PITS SB-9 AND SB-10
B-E-T Property, Idaho-Maryland Rd.
Grass Valley, CA 95945
901085.01

**PLATE
15**

LOG OF SB-11

DATE EXCAVATED: 9-10-93

DEPTH IN FEET

DEPTH IN FEET	SAMPLE NUMBER	MOISTURE CONTENT (%)	DRY DENSITY (LBS./FT.)
0 - 5	SB 11.2		
5 - 10	SB 11.5		
10 - 15			
15 - 20			

SAMPLES

SYMBOLS

DESCRIPTION

SAMPLES	SYMBOLS	DESCRIPTION
	ML	Sandy SILT (ML), Brown, dry, soft, many fine roots
☒	ML	Clayey SILT (ML), White to Grey, mottled with Orange and Dark Grey, very thin layers, many roots, dry, very stiff
	CL	Sandy CLAY (CL), Brown, moist, stiff with fine to medium gravel (Native Soil)
☒	CL	Gravelly CLAY (CL), Green, moist, stiff, with Orange and Grey mottles, Decomposed Serpentinite

TEST PIT TERMINATED AT 5 FEET
No free water encountered

VECTOR
ENGINEERING, Inc.
12438 Loma Rica Drive, Ste C
Grass Valley, CA. 95945
(916) 272-2448

LOG OF TEST PIT SB-11
B-E-T Property, Idaho-Maryland Rd.
Grass Valley, CA 95945
901085.01

PLATE
16

**PRELIMINARY GEOTECHNICAL
ENGINEERING REPORT**
for
**IDAHO-MARYLAND MINING
CORPORATION PROPERTY**
Nevada County, California

Prepared for:
Idaho-Maryland Mining Corp.
179 Clydesdale Court
Grass Valley, California 95945

Prepared by:
Holdrege & Kull
792 Searls Avenue
Nevada City, California 95959

Project No. 2416-03
October 25, 2004



Project No. 2416-03
October 25, 2004

Idaho-Maryland Mining Corp.
179 Clydesdale Court
Grass Valley, California 95945

Attention: Ross Guenther

Reference: *Idaho-Maryland Mining Corporation Property*
Idaho-Maryland Mine, New Brunswick, and Roundhole Easement Sites
Nevada County, California

Subject: *Preliminary Geotechnical Engineering Report*

Dear Mr. Guenther:

This report presents the results of our preliminary geotechnical engineering investigation for three sites on Idaho-Maryland Mining Corporation property. The Idaho-Maryland site encompasses 101 acres and is located south of Whispering Pines Lane and north of East Bennett Road near Grass Valley, California. The 37-acre New Brunswick site is located southwest of the intersection of Brunswick Road and East Bennett Road. The one-acre Roundhole Easement site is located north of Whispering Pines Lane near its intersection with Brunswick Road. We understand that, as currently proposed, the project will include the construction of industrial facilities associated with proposed mining on the Idaho-Maryland Site.

The preliminary findings presented in this report are based on a cursory surface reconnaissance at the site; review of selected geologic, soil survey and historical references; review of previous reports for the property; and our experience with subsurface conditions in the area. Based on our preliminary findings, the project as currently proposed appears to be feasible from a geotechnical engineering standpoint. We should be allowed to perform a subsurface investigation to confirm our preliminary recommendations as part of a design-level geotechnical engineering report. Furthermore, we should be allowed to perform testing and observation services during grading to confirm our design-level recommendations.

Please contact us if you have any questions regarding our observations or the preliminary recommendations presented in this report.

Sincerely,

HOLDREGE & KULL

Prepared by:

Reviewed by:

Zack Washburn
Staff Geologist

Jason W. Muir
C.E. 60167

copies: 6 to Idaho-Maryland Mining Corp. (one unbound)

F:\1 Job Data\2416 Idaho Maryland Mine Property\2416-03 prelim geotech report.wpd

TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	SITE DESCRIPTION	1
1.2	PROPOSED IMPROVEMENTS	1
1.3	PURPOSE	1
1.4	SCOPE OF SERVICES	2
2	SITE INVESTIGATION	2
2.1	GEOLOGIC SETTING	2
2.2.1	Idaho-Maryland Site	3
2.2.2	New Brunswick Site	3
2.2.3	Roundhole Easement Site	4
2.3	HISTORICAL RESEARCH	4
2.3.1	Geologic Map of the Grass Valley Quadrangle and Adjacent Area, Nevada County, California	4
2.3.1.1	Idaho-Maryland Site	4
2.3.1.2	New Brunswick Site	5
2.3.1.3	Roundhole Easement Site	5
2.3.2	Mines and Mineral Resources of Nevada County	5
2.3.3	Map of the Grass Valley Quadrangle included in the Nevada City Special Folio, California	6
2.3.4	Map Showing Mining Properties of the Grass Valley Mining District, Nevada County, California	6
2.3.4.1	Idaho-Maryland Site	6
2.3.4.2	New Brunswick Site	7
2.3.4.3	Roundhole Easement site	7
2.4	REVIEW OF OTHER REPORTS	7
2.5	FIELD INVESTIGATION	8
2.5.1	Surface Conditions	8
2.5.1.1	Idaho-Maryland Site	8
2.5.1.2	New Brunswick Site	10
2.5.1.3	Roundhole Easement Site	10
2.5.2	Surface and Groundwater Conditions	11
3	LABORATORY TESTING	11
4	CONCLUSIONS	11
5	PRELIMINARY RECOMMENDATIONS	13
5.1	GRADING	14
5.1.1	Clearing and Grubbing	14
5.1.2	Preparation for Fill Placement	14

5.1.3	Fill Placement	15
5.1.4	Differential Fill Depth	16
5.1.5	Cut/Fill Slope Grading	16
5.1.6	Erosion Control	17
5.1.7	Subsurface Drainage	17
5.1.8	Surface Water Drainage	18
5.1.9	Construction Monitoring	18
5.2	FOUNDATION SYSTEMS	19
6	LIMITATIONS	19

SHEETS

Sheet 1 Approximate Site Map

APPENDIX

Important Information About Your Geotechnical Engineering Report (included with permission of ASFE, Copyright 2004)

1 INTRODUCTION

At the request of Idaho-Maryland Mining Corporation (IMMC), Holdrege & Kull (H&K) performed a preliminary geotechnical engineering investigation of Idaho-Maryland Mining Corporation property in Nevada County, California. For your review, the Appendix contains a document prepared by ASFE entitled *Important Information About Your Geotechnical Engineering Report*, which summarizes the general limitations, responsibilities, and use of geotechnical reports.

1.1 SITE DESCRIPTION

The project includes three sites on IMMC property. The Idaho-Maryland site encompasses 101 acres and is located south of Whispering Pines Lane and north of East Bennett Road near Grass Valley, California. The 37-acre New Brunswick site is located southwest of the intersection of Brunswick Road and East Bennett Road. The one-acre Roundhole Easement site is located north of Whispering Pines Lane near its intersection with Brunswick Road. The sites are currently in an unincorporated portion of Nevada County adjacent to the city limits of Grass Valley, California. Site boundaries are shown on the attached Sheet 1.

1.2 PROPOSED IMPROVEMENTS

Our understanding of the project as currently proposed is based on our conversation with Mr. Ross Guenther and our review of a conceptual site plans prepared by IMMC dated May 2004. We understand that, as currently proposed, the project will include the construction of industrial facilities associated with proposed mining on the Idaho-Maryland site. A grading plan for the project was not available for our review.

1.3 PURPOSE

The purpose of our preliminary geotechnical investigation was to review pertinent geologic, soil survey and historical information; to review a report previously prepared by H&K; and to observe the site to assess the feasibility of development from a geotechnical engineering standpoint.

1.4 SCOPE OF SERVICES

To prepare this report, we performed the following scope of services:

- We performed a cursory reconnaissance of the site.
- We reviewed selected geologic and soil survey literature.
- We reviewed selected historical maps and literature pertinent to historic mining activity in the vicinity of the site.
- We reviewed our *Preliminary Geotechnical Engineering Report for Milco and Platner Property*, dated April 22, 2003, that pertains to a portion of the subject property.
- Based on observations made during our site reconnaissance, the results of our literature review and our experience with soil conditions in the area, we prepared this report, which provides preliminary geotechnical engineering recommendations for the proposed improvements.

2 SITE INVESTIGATION

The following sections summarize our literature review and field reconnaissance.

2.1 GEOLOGIC SETTING

We reviewed the Geologic Map of the Grass Valley - Colfax Area (A. Tuminas, 1983). According to this map, the Idaho-Maryland site is underlain by early Mesozoic rock associated with the Lake Combie complex. The geology of the western portion of the site is characterized by serpentized rock. The central portion of the site is underlain by gabbro and diorite and the eastern portion is characterized by massive diabase. The Mesozoic era occurred between approximately 245 and 65 million years before present (MYBP).

The central portion of the New Brunswick site lies on Quaternary alluvium (i.e., water lain sediments deposited in the past 2 million years); the flanks of the site are underlain by massive diabase of the Lake Combie complex.

The northern portion of the Roundhole Easement site is underlain by massive diabase, and the southern portion is characterized by serpentinized rock.

2.2 SITE SOIL CONDITIONS

2.2.1 Idaho-Maryland Site

We reviewed the *Soil Survey of the Nevada County Area, California* (USDA Soil Conservation Service, reissued August 1993). The soil survey indicates that the undisturbed portions of the southwestern part of the Idaho-Maryland site are located in an area typified by Secca-Rock outcrop complex. The soil survey describes the Secca soil type as moderately well drained soil underlain by metabasic or basic rock. Permeability is slow, and partly weathered basic rock is typically encountered at a depth of approximately 45 inches below the ground surface (bgs). Rock outcrop typically comprises 10 to 40 percent of the surface area typified by this complex. The undisturbed portions of the eastern side of the site are located in an area typified by Sites loam. The soil survey describes the Sites soil type as well drained soil underlain by tilted metasedimentary and metabasic rock. Weathered metasedimentary and basic rock is typically encountered at a depth of approximately 78 inches bgs. Permeability is moderately slow. The southern central portion of the site is classified by the soil survey as cut and fill land, which has been altered by methods other than mining. The survey states that deep accumulations of bark may be present at locations previously used as logging deck yards or lumber stack yards. The northwestern portion of the site is underlain by Placer diggings, according to the survey. This soil type occurs along drainage ways that have been placer mined and is typically comprised of gravel with little fines.

2.2.2 New Brunswick Site

The southwestern part of the New Brunswick is underlain by Aiken Loam according to the soil survey. The soil survey describes the Aiken Loam as a well-drained soil that forms on the sides of andesitic flows. According to the survey, permeability of the Aiken Loam soil type is moderately slow and weathered andesite is commonly encountered at about 64 inches bgs. The central portion of the site is characterized by Placer diggings while the northeastern portion is classified as clayey Alluvial Land. The soil survey describes clayey Alluvial Land as a

miscellaneous land type consisting of narrow areas of alluvial deposits. These soils are moderately well drained to poorly drained and permeability is moderately slow to very slow.

2.2.3 Roundhole Easement Site

The Roundhole Easement site lies entirely on Secca-Rock outcrop complex according to the soil survey. The properties of this soil type are described above.

2.3 HISTORICAL RESEARCH

We reviewed portions of the following documents pertaining to historic mining activities in the immediate vicinity of the subject property.

2.3.1 Geologic Map of the Grass Valley Quadrangle and Adjacent Area, Nevada County, California

2.3.1.1 Idaho-Maryland Site

The Geologic Map of the Grass Valley Quadrangle and Adjacent Area, Nevada County, California (1939) contained in *The Gold Quartz Veins of Grass Valley, California* (W.D. Johnston, Jr., Geological Survey Professional Paper 194, U.S. Department of the Interior, 1940) depicted the Maryland Mine north of the subject property on the Eureka-Idaho-Maryland vein. The vein strikes west-northwest and dips 50 to 70 degrees to the south-southwest. An underground inclined shaft extended south and southeast from the Maryland Mine. This shaft lies north of the northern boundary of the site, according to the map.

The Geologic Map of the Grass Valley Quadrangle and Adjacent Area, Nevada County, California (1939) shows the South Idaho vein striking west-northwest across the central portion of the site. The vein dips 60 degrees to the south. The South Idaho shaft is shown in the alignment of the vein. A horizontal or inclined tunnel is shown striking east along the vein within the southeast portion of the site.

According to *The Gold Quartz Veins of Grass Valley, California* (W.D. Johnston, Jr., Geological Survey Professional Paper 194, U.S. Department of the Interior, 1940), the Idaho-Maryland shaft inclined to the 1000-foot level at an angle of 70

degrees. The Canyon (or Cañon) shaft, an inclined winze raking to the east from the 1000-foot level, was advanced as far as the 1900-foot level to a depth greater than 2,500 feet bgs. The Eureka-Idaho-Maryland vein strikes north 77 degrees west and has an average dip of 70 degrees southwest, ranging between 50 and 80 degrees. The hanging wall is composed of diabase and gabbro and the footwall is composed of serpentine.

2.3.1.2 New Brunswick Site

The Geologic Map of the Grass Valley Quadrangle and Adjacent Area, Nevada County, California (1939) shows Union Hill Mine in the western part of the site on the Union Hill vein. The vein strikes northwest and dips between 50 and 90 degrees to the southwest. An underground inclined shaft extended south-southwest from the Union Hill Mine beneath the site. The Union Hill shaft was advanced to about 1050 feet bgs, according to the researched documents.

The Lucky and Cambridge shafts lie a few hundred feet west of the site. These shafts are vertical and intersect the Lucky Cambridge vein, which parallels the Union Hill vein. The Lucky shaft was apparently advanced to the 300-foot level, but the depth of the Cambridge shaft is not stated in the *The Gold Quartz Veins of Grass Valley, California* report. The New Brunswick (shown as Brunswick on the map) vertical shaft was included on the 1939 map, but no description of the shaft dimensions was included in the report.

2.3.1.3 Roundhole Easement Site

No information on the Roundhole shaft is provided in the *The Gold Quartz Veins of Grass Valley, California* or shown on the Geologic Map of the Grass Valley Quadrangle and Adjacent Area, Nevada County, California (1939). The approximate location of the Roundhole shaft, as shown on Sheet 1, was provided by IMMC.

2.3.2 Mines and Mineral Resources of Nevada County

We reviewed the *Mines and Mineral Resources of Nevada County* (Errol MacBoyle, California State Mining Bureau, December 1918). This publication contained information regarding the Eureka-Idaho-Maryland vein that was

discussed above, and contained additional information regarding the South Idaho Mine. The South Idaho vein is located approximately 1500 feet south of and parallel to the Eureka-Idaho-Maryland vein. The vein is located in diabase and gabbro, strikes north 85 degrees west, and dips 70 degrees to the south. The lode was developed by inclined shaft only to a depth of 155 feet at the time of the 1918 publication. A crosscut was driven south for a distance of 12 feet at a depth of 60 feet, and drifting was performed at the 100-foot level for a distance of 25 feet to the south. A tunnel was driven a distance of 800 feet on the vein east of the shaft location.

This publication also contained information regarding the Union Hill vein and shaft that was discussed above, but did not provide any information on the New Brunswick, Lucky, or Cambridge shafts.

2.3.3 Map of the Grass Valley Quadrangle included in the Nevada City Special Folio, California

The Map of the Grass Valley Quadrangle included *Nevada City Special Folio, California* (United States Geologic Survey, 1896) depicted the features described above that were shown on the 1939 Geologic Map of the Grass Valley Quadrangle and Adjacent Area, Nevada County, California.

2.3.4 Map Showing Mining Properties of the Grass Valley Mining District, Nevada County, California

2.3.4.1 Idaho-Maryland Site

The Map Showing Mining Properties of the Grass Valley Mining District, Nevada County, California (Division of Mines, 1930) showed the Idaho-Maryland site as being located within the Idaho-Maryland Mining Company claim. The map also depicted the Idaho-Maryland vein and shaft, as well as the South Idaho vein and shaft, as discussed above for the 1939 Geologic Map of the Grass Valley Quadrangle and Adjacent Area, Nevada County, California.

2.3.4.2 New Brunswick Site

The Map Showing Mining Properties of the Grass Valley Mining District, Nevada County, California (Division of Mines, 1930) showed the New Brunswick site as being located within the Idaho-Maryland Mining Company claim. The map also depicted the Union Hill vein and shaft, as well as the New Brunswick shaft, as discussed above for the 1939 Geologic Map of the Grass Valley Quadrangle and Adjacent Area, Nevada County, California.

2.3.4.3 Roundhole Easement site

The Map Showing Mining Properties of the Grass Valley Mining District, Nevada County, California (Division of Mines, 1930) did not show the Roundhole shaft, but did depict the area of the Roundhole shaft as being within the Idaho-Maryland Mining Company claim.

2.4 REVIEW OF OTHER REPORTS

In our 2003 *Preliminary Geotechnical Engineering Report for Milco and Platner Property*, we reviewed a report prepared by Neil O. Anderson and Associates, Inc. entitled *Preliminary Geotechnical Investigation, Grass Valley Business and Professional Park Between Idaho Maryland and East Bennett Rd, Grass Valley, California* (August 15, 1991). The 1991 investigation included the excavation of 22 exploratory trenches on portions of the Idaho-Maryland site. The trenches ranged from 2.5 to 13.5 feet deep.

The Anderson and Associates report described two previously graded areas on the Idaho-Maryland site that have loose, organic fill. One previously graded area lies in southeastern part of the site at the base of a cut slope. Fill up to 3.5 feet deep was encountered in the exploratory trenches excavated on the northern portion of this previously graded area. The fill was generally described as sand and gravel with organic material and occasional larger rock. Fill deeper than 13.5 feet was encountered in the exploratory trenches excavated on the southern end of this area. The fill was generally described as clay with abundant wood debris, as well as sand and gravel. There are no proposed structures shown on the site plan in the vicinity of the eastern previously graded area.

The other previously graded area lies in the southern part of the Idaho-Maryland site beneath the proposed employee parking area. Fill up to 4 feet deep was encountered in the exploratory trenches excavated on the perimeter of this area. The fill was generally described as sawdust, wood chips, clay, sand and gravel.

Atterberg Limits testing was performed using five bulk samples of clay soil obtained from depths ranging from 2.5 to 5.5 feet bgs in the exploratory trenches. Plasticity Indices ranged from 13 to 32, and Liquid Limits ranged from 37 to 57.

The Anderson and Associates report concluded that the relatively loose, organic fill onsite would not be suitable to support structural improvements.

We did not review any reports that pertain to the New Brunswick or Roundhole Easement sites.

2.5 FIELD INVESTIGATION

We performed a surface reconnaissance of the project sites on October 15 and 18, 2004 to observe near surface soil conditions and visible evidence of potential geologic hazards that may be present.

2.5.1 Surface Conditions

2.5.1.1 Idaho-Maryland Site

We have subdivided the Idaho-Maryland site into three sections to clarify discussion of the surface conditions at this site. We define the main area, southern area, and the southeastern area based on proposed use and topography.

The main area occupies the largest portion of the site and will include the ceramics plant and the majority of the other proposed improvements. The main area is located in the northwest part of the Idaho-Maryland site and had topography that slopes gently to the northwest. The slopes ranged from less than 5 percent along the perimeter of the main area to about 25 percent beneath the ceramics plant. The gently sloping areas (<5%) appeared to have been previously graded and much of their surfaces were covered with waste rock, presumably associated with past hard rock mining. The steeper slope in the vicinity of the proposed ceramics

plant was covered with piles of waste rock up to 10-feet in height. A ditch also crossed this slope in the vicinity of the proposed ceramics plant. The western part of the central area was relatively flat lying and had patchy areas of sandy material on the surface. Two approximately 40-foot high reinforced concrete towers were seen in the northwestern portion of the main area. Site elevations ranged from approximately 2490 feet above mean sea level (MSL) near the concrete towers to 2560 feet above MSL in the northeastern part of the main area.

Topography of the southern area was dominated by the western end of a small, west-trending ridge and the land that sloped away from the ridge to the north, south and west. The native soil had been cut from the ridge top and deposited along the edges of the resulting flat-lying area. A short, timber crib wall retained less than 5 feet of fill on the southern edge of the previously graded area, immediately north of a dirt access road. The remainder of the property appeared to consist primarily of undisturbed native soil. Elevations ranged from approximately 2620 feet above MSL on the ridge near the eastern property boundary to approximately 2530 feet above MSL near the southwest property corner. Slope gradients ranged from approximately 2 to 8 percent on the previously graded ridge top and from approximately 2:1, horizontal to vertical (H:V) on the land sloping away from the ridge.

The southeastern area contains the previously graded area, cut slopes, and a steep natural slope along the eastern boundary. The southeastern area was relatively flat-lying and characterized by extensive cut and fill associated with past lumber milling activities. Several relic foundations, apparently associated with the past lumber mill, as well as a concrete slab-on-grade and a pile of large concrete fragments, were observed within the previously graded area. Cut slopes on the east side of the graded area were up to 30 feet in height, and slope gradients ranged from approximately 1:1, horizontal to vertical (H:V), to near vertical. Significant residual rock structure was observed in the soil exposed in the cut slope faces. Elevations in this area ranged from approximately 2590 feet above MSL on the graded area at the toe of the cut slope to approximately 2730 feet above MSL near the eastern site boundary. Slope gradients were generally less than 10 percent, excluding the natural slope, the cut slope, and a relatively steep fill slope located on the southern end of the historic mill area.

2.5.1.2 New Brunswick Site

The New Brunswick site sits in a valley created by the South Fork of Wolf Creek. The site is bounded by Bennett Road to the north, a pond and associated dam to the east, and a steep slope (60%) to the south. Elevations across the site ranged from 2540 feet above MSL at the western site boundary to roughly 2750 feet above MSL around the New Brunswick Mine area. The site consisted of the generally flat lying surfaces around the New Brunswick Mine, gently sloping open fields and tree covered areas extending downstream of the dam, and steep slopes along the southern part of the site.

Deep fill was apparent in the vicinity of the New Brunswick Mine workings. We also observed the mine silo, concrete slabs-on-grade, and the covered New Brunswick shaft in this area.

The gently sloping surfaces along the valley floor were covered with thick vegetation and we could not evaluate the nature of the material in this area.

We observed concrete walls and waste rock piles associated with the Union Hill shaft in the northwestern part of the site. We also observed numerous waste rock piles on the northeast facing slopes across from the Union Hill shaft. These piles were up to 10 feet in height and were likely associated with mining from the Cambridge shaft and nearby exploration.

2.5.1.3 Roundhole Easement Site

The Roundhole Easement site lies on the slope immediately north of Whispering Pines Lane. The proposed site consists of a 300-foot long access road and 300-foot diameter circular area according the site plan. We observed a north facing 25 percent slope along the access road and a shallower northeast facing 15 percent slope in the circular area. Elevations across the site ranged from 2705 feet above MSL at the top of the access road to 2640 feet above MSL at the lowest part of the site. We observed the remains of a concrete structure and waste rocks piles in the northern part of the site. These features were likely associated with the Roundhole shaft.

2.5.2 Surface and Groundwater Conditions

We did not observe standing water at either the Idaho-Maryland site or the Roundhole Easement site. However, the ground surface of the flat lying portions of both sites were saturated from recent rain.

The South Fork of Wolf Creek trends northwest through the center of the New Brunswick site. The low-lying areas downstream of the dam were covered with marsh vegetation, but we did not observe standing water in these areas at the time of our site visit, which was performed at the end of the dry season. However, we observed flowing water in the South Fork of Wolf Creek.

3 LABORATORY TESTING

Laboratory testing was not included in the scope of our preliminary geotechnical engineering investigation. Laboratory testing would be required as part of a design-level geotechnical engineering investigation for the project.

4 CONCLUSIONS

The following conclusions are based on our field observations and our experience in the area.

- Based on the results of our preliminary geotechnical investigation, our opinion is that the project is feasible from a geotechnical standpoint. The recommendations contained in this report are preliminary in nature and should not be used for construction.
- Based on our review of geologic maps pertaining to the subject sites, we do not anticipate that naturally occurring asbestiform minerals will be encountered in the native soil/rock encountered in the majority of the three sites. However, the western edge of the Idaho-Maryland site was mapped as serpentine and may contain natural asbestiform minerals. In addition, material that may have been imported to the sites may contain asbestiform minerals, although we did not encounter evidence of asbestiform minerals during our site reconnaissance. The State of California Environmental Protection Agency and Air Resources Board have recognized asbestos as

a carcinogen. Grading in areas of fibrous serpentinite rock typically requires an asbestos dust mitigation plan. The plan would address engineering controls, air monitoring, laboratory testing, special handling and input from local regulatory agencies.

- Our primary concern, from a geotechnical standpoint, is the presence of relic mine features at the three sites and the presence of fill in portions of the previously graded areas of the Idaho-Maryland site and New Brunswick site. We observed and performed field density testing during fill placement in the area of the New Brunswick shaft, as summarized in our letter dated February 5, 1997. Much of the fill encountered during a previous subsurface investigation performed by others at the Idaho-Maryland site reportedly contained organic material that would not be suitable to support structural improvements. We anticipate that the relatively shallow fill across much of the southern area would be able to be removed or, if deemed suitable for the purpose, used for compacted fill. However, the deeper fill encountered by others in the southeastern area would likely require extensive excavation and would not likely be able to be reused due to the reported abundance of organic materials.
- The disturbed material and waste rock identified in the northwestern part of the Idaho-Maryland site and at the New Brunswick site may not be suitable to support structural improvements.
- Waste rock piles cover portions of the Idaho-Maryland, New Brunswick, and Roundhole Easement sites. In general, these piles are not suitable to support structural improvements. The waste rock piles in the area of the proposed ceramic plant would likely have to be removed prior to construction.
- The most notable historic mining features documented on the site were the New Brunswick shaft; the Roundhole shaft; the South Idaho shaft; and a horizontal tunnel that extends east along the South Idaho vein in the southeastern part of the site. If improvements are planned in the immediate recorded mining features, the features should be identified, if possible, and closed per the recommendations of H&K or another qualified

engineer. We would be able to provide closure recommendations as part of a design-level geotechnical engineering report.

- Based on our experience in the area, relatively shallow, resistant rock may be encountered in portions of the site during grading or excavation for utilities. Preliminary recommendations for resistant rock are presented in the following section. Subsurface soil and existing fill may also contain significant oversized rock and other large material that would require specific recommendations for use as fill. General recommendations for placement of oversized rock are also presented in the following section.
- Based on our experience in the area and our review of laboratory test results prepared by others, we anticipate that potentially expansive clay soil may be encountered in some portions of the site above relatively shallow, weathered rock. Expansive clay soil is typically encountered in this area in thin layers that require relatively modest design modification. General recommendations pertaining to expansive soil are presented in the following section.
- If the proposed improvements are to be located immediately above or below the relatively high cut slopes on the southeastern area of the Idaho-Maryland site, we anticipate that the slopes would require further evaluation.
- Other mine features may be present on or extending beneath the subject properties which were not identified during this preliminary investigation.

5 PRELIMINARY RECOMMENDATIONS

The following preliminary geotechnical engineering recommendations are based on our understanding of the project as currently proposed, our field observations, and our experience in the area. The recommendations are preliminary and should be verified by a design-level geotechnical engineering investigation.

5.1 GRADING

5.1.1 Clearing and Grubbing

Subgrade for fill placement, paved areas, and building pads should be cleared and grubbed of vegetation and other deleterious materials as described below.

1. Strip and remove organic surface soil (typically 0 to 2 inches in undisturbed areas) containing shallow vegetation and any other deleterious materials. Topsoil can be stockpiled onsite and used in landscape areas, but is not suitable for use as fill. The actual depth of stripping may vary across the site. We anticipate that deeper fill with organics will be encountered in portions of the previously graded areas.
2. Overexcavate loose fill, debris and/or other onsite excavations to underlying, competent material. Possible excavations include exploratory trenches excavated by others, mantles or soil test pits, mining features, and tree stump holes.
3. Remove all rocks greater than 8 inches in greatest dimension (oversized rock) from the top 12 inches of soil. Oversized rock should be placed in deep fill per the recommendations of the project geotechnical engineer, stockpiled for later use in landscape areas or stacked rock walls, or removed from the site.
4. Vegetation, tree stumps and exposed root systems, any other deleterious materials and oversized rocks not used in landscape areas should be removed from the site.

5.1.2 Preparation for Fill Placement

Upon completion of site clearing, grubbing and overexcavation, the exposed native soil should be observed by a representative of our firm prior to placement of fill at the project site. Fill placed on slopes steeper than 5:1, horizontal:vertical (H:V), should be benched into the existing slope to allow placement of fill in horizontal lifts.

5.1.3 Fill Placement

Fill should be placed according to the following guidelines:

1. Material used for fill construction should consist of uncontaminated, predominantly granular, non-expansive native soil or approved import soil. Rock used in fill should be no larger than 8 inches in diameter. Rocks larger than 8 inches are considered oversized material and should be placed in deep fill per the recommendations of the project geotechnical engineer, stockpiled for use in landscape areas or rock walls, or removed from the site.
2. Oversized material may be windrowed in deeper fill under the observation of a representative of the project geotechnical engineer. The windrows should be separated by at least one equipment width. Compacted fill should be worked into the sides of each windrow, and remaining voids should be filled with smaller rock. If the oversized material is to be incorporated into a rock fill that does not permit density testing by nuclear methods, the contractor should prepare a test fill during initial fill placement for observation and testing. The means and methods of subsequent fill placement will be evaluated for conformance with the approved test fill. Subsurface seepage should be addressed in areas of oversized rock placement and rock fill to reduce the chance of soil migration in the fill associated with groundwater seepage through the oversized material or rock fill.
3. Imported fill material should be predominantly granular, non-expansive and free of deleterious or organic material. If imported material is required to grade the site, it should be submitted to H&K for approval and laboratory analysis at least 72 hours prior to use as fill.
4. Clay soil, if encountered, may be used as fill if mixed with granular soil at a ratio determined by the project geotechnical engineer. A typical mixing ratio for granular soil to clay soil is four to one.
5. Fill should be uniformly moisture conditioned and placed in maximum 8-inch thick loose lifts (layers) prior to compacting.

6. All fill should be compacted to at least 90 percent of the maximum dry density per ASTM D1557. The upper 8 inches of fill in building footprints and paved areas should be compacted to a minimum of 95 percent of the maximum dry density per ASTM D1557.
7. The moisture content, density and relative compaction of all fill should be evaluated by our firm during construction.

5.1.4 Differential Fill Depth

To reduce the magnitude of differential settlement associated with variable fill depth beneath structures, we recommend that differential fill depths beneath structures should not exceed 5 feet. For example, if the maximum fill depth is 8 feet across a building pad, the minimum fill depth beneath that pad should not be less than 3 feet. If a cut-fill building pad is used in this example, the cut portion would need to be overexcavated 3 feet and replaced with compacted fill. As part of a design-level geotechnical investigation, we would be able to provide additional recommendations to reduce differential settlement for structures, such as the proposed ceramics plant, which are to be located in moderately sloping portions of the site.

5.1.5 Cut/Fill Slope Grading

1. Cut and fill slopes should generally be no steeper than 2:1, H:V. Based on our experience in the area, 1½:1, H:V, or steeper cut slope gradients may be possible in some areas that have significant rock structure. Allowable slope gradients must be verified based on the results of laboratory testing performed as part of a design-level geotechnical investigation.
2. Fill slopes should be constructed by overbuilding the slope face and then cutting it back to the design slope gradient. Fill slopes should not be constructed or extended horizontally by placing soil on an existing slope face and/or compacted by track walking.
3. Benching during placement of fill on an existing slope must extend through loose surface soil into firm material, and be performed at intervals such that

no loose soil is left beneath the fill. An equipment width bench should be made at least every 5 vertical feet.

4. Our observation of rock outcrop and our experience in the area has shown that isolated areas of moderately or slightly weathered rock that is difficult to trench with conventional trenching equipment may be encountered in some portions of the site during grading or trenching. Pre-ripping, blasting, or splitting may be required in these isolated areas.

5.1.6 Erosion Control

Graded portions of the site should be seeded as soon as possible following grading to allow vegetation to become established prior to the rainy season. The following erosion control measures should be implemented for cut and fill slopes to reduce erosion.

1. Slopes should be hydroseeded or hand seeded/strawed with an appropriate seed mixture compatible with the soil and climate conditions of the site as recommended by the local Resource Conservation District office.
2. Following seeding, jute netting should be placed and secured over the slopes to keep seeds and straw from being washed or blown away. Tackifiers or binding agents may be used in lieu of jute netting. Surface water drainage ditches should be established at the top of all graded slopes to intercept and redirect surface water away from the slope face.
3. Under no circumstances should surface water be allowed to run over slope faces. The intercepted water should be discharged into natural drainage courses or into the on site storm water drainage system.

5.1.7 Subsurface Drainage

If grading is performed during or immediately following the rainy season, seepage may be encountered, particularly in the low-lying portions of the New Brunswick and Idaho-Maryland sites. If groundwater or saturated soil conditions are encountered during grading, we anticipate that dewatering may be possible by gravity or by installation of sump pumps in the excavation. Control of subsurface

seepage at the base of fill areas can typically be accomplished by placement of an area drain or a strip drain. Underlying, saturated soil is typically removed and replaced with free draining, granular drain rock enveloped in geotextile fabric. Fill soil can be placed after placing the granular rock to an elevation that is higher than the encountered groundwater. Rock drains typically consist of open graded rock enveloped in a non-woven geotextile filter fabric such as Amoco 4546™ or equivalent. Drains should have a minimum 4-inch diameter, perforated, schedule 40, PVC pipe placed at the low point of the drain, inside the drainrock, with the perforations placed down. The PVC pipe should be sloped so that water is directed away from the fill placement area by gravity. Site specific subsurface drainage recommendations can be provided as part of a design-level geotechnical report.

5.1.8 Surface Water Drainage

Proper surface water drainage is important to the successful development of the project. We recommend the following measures to help mitigate surface water drainage problems:

1. Slope final grade in structural areas so that surface water drains away from buildings at a minimum 2 percent slope for a minimum distance of 10 feet.
2. Compact and slope all soil placed adjacent to building foundations such that water is not allowed to pond or infiltrate. Backfill should be free of deleterious material.
3. Direct downspouts to a closed collector pipe which discharges flow to positive drainage.

5.1.9 Construction Monitoring

Construction monitoring includes review of plans and specifications and observation of onsite activities during construction as described below.

1. We should be allowed to review the final grading plans prior to construction to determine whether recommendations presented in the design-level

geotechnical report have been implemented, and if necessary, to provide additional and/or modified recommendations.

2. We should be allowed to perform construction monitoring of earthwork grading performed by the contractor to determine whether our recommendations have been implemented, and if necessary, provide additional and/or modified recommendations.

5.2 FOUNDATION SYSTEMS

Our preliminary opinion is that shallow spread footings are suitable for support of structures across much of the subject site. Footings should be founded on native, undisturbed soil/rock or compacted, tested fill. Foundation design criteria and construction recommendations are typically provided as part of a design-level geotechnical engineering report.

If adverse subsurface conditions such as loose fill or expansive soil are encountered, such as the deeper fill documented in the eastern side of the Idaho-Maryland site, a deep foundation or removal and replacement of the fill may be required. Based on the larger material encountered by others in the deep fill, we do not anticipate that drilled piers would be appropriate at that particular location. We understand that improvement of this area is not currently proposed.

Footings should be deepened through expansive clay soil, if encountered at the base of the footing excavations. Expansive clay soil is occasionally encountered in relatively thin layers above the weathered rock in this area.

6 LIMITATIONS

The following limitations apply to the findings, conclusions and recommendations presented in this report:

1. Our professional services were performed consistent with the generally accepted geotechnical engineering principles and practices employed in northern California. This warranty is in lieu of all other warranties, either expressed or implied.

2. These services were performed consistent with our agreement with our client. We are not responsible for the impacts of any changes in environmental standards, practices or regulations subsequent to performance of our services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report. This report is solely for the use of our client. Any reliance on this report by a third party is at the risk of that party.
3. If changes are made to the nature or design of the project as described in this report, then the conclusions and recommendations presented in this report should be considered invalid by all parties. Only our firm can determine the validity of the conclusions and recommendations presented in this report. Therefore, we should be allowed to review all project changes and prepare written responses with regards to their impacts on our conclusions and recommendations. Subsurface investigation and laboratory testing will be required to develop design-level recommendations.
4. The analyses, conclusions and recommendations presented in this report are preliminary, based on site conditions as they existed at the time we performed our surface observations. The subsurface conditions should be confirmed by a design-level geotechnical investigation prior to construction.
5. Our scope of services did not include evaluating the project site for the presence of hazardous materials. Waste rock associated with historic mining has the potential to contain elevated metals concentrations which may pose a hazard to human health and water quality. Although we did not identify hazardous materials at the time of our field investigation, we understand that petroleum products have been released at the subject site. Project personnel should be careful and take the necessary precautions should hazardous materials be encountered during construction.
6. The findings of this report are valid as of the present date. Changes in the conditions of the property can occur with the passage of time. The changes may be due to natural processes or to the works of man, on the project site or adjacent properties. In addition, changes in applicable or appropriate standards can occur, whether they result from legislation or the broadening of knowledge. Therefore, the recommendations presented in this report should not be relied upon after a period of two years from the issue date without our review.

SHEETS

Sheet 1 Approximate Site Map

APPENDIX

***IMPORTANT INFORMATION ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT***

(included with permission of ASFE, Copyright 2004)



APPROXIMATE SCALE
1 INCH = 300 FEET

CONTOUR INTERVAL
5 FEET

- LEGEND**
- APPROXIMATE LOCATION OF OBSERVED ROCK OUTCROP
 - LCsp** LAKE COMBIE SERPENTINIZED ROCK
 - LCmd** LAKE COMBIE MASSIVE DIABASE
 - LCgb** LAKE COMBIE GABBRO / DIORITE
 - Qa** QUATERNARY ALLUVIUM
 - HISTORIC ADIT AND WASTE ROCK PILE INFORMATION PROVIDED BY: IDAHO-MARYLAND MINING CORPORATION
 - DENSE VEGETATION
 - DEPRESSION

NOTES

BASE MAP PREPARED BY:
IDAHO-MARYLAND MINING CORPORATION

TOPOGRAPHY SHOWN HEREON IS
COMPILED FROM AERIAL SURVEY.

DESIGNED BY:	ZW
DRAWN BY:	DFD
DATE:	OCTOBER 2004
DRAWING NAME:	2416-03-FIG1
PROJECT No.:	2416-03

NO.	REVISIONS

APPROXIMATE SITE MAP FOR
IDAHO-MARYLAND, NEW BRUNSWICK
AND ROUNDHOLE EASEMENT SITES
NEVADA COUNTY, CALIFORNIA

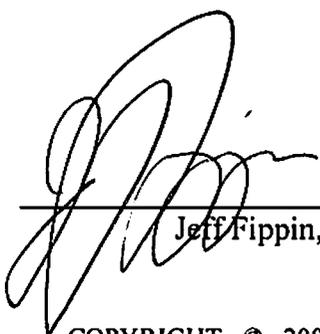
HK HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS
792 SEARLES AVENUE
NEVADA CITY, CA 95959
(530) 478-1805 FAX 478-1019

**GEOTECHNICAL REPORT
IDAHO-MARYLAND MINE
SURFACE FACILITIES AND IMPROVEMENTS
GRASS VALLEY, CALIFORNIA**

SUBMITTED TO
IDAHO MARYLAND MINING CORPORATION
179 CLYDESDALE COURT
GRASS VALLEY, CALIFORNIA

PREPARED
BY
ENGEO INCORPORATED
PROJECT NO. 7546.5.001.01

MARCH 6, 2007
REISSUED MAY 1, 2007



Jeff Fippin, GE





Mark M. Gilbert, GE

COPYRIGHT © 2007 ENGEO INCORPORATED. THIS DOCUMENT MAY NOT BE REPRODUCED IN WHOLE OR IN PART BY ANY MEANS WHATSOEVER, NOR MAY IT BE QUOTED OR EXCERPTED WITHOUT THE EXPRESS WRITTEN CONSENT OF ENGEO INCORPORATED.

TABLE OF CONTENTS

1. INTRODUCTION..... 1

 1.1 SCOPE OF SERVICES 1

 1.2 PROJECT LOCATION 2

 1.3 PROJECT DESCRIPTION..... 2

 1.4 SITE HISTORY 3

2. FINDINGS 3

 2.1 SEISMICITY 3

 2.2 SITE GEOLOGY 4

 2.3 SURFACE CONDITIONS 4

 2.4 SUBSURFACE CONDITIONS..... 6

 2.5 GROUNDWATER CONDITIONS 8

 2.6 LABORATORY TESTING 9

3. SLOPE STABILITY ANALYSES 9

4. CONCLUSIONS 10

 4.1 NON-ENGINEERED FILL 10

 4.2 EXPANSIVE SOIL 11

 4.3 SHALLOW BEDROCK 12

 4.4 DIFFERENTIAL FILL THICKNESS..... 12

 4.5 SOIL CORROSION POTENTIAL 12

 4.6 EXCAVATABILITY 14

 4.7 STATIC AND PERCHED GROUNDWATER 14

 4.8 FUTURE CULVERT STRUCTURE OPERATIONS..... 15

 4.9 2001 CBC SEISMIC DESIGN PARAMETERS 15

5. EARTHWORK RECOMMENDATIONS 16

 5.1 GENERAL SITE CLEARING..... 16

 5.2 CUT PADS AND CUT/FILL PAD TRANSITIONS 16

 5.3 DIFFERENTIAL FILL THICKNESS..... 17

 5.4 NON ENGINEERED FILL REMOVAL 17

 5.5 EXPANSIVE SOIL MITIGATION 18

 5.6 OVER-OPTIMUM SOIL MOISTURE CONDITIONS 18

 5.7 ACCEPTABLE FILL..... 18

 5.8 COMPACTION 19

 5.9 UNDERGROUND UTILITY BACKFILL 20

5.10	LANDSCAPE FILL.....	20
5.11	SLOPES	20
5.11.1	Gradients.....	20
5.11.2	Fill Placed on Existing Slopes.....	20
5.12	SITE DRAINAGE	21
5.12.1	Surface Drainage	21
5.12.2	Subsurface Drainage.....	21
6.	FOUNDATIONS	21
6.1	GENERAL APPROACH.....	21
6.2	SHALLOW FOUNDATIONS.....	22
6.3	SPREAD FOOTINGS IN BEDROCK	23
6.4	DRILLED PIER FOUNDATIONS.....	24
6.5	STORAGE TANK FOUNDATION.....	25
6.6	INTERIOR CONCRETE FLOOR SLABS.....	26
6.6.1	Minimum Design Section.....	26
6.6.2	Slab Moisture Vapor Reduction	27
6.6.3	Subgrade Modulus for Structural Slab Design	28
7.	CULVERT STRUCTURE ENDWALLS	28
7.1	LATERAL SOIL PRESSURES.....	28
7.2	WALL DRAINAGE	28
7.3	BACKFILL	29
7.4	FOUNDATIONS	29
8.	PAVEMENT DESIGN	29
8.1	FLEXIBLE PAVEMENTS	29
8.2	SUBGRADE AND AGGREGATE BASE COMPACTION	30
9.	RISK MANAGEMENT.....	31
10.	LIMITATIONS.....	31

FIGURES

- Figure 1: Site Vicinity Map
- Figure 2: Site Location Plan
- Figure 3: Proposed Development
- Figure 4: Geology Map
- Figure 5: Berm Road Site Map
- Figure 6: Berm Cross Section at Culvert

- Figure 7: Slope Stability at Boring B20 – Static Loading
Figure 8: Slope Stability at Boring B20 – Pseudo Static Loading
Figure 9: Slope Stability at Boring B22 – Static Loading
Figure 10: Slope Stability at Boring B22 – Pseudo Static Loading

Table A - Summary of Geotechnical Condition and Foundation Recommendations

Appendix A - Field Exploration Description & Logs

Appendix B - Laboratory Test Data

Appendix C - Logs of Subsurface Explorations by Idaho Maryland Mining Corporation

1. INTRODUCTION

ENGEO Incorporated prepared this geotechnical report for design of surface facilities and improvements at the Idaho-Maryland Mine (IMM) in Grass Valley, California. This report contains geotechnical recommendations for design of various structures and roadway improvements and discussion of stability of the existing berm at the site.

For our use we received the following:

1. Idaho-Maryland Mining Corporation, "Request For Proposal," dated January 10, 2007, Received via mail.
2. Email from Jim Wood of Idaho-Maryland Mining Corporation, "IMMC RFP Addendum," dated January 12, 2007.
3. Idaho-Maryland Mining Corporation, Site Plan, G1-06-001, Prepared by Idaho-Maryland Mining Corporation, dated December 21, 2006, Received via email.
4. Idaho-Maryland Mining Corporation, Site Geology Map, G2-06-002, Prepared by Idaho-Maryland Mining Corporation, dated December 21, 2006, Received via email
5. Idaho-Maryland Mining Corporation, Suggested Sample Locations and Methods, G3-06-003, Prepared by Idaho-Maryland Mining Corporation, dated January 2, 2007, Received via email.
6. Holdredge & Kull, "Preliminary Geotechnical Engineering Report for Idaho-Maryland Mining Corporation Property" Nevada County, California, dated October 25, 2004.

1.1 SCOPE OF SERVICES

ENGEO prepared this report as outlined in our agreement dated January 16, 2007. The Idaho-Maryland Mining Corporation (IMMC) authorized ENGEO to conduct the scope of services, which included the following:

- Service Plan Development
- Subsurface Field Exploration
- Soil Laboratory Testing
- Engineering Analysis and Conclusions
- Report Preparation.

1.2 PROJECT LOCATION

Figure 1 displays a Site Vicinity Map. The site is located on the Idaho-Maryland Mine site south of Idaho Maryland Road and north of East Bennett Road in the City of Grass Valley, California. The site is accessed from the northeast near the intersection of Centennial Road and Whispering Pines Lane, from the northwest along a gated drive off of Idaho-Maryland Road, and from the southeast at two points of entry off of East Bennett Road.

Figure 2 shows site boundaries, proposed building and pavement areas, and our exploratory locations. The northern boundary of the site is bounded by Idaho-Maryland Road. Centennial Road and Whispering Pines Lane border the site to the northeast, and East Bennett Road lies along portions to the southeast. The property is surrounded by undeveloped land on the south, southwest, and east. Mixed use commercial properties are located along the north, northwest and northeast. A pond is located immediately northeast of the property and an existing office building and other businesses are located along the northern side of the project, across Idaho-Maryland Road.

1.3 PROJECT DESCRIPTION

Based on our discussions with representatives of the Idaho-Maryland Mining Corporation (IMMC) and review of References 1 through 5, we understand that site improvements will include construction of several pre-fabricated steel buildings with concrete slab-on-grade floors, storage areas, paved roadways and parking areas, underground utilities, a settling pond and a detention pond. The proposed improvements are shown on Figure 3. In addition, we itemize the improvements in Table A.

We understand that most of the proposed structures will be one-story with some two-story buildings, however building loads are not available at this time. The equipment in the buildings, including crushing, grinding, and processing equipment, is to be structurally isolated from the building. The Substation will be primarily a fenced-in gravel yard with some concrete pads for transformers and equipment panels.

Centennial Road will be constructed immediately west of the existing berm along the northeastern boundary of the site; it will be a two-lane paved roadway. The extension of Centennial Drive will require extension of the existing culvert where it will pass beneath the new road, as well as construction of a headwall and wingwalls at the outlet.

Based on review of the topographic data and improvement plans provided by IMMC, it appears that earthwork cuts and fills will range between approximately 15 and 30 feet, respectively.

1.4 SITE HISTORY

The Idaho-Maryland Mine was reportedly in operation from approximately 1851 through 1956. The project site was previously occupied by facilities used to process the ore from the mine and from other mines in the area. The berms in the north and eastern portions of the sites were used as tailings dams and were constructed sometime during mine operations. The pond on the east side of the eastern berm appears to have been historically used as a tailings pond. Much of the project site is covered with tailings from the operations at the site.

A lumber mill was previously located in the southeastern portion of the site, as shown on Figure 3. An existing lumber mill is located in the northeastern portion of the site, as shown on Figure 3. No buildings remain on site from the former mining or milling activities.

2. FINDINGS

We visited the site on January 23 and January 29 through February 2, 2007 to perform our site exploration. Section 2 presents descriptions of surface and subsurface conditions observed during our exploration.

2.1 SEISMICITY

The site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone and no known surface expression of active faults is believed to exist within the site. Fault rupture through the site, therefore, is not anticipated.

The site does lie within a seismically active region. According to the Fault Activity Map of California and Adjacent Areas (Jennings 1994) and The Simplified Fault Activity map of California (Jennings and Saucedo 1999, revised 2002) the site lies within the Foothills Fault System. The Foothills Fault System has been assigned a moment magnitude of 6.5. The nearest mapped active portion of the Foothill Fault System is approximately 20 miles northwest of the site on a segment of the Bear Mountain Fault. The nearest mapped potentially active segments of faults in the Foothill Fault System are approximately 5 mile south, 8 miles east, and 7 mile southwest of the site.

Other active faults in the region include the Mohawk-Honey Lake Fault zone approximately 36 miles away, considered capable of a moment magnitude of 7.3 and the Great Valley Fault system approximately 62 miles away capable of a moment magnitude of 6.8.

We reviewed the California Geologic survey website "Probabilistic Seismic Hazards Mapping Ground Motion Page to determine an estimate of probabilistic ground shaking at the site. Based on the depth to bedrock at the site, we utilized a soft rock profile in estimating the site peak ground acceleration (PGA). Based on this approach, we developed a design PGA of 0.13g with a 10 percent probability of being exceeded in 50 years.

2.2 SITE GEOLOGY

We present the following information on site geology based on our field reconnaissance, subsurface exploration, review of the Geologic Map of the Chico Quadrangle, California (1:250,000 scale) by Saucedo and Wagner, 1992, and review of geologic mapping previously performed by IMMC representatives. The geologic formations beneath the site appear to be Mesozoic and Paleozoic rocks of an ophiolitic mélange assemblage; the rock types at the site are specifically mapped as andesite pyroclastic rock, ultramafic rock, massive diabase, diorite, and gabbroic rock. According to our exploration and geologic data reviewed, the rocks have been slightly metamorphosed at low or medium grade.

Other geologic formations mapped in the vicinity of the site include serpentinite associated with the Grass Valley Fault system southwest of the site and the Idaho Fault mapped north of the site. Northwest trending lineaments of the Grass Valley fault system have been mapped by IMMC representatives in the southwest portion of the site. The Grass Valley Fault is not considered active.

2.3 SURFACE CONDITIONS

We observed the following site features during our reconnaissance:

- The approximately 138 acre site consists of rolling terrain and with surface grades ranging from approximately Elevation 2730 feet in the southeast to approximately Elevation 2480 feet in the northwest (Datum: 0 Feet = Mean Sea Level). Pines, oaks, and Manzanita brush covered most of the site.
- A gravel road extends from the northern portion of the site in the vicinity of Centennial Drive through to East Bennett Road. A private buried water line is located within this alignment.
- Several dirt access roads that meander through the site.
- Overhead power lines were located along the south side of Idaho-Maryland Road.

- Concrete pads and foundations, apparently from a former lumber mill, were located in the southeastern portion of the site. The concrete within the pads and foundations was weathered and deteriorated.
- The berm located in the vicinity of the proposed southern extent of Centennial Drive was approximately 25 feet tall from the western toe to the crest. The crest was approximately 20 feet wide. A gravel road was built along the crest.
- Based on our visual observations, the berm slopes appeared to be approximately 1¾:1 (horizontal:vertical) to 2:1. The bottom approximately two-thirds of the western side of the berm was covered with approximately 8- to 12-inch size rock rip-rap. We did not observe any surface signs of sloughing or oversteepening of the berm slopes on either the east or west slopes.
- We observed a pond off of the site on the east side of the berm.
- A 3 foot diameter concrete box culvert that allowed water through the berm (as shown in plan on Figure 5); the water flowed east to west. The inlet was a tower structure approximately 36 feet high. The tower structure was adaptable through the addition of batter boards; this structure appeared to have been constructed to allow for the collection of mine tailings while allowing water to flow through the structure. It appeared that approximately 12 feet of batter boards were in place and approximately 12 feet of tailings were retained by the berm at the time of our site visit. We observed that a screen at the top of the tailings level was clogged with debris and the clogged screen was impounding 2 feet of water in the pond at the inlet. A small amount of water was observed flowing through the culvert at the time of our visit. The culvert discharged to a small creek on the west side of the berm. Figure 6 shows a cross section of the berm and culvert for reference.
- An additional berm located in the northwestern portion of the site was approximately 20 feet tall from the northern toe to the crest and approximately 17 feet tall from the southern toe to the crest. The crest was approximately 25 feet wide and narrowed to the east. Based on our visual observations, the berm slopes were approximately 1¾:1 (horizontal:vertical) to 2:1.
- We observed a small pond on site on the south side of the berm.
- A 3 foot diameter concrete box culvert allowed water through the berm, the water flowed south to north. The inlet was a tower structure similar to that describe above for the berm located in the vicinity of Centennial Drive. It appeared that approximately 4 feet of batter boards were in place and approximately 2½ feet of tailings were retained by the berm in the vicinity of this tower structure at the time of our site visit. The culvert discharged to a small creek on the north side of the berm.

Please refer to the Site Plan, Figure 2, for more information on site features.

2.4 SUBSURFACE CONDITIONS

We observed drilling of 19 borings at the site; the borings ranged in depth between approximately 10 and 50 feet at the locations shown on the Site Plan, Figure 2. We also observed excavation of 11 test pits at the site; the test pits ranged in depth from approximately 5½ to 13½ feet. Additionally, a total of 27 previous explorations were performed on the site by IMMC personnel. We included the general findings of these explorations in developing our recommendations.

For the explorations completed for this study, we summarize the exploration locations, the type of exploration, thickness of existing fill, depth to bedrock, and the depth of exploration in the table below:

TABLE 1
Summary of Subsurface Exploration

Exploration No.	Exploration Type	Approximate Fill Thickness (feet)	Approximate Depth to Bedrock (feet)	Exploration Depth (feet)
1	Boring	2½	10	10½
2	Test Pit	7½	9	13½
3	Test Pit	3½	4½	11
4	Boring	6	6	20½
5	Boring	0	10	11½
6	Boring	0	5	10
7	Boring	0	10	10½
8	Boring	10	10	15½
9	Boring	10	15	15½
10	Boring	30	30	30½
11	Test Pit	2½	2½	10
12	Boring	15	15	20½
13	Test Pit	1	1	5½
14	Test Pit	1	1	6½
15	Test Pit	1½	1½	5½
16	Test Pit	3½	3½	10
17	Test Pit	1½	2½	10
18	Test Pit	3½	3½	10

TABLE 1 (continued)
Summary of Subsurface Exploration

Exploration No.	Exploration Type	Approximate Fill Thickness (feet)	Approximate Depth to Bedrock (feet)	Exploration Depth (feet)
19	Test Pit	6	6	11½
20	Boring	20	35½	36
21	Test Pit	4½	4½	11
22	Boring	25	39	50½
23	Boring	30½	30½	50½
24	Boring	3½	3½	21
25	Boring	1½	1½	10½
26	Boring	4	4	20½
27	Boring	1	1	6½
28	Boring	10½	10½	20½
29	Boring	0	10	15½
30	Boring	10½	10½	40½

BERM EXPLORATIONS

We observed two borings, B20 and B22, along the crest of the existing berm on the eastern boundary of the site. Our borings encountered approximately 23 to 26 feet of fill over native soil over meta-andesite bedrock. The materials encountered in our borings are described as follows:

Fill: Both borings encountered approximately 2½ to 3 feet of medium dense sandy gravel underlain by approximately 10 to 12 feet of fine to medium grained silty sand and gravelly sand; the sand varied in consistency from very loose to medium dense. Below the sandy fill, we encountered layers of hard silty clay, hard clayey silt and very dense silty sand. This fill material is possibly soil generated from the historic mining or gold production at the site, though it could have been generated from existing surficial soil across the project site. The variability of material consistency indicates that compactive effort likely varied during the placement of the soil.

Native Soil: Below the embankment fill, we encountered native soil consisting of gray and bluish gray deposits of very stiff silty and sandy clay, and very dense silty sand.

Bedrock: The bedrock consists of meta-andesite rock. The rock encountered in our borings was generally weak and deeply weathered.

HISTORIC LUMBER MILL SITE EXPLORATIONS

We observed seven borings (B23, B24, B25, B26, B27, B28, and B30) in the vicinity of the historic lumber mill in the southeastern corner of the site. These borings generally encountered fill over meta-andesite bedrock. The fill thickness and composition varied dramatically. The fill consisted of mine tailings (soil) interlayered with lumber mill waste, and ranged in thickness from 1 to 30 feet, as shown on Figure 2. The mine tailings encountered were primarily granular consisting of silt and sand with occasional layers of clay. The lumber mill waste encountered ranged in consistency from bark sized chips of wood to layers of sawdust sized waste. The rock encountered in our borings was generally weak and deeply weathered.

REMAINDER OF SITE

Within the remainder of the site, we performed explorations that included 11 test pits and 10 borings. Our explorations typically encountered fill over weathered bedrock. The fill generally consisted of mine tailings, which ranged in thickness from 1 to 15 feet. Figure 2 shows the depth of fill encountered at each exploration location. The mine tailings encountered were primarily granular consisting of silt and sand with occasional gravel and clay. The bedrock in this portion of the site consisted primarily of gabbro and diabase. In general, the gabbro was weak and highly weathered while the diabase was generally strong and moderately weathered.

Boring B10, drilled through an existing berm near the north portion of the site, encountered approximately 30 feet of loose to medium dense tailings fill. No fill was encountered in Boring B29.

Consult the Site Plan and boring logs for specific soil, rock, and groundwater conditions at each location. Figure 2 shows the approximate limits of fill and shows the thickness of fill encountered at each exploration location. We include our boring logs in Appendix A. The logs contain the soil/rock type, color, consistency, and visual classification in general accordance with the Unified Soil Classification System. Appendix A also provides additional exploratory information in the general notes to the logs. The logs of previous explorations performed by IMMC are attached as Appendix C.

2.5 GROUNDWATER CONDITIONS

We observed groundwater at the bottom of Boring B22. Since the boring was terminated approximately 11 feet into weathered bedrock, this water may be perched water that has become trapped within the rock formation. Perched groundwater was encountered in Test Pits TP2 and

TP18 at depths of 9 and 3½ feet, respectively. Groundwater was not encountered in any of the other explorations.

Fluctuations in the level of groundwater may occur due to variations in rainfall and other factors not evident at the time measurements were made.

2.6 LABORATORY TESTING

For this project, we performed moisture content, dry density, unconfined compression, plasticity index, corrosion, direct shear, R-value, and grain size analysis. Lab test results are included on the boring logs and in Appendix B.

3. SLOPE STABILITY ANALYSES

To analyze the stability of the berm on the eastern side of the project, we performed limit equilibrium slope stability analyses using Bishops Modified Method of slices (Bishop, 1955). We used the computer slope stability software Gslope (2002). Gslope is a computer program that allows the user to perform two-dimensional limit equilibrium computations utilizing a variety of methods and search types. Circular failure surfaces were used with various searches to obtain the critical failure surfaces having the lowest factor of safety.

For our analyses, we modeled soil strengths based on boring log data, blow counts, visual soil descriptions, results of our laboratory testing and our previous experience with the soil in the project area.

We performed slope stability analyses on the berm to evaluate the stability of the existing configuration and to determine if any modifications are necessary. We prepared a cross-section at each of our boring locations as shown on Figure 5. We assumed that the embankment impounds 2 feet of water based on our observations in the field and discussions with IMMC personnel regarding future use of the adjacent parcel. We also assumed that the upper 12 feet of material on the east side of the berm consists of tailings and that the original berm continues below the tailings at a constant slope down to the elevation of the native soil encountered in our borings. This assumption is based on our field observations and information provided by IMMC personnel regarding the drainage tower and culvert detailed in Figure 6 and discussed in Section 2.5.

We evaluated the long-term stability of the selected cross-section under static conditions. Additionally, we modeled the stability of the cross-section during seismic loading utilizing a pseudo-static analysis. For the pseudo-static coefficient, we utilized a value of one-half the PGA

discussed in Section 2.2.2, per the recommendations of Hynes-Griffin and Franklin (1984). We only analyzed stability of the western side of the embankment as the eastern side will be made more stable by the tailings.

The following criteria were used to evaluate the stability of the dam embankment:

TABLE 2
Slope Stability Criteria

Loading Condition	Minimum Factor of Safety
Long-Term, Static Stability	1.5
Pseudo-Seismic Stability	1.1

Figures 6 through 10 show the results of these analyses. Our analyses resulted in factors of safety meeting or exceeding the slope stability criteria above.

4. CONCLUSIONS

From a geotechnical engineering viewpoint, in our opinion, the site is suitable for the proposed development. The primary geotechnical concerns that could affect development on the site are the existing fills, expansive soil, shallow bedrock, differential fill thickness, and future operations of the culvert tower structure. We summarize our conclusions below.

4.1 NON-ENGINEERED FILL

As discussed in Section 2, much of the site is covered with existing fill that we consider to be "non-engineered." This fill consists of mine tailings, lumber mill waste and fill placed as part of previous site use. Non-engineered fills can undergo excessive settlement, especially under new fill or building loads. The existing berms on the site, previously discussed, should be considered non-engineered fill and are not suitable for retention of water and could be subject to significant settlements if loads from structures or earthwork are added to them.

A proven method to reduce damage from potential fill settlement is to remove all non-engineered fills and construct all improvements on competent native soil or properly engineered fill. The majority of the fill that we observed during our exploration can be reused as engineered fill for this project. Soil meeting the requirements of Section 5.3 may be reused as engineered fill. Fill should be placed in accordance with the recommendations in sections 5.6 and 5.7.

Due to the depth of fill beneath some of the proposed improvements, such as the Truck Shop and Core Shed, it may be preferred to leave a portion of the fill in place and construct the improvements on top of the fill. To control settlement of structural improvements while leaving existing fill in place, it will be necessary to either extend the structural loads below the fill with drilled piers or accept some level of differential foundation movement as acceptable.

It may be feasible to surcharge fill in building areas to reduce total settlement from future building loads. Surcharging, if performed to appropriate pressures, can be an effective means of nearly eliminating differential settlement. However, the feasibility of surcharging is highly dependant on the thickness of fill and the proposed building loads. Once building loads have been developed, we can evaluate the suitability of this approach and provide supplemental recommendations as appropriate.

In pavement areas it may be practical to mechanically compact the fill in order to prepare a non-yielding subgrade. However, depending on the actual thickness of tailings, compaction of the tailings alone may not be successful in stabilizing the subgrade. We recommend the owner establish a contingency fund for subgrade stabilization during construction. Stabilization methods that may be effective include:

- Removal of non-engineered fill down to competent native material, and recompaction of excavated material in lifts;
- Removal of non-engineered fill to competent native material and compaction of imported fill;
- Removal of a portion of unstable subgrade and stabilization with geogrid reinforcement and compacted aggregate base; or
- Chemical treatment of the upper 18 inches of subgrade with lime or cement.

4.2 EXPANSIVE SOIL

We observed potentially expansive clay layers within the tailings encountered on the site. In general, our laboratory testing indicates that these soils exhibit low to moderate shrink/swell potential with variations in moisture content. We encountered moderately to highly expansive clay layers in Test Pits TP3, TP15, TP18 and TP19, however we anticipate that limited amounts of highly expansive clay may be encountered in other areas of the site. Expansive soil can cause distress to foundations, floor slabs, pavements, sidewalks, and other improvements which are sensitive to soil movements.

Due to the limited amount of potentially expansive clay encountered in our explorations, we anticipate that these clays will not significantly affect the design of the proposed improvements. We recommend that any clay encountered during grading be buried in deeper fills or blended to reduce the expansion potential such that the resulting Plasticity Index is less than 15. Concentrations of clay should not be placed in the upper 1½ feet of building pads.

4.3 SHALLOW BEDROCK

Cuts for the proposed improvements will encounter shallow bedrock in certain areas. Our explorations encountered bedrock as shallow as 1 foot below existing grade. To improve subsurface drainage and facilitate shallow excavations, we recommend that any undisturbed native material within 1½ feet of building pad subgrade be overexcavated, processed to remove any oversize material, and recompacted. We should review site grading plans once completed to determine which building pads will require overexcavation and recompaction.

Note that some potentially hard bedrock may be encountered to the depth of the proposed cuts.

4.4 DIFFERENTIAL FILL THICKNESS

Differential building movements may result from conditions where building pads have significant differentials in fill thickness. We recommend that the differential fill thickness across any structure be no greater than 10 feet. See section 5.4 for specific recommendations.

4.5 SOIL CORROSION POTENTIAL

We submitted 15 soil samples to an analytical lab for determination of pH, resistivity, sulfate, and chloride. We summarize the results below:

TABLE 3
Summary of Corrosion Test Results

Exploration No.	Depth of Sample (ft)	Corrosion Test			
		Soil pH	Minimum Resistivity (ohm-cm x1000)	Chloride (ppm)	Sulfate (ppm)
TP-3	5	7.53	0.83	5.9	113.4
TP-18	1½	8.15	5.9	14.2	30.4
B-24	3½	6.16	2.95	11.3	12.6
B-25	0	5.6	5.36	16.1	0.8

TABLE 3 (continued)
Summary of Corrosion Test Results

Exploration No.	Depth of Sample (ft)	Corrosion Test			
		Soil pH	Minimum Resistivity (ohm-cm x1000)	Chloride (ppm)	Sulfate (ppm)
B-27	0	6.09	5.90	9.6	4.5
B-28	6½	7.77	3.22	12.6	5.5
B-29	3	7.28	4.29	7.6	1.6
B-12	10	6.96	2.95	4.2	42.2
B-5	3	7.62	2.68	4.6	32.9
B-8	3	7.02	0.88	8.5	206.2
B-28	2	6.54	3.48	6.3	5.7
B-9	6	6.93	2.95	8.2	69
B-22	10½	6.77	6.97	12.2	5.9
B-20	1½	8.05	4.56	8.1	25.9
B-30	1	7.26	3.48	8.4	27.7

pH and Minimum Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

The sulfate lab test results indicate the sulfate exposure may be categorized as “Negligible” in accordance with Table 19-A-4 of the California Building Code. For “Negligible” sulfate exposure, the CBC indicates that either Type I or Type II Portland Cement may be used for concrete mix designs.

ASTM STP 1013 (Escalante 1989) suggests the following relationship between soil resistivity and soil corrosivity:

TABLE 4
Relationship between Soil Resistivity and Soil Corrosivity

Soil Resistivity ohm-cm	Classification of Soil Corrosiveness
0 to 900	Very Severely Corrosive
900 to 2,300	Severely Corrosive
2,300 to 5,000	Moderately Corrosive
5,000 to 10,000	Mildly Corrosive
> 10,000	Very Mildly Corrosive

The resistivity results in Table 3 suggest that the samples tested range from very severely corrosive to mildly corrosive. Samples TP3 @ 5 feet and B8 @ 3 feet had low resistivities, indicating that they are very severely corrosive to buried metal.

If desired to investigate this further, we recommend a corrosion consultant be retained to determine if specific corrosion recommendations are necessary for the project. The analytical lab test results are included in Appendix B.

4.6 EXCAVATABILITY

We used a Cat 320C with 24 inch bucket during our exploratory work. Based upon our observation and experience, we provide the following conclusions regarding excavation resistance at the site:

1. Conventional grading and backhoe equipment will likely be able to excavate the fill and native soil deposits.
2. The upper 5 feet of the andesite and gabbro bedrock is typically weathered to a degree that it appears excavatable with larger equipment, such as a Cat 235 or larger excavator.
3. Cuts and excavations more than 5 feet into the andesite and gabbro or into the diabase bedrock will likely require significant effort with a CAT D9 or larger bulldozer, equipped with a single tooth ripper. A CAT 235 or larger excavator will likely be necessary to facilitate economical trench excavations with significant effort. An air spade or blasting may be required where large boulders or resistant bedrock are encountered.

Figure 4 can be used to determine which geologic formation to expect in various portions of the site. We provide the above excavatability information for general planning purposes only. This information is not intended for bidding purposes.

4.7 STATIC AND PERCHED GROUNDWATER

It does not appear that the static groundwater level beneath the site will affect the proposed development. However, perched water can:

1. Impede grading activities;
2. Cause moisture damage to sensitive floor coverings;

3. Transmit moisture vapor through slabs causing excessive mold/mildew build-up, fogging of windows, and damage to computers and other sensitive equipment; and,
4. Cause premature pavement failure if hydrostatic pressures build up beneath the section.

We provide recommendations to reduce the effects of perched water in the sections addressing Over Optimum Soil Conditions, Site Drainage, Slab Moisture Vapor Reduction, and Cut-off Curbs.

4.8 FUTURE CULVERT STRUCTURE OPERATIONS

We recommend that the culvert inlet tower be modified so that batter boards cannot be added to allow the existing structure to retain water and the screen cleaned so the existing water retained by the berm is allowed to drain. If the batter boards are raised in the culvert tower the pond will store more water and the berm will act as a dam. If the berm were to act as a dam, it could potentially fall under the jurisdiction of the State of California Division of Safety of Dams and a more rigorous set of evaluation criteria would be required to assess the berm stability. We assumed the future culvert operations being the same as current in our berm stability evaluation.

4.9 2001 CBC SEISMIC DESIGN PARAMETERS

To provide California Building Code (CBC) seismic design parameters, we reviewed the 2001 CBC and the February 1998 California Divisions of Mines and Geology "Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada". Note, the 1997 Uniform Building Code (UBC) was adopted as the 2001 CBC, so UBC design parameters are identical to CBC parameters. Additionally, we reviewed the 2003 International Building Code (IBC) to provide IBC seismic parameters.

Based on our review, we provide the 2001 California Building Code (CBC) and 2003 IBC seismic parameters in Table 5 below. Note that these parameters apply to the entire site.

TABLE 5
2001 CBC and 2003 IBC Seismic Parameters

Categorization	CBC Design Value	IBC Design Value
Soil Profile	S _c	C
Seismic Zone	3	N/A
Seismic Zone Factor, Z	0.3	N/A
Seismic Coefficient C _a	0.33	N/A

TABLE 5 (continued)
2001 CBC and 2003 IBC Seismic Parameters

Categorization	CBC Design Value	IBC Design Value
Seismic Coefficient C_v	0.45	N/A
0.2 second Spectral Response Acceleration, S_s	N/A	0.55
1.0 second Spectral Response Acceleration, S_1	N/A	0.2
Site Coefficient, F_a	N/A	1.2
Site Coefficient, F_v	N/A	1.6
Maximum considered earthquake spectral response accelerations for short periods, S_{MS}	N/A	0.66
Maximum considered earthquake spectral response accelerations for 1-second periods, S_{M1}	N/A	0.32
Design spectral response acceleration at short periods, S_{DS}	N/A	0.44
Design spectral response acceleration at 1-second periods, S_{D1}	N/A	0.21

5. EARTHWORK RECOMMENDATIONS

5.1 GENERAL SITE CLEARING

Clear the areas to be developed of all surface and subsurface deleterious materials including existing building foundations, slabs, buried utility and irrigation lines, pavements, debris, and designated trees, shrubs, and associated roots. Clean and backfill excavations extending below the planned finished site grades with suitable material compacted to the recommendations presented in Section 5.4. ENGEO should be retained to observe and test all backfilling.

Following clearing, strip the site to remove surface organic materials. Strip organics from the ground surface to a depth of at least 2 to 3 inches below the surface. Remove strippings from the site or use them in landscape fill. It may also be feasible to mulch organics in place, depending on the amount and type of vegetation present at the time of grading as well as the proposed mulching method. If desired, ENGEO will evaluate site vegetation at the time of grading to determine the feasibility of mulching organics in place.

5.2 CUT PADS AND CUT/FILL PAD TRANSITIONS

Building pads constructed in cuts may encounter variable subsurface conditions, including potentially hard rock. Building pads that transition from cut to fill within the building pad area also can experience differential soil movements.

We recommend such building pads be reconstructed to create uniform subgrade conditions. This can be accomplished by subexcavating the soil on the building pads to a minimum depth of 1½ feet below finished pad grade on all cut lots or lots constructed over cut-and-fill transitions and replacing the subexcavated material with uniformly-mixed compacted fill. The subexcavation should be performed over the entire flat pad area. Compacted fill used to replace subexcavated soil should be placed in accordance with Section 5.8.

5.3 DIFFERENTIAL FILL THICKNESS

Differential building movements may result from conditions where building pads have significant differentials in fill thickness. To limit potential foundation differential settlements to those stated in Section 6.2, we recommend that the differential fill thickness across any structure be no greater than 10 feet.

Based on the proposed pad elevation, it appears that only the Ceramics Plant structure is affected by this recommendation. On the Ceramics Plant, the fill extends to approximately 15 feet thick at the northeastern corner. Over an approximately 25,500 square foot area, extending approximately 195 feet from the northeastern corner of the building, the fill transitions from a maximum thickness of 15 feet to cut. Rather than overexcavate the remainder of this large building pad to a depth of 5 feet to comply with the above recommendation, we recommend that a limited area be overexcavated to provide a transition zone. We recommend that a zone approximately 100 feet wide beyond the cut-fill line be overexcavated to limit the fill differential to a maximum of 10 feet. This will result in a more gradual transition from the deeper fill area to the cut portion of the pad.

5.4 NON ENGINEERED FILL REMOVAL

If the owner chooses the foundation option that requires removal of existing fill from building areas, remove all existing fill down to competent native material, as determined by ENGEO. Figure 2 displays the approximate lateral extent of existing fill at the site and the depth of fill encountered at the exploration locations. The lateral extent and depth of fill is expected to vary. Consult the boring and test pit logs in Appendix B for subsurface conditions at specific locations.

In parking areas that are underlain by relatively thick existing fill, it may be impractical to completely remove all the existing fill. If increased post-construction pavement maintenance and cracking is acceptable to the owner, then we recommend that only 2 feet of the existing fill be overexcavated and recompacted.

5.5 EXPANSIVE SOIL MITIGATION

If the owner chooses to perform recompaction of the existing fills on the site, we recommend that any clay encountered during grading be buried in deeper fills or blended to reduce the expansion potential such that the resulting Plasticity Index is less than 15. Concentrations of clay should not be placed in the upper 1½ feet of building pads extending at least 10 feet laterally beyond building areas.

5.6 OVER-OPTIMUM SOIL MOISTURE CONDITIONS

The contractor should anticipate encountering excessively over-optimum (wet) soil moisture conditions during winter or spring grading, or during or following periods of rain. In addition, wet soil conditions may be found in the area of the culvert discharge. Wet soil can make proper compaction difficult or impossible. Wet soil conditions can be mitigated by:

1. Frequent spreading and mixing during warm dry weather;
2. Mixing with drier materials;
3. Mixing with a lime, lime-flyash, or cement product; or
4. Stabilizing with aggregate, geotextile stabilization fabric, or both.

Options 3 and 4 should be evaluated and approved by ENGEO prior to implementation.

5.7 ACCEPTABLE FILL

On-site soil and rock material, including the existing fill, is suitable for use as engineered fill material provided it is processed to remove concentrations of organic material, debris, and particles greater than 8 inches in maximum dimension. Concentrations of clay should not be placed in the upper 1½ feet of building pads. Any lumber mill waste should not be reused as structural fill on the site, but could be buried in landscape areas.

Imported fill materials should meet the above requirements and have a plasticity index less than 15. Allow ENGEO to sample and test proposed imported fill materials at least 72 hours prior to delivery to the site.

IMMC further requires that all fill and backfill meet the following corrosion requirements:

Resistivity:	1,000 ohm-cm (minimum)
pH:	4.5 to 9.5
Chlorides:	200 ppm (maximum)
Sulfates:	1,000 ppm (maximum)

5.8 COMPACTION

The relative compaction and optimum moisture content of soil, rock, and aggregate base referred to in this report are based on the most recent ASTM D1557 test method. Compacted soil is not acceptable if it is unstable. It should exhibit only minimal *flexing* or *pumping*, as determined by an ENGEO representative.

As used in this report, the term “moisture condition” refers to adjusting the moisture content of the soil by either drying if too wet or adding water if too dry.

We define “structural areas” as any area sensitive to settlement of soil. These areas include, but are not limited to building pads, equipment pads, foundations, sidewalks, pavement areas, and retaining walls.

Perform subgrade compaction prior to fill placement, following cutting operations, and in areas left at grade as follows.

1. Scarify to a depth of at least 8 inches;
2. Moisture condition soil to at least 1 percentage point above the optimum moisture content;
and
3. Compact the subgrade to at least 90 percent relative compaction. Compact the upper 6-inches of finish pavement subgrade to at least 95 percent relative compaction prior to aggregate base placement.

After the subgrade soil has been compacted, place and compact acceptable fill (defined in Section 4) as follows:

1. Spread fill in loose lifts that do not exceed 8 inches;
2. Moisture condition lifts to at least 1 percentage point above the optimum moisture content;
and
3. Compact fill to a minimum of 90 percent relative compaction; Compact the upper 6 inches of fill in pavement areas and all fills placed deeper than 10 feet below finished grade to 95 percent relative compaction prior to aggregate base placement.

Compact the pavement Caltrans Class 2 Aggregate Base section to at least 95 percent relative compaction (ASTM D1557). Moisture condition aggregate base to or slightly above the optimum moisture content prior to compaction.

5.9 UNDERGROUND UTILITY BACKFILL

The contractor is responsible for conducting all trenching and shoring in accordance with CALOSHA requirements. Project consultants involved in utility design should specify pipe bedding materials.

Place and compact acceptable trench backfill in structural areas as follows:

1. Trench backfill shall comply with Section 5.3 and have a maximum particle size of 6 inches;
2. Moisture condition trench backfill to or slightly above the optimum moisture content. Moisture condition backfill outside the trench;
3. Place fill in loose lifts not exceeding 12 inches;
4. Compact fill to a minimum of 90 percent relative compaction (ASTM D1557).

5.10 LANDSCAPE FILL

Process, place and compact fill in accordance with Sections 5.4 and 5.5, except compact to at least 85 percent relative compaction (ASTM D1557).

5.11 SLOPES

5.11.1 Gradients

Construct final slope gradients to 2:1 (horizontal:vertical) or flatter. The contractor is responsible to construct temporary construction slopes in accordance with CALOSHA requirements.

5.11.2 Fill Placed on Existing Slopes

We recommend keying and benching where fills are placed on original grade with a gradient of 6:1 or steeper.

Construct a minimum 8-foot wide key inward from the toe of the new fill slope. Extend the key at least 2 feet below original grade into firm competent soil/rock, as determined by ENGEO. Slope the key bottom at least 5 percent downward toward the slope crest. Deeper keys may be required by ENGEO based on actual soil/rock conditions observed during construction.

Cut benches into original grade after the key has been filled and compacted in accordance with Section 4. Construct benches into original slope grade as filling proceeds every 2 feet vertically, to remove loose soil/rock. Deeper bench depths may be required by ENGEO depending on actual conditions observed during construction. Bench widths will vary depending on the original slope grade and actual bench depth.

5.12 SITE DRAINAGE

5.12.1 Surface Drainage

The project civil engineer is responsible for designing surface drainage improvements. With regard to geotechnical engineering issues, we provide the following minimum recommendation for surface drainage.

1. Slope pavement areas a minimum of 1 percent towards drop inlets or other surface drainage devices.
2. Slope finished grade away from any building exteriors at a minimum of 1 percent for a distance of at least 5 feet.

5.12.2 Subsurface Drainage

Based on our site exploration and current grading concepts for the site, we do not anticipate that subdrainage systems will be necessary. We recommend that we review the site grading plans to further evaluate the need for subdrainage systems as well as observe the earthwork operations during site grading.

6. FOUNDATIONS

6.1 GENERAL APPROACH

We present several options for foundation support depending on the amount of fill underlying each structure and the whether the fill has been processed or not. Based on our past experience, where fills are generally less than 5 to 10 feet thick, it is often economical to remove and recompact all fills and construct shallow foundations. Where fills are thicker, deeper foundations with some limited rework of pad fill for slab support may be more economical than complete rework of the fill. In areas where waste fills were encountered, such as the proposed Substation, drilled pier foundations with a structural floor slab will be necessary to support any heavy loads or facilities that may be sensitive to differential movement.

Based on the subsurface conditions we anticipate to exist at each of the proposed structures or facilities, we developed our recommended foundation approach. We considered the following options:

- Areas with no existing fill: We recommend the use of conventional shallow footings with a slab-on-grade floor slabs.
- Areas with existing fill: We recommend overexcavation of fills down to native soil and recompaction of fill where suitable for reuse as engineered fill (see Section 4.6). If some level of differential movement is acceptable for the structure, then only limited overexcavation to a depth of 5 feet and recompaction of fill may be a practical alternative. This may apply to the Core Shed, Fuel oil Storage, and Truck Shop, for example.
- Areas with waste fill: We recommend the use of drilled pier foundations to support any heavy loads or structures sensitive to differential movement

Using the above, we summarize the proposed improvements and recommended foundation approach in Table A at the end of this report. Table A shows the pertinent information for each improvement as well as the relevant exploration numbers, the thickness of fill and depth to bedrock.

6.2 SHALLOW FOUNDATIONS

We recommend that shallow foundations be considered for buildings that will bear on native soil (i.e., no fill is present). For buildings to be constructed over existing fill, shallow foundations may be used provided the existing fill is completely removed and recompacted in accordance with the Earthwork recommendations of this report.

Provide minimum footing dimensions as follows:

Table 6
Minimum Footing Dimensions

Footing Type	*Minimum Depth (in.)	Minimum Width (in.)
Continuous	18	12
Isolated	18	18

*below lowest adjacent pad grade

Minimum footing depths shown above are taken from lowest adjacent pad grade. The cold joint between the exterior footing and slab-on-grade should be located at least 4 inches above adjacent exterior grade.

Design the foundations recommended above for a maximum allowable bearing pressure of 2,500 pounds per square foot (psf) for dead plus live loads. Increase this bearing capacity by one-third for the short-term effects of wind or seismic loading.

The maximum allowable bearing pressure is a net value; the weight of the footing may be neglected for design purposes. All footings located adjacent to utility trenches should have their bearing surfaces below an imaginary 1:1 (horizontal:vertical) plane projected upward from the bottom edge of the trench to the footing.

Lateral loads may be resisted by friction along the base and by passive pressure along the sides of foundations. The passive pressure is based on an equivalent fluid pressure in pounds per cubic foot (pcf). We recommend the following allowable values for design:

Passive Lateral Pressure: 300 pcf

Coefficient of Friction: 0.35

The above allowable values include a factor of safety of 1.5. Increase the above values by one-third for the short-term effects of wind or seismic loading.

Footing settlements under the recommendations above will be dependant on the actual structural loads and footings sizes. Although structural loads are not yet known, we estimate that total and differential footing settlements will be less than approximately ½ and ¾ inch, respectively, for lightly loaded footings, provided the recommendations for building pad preparation and foundation design in this report are followed. Once structural loads and preliminary footing layouts are known, we recommend that we be retained to estimate the total and differential footing settlements to assist the designer in checking tolerable settlements.

6.3 SPREAD FOOTINGS IN BEDROCK

Where cuts will encounter bedrock, spread footings may be designed for higher allowable bearing pressures. Use the minimum footing dimensions shown in Table 6. We recommend that the minimum footing dimensions be designed using a maximum allowable bearing pressure of

7,000 pounds per square foot (psf) for dead plus live loads. Increase this bearing capacity by one-third for the short-term effects of wind or seismic loading. Footings designed using this methodology should bear a minimum of 1 foot into the weathered bedrock.

The maximum allowable bearing pressure is a net value; the weight of the footing may be neglected for design purposes. All footings located adjacent to utility trenches should have their bearing surfaces below an imaginary 1:1 (horizontal:vertical) plane projected upward from the bottom edge of the trench to the footing.

For resistance of lateral loads, we recommend the following allowable values for design:

Passive Lateral Pressure: 400 pcf

Coefficient of Friction: 0.40

Neglect any non-engineered fill from calculations of passive lateral pressures. The above allowable values include a factor of safety of 1.5. Increase the above values by one-third for the short-term effects of wind or seismic loading

Footing settlements under the recommendations above will be dependant on the actual structural loads and footings sizes. Although structural loads are not yet known, footings bearing on clean, undisturbed bedrock will experience very little settlement, probably less than ¼ inch. Once structural loads and preliminary footing layouts are known, we recommend that we be retained to estimate the total and differential footing settlements to assist the designer in checking tolerable settlements. We should also review potential differential footing settlements where footings transition from bedrock to compacted fill.

6.4 DRILLED PIER FOUNDATIONS

Where high uplift loads are present or where fills are left in place, we recommend that drilled piers be used to support building loads, isolated equipment. This includes the headframe structure at the shaft. Piers should have a minimum diameter of 24 inches and should be at least 10 feet long and extend a minimum of 5 feet below any fill. Design piers for vertical loading based on either an a allowable skin friction below the fill of 1,000 pounds per square foot or an allowable end bearing capacity of 8,000 psf. Piers designed for end bearing will require cleaning of the pier bottom. Resistance to uplift loads will be developed in friction along the pier shafts. We recommend that the values for allowable downward friction be factored by 70 percent for uplift resistance. The full embedment length of the pier may be used for uplift. For calculating resistance to lateral loading, apply an allowable passive lateral pressure of 300 pcf on the pier.

This passive pressure may be applied to a width twice the diameter of the pier provided that a top of pier lateral deflection of up to ½ inch is tolerable. Neglect the upper one diameter of the pier for estimating lateral resistance

Drilled pier settlements under the recommendations above will be dependant on the actual structural loads and pier dimensions. Allowable skin friction for drilled piers is typically mobilized with less than ½- to ¾-inch top of pier deflection. Once structural loads and preliminary pier layouts and dimensions are known, we recommend that we be retained to estimate the total and differential settlements to assist the designer in checking tolerable settlements.

6.5 STORAGE TANK FOUNDATION

The proposed 42,000 gallon water storage tank is likely to bear in native soil. We recommend the water storage tank be supported on a continuous ring footing bearing in competent native soil. We provide minimum footing dimensions as follows to achieve the design bearing capacity.

Minimum Depth = 24 inches below lowest adjacent soil grade

Minimum Width = 12 inches

Design tank ring footings using a maximum allowable bearing pressure of 3,000 pounds per square foot (psf) for dead plus live loads. Increase this bearing capacity by one-third for the short term effects of wind or seismic loading.

Lateral loads may be resisted by friction along the base of footings and by passive pressure along the sides of footings. The passive pressure is based on an equivalent fluid pressure in pounds per cubic foot (pcf). We recommend the following allowable values for design:

Passive Lateral Pressure: 300 pcf

Coefficient of Friction: 0.35

The above allowable values include a factor of safety of 1.5. These allowable values may be increased by one-third for the short term effects of wind or seismic loading. Passive lateral pressure should not be used for footings on or above slopes.

Ring footing settlements under the recommendations above will be dependant on the actual structural loads and footings dimensions. Although structural loads are not yet known, we estimate that total and differential footing settlements will be less than approximately ½ and

¾ inch, respectively. Once structural loads and preliminary footing dimensions are known, we recommend that we be retained to estimate the total and differential settlements to assist the designer in checking tolerable settlements.

The tank will experience differential settlement between the footing and center of tank due to the weight of the fluid in the tank. We recommend that the approximately 20 foot diameter tank be designed to accommodate at least ½ inch of differential settlement between the perimeter and center of the tank. We should be retained to review this estimate once the tank diameter and height is known.

To provide more uniform support for the tank bottom, we recommend that a minimum 12-inch section of Class 2 aggregate base be placed and compacted beneath the tank bottom. The aggregate base should be brought to at least the optimum moisture content and compacted to at least 95 percent relative compaction (ASTM D1557). A layer of sand may be placed above the aggregate base, directly below the tank bottom, provided that the sand is compacted to 95 percent relative compaction. If a sand layer is placed, the contractor should take care to not disturb the compacted sand prior to placing the tank so that the sand layer may provide uniform tank support.

6.6 INTERIOR CONCRETE FLOOR SLABS

6.6.1 Minimum Design Section

The design of interior concrete floor slabs will be dependant on the use of the floor and whether the slab derives support from the soil below or whether it is designed to structurally span between foundations. We recommend the following minimum design for non-structural slab-on-grade:

1. Provide a minimum concrete thickness of 5 inches for all interior floor slabs.
2. Place No. 3 rebar on 18-inch centers within the middle third of the slab to help control the width of shrinkage cracks, which inherently occur as concrete cures.

The structural engineer should provide final design thickness and additional reinforcement for any structural loads, including traffic or rack loads. We anticipate that floor slabs for industrial purposes will generally be thicker than the above minimum recommendations.

Interior floor slabs subject to industrial loading such as from equipment, racks, or fork lifts should be underlain by a uniform granular base layer at least 6 inches thick. Granular base should have a minimum R-value of 50, a plasticity index less than 12, and no more than 10 percent passing the No. 200 sieve. The base should be compacted to at least 95 percent relative compaction (ASTM D1557) to provide firm, uniform support for the slab-on-grade. Prior to construction of the slab, the surface should be proof-rolled with heavy equipment to check that the base material is uniformly compacted and does not deflect under equipment loads. Slab reinforcing should be provided in accordance with the anticipated use and loading of the slab.

6.6.2 Slab Moisture Vapor Reduction

When buildings are constructed with concrete slab-on-grade, water vapor from beneath the slab will migrate through the slab and into the building. This water vapor can be reduced but not stopped. Vapor transmission can negatively affect floor coverings and lead to increased moisture within a building. For buildings where water vapor migrating through the slab would be undesirable, we recommend the following to reduce, but not stop, water vapor transmission upward through the slab-on-grade.

1. Construct a moisture retarder system directly beneath the slab on-grade that consists of the following:
 - a) Vapor retarder membrane sealed at all seams and pipe penetrations and connected to all footings. Vapor retarders shall conform to Class A vapor retarder per ASTM E 1745-97 "Standard Specification for Plastic Water Vapor Retarders used in Contact with Soil or Granular Fill under Concrete Slabs."
 - b) The vapor retarder should be underlain by 4 inches of clean crushed rock. Crushed rock should have 100 percent passing the ¾-inch sieve and less than 5 percent passing the No. 4 Sieve.
2. Use a concrete water-cement ratio for slabs-on-grade of no more than 0.50.
3. Provide inspection and testing during concrete placement to check that the proper concrete and water cement ratio are used.
4. Moist cure slabs for a minimum of 3 days or use other equivalent curing specified by the structural engineer.

The structural engineer should be consulted as to the use of a layer of clean sand or pea gravel (less than 5 percent passing the U.S. Standard No. 200 Sieve) placed on top of the vapor retarder membrane to assist in concrete curing.

6.6.3 Subgrade Modulus for Structural Slab Design

Provided the site earthwork is conducted in accordance with the recommendations of this report, a subgrade modulus of 100 psi/in can be used for structural slab design.

7. CULVERT STRUCTURE ENDWALLS

7.1 LATERAL SOIL PRESSURES

Design proposed walls to resist lateral earth pressures from adjoining natural materials and/or backfill and from any surcharge loads. Provided that adequate drainage is included as recommended below, the end walls using an equivalent fluid pressure of 60 pounds per cubic foot (pcf). In addition, design walls to resist an additional uniform pressure equivalent to one-half of any surcharge loads applied at the surface.

The above lateral earth pressures assume level backfill conditions and sufficient drainage behind the walls to prevent any build-up of hydrostatic pressures from surface water infiltration and/or a rise in the groundwater level. If adequate drainage is not provided, we recommend that an additional equivalent fluid pressure of 40 pcf be added to the values recommended above for both restrained and unrestrained walls. A wet soil unit weight of 120 pounds per cubic foot may be used along with a friction angle of 30 degrees. We recommend that we review any calculations using these above values to check that they are properly applied.

Construct a drainage system, as recommended below, to reduce hydrostatic forces behind the retaining wall.

7.2 WALL DRAINAGE

Construct either graded rock drains or geosynthetic drainage composites behind the retaining walls to reduce hydrostatic lateral forces. For rock drain construction, we recommend two types of rock drain alternatives:

1. A minimum 12-inch-thick layer of Class 2 Permeable Filter Material (Caltrans Specification 68-1.025) placed directly behind the wall, or

2. A minimum 12-inch-thick layer of washed, crushed rock with 100 percent passing the ¾-inch sieve and less than 5 percent passing the No. 4 sieve. Envelope rock in a nonwoven geotextile filter fabric such as Mirafi 140NC, or equivalent.

For both types of rock drains:

1. Place the rock drain directly behind the walls of the structure.
2. Extend rock drains from the wall base to within 12 inches of the top of the wall.
3. Place a minimum of 4-inch-diameter perforated pipe at the base of the wall, inside the rock drain and fabric, with perforations placed down.
4. Place pipe at a gradient at least 1 percent to direct water away from the wall by gravity to a drainage facility.

ENGEO should review and approve geosynthetic composite drainage systems prior to use.

7.3 BACKFILL

Backfill behind retaining walls should be placed and compacted in accordance with Section 4.5. Use light compaction equipment within 5 feet of the wall face. If heavy compaction equipment is used, the walls should be temporarily braced to avoid excessive wall movement.

7.4 FOUNDATIONS

Culvert walls may be supported on continuous footings. Design footings based on an allowable bearing capacity of 2,500 pounds per square foot. Footings should have a minimum depth of 24 inches below lowest adjacent grade and a minimum width of 18 inches. Footing excavations should extend through all tailings, if present, and should bear in competent, non-yielding native soil. If the base of the footing excavation encounters loose or soft material, the footing should be deepened to competent soil as determined in the field by an ENGEO representative.

8. PAVEMENT DESIGN

8.1 FLEXIBLE PAVEMENTS

We performed two R-value tests on representative soil from the site. Both of our tests resulted in R-values greater than 50. We used this value for determining pavement design sections. Using

estimated traffic indices for various pavement loading requirements, we developed the following recommended pavement sections using Procedure 608 of the Caltrans Highway Design Manual (including the asphalt factor of safety), presented in Table 7 below.

Table 7
Asphalt Concrete Pavement Sections

Traffic Index	Section	
	Asphalt Concrete (in.)	Class 2 Aggregate Base (in.)
5	3	4
6	3	5
7	4	5
8	4½	6

The civil engineer should determine the appropriate traffic indices based on the estimated traffic loads and frequencies.

The above recommended pavement sections are based upon soil with an R-value of 50. If during construction, clay is encountered, we recommend the upper 1 foot be removed and replaced with R-value 50 material.

8.2 SUBGRADE AND AGGREGATE BASE COMPACTION

Compact finish subgrade and aggregate base in accordance with Section 5.8. Aggregate Base should meet the requirements for ¾ -inch maximum Class 2 AB per section 26-1.02a of the latest Caltrans Standard Specifications.

9. RISK MANAGEMENT

Our experience and that of our profession clearly indicates that the risk of costly design, construction, and maintenance problems can be significantly lowered by retaining the design geotechnical engineering firm to provide construction monitoring services as outlined below:

1. Retain ENGEO to review the final grading, foundation and culvert wall plans prior to construction to determine whether our recommendations have been implemented, and to provide additional or modified recommendations, if necessary.
2. Retain ENGEO to perform construction monitoring to check the validity of the assumptions we made to prepare this report. Our services would include testing and observation during site clearing, mass grading, subdrain installation, foundation excavation, underground utility construction, and pavement subgrade and aggregate base compaction.
3. If any changes occur in the nature, design or location of the proposed improvements, then retain ENGEO to review the changes and prepare a written response and validate the conclusions and recommendations in this report.
4. If conditions have changed because of natural causes or construction operations on or near the site between the time this report was prepared and construction, then retain ENGEO to review this report for applicability to the new conditions. This report is applicable only for the project and site studied.

If we are not retained to perform the services described above, then we are not responsible for any party's interpretation of our report (and subsequent addenda, letters, and verbal discussions).

10. LIMITATIONS

This report presents geotechnical recommendations for construction of improvements discussed in Section 1.3 for the Idaho-Maryland Mine, Berm Road and Centennial Drive Extension project. If changes occur in the nature or design of the project, we should be allowed to review this report and provide additional recommendations, if any.

We strived to perform our professional services in accordance with generally accepted geotechnical engineering principles and practices currently employed in the area; no warranty is expressed or implied.

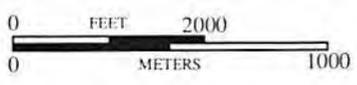
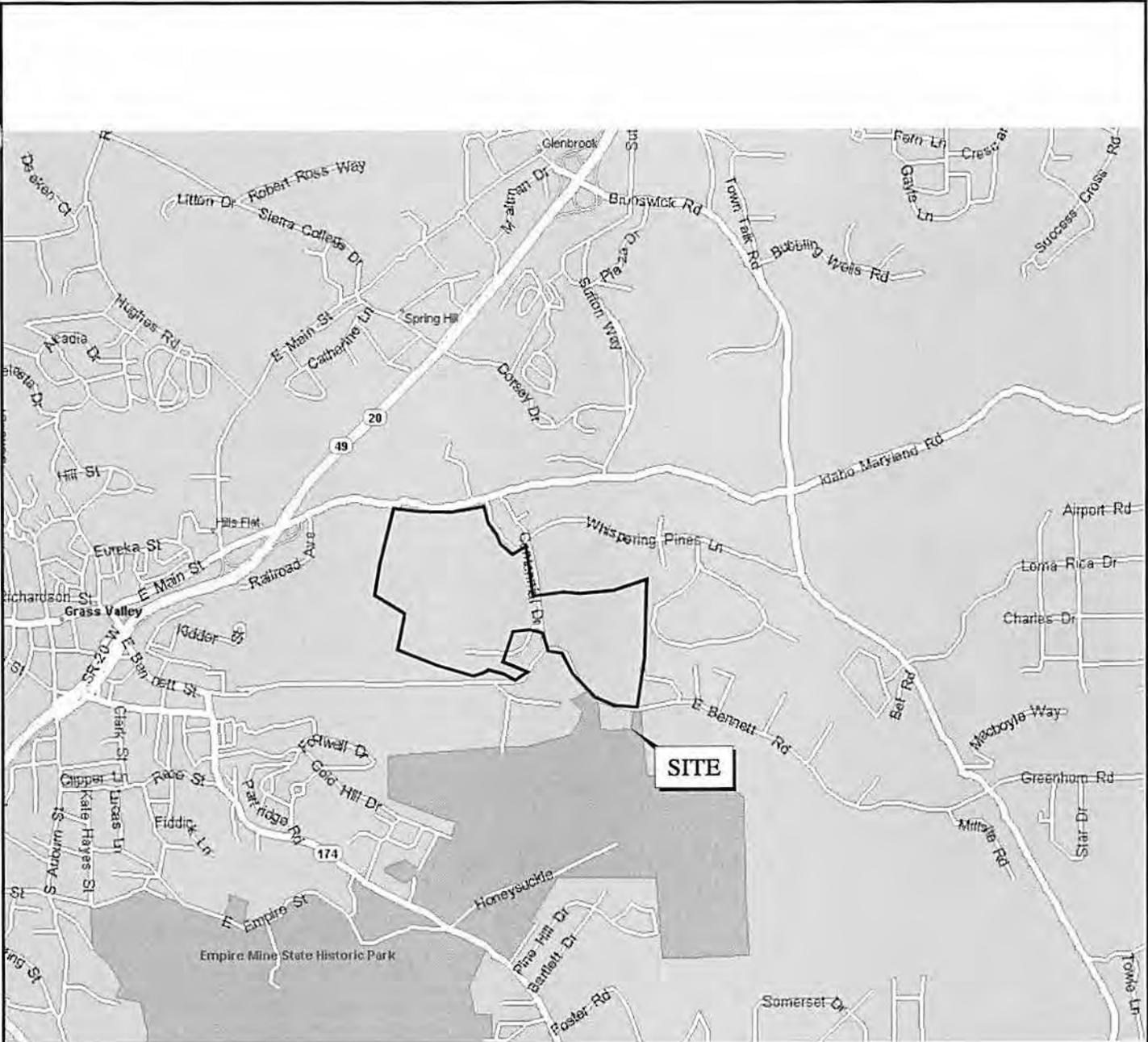
We developed this report with limited subsurface exploration data. We assumed that our subsurface exploration data is representative of soil, rock and groundwater conditions across the site. Considering possible underground variability of soil, rock, stockpiled material, and groundwater, additional costs may be required to complete the project. We recommend that the owner establish a contingency fund to cover such costs. The amount of contingency will be dependant on the information available and the methods and assumptions used for estimating construction costs. On a preliminary basis, due to the potential unknowns related to the geotechnical conditions at the site, we recommend that you consider significant contingencies on your earthwork construction costs, possibly on the order of 20 to 40 percent. If unexpected conditions are encountered, notify ENGEO immediately to review these conditions and provide additional and/or modified recommendations, as necessary.

The location and elevations of our borings and test pits were determined by IMMC personnel using hand-held GPS equipment.

Our services did not include excavation sloping or shoring, soil volume change factors, flood potential, or a geohazard exploration.

This geotechnical exploration did not include work to determine the existence of possible hazardous materials. If any hazardous materials are encountered during construction, then notify the proper regulatory officials immediately.

© 2007 BY ENGeo INCORPORATED. THIS DOCUMENT MAY NOT BE REPRODUCED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN CONSENT OF ENGeo INCORPORATED.



BASE MAP SOURCE: MS STREETS AND TRIPS



VICINITY MAP
 IDAHO-MARYLAND MINE - SURFACE FACILITIES AND IMPROVEMENTS
 GRASS VALLEY, CALIFORNIA

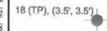
PROJECT NO: 7645.5.001.01	FIGURE NO.
DATE: MARCH 2007	1
DRAWN BY: RJS	
CHECKED BY: MMG	

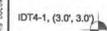


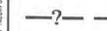
PROJECT BOUNDARY

PROJECT BOUNDARY

EXPLANATION

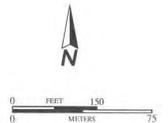
- 
 18 (TP), (3.5', 3.6')

APPROXIMATE LOCATION OF EXPLORATION; B=BORING, TP=TEST PIT
(FILL THICKNESS, DEPTH TO BEDROCK)
- 
 IDT4-1, (3.0', 3.0')

PREVIOUS EXPLORATIONS BY IDAHO-MARYLAND MINING CORPORATION
(FILL DEPTH, BEDROCK DEPTH)
- 

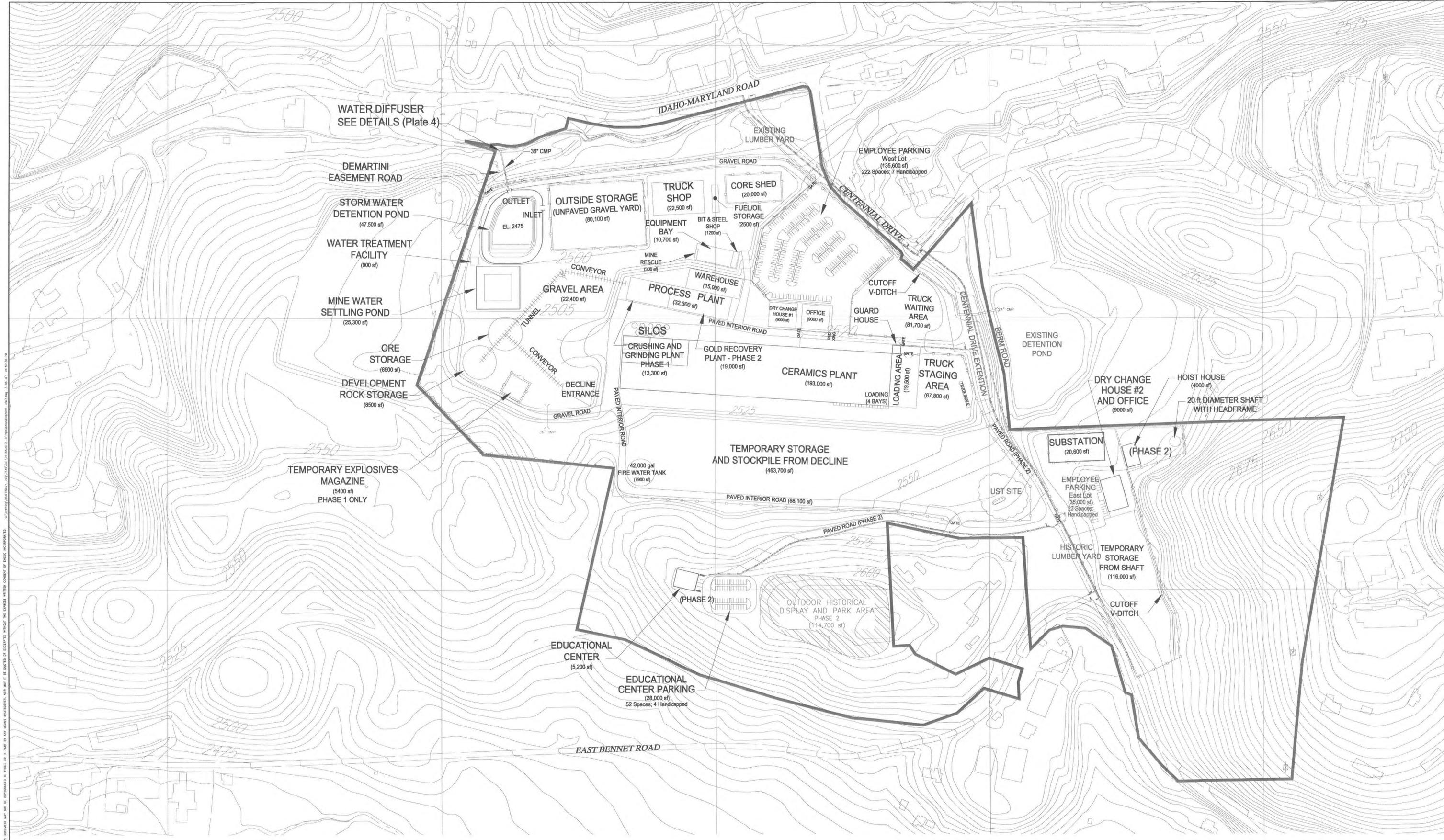
APPROXIMATE LIMITS OF NON-ENGINEERED FILL WITHIN PROJECT
BOUNDARY (INCLUDES TAILINGS, LUMBER MILL WASTE, AND
OTHER NON-ENGINEERED FILLS)

LIMITS OF NON-ENGINEERED FILL INTERPOLATED FROM DATA
OBTAINED FROM IDAHO-MARYLAND MINING CORPORATION AND
EXPLORATION PERFORMED FOR THIS REPORT.



EXPLORATION NUMBER	EASTING	NORTHING	ELEVATION
1	6832523.488	2208610.084	2482.121
2	6833238.773	2208011.211	2523.558
3	6833355.349	2208000.053	2524.342
4	6832188.1	2208126.68	2501.46
5	6833007.113	2208651.796	2495.012
6	6833135.891	2208721.001	2493.787
7	683315.831	2208765.639	2490.871
8	6833555.202	2208219.121	2519.104
9	6833119.756	2208481.685	2496.23
10	6832714.338	2208517.768	2498.671
11	6832245.141	2208316.361	2492.252
12	6832859.06	2208450.036	2490.155
13	6832230.411	2207933.995	2507.153
14	6832817.653	2208077.671	2550.117
15	6832457.537	2207736.939	2506.93
16	6832737.152	2207848.949	2511.68
17	6833034.664	2208123.475	2526.207
18	6833297.498	2207798.322	2529.342
19	6833821.592	2208125.585	2536.184
20	6833999.216	2207992.35	2557.295
21	6833990.469	2207666.845	2536.955
22	6834060.27	2207672.368	2556.995
23	6834243.461	2207525.345	2570.407
24	6834515.766	2207491.402	2587.232
25	6834663.861	2207528.169	2589.183
26	6834215.772	2207262.605	2574.4
27	6834481.997	2207350.849	2589.752
28	6834307.373	2207065.293	2577.552
29	6832895.631	2207032.691	2591.513
30	6834387.721	2207522.473	2583.731

COPYRIGHT © 2007 BY ENGE INCORPORATED. THIS DOCUMENT MAY NOT BE REPRODUCED IN WHOLE OR IN PART BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE EXPRESS WRITTEN CONSENT OF ENGE INCORPORATED.
 3-27-07 10:36:32 AM

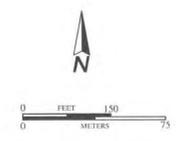


Copyright © 2007 by ENGeo Incorporated. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without the express written consent of ENGeo Incorporated.

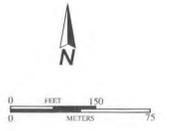
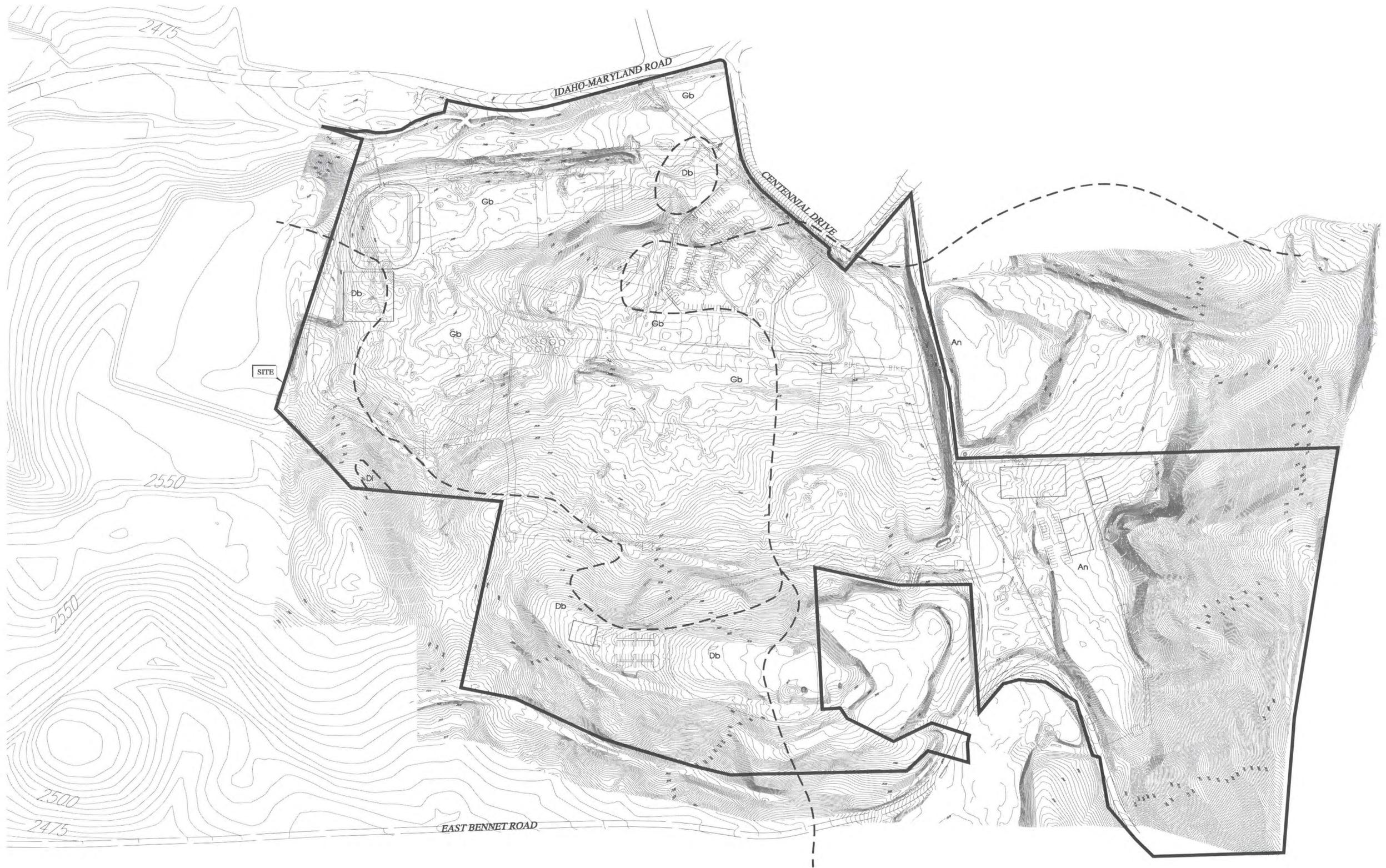
EXPLANATION

- PROPERTY BOUNDARY
- SECURITY FENCE
- BIKE LANE

NOTE:
ALL AREA SIZES ARE APPROXIMATE

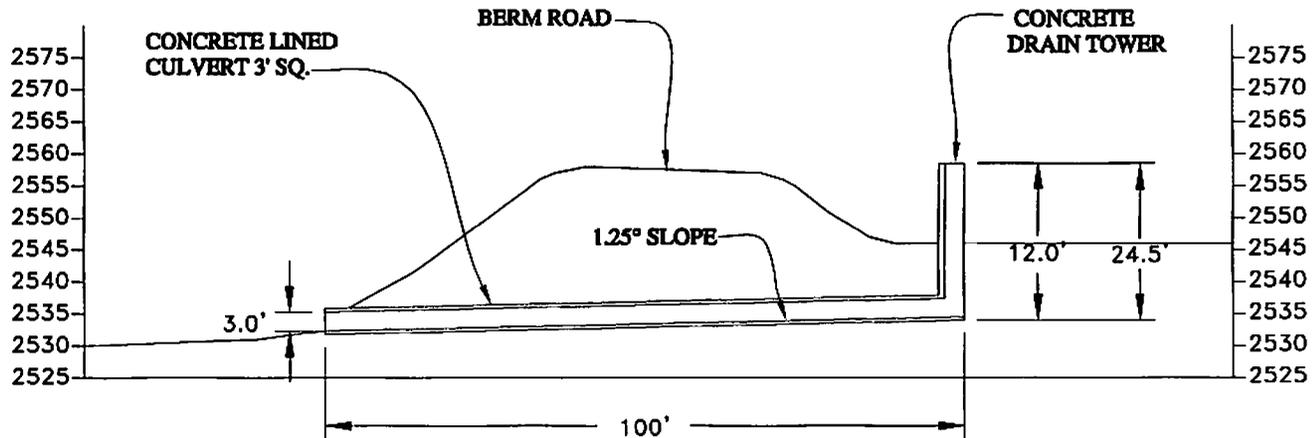


COPYRIGHT © 2007 BY ENGEO INCORPORATED. THIS DOCUMENT MAY NOT BE REPRODUCED IN WHOLE OR IN PART BY ANY MEANS WHATSOEVER, NOR MAY IT BE STORED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, WITHOUT THE EXPRESS WRITTEN CONSENT OF ENGEO INCORPORATED. 01/07/07 10:47:33 AM C:\WORK\2007\200702\20070201\20070201.dwg 2:08:27 64.9122 2N



- EXPLANATION**
- Db DIABASE
 - Gb GABBRO
 - An ANDESITE
 - DI DIORITE

C:\Working\DRAT\FIGS\DWG\7645.001\64550010-880m\crosssection\cuvint-0307.dwg 3-08-07 04:52:43 PM



BASE MAP SOURCE: IDAHO-MARYLAND MINING CORPORATION

1"=30'



CROSS SECTION AT CULVERT
 IDAHO-MARYLAND MINE - SURFACE FACILITIES AND IMPROVEMENTS
 GRASS VALLEY, CALIFORNIA

PROJECT NO: 7645.5.001.01
 DATE: MARCH 2007
 DRAWN BY: RJS CHECKED BY: MMG

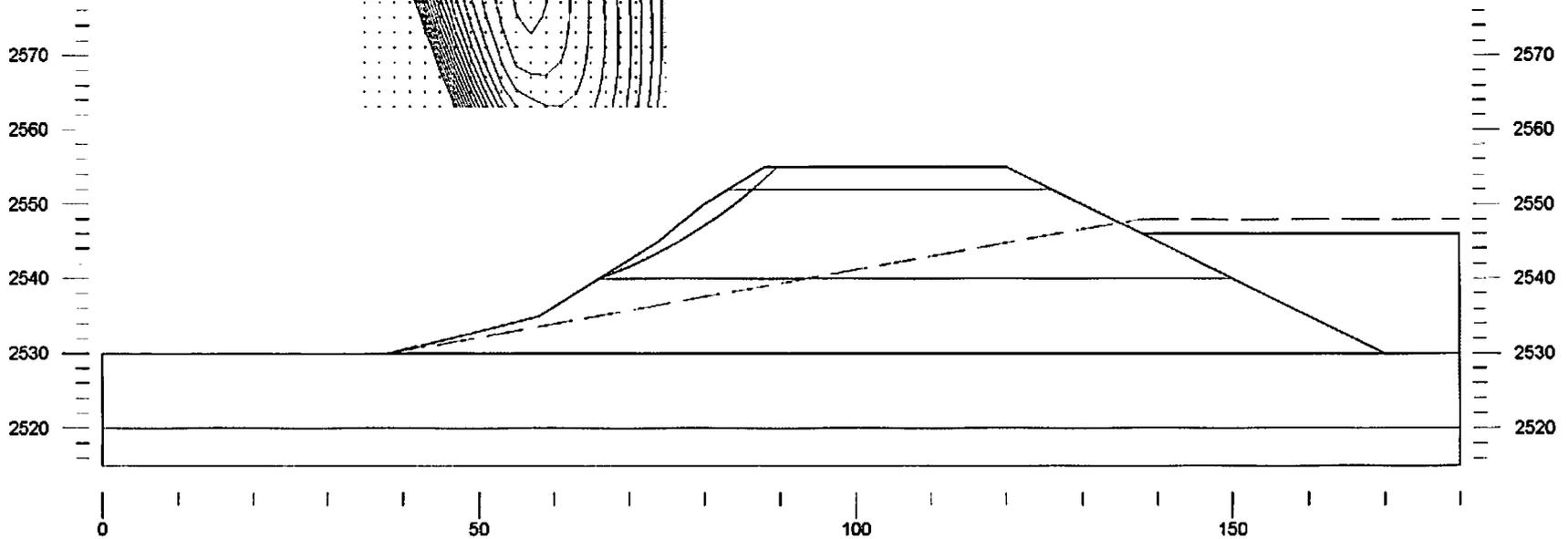
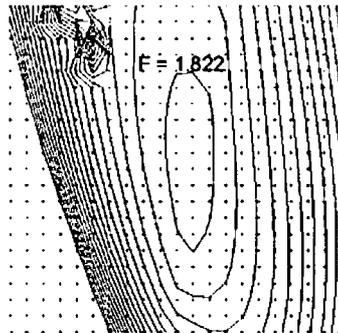
FIGURE NO.
6

ORIGINAL FIGURE PRINTED IN COLOR

C:\Working\BORA\Ince\Draw\645.001\645500101-Steps\main\ygenmg30-0307.dwg 1-06-07 04:53:26 PM

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Tailings	120	0	20	1
Fill (GM)	120	0	35	1
Fill (SM/SP)	115	100	30	1
Fill (CL)	115	2000	0	1
Overburden Soil	120	0	35	1
Bedrock	140	7000	0	1

Engco - San Ramon, CA
 7645.5.001.01
 Idaho Maryland Mining Company
 February 2007
 Cross - Section at Boring B20



BASE MAP SOURCE: IDAHO-MARYLAND MINING CORPORATION



SLOPE STABILITY AT BORING B20 - STATIC LOADING
 IDAHO-MARYLAND MINE - SURFACE FACILITIES AND IMPROVEMENTS
 GRASS VALLEY, CALIFORNIA

PROJECT NO.: 7645.5.001.01
 DATE: MARCH 2007
 DRAWN BY: RJS CHECKED BY: MMG

FIGURE NO.

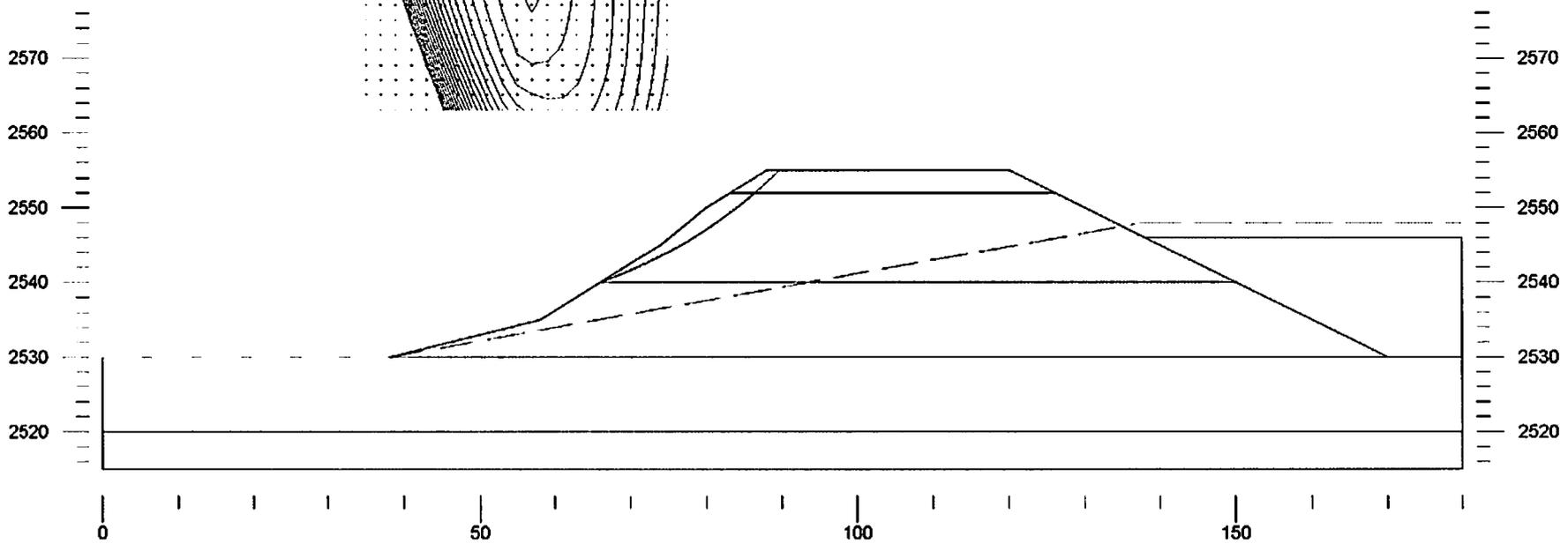
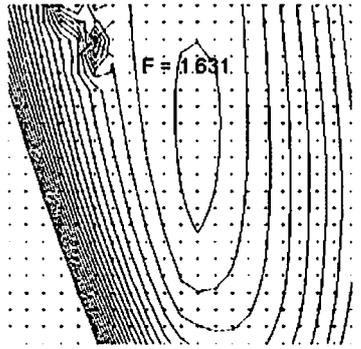
7

Z:\Working\06A\FAC2\DWG\7645\001\76455001.01-850pstatic\boring20-0207.dwg 3-06-07 04:54:07 pu

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Tailings	120	0	20	1
Fill (GM)	120	0	35	1
Fill (SM/SP)	115	100	30	1
Fill (CL)	115	2000	0	1
Overburden Soil	120	0	35	1
Bedrock	140	7000	0	1

Seismic coefficient = 0.065

Engco - San Ramon, CA
 7645.5.001.01
 Idaho Maryland Mining Company
 February 2007
 Cross - Section at Boring B20
 Pseudo Static



BASE MAP SOURCE: IDAHO-MARYLAND MINING CORPORATION



SLOPE STABILITY AT BORING B20 - PSEUDOSTATIC
 IDAHO-MARYLAND MINE - SURFACE FACILITIES AND IMPROVEMENTS
 GRASS VALLEY, CALIFORNIA

PROJECT NO.: 7645.5.001.01
DATE: MARCH 2007
DRAWN BY: RJS CHECKED BY: MMG

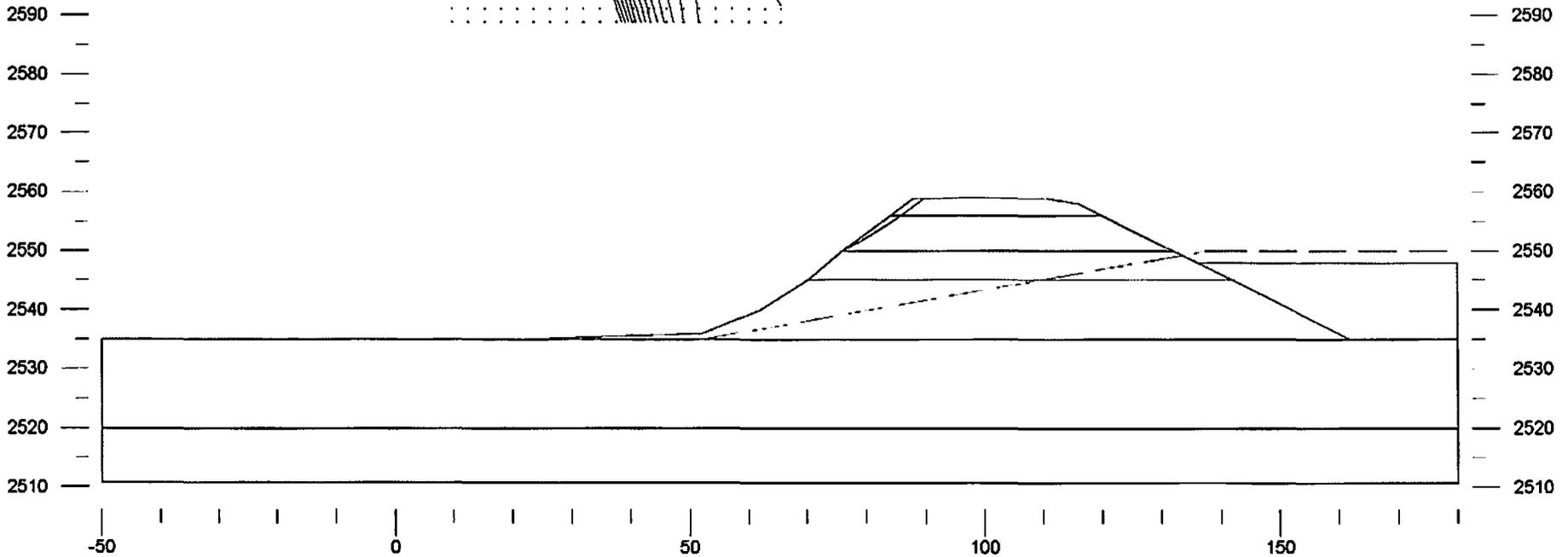
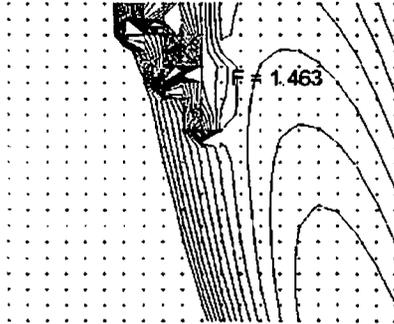
FIGURE NO.
8

ORIGINAL ENGINE DRAWING BY COLOR

Engeo - San Ramon, CA
 7645.5.001.01
 Idaho Maryland Mining Company
 February 2007
 Cross - Section at Boring B22
 Pseudo Static

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Tailings	120	0	20	1
Fill (GM)	120	0	35	1
Fill (loose SM)	115	50	28	1
Fill (dense SM)	115	600	45	1
Fill (CL)	115	2000	0	1
Overburden Soil	120	500	33	1
Bedrock	140	7000	0	1

Seismic coefficient = 0.065



BASE MAP SOURCE: IDAHO-MARYLAND MINING CORPORATION



SLOPE STABILITY AT BORING B22 - PSEUDOSTATIC
 IDAHO-MARYLAND MINE - SURFACE FACILITIES AND IMPROVEMENTS
 GRASS VALLEY, CALIFORNIA

PROJECT NO: 7645.5.001.01
 DATE: MARCH 2007
 DRAWN BY: RJS CHECKED BY: MMG

FIGURE NO.
10

S:\Boring\B22\B22.dwg 7645.5.001.01-10510051001.dwg 3-06-07 04:58:00 PM

TABLE A

Summary of Geotechnical Condition and Foundation Recommendations

APPENDIX A

**Field Exploration Notes
Key to Boring Logs
Key to Rock Characteristics
Exploratory Logs**

FIELD EXPLORATION NOTES

We drilled 19 borings on the site for this report. An ENGEO representative supervised the drilling and logged the subsurface conditions. A CME 75 and a CME 850 drill rig were used to drill the borings using hollow stem auger methods.

The boring logs present descriptions and graphically depict the subsurface soil, rock and groundwater conditions encountered. The maximum depth penetrated by the borings was approximately 50 feet.

We obtained bulk soil samples from drill cuttings. We also retrieved soil samples at various intervals in the borings using Standard Penetration Tests (SPT) and a Modified California Sampler (3-inch O.D. split spoon sampler with thin walled liners).

The SPT and Modified California Sampler blow counts were obtained by dropping a 140-pound hammer through a 30-inch free fall. Unless otherwise indicated, the blows per foot recorded on the boring log represent the accumulated number of blows required to drive the last 12 inches.

Additionally we excavated 11 test pits using a Caterpillar 320C with a 24 inch wide bucket. An ENGEO representative observed the test pit excavation. The test pit logs present descriptions and graphically depict the subsurface soil, rock and groundwater conditions encountered. The maximum depth penetrated by the test pits was approximately 13 feet.

We obtained bulk soil samples from the excavations.

NOTES TO THE LOGS

We determined the lines designating the interface between soil/rock materials on the logs using visual observations. The transition between the materials may be abrupt or gradual.

The logs contain information concerning samples recovered, indications of the presence of various materials such as sand, silt, rock, existing fill, etc., and observations of groundwater encountered. The field logs also contain our interpretation of the soil/rock conditions between samples. Therefore, the logs contain both factual and interpretative information. Our recommendations are based on the contents of the final logs. The final logs represent our interpretation of the contents of the field logs.

KEY TO BORING LOGS

MAJOR TYPES

DESCRIPTION

COARSE-GRAINED SOILS MORE THAN HALF OF MAT'L. LARGER THAN #200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES		GW - Well graded gravels or gravel-sand mixtures
		GRAVELS WITH OVER 12 % FINES		GP - Poorly graded gravels or gravel-sand mixtures
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES		SW - Well graded sands, or gravelly sand mixtures
		SANDS WITH OVER 12 % FINES		SP - Poorly graded sands or gravelly sand mixtures
FINE-GRAINED SOILS MORE THAN HALF OF MAT'L. SMALLER THAN #200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50 % OR LESS			ML - Inorganic silt with low to medium plasticity
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50 %			CL - Inorganic clay with low to medium plasticity
				OL - Low plasticity organic silts and clays
				MH - Inorganic silt with high plasticity
	HIGHLY ORGANIC SOILS			CH - Inorganic clay with high plasticity
HIGHLY ORGANIC SOILS			OH - Highly plastic organic silts and clays	
HIGHLY ORGANIC SOILS			PT - Peat and other highly organic soils	

GRAIN SIZES

U.S. STANDARD SERIES SIEVE SIZE				CLEAR SQUARE SIEVE OPENINGS			
200	40	10	4	3/4"	3"	12"	
SAND		GRAVEL					
FINE	MEDIUM	COARSE	FINE	COARSE		COBBLES	BOULDERS

RELATIVE DENSITY

SANDS AND GRAVELS	BLOWS/FOOT (S.P.T.)
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	OVER 50

CONSISTENCY

SILTS AND CLAYS	STRENGTH*	BLOWS/FOOT (S.P.T.)
VERY SOFT	0-1/4	0-2
SOFT	1/4-1/2	2-4
MEDIUM STIFF	1/2-1	4-8
STIFF	1-2	8-15
VERY STIFF	2-4	15-30
HARD	OVER 4	OVER 30

MOISTURE CONDITION

DRY	Absence of moisture, dusty, dry to touch
MOIST	Damp but no visible water
WET	Visible freewater
SATURATED	Below the water table

MINOR CONSTITUENT QUANTITIES (BY WEIGHT)

TRACE	Particles are present, but estimated to the less than 5%
SOME	5 to 15%
WITH	15 to 30%
.....Y	30 to 50%

SAMPLER SYMBOLS

	Modified California (3" O.D.) sampler
	California (2.5" O.D.) sampler
	S.P.T. - Split spoon sampler
	Shelby Tube
	Continuous Core
	Bag Samples
	Grab Samples
NR	No Recovery

LINE TYPES

—————	Solid - Layer Break
-----	Dashed - Gradational or approximate layer break

GROUND-WATER SYMBOLS

	Groundwater level during drilling
	Stabilized groundwater level

ENGEEO

INCORPORATED

EXCELLENT SERVICE SINCE 1921

(S.P.T.) Number of blows of 140 lb. hammer falling 30" to drive a 2-inch O.D. (1-3/8 inch I.D.) sampler

* Unconfined compressive strength in tons/sq. ft., asterisk on log means determined by pocket penetrometer

KEY TO ROCK CHARACTERISTICS

STRENGTH

Weak	Plastic or very low strength
Friable	Crumbles easily by hand
Moderately strong	Crumbles under light hammer blows
Strong	Crumbles under a few heavy hammer blows
Very strong	Breaks into large pieces under heavy, ringing hammer blows

FRACTURING

<u>Fracture Spacing</u>	<u>Size of Pieces</u>
Very widely	Greater than 4 feet
Widely	1 foot to 4 feet
Moderately	6 inches to 1 foot
Closely	1 inch to 6 inches
Very closely	½ inch to 1 inch
Crushed	Less than ½ inch

BEDDING OF SEDIMENTARY ROCKS

<u>Stratification</u>	<u>Thickness of Beds</u>
Massive	No apparent bedding
Very thick bedding	Greater than 4 feet
Thick bedding	2 feet to 4 feet
Thin bedding	2 inches to 2 feet
Very thin bedding	½ inch to 2 inches
Laminated	Less than 1/8 inch to ½ inch

WEATHERING

Deep	Moderate to complete decomposition; extensive disintegration; deep and thorough discoloration; many extensively-coated fractures.
Moderate	Slight decomposition of minerals; little disintegration; moderate discoloration; moderately coated fractures.
Little	No megascopic decomposition of minerals; slight to no effect on cementation; slight and intermittent, or localized discoloration; few stains on fracture surfaces.
Fresh	Unaffected by weathering agents; no disintegration or discoloration; fractures usually less numerous than joints.

TABLE A
Summary of Geotechnical Condition and Foundation Recommendations

Improvement	Proposed Pad Grade (ft)	Area (sq. ft.)	Nearby Explorations TP –ENGEО Test Pit B –ENGEО Boring IDT –IMMC Exploration	Approximate Thickness of Existing Fill (ft)	Approximate Depth to Bedrock (ft)	Proposed Range of Cut (C) / Fill (F) Thickness (ft)	Recommended Foundation Approach		
							Shallow Footings on Native Soil	Shallow Footings on Engineered Fill	Drilled Piers with Structural Floor Slab
Ceramic Plant	2520	193,000	TP16, TP18, IDT4-3, IDT4-6, IDT4-6, IDT4-8, IDT4-9, IDT4-1, IDT4-4, IDT4-4, IDT4-6	3½	3½	15 C to 15 F		✓ (1)	
Process Plant	2520	32,300	TP14, TP17, IDT4-2	1	1	10 C to 2 F		✓	
Hoist House	2580	4,000	B24	3½	3½	1 to 6 C	✓		
Shaft with Headframe	2580	20 foot Diameter	B25	1½	1½	5 to 10 C			✓
Warehouse Building	2520	15,000	TP17, TP14, IDT4-2	1½	2½	4 to 10 C	✓		
Core Shed	2500	20,000	B9, B12, IDT3-10	10	15	6 C to 6 F		✓ (2)	
Equipment Bay	2500	10,700	TP17	1½	2½	25 to 30 C	✓		
Dry Change House #1	2520	9,000	TP2, TP8, IDT4-7	7½	9	1 to 3 C		✓	
Dry Change House #2 and Office	2585	9,000	B27	1	1	5 C to 2 F	✓		
Office	2520	9,000	TP8, TP2, IDT4-7, IDT2-1	3½	4½	2 to 5 C		✓	
Temporary Explosives Magazine	2500	5,400	TP15	1 – 1½	1 – 1½	5 to 19 C	✓		
Educational Center	2590	5,200	B29	0	10	4 C to 3 F	✓		
Substation	2575	20,600	B23, B30	10½ - 30½	10½ - 30½	6 C to 5 F			✓
Fire Water Tank	2540	7,900	B29, TP15	0 – 1½	1½ - 10	15 to 20 C	✓		
Fuel/Oil Storage	2500	2,500	B9, B5, B12, IDT3-10	10 – 15	15	1 to 6 F		✓(2)	
Truck Shop	2500	22,500	B9, B5, B12, IDT3-10	15	15	2 C to 5 F		✓(2)	

(1) Transition overexcavation required due to differential fill thickness greater than 10 feet

(2) Limited overexcavation to a depth of 5 feet below pad grade is acceptable provided some differential soil movement is tolerable for these structures



Expect Excellence

LOG OF BORING B4

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 2/1/2007
HOLE DEPTH: Approx. 20½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2499 ft.

LOGGED / REVIEWED BY: M. Johnson / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
0	0		CLAYEY SAND (SC), reddish brown, medium dense, moist, medium plasticity, fine to medium sand. (FILL, TAILINGS)			9				53			
1	1		Becomes dense to very dense, with some gravel			43				51			
2	2		GABBRO, reddish brown, moderately strong, closely fractured, moderately weathered			52				23	102		
3	3		Light brown			25				25			
4	4												
5	5		Strong			49				12			
6	6		No groundwater encountered.			69/9"							

LOG - GE01
LOCAL 7645 5 001.01 IMMC BERM ROAD GPJ ENGEO INC.GDT 3/6/07



Expect Excellence

LOG OF BORING B5

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 2/1/2007
HOLE DEPTH: Approx. 11½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2489 ft.

LOGGED / REVIEWED BY: M. Johnson / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
0	0		CLAYEY GRAVEL (GC), reddish brown and light gray, dense, moist, fine gravel, with cobbles			45				7			
1	1					67							
5	5					77							
2	2		GABBRO, light brown, strong, closely fractured, moderately weathered			80							
10	10		No groundwater encountered.										



Expect Excellence

LOG OF BORING B6

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 2/1/2007
HOLE DEPTH: Approx. 10 ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2487 ft.

LOGGED / REVIEWED BY: M. Johnson / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
0 - 1	0 - 0.3		SILTY GRAVEL (GM), reddish brown, medium dense, moist, with fine sand			27				18			
1 - 5	0.3 - 1.5		GABBRO, light brown, friable, crushed, deeply weathered			20							
5 - 10	1.5 - 3.0		No groundwater encountered.			55							
10	3.0					50/6"				10			



Expect Excellence

LOG OF BORING B7

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 2/1/2007
HOLE DEPTH: Approx. 10½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2490 ft.

LOGGED / REVIEWED BY: M. Johnson / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
			GRAVEL (GP), gray, dense, moist										
	1		SANDY GRAVEL (GM), light gray, medium dense, moist			11							
	5		Very dense			90/9"							
	2												
	10		GABBRO, light brown, strong, closely fractured, moderately weathered			50/6"							
	3		No groundwater encountered.										



Expect Excellence

LOG OF BORING B8

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 2/1/2007
HOLE DEPTH: Approx. 15½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2517 ft.

LOGGED / REVIEWED BY: M. Johnson / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
			GRAVEL (GP), gray, very dense, moist, (FILL)			50/4"							
1			SAND (SP), brown, medium dense, moist, (FILL, TAILINGS)			10							
5													
2													
10			META-ANDESITE, gray, moderately strong, crushed, deeply weathered			16							
3													
4													
15			Very strong No groundwater encountered.			71							
						76/12"							

LOG - GEOTL CAL 7645.5.001.01 IMMC BERM ROAD.GPJ ENGEO INC GDT 3/6/07



Expect Excellence

LOG OF BORING B9

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 2/1/2007
HOLE DEPTH: Approx. 15½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2550 ft.

LOGGED / REVIEWED BY: M. Johnson / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
0	0		SAND (SP), reddish brown and gray, loose, moist, fine sand, with gravel, (FILL, TAILINGS)			8				30			
1	1					6					17	111	
5	5		CLAYEY SAND (SC), reddish brown, loose, moist, (FILL, TAILINGS)			5							
2	2												
10	10		SILTY GRAVEL (GM), light gray and reddish brown, dense, moist			30					25	102	
4	4												
15	15		DIABASE, reddish brown, strong, closely fractured, moderately weathered			50/3"							
			No groundwater encountered.										

LOG - GEO. CAL 7645.5.001.01 IMMC BERM ROAD.GPJ ENGEO, INC.GDT. 3/6/07



Expect Excellence

LOG OF BORING B12

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 2/1/2007
HOLE DEPTH: Approx. 20½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2493 ft.

LOGGED / REVIEWED BY: M. Johnson / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
			SAND (SP), gray, loose, wet, (FILL, TAILINGS)										
1		Medium dense				12				28			
5		Very loose				19				92			
2						4							
10		Medium dense, with fine gravel				23							
4													
15		GABBRO, reddish brown, strong, closely fractured, moderately weathered				35				17			
5													
20		No groundwater encountered.				72/12"							
6													

LOG - GEOTE. CAL 7645.5.001.01 IMM C BERM ROAD GPJ ENGEO, INC GDT 3/6/07



Expect Excellence

LOG OF BORING B20

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 1/23/2007
HOLE DEPTH: Approx. 36 ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2557 ft.

LOGGED / REVIEWED BY: M. Turner / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
			SILTY GRAVEL (GM), gray, dense, moist, fine to medium sand, with silt, (FILL, TAILINGS)			30							
1			SILTY SAND (SM), brown, medium dense, moist, fine to medium sand, with gravel, (FILL, TAILINGS)			19				4			
2			GRAVELLY SAND (SP), brown, medium dense, moist, fine to coarse sand, with silt, (FILL, TAILINGS)			25				31			
3			SILTY SAND (SM), brown, medium dense, moist, fine to medium sand, with gravel, (FILL, TAILINGS)			18						1.27	
4													
5			SANDY CLAY (CL), reddish brown, stiff, moist, low plasticity, fine to medium sand, with silt, with some gravel, (FILL, TAILINGS)			20				19 25	109 99	4*	
6			SILTY SAND (SM), gray, very dense, moist, fine to medium sand, with gravel, with clay, (FILL, TAILINGS)			51							
7													
25													

LOG - GEOTECHNICAL 7645.5.001.01 IMM/C BERM ROAD GPJ ENGEO INC GDT 3/6/07



Expect Excellence

LOG OF BORING B20

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 1/23/2007
HOLE DEPTH: Approx. 36 ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2557 ft.

LOGGED / REVIEWED BY: M. Turner / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
8			SANDY SILT (ML), gray, stiff, moist, fine sand, with some clay, (FILL, TAILINGS)Continued from previous			19							
			SILTY CLAY (CL), gray, very stiff, moist, low plasticity, with fine sand, with some gravel								22	106	4.25*
30			SILTY SAND (SM), gray, very dense, moist, fine to coarse sand, with gravel			50/4"							
35			META-ANDESITE, gray, weak, crushed, deeply weathered, with visible rock fabric			50/5"					14	102	
			Bottom of boring at 36 feet No groundwater encountered.										



Expect Excellence

LOG OF BORING B22

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 1/23/2007
HOLE DEPTH: Approx. 50 1/2 ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2559 ft.

LOGGED / REVIEWED BY: M. Turner / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
			SANDY GRAVEL (GM), gray, medium dense, moist, fine to medium sand, with silt, (FILL, TAILINGS)			16							
1			SILTY SAND (SM), reddish brown, loose, moist, fine to medium sand, with silt, (FILL, TAILINGS)			4			23				
5			Very loose										
2			Loose, fine sand, with clay, little gravel, more silt			8				18			
10			Dense			37							
4			SILTY CLAY (CL), reddish brown, hard, moist, low plasticity, with fine sand, with some gravel, (FILL, TAILINGS)			41						2.60	
15			CLAYEY SILT (ML), brown, hard, moist, with fine sand, and gravel, (FILL, TAILINGS)									4*	
5			SILTY CLAY (CL), brown mottled with dark brown, hard, moist, low plasticity, trace fine sand, with some gravel, (FILL, TAILINGS)			30	29	48	19				
20			SANDY CLAY (SC), bluish gray, very stiff, moist, fine to coarse sand, with some gravel										
7													
25													

LOG - GEO1 CAL 7645.5.001.01 IMMC BERM ROAD.GPJ ENGEO, INC.GDT_3/5/07



Expect Excellence

LOG OF BORING B22

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 1/23/2007
HOLE DEPTH: Approx. 50 1/2 ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2559 ft.

LOGGED / REVIEWED BY: M. Turner / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
8			SANDY CLAY (SC), bluish gray, very stiff, moist, fine to coarse sand, with some gravel Continued from previous			21					21	103	
30	9		SILTY SAND (SM), bluish gray, very dense, moist, fine to coarse sand, with some gravel			50/6"							
35	11		SILTY CLAY (CL), bluish gray, hard, moist, low plasticity, with fine sand, and gravel			46							
40	12		META-ANDESITE, gray and brown, weak, crushed, deeply weathered			52							
45	14					87/11"					21		
50	15												

LOG - GEOT. CAL 7645.5.001.01 IMMC BERM ROAD.GPJ ENGEO INC.GDT 3/6/07



Expect Excellence

LOG OF BORING B22

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 1/23/2007
HOLE DEPTH: Approx. 50½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2559 ft.

LOGGED / REVIEWED BY: M. Turner / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
			Bottom of boring at approximately 50½ feet. Groundwater encountered at approximately 50 feet.	▨		50/1"							



Expect Excellence

LOG OF BORING B23

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 1/29/2007
HOLE DEPTH: Approx. 50½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2571 ft.

LOGGED / REVIEWED BY: M. Turner / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
			SANDY SILT (ML), dark brown, soft, moist, with fine sand, and gravel, and organics, (FILL, TAILINGS)			31							
			SANDY GRAVEL (GM), gray, medium dense, moist, with fine sand, and silt, and organics, (FILL, TAILINGS)										
1			SILTY CLAY (CL), gray, very stiff, moist, low plasticity, with organics, (FILL, TAILINGS)			30	28	47	19				
5			Grading with more fine sand			22							
2			SILTY SAND (SM), gray, loose, moist, fine sand, with clay, with organics, (FILL, TAILINGS)			13							
10			LUMBER MILL WASTE, dark brown and black, very soft, moist, fine wood chips up to 1/4 inch maximum dimension, no odor, (FILL).			8							
4			Grading with silt and clay, with strong organic odor										
15			CLAYEY SAND (SC), gray, loose, moist, fine sand, with gravel, and silt, with bark up to 2 inches maximum dimension, (FILL, TAILINGS)			7							
5													
20			LUMBER MILL WASTE, dark brown, very soft, moist, fine wood chips up to 1/4 inch maximum dimension, no odor, (FILL).			12							
6													
7													
25													

LOG - GEOTL AL 7645.5.001.01 MMCM BERM ROAD GP1 ENGEO INC.GDT 3/6/07



--- Expect Excellence ---

LOG OF BORING B23

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 1/29/2007
HOLE DEPTH: Approx. 50½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2571 ft.

LOGGED / REVIEWED BY: M. Turner / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
8			SAND (SP), gray, medium dense, wet, fine sand, (FILL, TAILINGS)	[Symbol]		23				3	35	75	
			CLAYEY SAND (SC), gray, medium dense, moist, fine sand, with organics, (FILL, TAILINGS)	[Symbol]		18							
9			SAND (SP), gray, medium dense, wet, fine sand, (FILL, TAILINGS)	[Symbol]		75/12"							
30			META-ANDESITE, gray and brown, weak, crushed, deeply weathered	[Symbol]		75/12"							
10													
35			Reddish brown with iron oxide mineralization along fractures	[Symbol]		75/12"					19	108	
11													
40						50/6"							
12													
45			Very closely spaced fractures	[Symbol]		64/10"					20		
14													
15													
50													

LOG - GEOTE. CAL 7645.5.001.01 IMM/C BERM ROAD GPJ ENGEO INC GDT 3/6/07



LOG OF BORING B23

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 1/29/2007
HOLE DEPTH: Approx. 50½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2571 ft.

LOGGED / REVIEWED BY: M. Turner / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
			Bottom of boring at approximately 50½ feet. No groundwater encountered.	▨		50/1"							



Expect Excellence

LOG OF BORING B24

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 1/29/2007
HOLE DEPTH: Approx. 21 ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2583 ft.

LOGGED / REVIEWED BY: M. Turner / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (1st) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
			ORGANIC SOIL (OL), black, soft, moist, with silt, and fine sand, (FILL)			9							
			SILTY SAND (SM), reddish brown, loose, moist, with some gravel										
1			META-ANDESITE, tan and reddish brown, weak, crushed, deeply weathered, fractures filled with red clay, iron oxide mineralization along fractures surfaces			46				29	92		
5			Bluish gray and reddish brown			83							
2						52							
10						57							
3													
4													
15			No clay present within fractures			50/6"				13	94		
5													
20						85/9"				14			
6			No groundwater encountered.										

LOG - GEOTE. CAL 7645.5.001.01 IMMC BERM ROAD GPJ ENGEO INC.GDT 3/6/07



— Expect Excellence —

LOG OF BORING B25

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 1/29/2007
HOLE DEPTH: Approx. 10½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2586 ft.

LOGGED / REVIEWED BY: M. Turner / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
			ORGANIC SOIL (OL), brown, soft, moist, with fine sand, and clay, composed of wood chips, (FILL)										
			META-ANDESITE, green and reddish brown, weak, crushed, deeply weathered, iron oxide mineralization along fracture surface			41				25	89		
1						40/2"							
5						50/3"							
2						50/6"							
10						50/6"				8			
			No groundwater encountered.										



— Expect Excellence —

LOG OF BORING B26

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 1/30/2007
HOLE DEPTH: Approx. 20½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2570 ft.

LOGGED / REVIEWED BY: M. Turner / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
			6 inches concrete, no base rock, (FILL)										
			SILTY CLAY (CL), reddish brown, medium stiff, moist, medium plasticity, with fine sand, and gravel			10							
1						34				55			
5			META-ANDESITE, reddish brown, weak, crushed, deeply weathered, iron oxide mineralization along fracture surfaces			66							
2						66/12"					16	103	
10						77/10"							
4													
15			Moderately strong			92/8"							
5													
20			No groundwater encountered.			50/3"					5		

LOG - GEOTECHNICAL CAL 7645.5.001.01 IMMC BERM ROAD.GPJ ENGEO INC.GDT 3/6/07



Expect Excellence

LOG OF BORING B27

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 1/29/2007
HOLE DEPTH: Approx. 6½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2586 ft.

LOGGED / REVIEWED BY: M. Turner / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (1sf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
			SANDY SILT (SM), dark brown, soft, moist, fine sand, with organics, organics composed of wood chips, (FILL)										
			META-ANDESITE, gray, weak, crushed, deeply weathered, with red clay filled fractures			55							
1						67/8"				34	81		
5						50/1"							
			No groundwater encountered.										



Expect Excellence

LOG OF BORING B28

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 1/30/2007
HOLE DEPTH: Approx. 20½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2569 ft.

LOGGED / REVIEWED BY: M. Turner / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
		X	SILTY CLAY (CL), reddish brown, medium stiff, moist, low plasticity, with fine sand, with some gravel, and cobbles, (FILL)				24	43	19				
			SILTY SAND (SM), dark brown, loose, moist, fine to coarse sand, and gravel, (FILL)			13							
1			CLAYEY SAND (SC), reddish brown, loose, moist, fine to coarse sand, and silt, with some gravel, (FILL)			11				28		3.5*	
2			SILTY CLAY (CL), reddish brown mottled with gray, medium stiff, moist, low plasticity, with fine to medium sand, with some gravel, (FILL)			9					27	95	1.5*
3			META-ANDESITE, gray and green, weak, crushed, deeply weathered, iron oxide mineralization along fracture surfaces			70/12"					16	110	
4													
5			Moderately strong			50/3"							
6			No groundwater encountered.			97/8"					11		

LOG - GEOTECH - CAL 7645.5.001.01 IMMC BERM ROAD GPJ ENGEO INC.GDT 3/6/07



Expect Excellence

LOG OF BORING B29

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 2/1/2007
HOLE DEPTH: Approx. 15½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2589 ft.

LOGGED / REVIEWED BY: M. Johnson / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
0	0		CLAYEY SAND (SC), reddish brown and light gray, medium dense, moist			80/9"				16			
1	0.3					70/10"							
5	1.5		SILTY SAND (SM), light brown, hard, moist			84/9"							
2	0.6												
10	3.0		DIABASE, reddish brown, friable, crushed, deeply weathered			37							
4	1.2					50/4"							
15	4.5		No groundwater encountered.			50/3"							

LOG - GEOTECH...CAL 7645 5 001 01 IMMOC BERM ROAD GPJ ENGEO INC GDT 36507



Expect Excellence

LOG OF BORING B30

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 1/29/2007
HOLE DEPTH: Approx. 40 1/2 ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2578 ft.

LOGGED / REVIEWED BY: M. Turner / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
		X	SANDY SILT (ML), dark brown, soft, moist, fine sand, with gravel, and cobbles, (FILL)										
			SILTY GRAVEL (GM), brown and gray, medium dense, moist, fine sand, and cobbles, (FILL)			20							
1			CLAYEY SILT (ML), bluish gray, very stiff, moist, with fine sand, and organics, organics composed of wood chips, (FILL)			26						4.5*	
5			SILTY CLAY (CL), reddish brown mottled with bluish gray, very stiff, moist, low plasticity, with fine sand, (FILL)			21							
10			META-ANDESITE, bluish gray, weak, crushed, deeply weathered, iron oxide mineralization along fracture surfaces			44							
15						67							
20						43							
25													

LOG - GEOTECHNICAL 7645.5.001.01 IMMBC BERM ROAD GPJ ENGEO INC. GDT 3/6/07

LOG OF BORING B30

Idaho-Maryland Mining Corp.
Surface Improvements
Grass Valley, California
7645.5.001.01

DATE DRILLED: 1/29/2007
HOLE DEPTH: Approx. 40½ ft.
HOLE DIAMETER: 6.0 in.
SURF ELEV (FT-MSL): Approx. 2578 ft.

LOGGED / REVIEWED BY: M. Turner / JAF
DRILLING CONTRACTOR: V&W Drilling
DRILLING METHOD: Hollow Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits			Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
							Plastic Limit	Liquid Limit	Plasticity Index				
8			META-ANDESITE, bluish gray, weak, crushed, deeply weathered, iron oxide mineralization along fracture surfaces Continued from previous Moderately strong strong			70/12"							
30		Strong				50/6"							
35						50/3"							
40			No groundwater encountered.			50/5"							

IDAHO- MARYLAND MINE SURFACE IMPROVEMENTS
NEVADA COUNTY, CALIFORNIA

TEST PIT LOGS

Test Pit Number	Depth (Feet)	Description
TP2	0 – 1	SILTY SAND (SM), gray, loose moist, fine grained, with clay, (FILL, TAILINGS)
	1 – 9 ½	SANDY CLAY (CL), soft, moist, fine grained sand, low plasticity, with silt, (FILL, TAILINGS) At 3 feet, becomes very soft At 7 ½ feet, becomes dark gray and dark green, with gravel and organics, organics composed of wood chips,(native soil, non fill) At 9 feet perched groundwater encountered
	9 ½ -13 ½	GABBRO, green and brown, weak, crushed, deeply weathered Bottom at 13 ½ feet. Perched groundwater at 9 feet.
TP3	0 – 3 ½	SILTY SAND (SM), gray with rust seams, loose, moist, fine grained, (FILL, TAILINGS)
	3 ½ - 4 ½	SANDY CLAY (CL), reddish brown, very soft, moist, fine grained sand, low to medium plasticity
	4 ½ - 11	GABBRO, green and reddish brown, weak, crushed, deeply weathered Bottom at 11 feet. No groundwater encountered.

Logged By: M. Turner
Project No. 7645.5.001.01
Logged Date: 01/31/07

IDAHO- MARYLAND MINE SURFACE IMPROVEMENTS
NEVADA COUNTY, CALIFORNIA

TEST PIT LOGS

Test Pit Number	Depth (Feet)	Description
TP11	0 - 2 ½	SILTY SAND (SM), gray, loose, very moist, fine grained sand, (FILL, TAILINGS)
	2 ½ - 10	GABBRO, gray and white, weak, crushed, deeply weathered Bottom at 10 feet. No groundwater encountered.
TP13	0 - 1	CLAYEY SAND, reddish brown, loose, moist, low plasticity, fine grained sand and gravel, (FILL, TAILINGS)
	1 - 5 ½	GABBRO, dark gray, moderately strong, closely spaced fractures, medium weathering, iron oxide mineralization along fracture surfaces At 4 ½ feet grades moderately strong to strong, medium spaced fractures, medium weathering Bottom at 5 ½ feet. No groundwater encountered.
TP14	0 - 1	SILTY CLAY (CL), brown, soft, moist, with fine grained sand, low plasticity, (FILL, TAILINGS)
	1 - 6 ½	GABBRO, white and green, weak, crushed, deeply weathered (albite rich, highly altered with chlorite) [DIABASE Vein at 3 ½ feet, brown, medium strong, closely spaced fractures, medium weathering 1'-2' wide] Bottom at 6 ½ feet. No groundwater encountered.

Logged By: M. Turner
Project No. 7645.5.001.01
Logged Date: 01/31/07

IDAHO- MARYLAND MINE SURFACE IMPROVEMENTS
NEVADA COUNTY, CALIFORNIA

TEST PIT LOGS

Test Pit Number	Depth (Feet)	Description
TP15	0 - 1 ½	SANDY CLAY (CH), tan and reddish brown, medium stiff, moist, medium plasticity, fine grained sand with gravel, (FILL, TAILINGS)
	1 ½ - 5 ½	GABBRO greenish brown, moderately strong, moderate to deeply weathered Bottom at 5 ½ feet. No groundwater encountered.
TP16	0 - 3 ½	SANDY SILT (ML), brown, soft, moist, fine grained sand, with organics and rock, (FILL, TAILINGS)
	3 ½ - 5	SANDY GRAVEL (GM), greenish white, loose, moist, (FILL)
	5 - 6	SILTY CLAY (CL), reddish brown, medium stiff, moist, with fine grained sand
	6 - 10	GABBRO, weak, crushed, deeply weathered. Bottom at 10 feet. No groundwater encountered.
TP17	0 - ½	SANDY GRAVEL (GM), greenish brown, loose, moist, fine to medium sand, (FILL, TAILINGS)
	½ - 1 ½	SILTY SAND (SM), tan, loose, moist, fine to medium sand, (FILL, TAILINGS)
	1 ½ - 2 ½	SILTY CLAY (CL), reddish brown, medium stiff, moist, with fine grained sand, with gravel and cobble

Logged By: M. Turner
Project No. 7645.5.001.01
Logged Date: 01/31/07

IDAHO- MARYLAND MINE SURFACE IMPROVEMENTS
NEVADA COUNTY, CALIFORNIA

TEST PIT LOGS

Test Pit Number	Depth (Feet)	Description
	2 ½ - 10	META-ANDESITE, moderately strong, closely spaced fractures, moderate weathering At 5 ½ feet, becomes medium spaced fractures Bottom at 10 feet. No groundwater encountered.
TP18	0 -1	SANDY SILT (ML), brown, soft, moist, fine grained sand, with organics, (FILL, TAILINGS)
	1 -3 ½	SILTY CLAY (ML), gray, soft, moist, moderate plasticity, (FILL, TAILINGS) At 3 ½ feet, perched groundwater encountered
	3 ½ - 10	GABBRO, gray brown, weak, crushed, deeply weathered At 8 ½ feet grades friable Bottom at 10 feet. Perched groundwater encountered at 3 ½ feet.
TP19	0 -1	SILTY SAND (SM), reddish brown, loose, moist, fine grained sand, (FILL, TAILINGS)
	1 - 6	CLAY (CL), light gray, very soft, moist moderately plasticity, (FILL, TAILINGS) At 1 foot, Sample collected for environmental testing At 4 feet, grades dark brown, with silt, organics, and fine grained sand

Logged By: M. Turner
Project No. 7645.5.001.01
Logged Date: 01/31/07

IDAHO- MARYLAND MINE SURFACE IMPROVEMENTS
NEVADA COUNTY, CALIFORNIA

TEST PIT LOGS

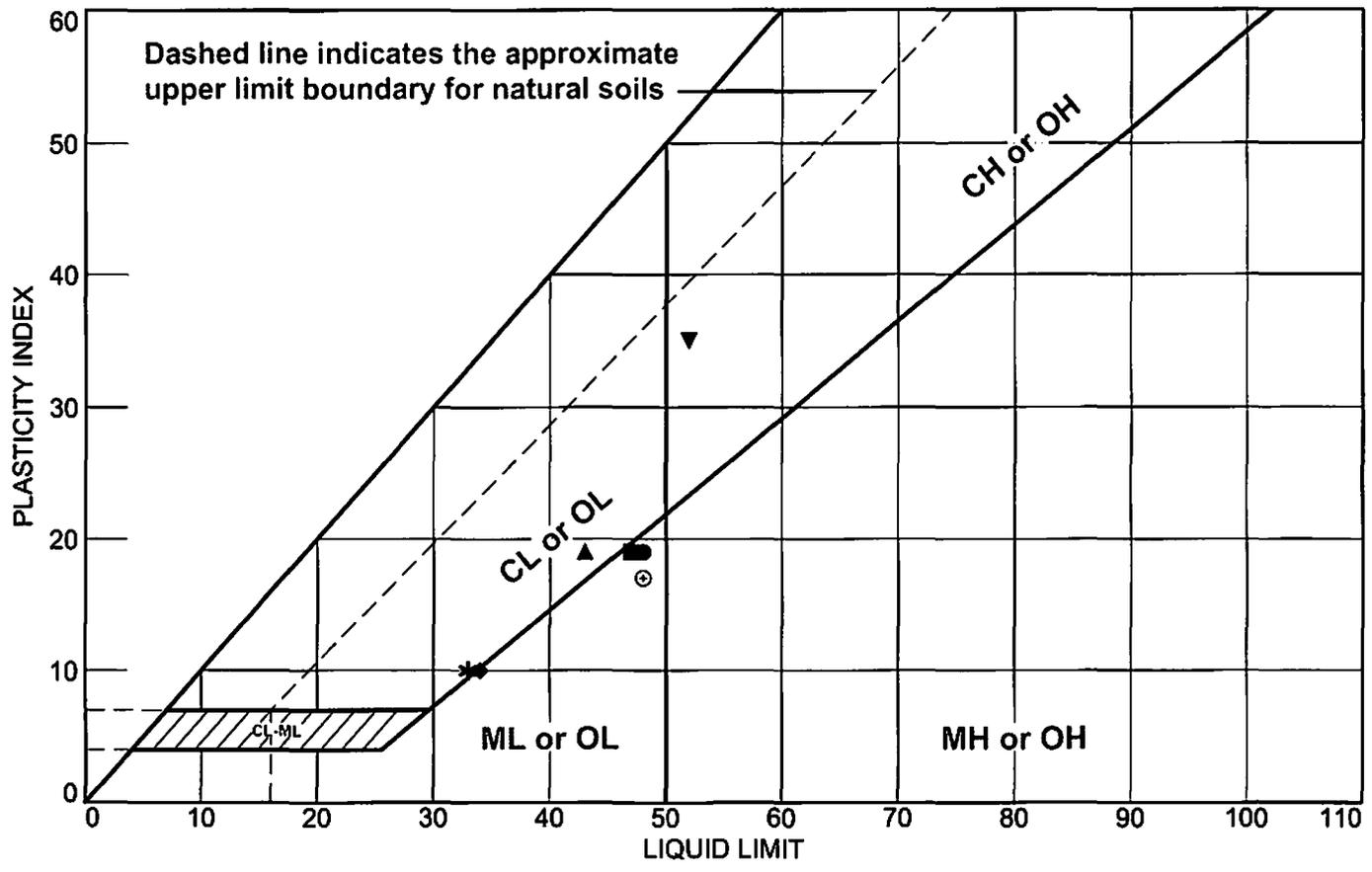
Test Pit Number	Depth (Feet)	Description
		At 4 feet, Sample collected for environmental testing
		At 5 feet, Sample collected for environmental testing
	6 – 11 ½	GABBRO, greenish white, weak, crushed, deeply weathered
		Bottom at 11 ½ feet. No groundwater encountered.
TP21	0 -1	SANDY SILT (ML), brown, loose, moist, fine grained sand with gravel and cobble, (FILL, TAILINGS)
	1 – 4 ½	SANDY GRAVEL (GM), brown, loose, moist, fine grained sand with cobble and organics, (FILL)
	4 ½ - 11	META-ANDESITE, gray brown, weak, crushed, deeply weathered
		Bottom at 11 feet. No groundwater encountered.

Logged By: M. Turner
Project No. 7645.5.001.01
Logged Date: 01/31/07

**APPENDIX B
LABORATORY TEST DATA**

Liquid and Plastic Limits Test Report
Unconfined Compression Test (2 pages)
Particle Size Distribution Report (14 pages)
R-Value Test Report (2 pages)
Direct Shear Test Report (4 pages)
Expansion Index Test Report
Analytical Results of Soil Corrosion

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	GEX	B22@21	21 feet		29	48	19	ML
■	GEX	B23@3.5	3 1/2 feet		28	47	19	ML
▲	GEX	B28@0	Surface		24	43	19	CL
◆	GEX	TP2@1	1 feet		24	34	10	ML
▼	GEX	TP15@0	Surface		17	52	35	CH
*	GEX	TP17@2	2 feet		23	33	10	CL
⊙	GEX	TP19@2	2 feet		31	48	17	ML

ENGEO, Inc.

Rocklin, CA

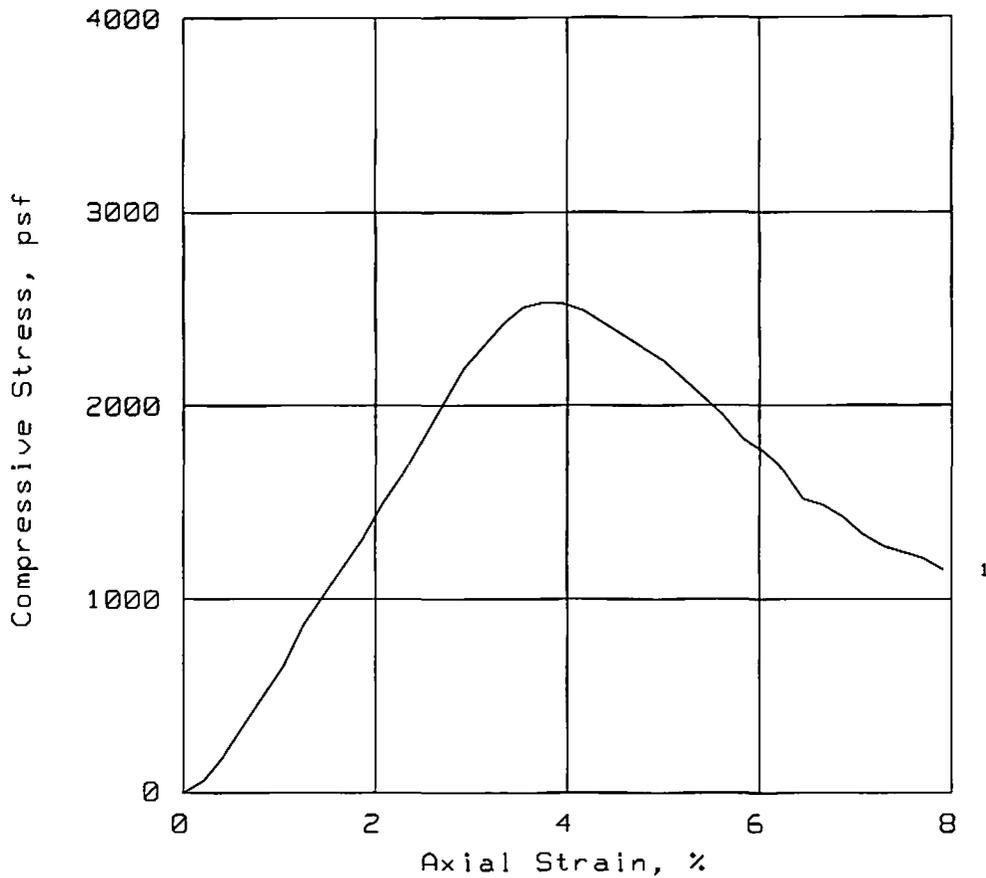
Client:

Project: Idaho-Maryland Mine Reopening

Project No.: 7645.5.001.01

Figure

UNCONFINED COMPRESSION TEST



SAMPLE NO.:	1		
Unconfined strength, psf	2531		
Undrained shear strength, psf	1266		
Failure strain, %	3.8		
Strain rate, %/min	2.79		
Water content, %	13.6		
Wet density, pcf	121.2		
Dry density, pcf	106.7		
Saturation, %	65.6		
Void ratio	0.5510		
Specimen diameter, in	2.42		
Specimen height, in	4.80		
Height/diameter ratio	1.98		

Description: Brown silty sand (SM)

GS= 2.65

Type: In situ

Project No.: 7645.5.001.01

Date: 2/2/07

Remarks:

Assumed Specific

Gravity

Client:

Project: Idaho-Maryland Mine Reopening

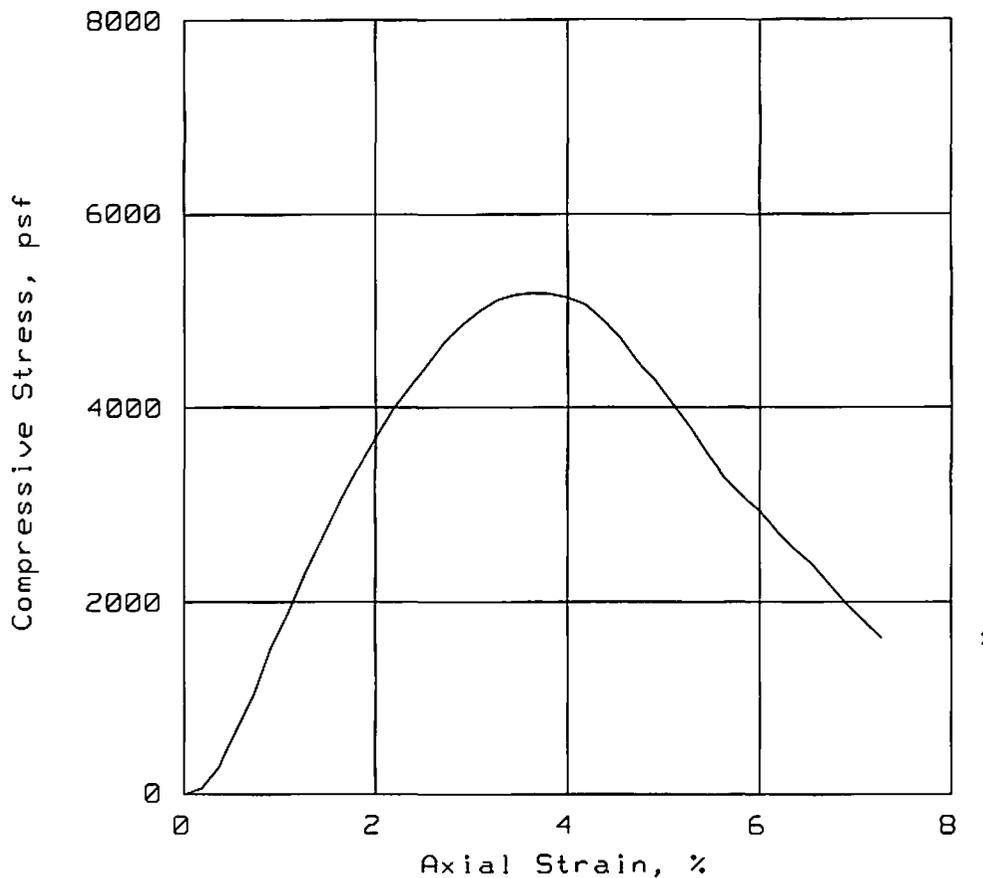
Location: B20@10.5

UNCONFINED COMPRESSION TEST

ENGE0, INCORPORATED

Fig. No.: _____

UNCONFINED COMPRESSION TEST



SAMPLE NO.:	1			
Unconfined strength, psf	5189			
Undrained shear strength, psf	2595			
Failure strain, %	3.6			
Strain rate, %/min				
Water content, %	21.7			
Wet density, pcf	120.9			
Dry density, pcf	99.3			
Saturation, %	86.4			
Void ratio	0.6657			
Specimen diameter, in	2.42			
Specimen height, in	5.50			
Height/diameter ratio	2.27			

Description: Reddish brown Silty clay (CL)

GS= 2.65

Type: In situ

Project No.: 7645.5.001.01

Date: 2/2/07

Remarks:

1/2 clay and 1/2 silt

Client:

Project: Idaho-Maryland Mine Reopening

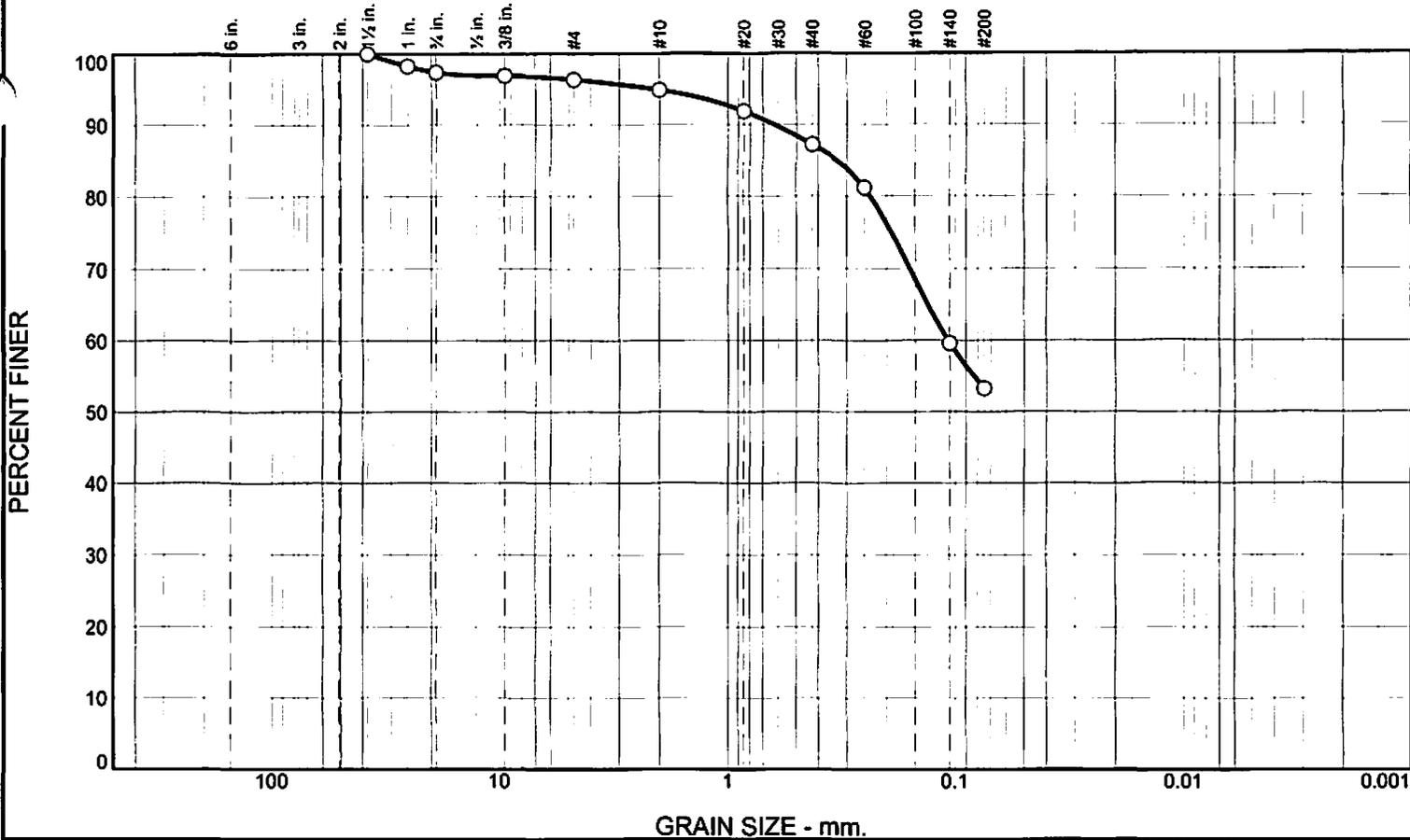
Location: B22@15.5

UNCONFINED COMPRESSION TEST

ENGE0, INCORPORATED

Fig. No.: _____

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.6	1.1	1.4	7.7	33.9	53.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	98.3		
.75	97.4		
.375	96.9		
#4	96.3		
#10	94.9		
#20	91.9		
#40	87.2		
#60	81.2		
#140	59.6		
#200	53.3		

Soil Description
Reddish brown sandy clay

Atterberg Limits (ASTM D 4318)
 PL= LL= PI=

Classification
 USCS= CL AASHTO=

Coefficients
 D₈₅= 0.3297 D₆₀= 0.1080 D₅₀=
 D₃₀= D₁₅= D₁₀=
 C_u= C_c=

Date Tested: Tested By:

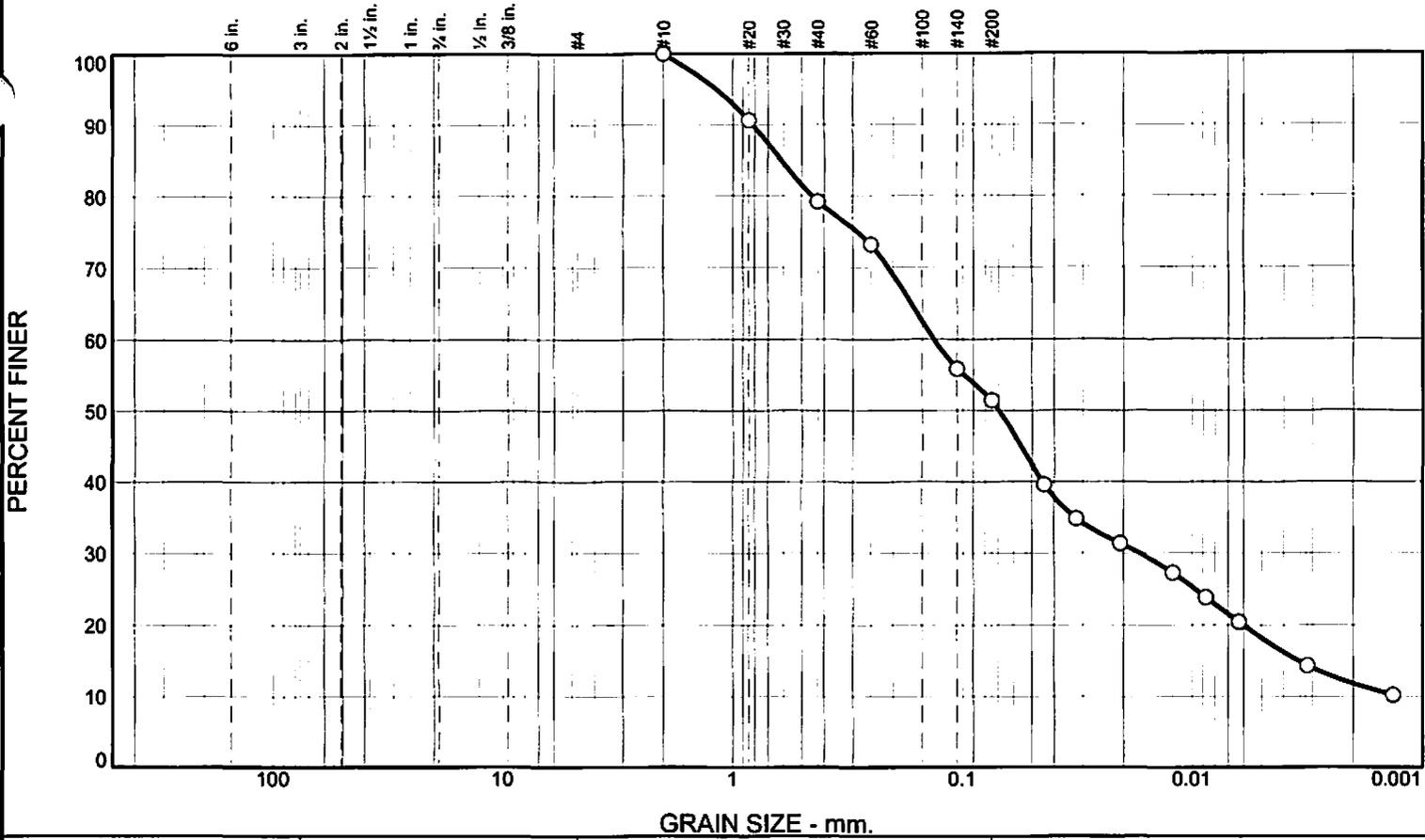
Remarks

* (no specification provided)

Sample No.: B4@1 Source of Sample: GEX Date Sampled: Elev./Depth: 1 feet
 Location: Title:
 Checked By: Title:

ENGEO, Inc. Rocklin, CA	Client: Project: Idaho-Maryland Mine Reopening Project No: 7645.5.001.01
Figure	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	20.8	27.8	39.6	11.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	90.6		
#40	79.2		
#60	73.2		
#140	55.9		
#200	51.4		

Soil Description
 Reddish brown sandy silt

Atterberg Limits (ASTM D 4318)
 PL= _____ LL= _____ PI= _____

Classification
 USCS= ML AASHTO= _____

Coefficients
 D₈₅= 0.6135 D₆₀= 0.1334 D₅₀= 0.0694
 D₃₀= 0.0169 D₁₅= 0.0034 D₁₀= _____
 C_u= _____ C_c= _____

Date Tested: _____ Tested By: _____

Remarks

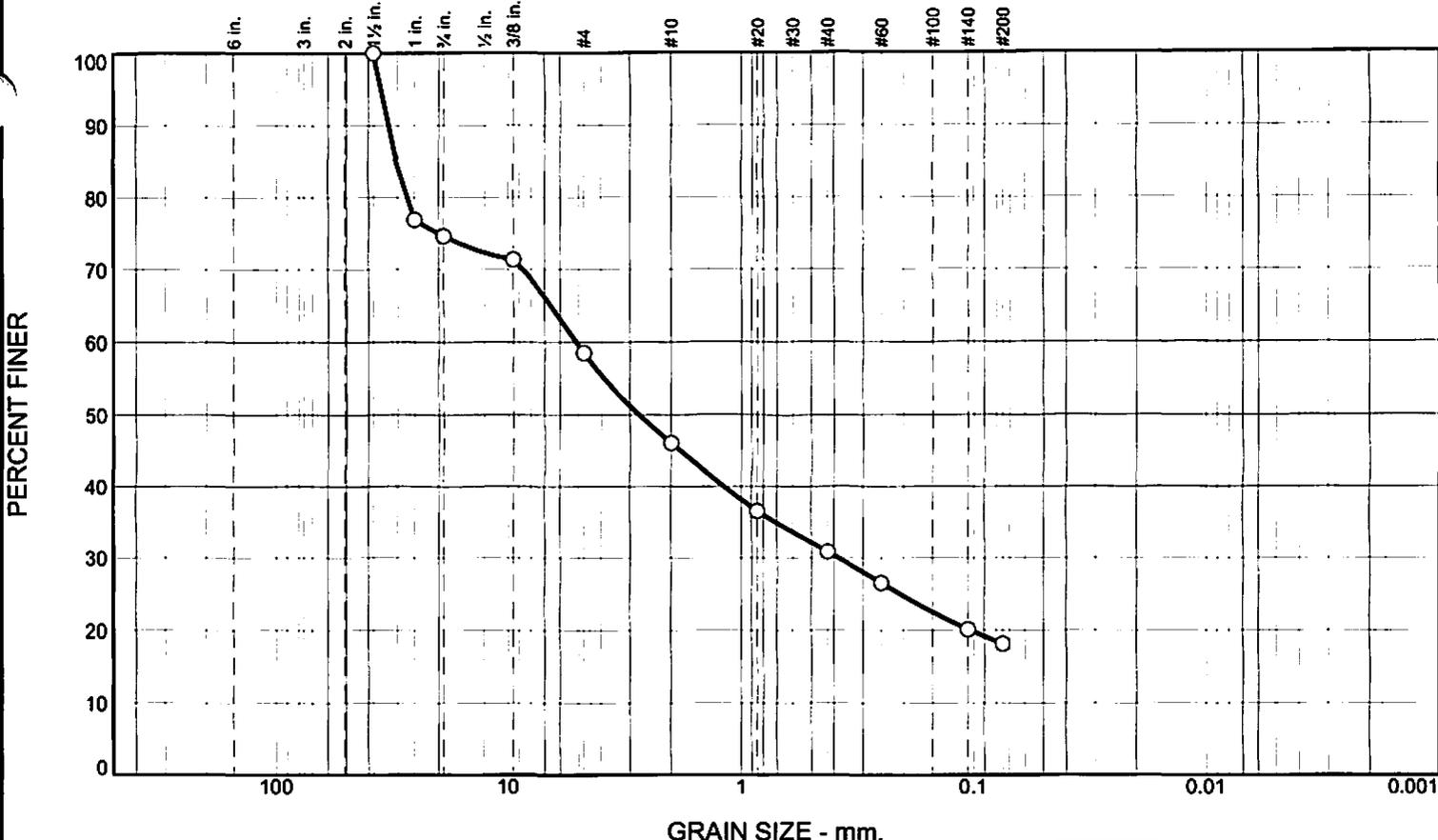
* (no specification provided)

Sample No.: B4@3 Source of Sample: GEX Date Sampled: _____
 Location: _____ Title: _____ Elev./Depth: 3 feet
 Checked By: _____

ENGEO, Inc. Rocklin, CA	Client: _____ Project: Idaho-Maryland Mine Reopening Project No: 7645.5.001.01
--	--

Figure _____

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	25.4	16.1	12.5	15.1	12.7	18.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	76.9		
.75	74.6		
.375	71.3		
#4	58.5		
#10	46.0		
#20	36.6		
#40	30.9		
#60	26.5		
#140	20.1		
#200	18.2		

Soil Description

Reddish brown sandy gravel with silt

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS= GM AASHTO= _____

Coefficients

D₈₅= 30.4607 D₆₀= 5.1313 D₅₀= 2.7446
 D₃₀= 0.3811 D₁₅= _____ D₁₀= _____
 C_u= _____ C_c= _____

Date Tested: _____ Tested By: _____

Remarks

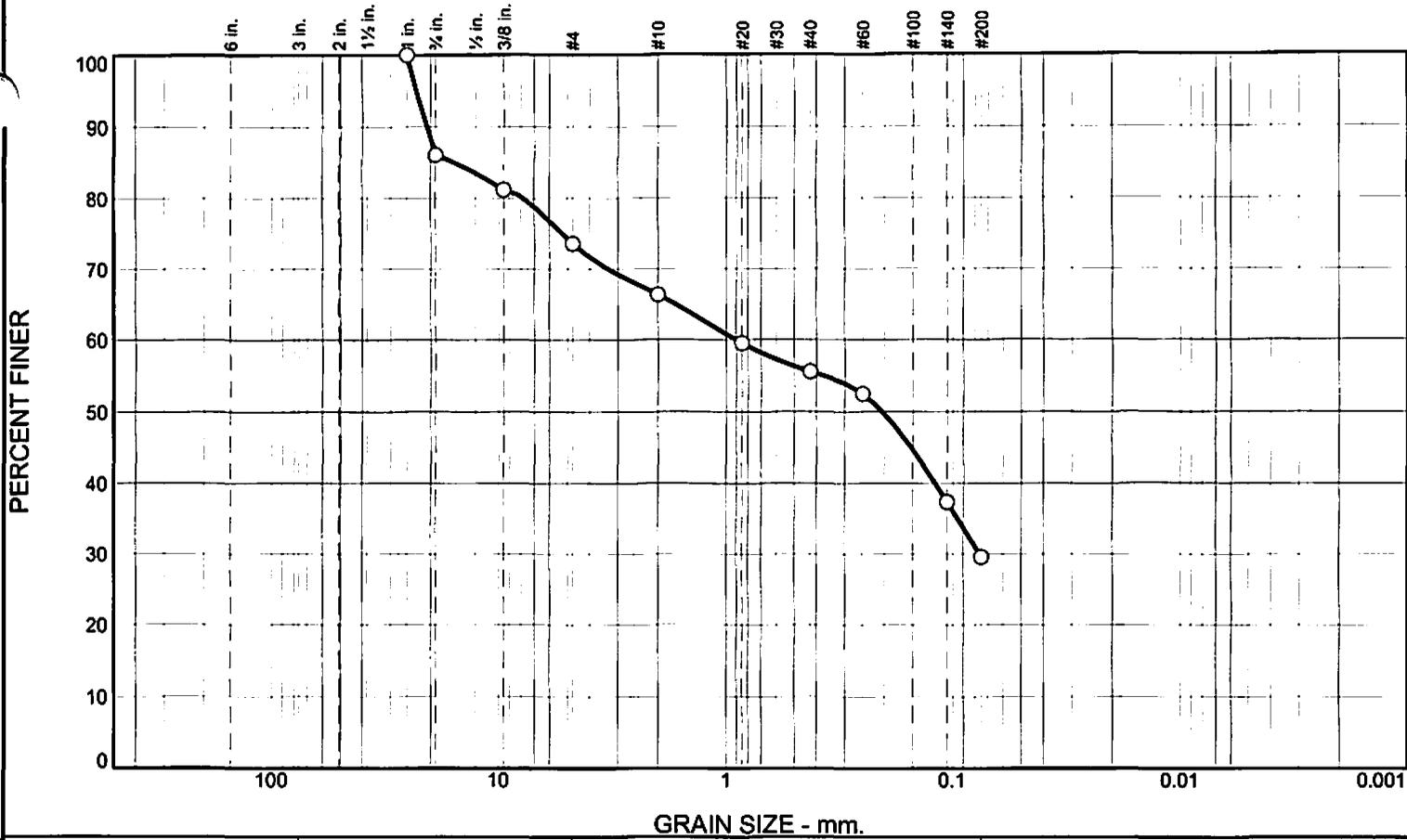
(no specification provided)

Sample No.: B6@1 Source of Sample: GEX Date Sampled: _____
 Location: _____ Title: _____ Elev./Depth: 1 feet
 Checked By: _____

ENGEO, Inc. Rocklin, CA	Client: Project: Idaho-Maryland Mine Reopening Project No: 7645.5.001.01
--	---

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines		Clay
	Coarse	Fine	Coarse	Medium	Fine	Silt		
0.0	13.9	12.5	7.3	10.7	26.0	29.6		

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	86.1		
.375	81.2		
#4	73.6		
#10	66.3		
#20	59.5		
#40	55.6		
#60	52.5		
#140	37.4		
#200	29.6		

(no specification provided)

Soil Description

Reddish brown silty sand with gravel

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS= SM AASHTO= _____

Coefficients

D₈₅= 15.6973 D₆₀= 0.9076 D₅₀= 0.2044

D₃₀= 0.0764 D₁₅= _____ D₁₀= _____

C_u= _____ C_c= _____

Date Tested: _____ Tested By: _____

Remarks

Sample No.: B9@1 Source of Sample: GEX Date Sampled: _____

Location: _____ Title: _____ Elev./Depth: 1 feet

Checked By: _____

ENGEO, Inc.

Rocklin, CA

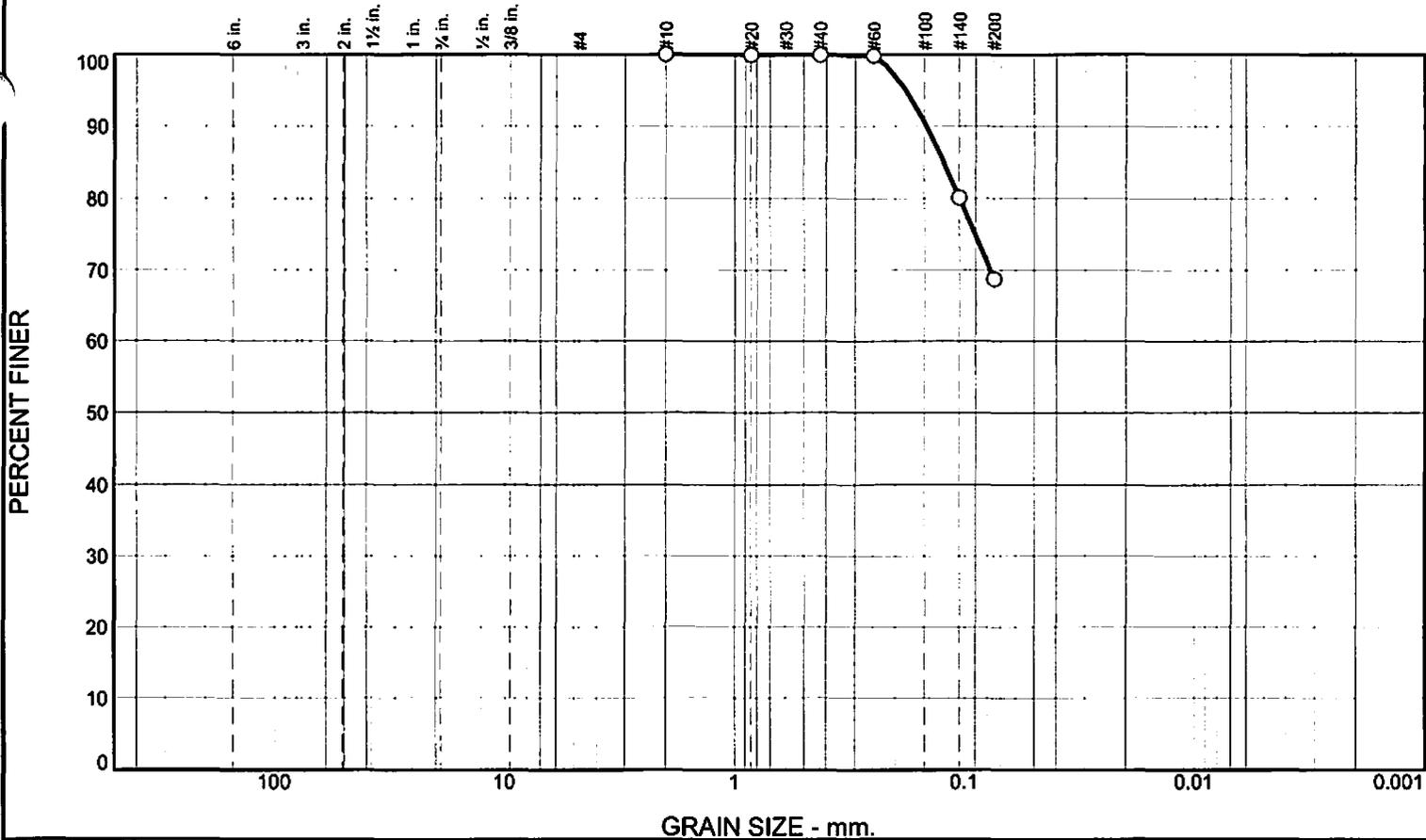
Client: _____

Project: Idaho-Maryland Mine Reopening

Project No: 7645.5.001.01

Figure _____

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	31.3	68.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	100.0		
#60	99.9		
#140	80.1		
#200	68.7		

Soil Description

Light brown sandy silt

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS= ML AASHTO= _____

Coefficients

D₈₅= 0.1238 D₆₀= _____ D₅₀= _____
 D₃₀= _____ D₁₅= _____ D₁₀= _____
 C_u= _____ C_c= _____

Date Tested: _____ Tested By: _____

Remarks

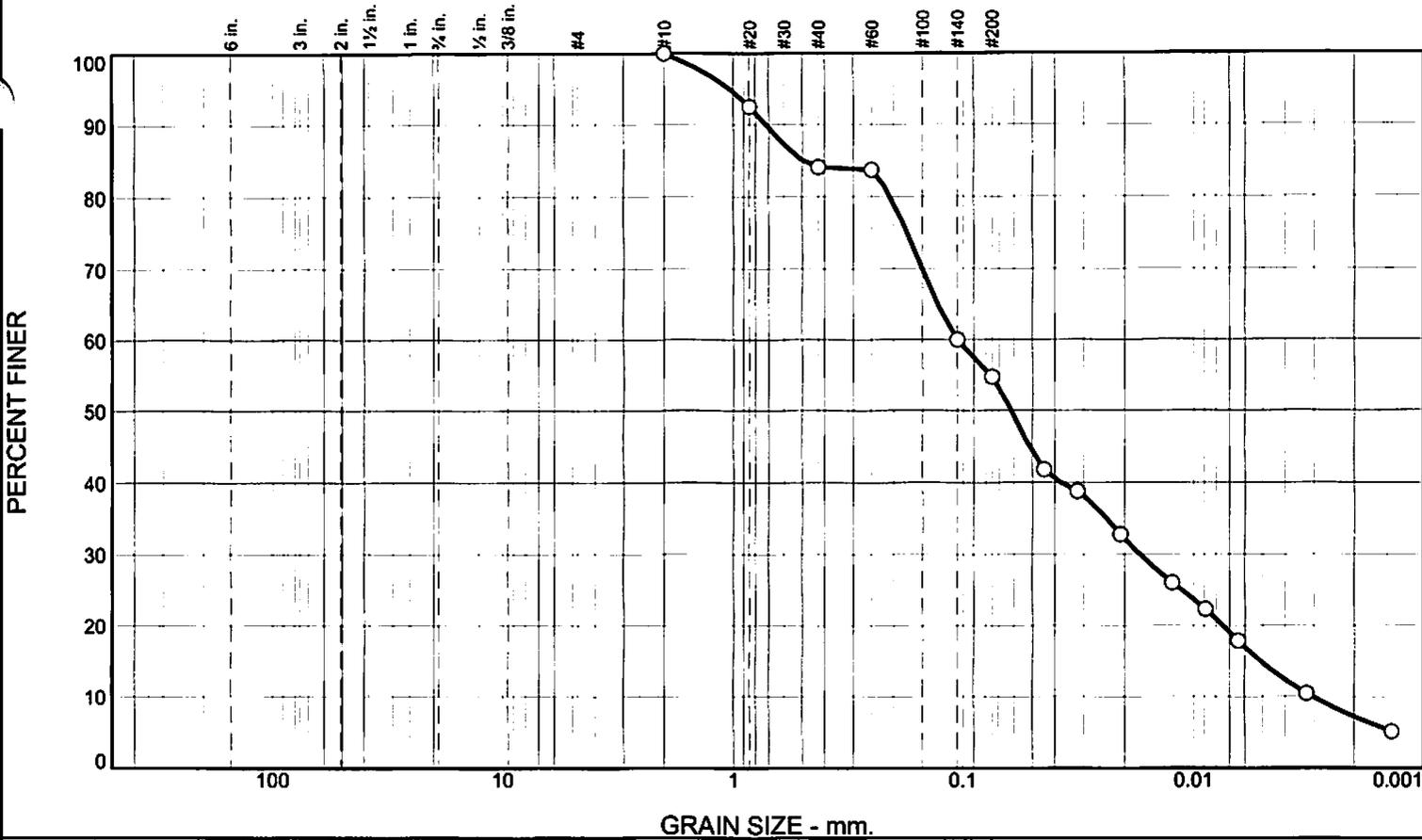
* (no specification provided)

Sample No.: B10@5 Source of Sample: GEX Date Sampled: _____
 Location: _____ Elev./Depth: 5 feet
 Checked By: _____ Title: _____

ENGEO, Inc. Rocklin, CA	Client: Project: Idaho-Maryland Mine Reopening Project No: 7645.5.001.01
--	--

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	15.9	29.4	47.5	7.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	92.5		
#40	84.1		
#60	83.7		
#140	60.0		
#200	54.7		

Soil Description
 Reddish brown sandy silt

Atterberg Limits (ASTM D 4318)
 PL= LL= PI=

Classification
 USCS= ML AASHTO=

Coefficients
 D₈₅= 0.4987 D₆₀= 0.1061 D₅₀= 0.0618
 D₃₀= 0.0171 D₁₅= 0.0051 D₁₀= 0.0030
 C_u= 34.87 C_c= 0.91

Date Tested: Tested By:

Remarks

* (no specification provided)

Sample No.: B26@3.5 Source of Sample: GEX
 Location:
 Checked By:

Date Sampled:
 Elev./Depth:

Title:

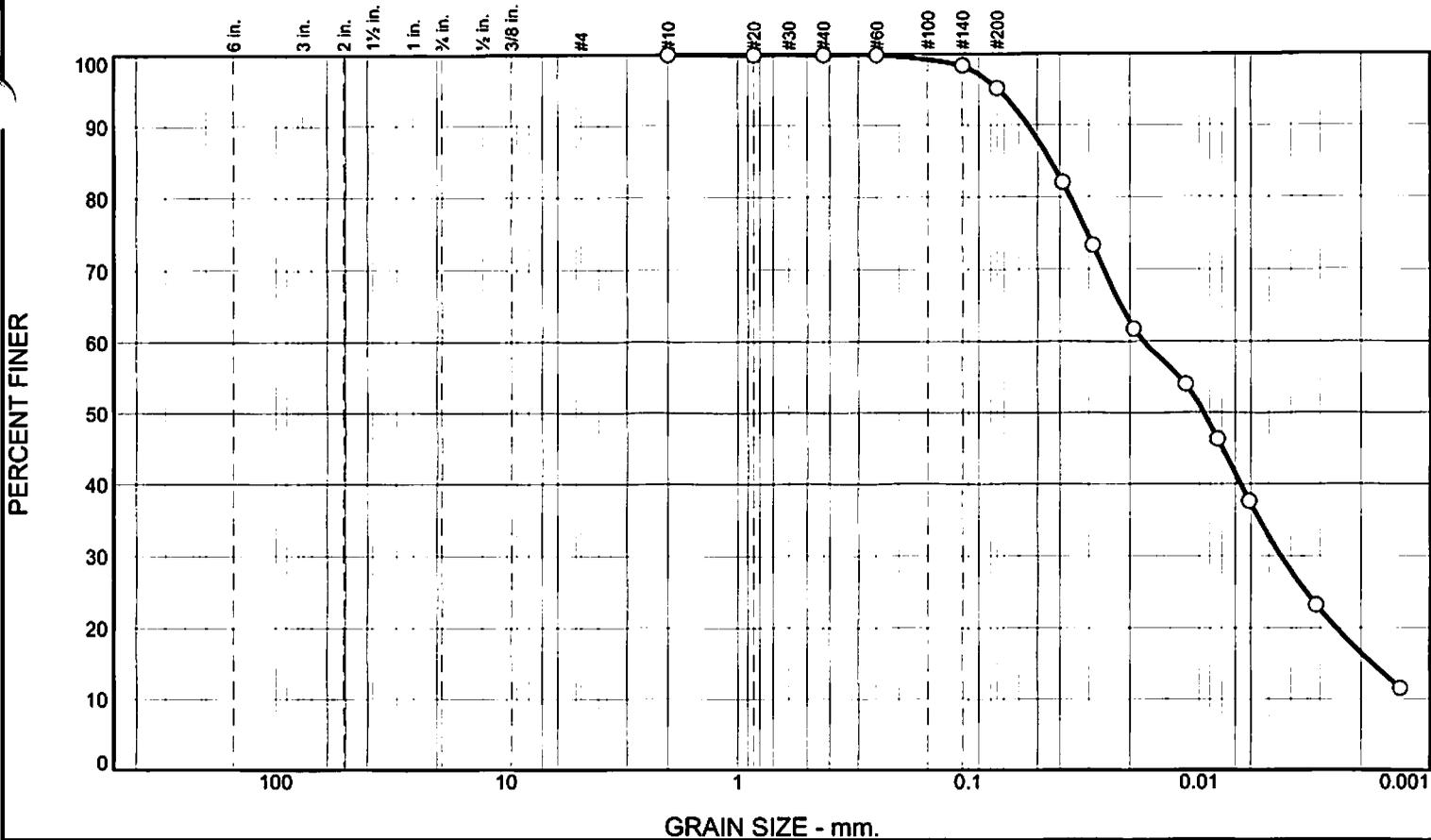
ENGEO, Inc.

Rocklin, CA

Client:
 Project: Idaho-Maryland Mine Reopening
 Project No: 7645.5.001.01

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	4.7	78.7	16.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	99.9		
#60	99.9		
#140	98.4		
#200	95.2		

Soil Description

Gray silty clay

Atterberg Limits (ASTM D 4318)

PL= 24 LL= 34 PI= 10

Classification

USCS= CL AASHTO= A-4(10)

Coefficients

D₈₅= 0.0439 D₆₀= 0.0175 D₅₀= 0.0096
 D₃₀= 0.0044 D₁₅= 0.0018 D₁₀=
 C_u= C_c=

Date Tested: Tested By:

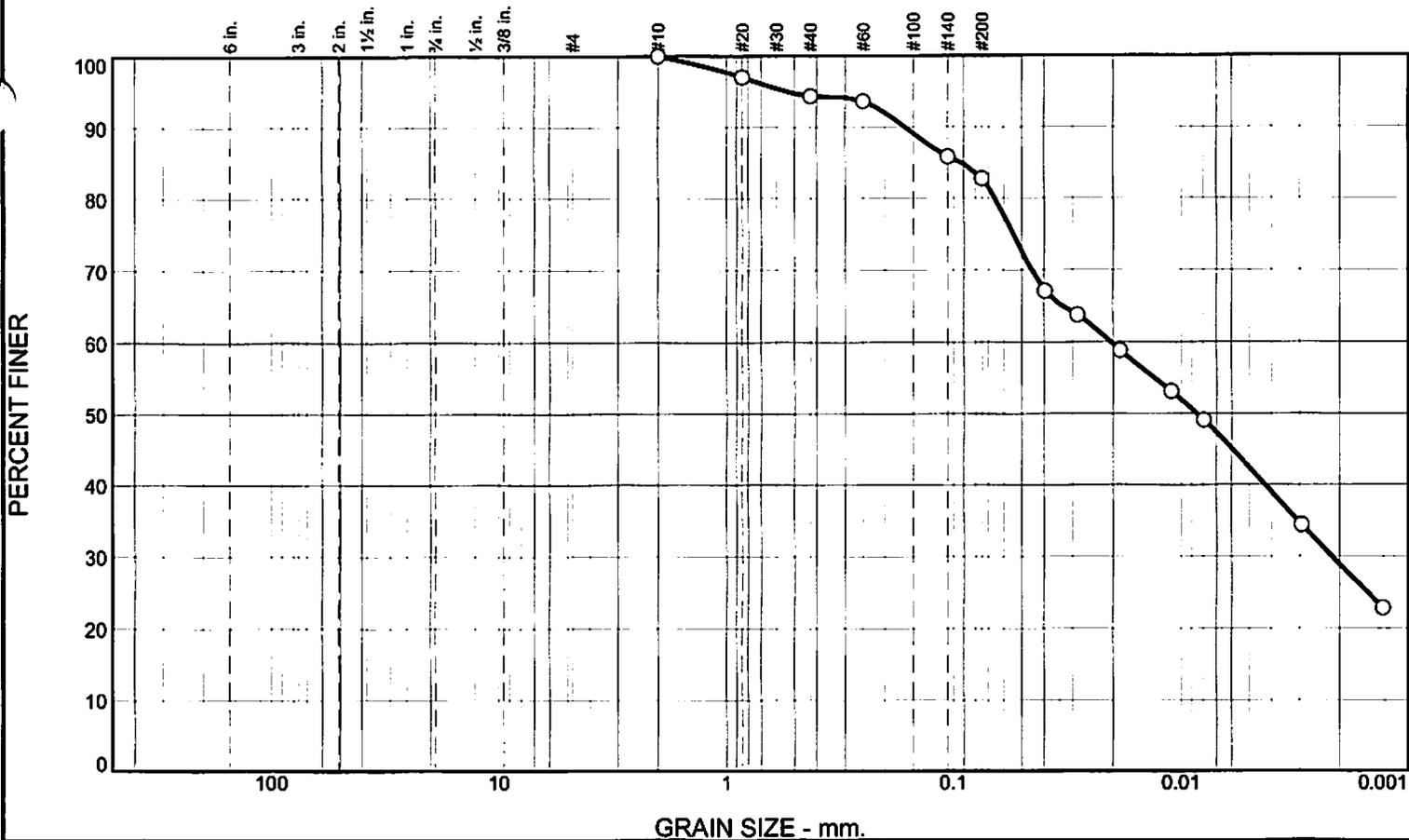
Remarks

* (no specification provided)

Sample No.: TP2@1 Source of Sample: GEX Date Sampled:
 Location: Elev./Depth: 1 feet
 Checked By: Title:

ENGEO, Inc. Rocklin, CA	Client: Project: Idaho-Maryland Mine Reopening Project No: 7645.5.001.01
Figure	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	5.6	11.6	53.9	28.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	97.1		
#40	94.4		
#60	93.7		
#140	85.8		
#200	82.8		

Soil Description
 Reddish brown silty clay with sand

Atterberg Limits (ASTM D 4318)
 PL= 17 LL= 52 PI= 35

Classification
 USCS= CH AASHTO= A-7-6(29)

Coefficients
 D₈₅= 0.0929 D₆₀= 0.0204 D₅₀= 0.0085
 D₃₀= 0.0022 D₁₅= D₁₀=
 C_u= C_c=

Date Tested: Tested By:
 Remarks

* (no specification provided)

Sample No.: TP15@0 Source of Sample: GEX Date Sampled:
 Location: Elev./Depth: Surface
 Checked By: Title:

ENGEO, Inc. Rocklin, CA	Client: Project: Idaho-Maryland Mine Reopening Project No: 7645.5.001.01
--	--

Figure

**R-VALUE TEST DATA
CAL-301**

PROJECT NAME: Idaho-Maryland Mine Reopen

REPORT DATE: 2/12/07

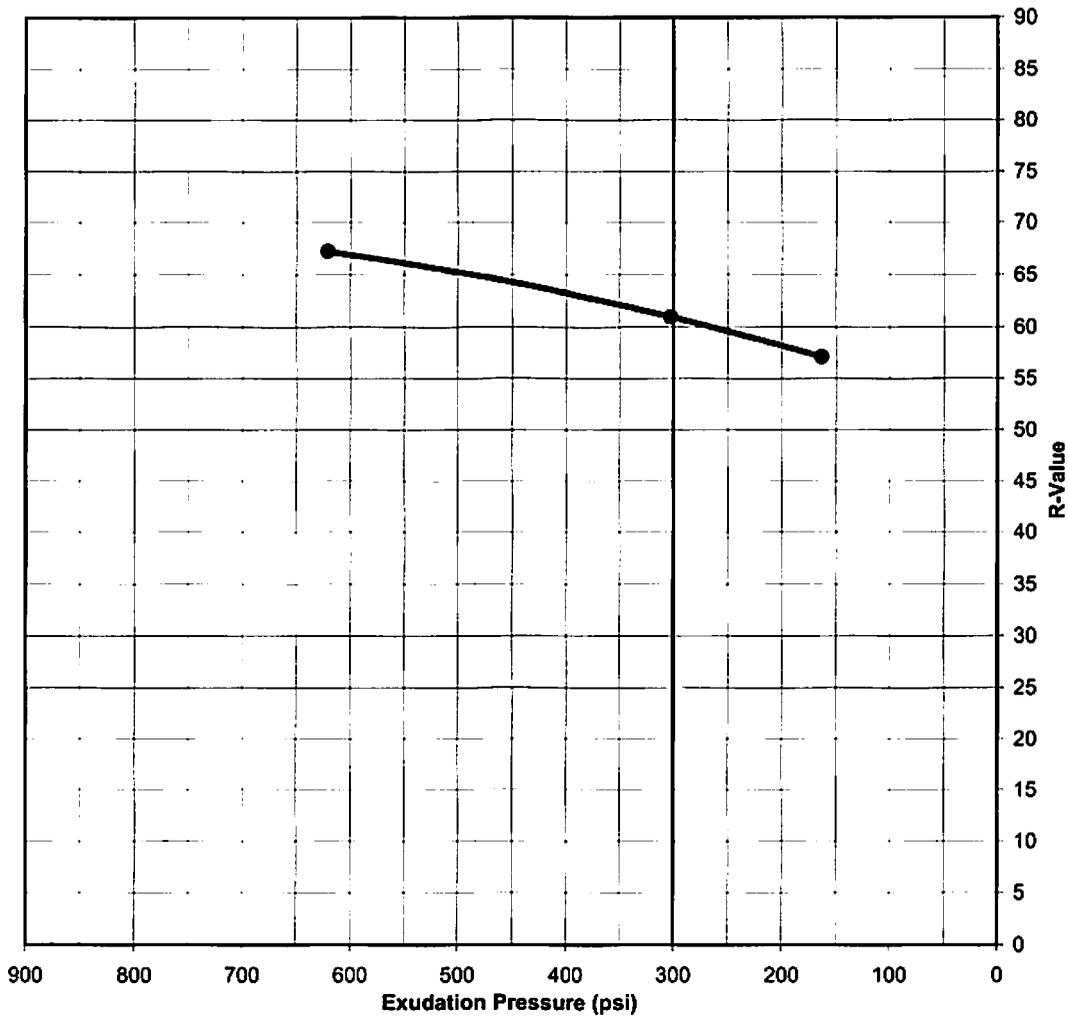
PROJECT NO. 7645.5.001.01

TESTED BY: SEL

SAMPLE LOCATION: B11@0-1

SAMPLE DATE: Unknown

SAMPLE DESCRIPTION:



Specimen	A	B	C
Exudation Pressure, p.s.i.	621	302	163
Expansion dial (.0001")	92	67	58
Expansion Pressure, p.s.f.	398	290	251
Resistance Value, "R"	67	61	57
% Moisture at Test	19.7	20.6	21.6
Dry Density at Test, p.c.f.	101.5	98.0	97.7
"R" Value at 300 p.s.i., Exudation Pressure	62		

**R-VALUE TEST DATA
CAL-301**

PROJECT NAME: Idaho-Maryland Mine Reopen

REPORT DATE: 2/13/07

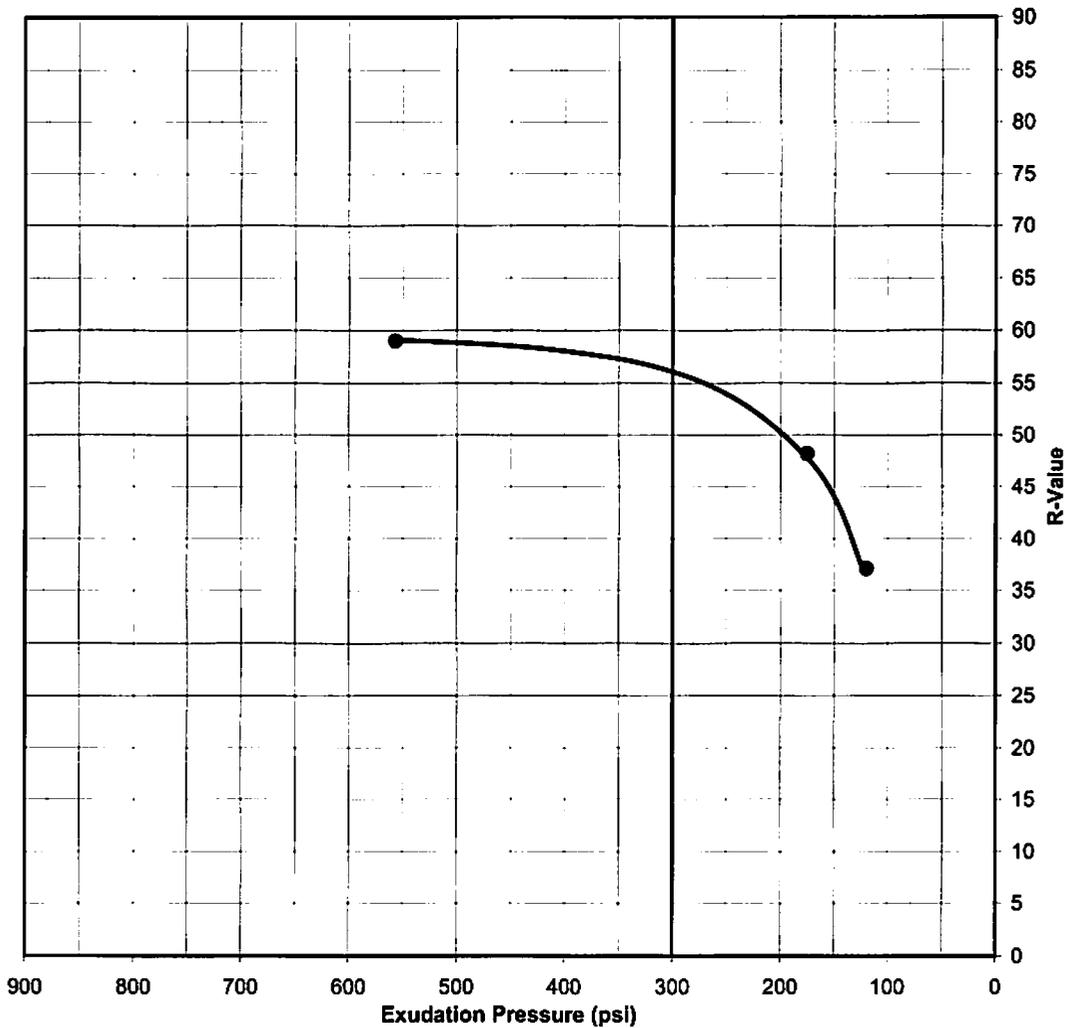
PROJECT NO. 7645.5.001.01

TESTED BY: SEL

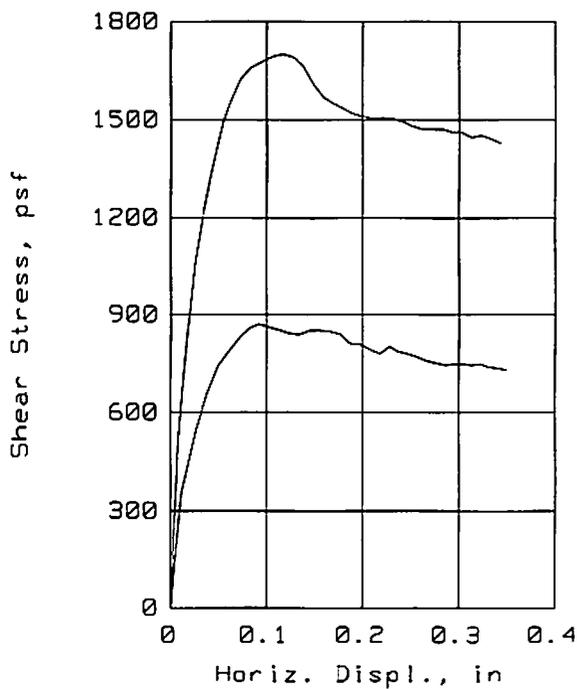
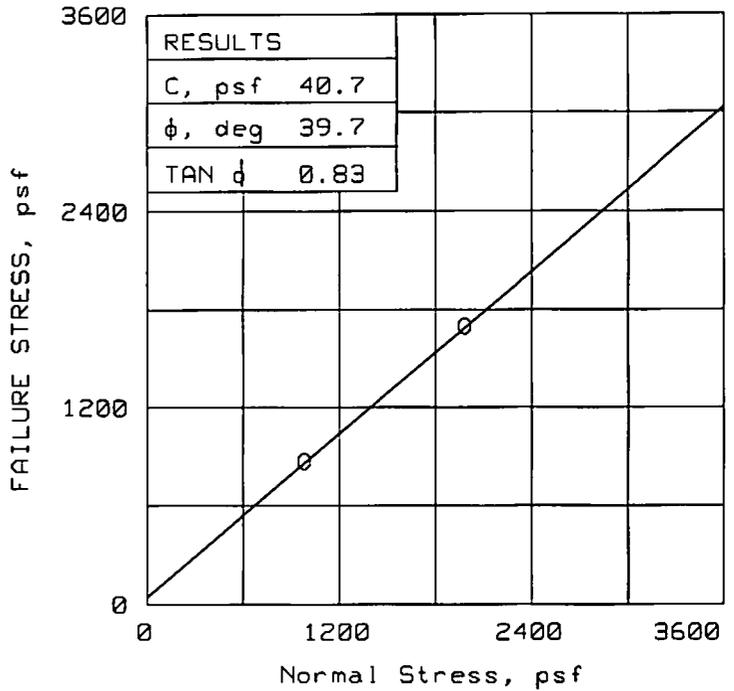
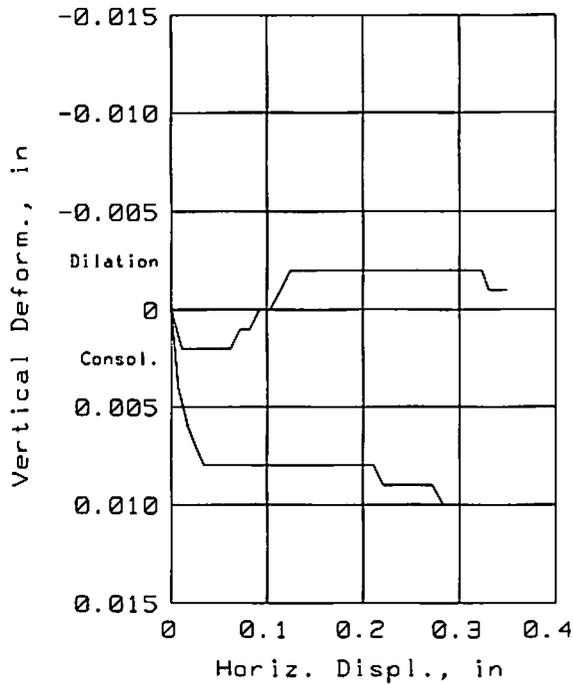
SAMPLE LOCATION: B12-Bulk 0-1'

SAMPLE DATE: 2/1/07

SAMPLE DESCRIPTION: Gray very fine grained sand (SP)



Specimen	A	B	C
Exudation Pressure, p.s.i.	557	175	119
Expansion dial (.0001")	105	79	47
Expansion Pressure, p.s.f.	455	342	204
Resistance Value, "R"	59	48	37
% Moisture at Test	14.7	15.1	15.9
Dry Density at Test, p.c.f.	114.3	113.0	112.3
"R" Value at 300 p.s.i., Exudation Pressure	57		



SAMPLE NO.:		1	2
INITIAL	WATER CONTENT, %	43.9	25.8
	DRY DENSITY, pcf	85.0	95.1
	SATURATION, %	120.5	90.1
	VOID RATIO	0.984	0.773
	DIAMETER, in	2.42	2.42
	HEIGHT, in	1.00	1.00
AT TEST	WATER CONTENT, %	42.5	25.5
	DRY DENSITY, pcf	88.1	98.2
	SATURATION, %	125.5	96.2
	VOID RATIO	0.913	0.716
	DIAMETER, in	2.42	2.42
	HEIGHT, in	0.96	0.97
	NORMAL STRESS, psf	1000	2000
	FAILURE STRESS, psf	870	1700
	DISPLACEMENT, in	0.09	0.12
	ULTIMATE STRESS, psf		
	DISPLACEMENT, in		
	Strain rate, %/min	0.21	0.11

SAMPLE TYPE: In situ
 DESCRIPTION: Gray and brown silt and brown sandy silt

SPECIFIC GRAVITY= 2.7
 REMARKS: Assumed Specific Gravity; Pt A - silt
 Pt B - sandy silt

Fig. No.: _____

CLIENT:

PROJECT: Idaho-Maryland Mine

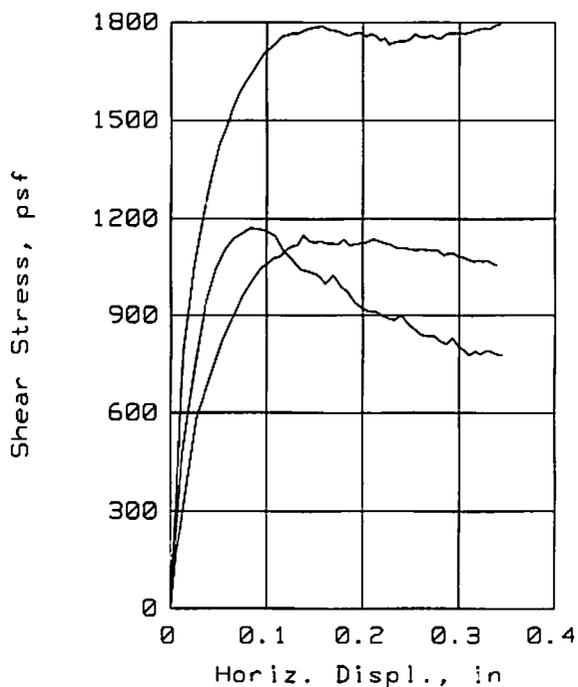
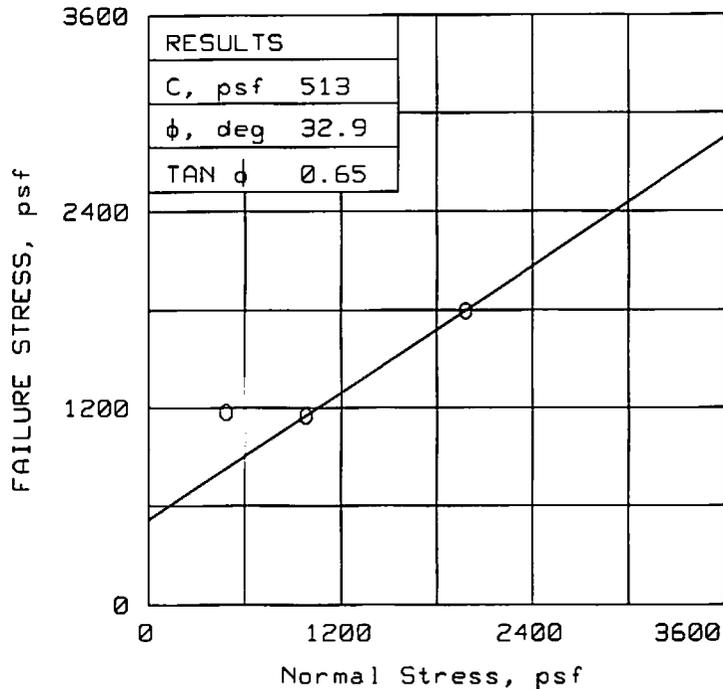
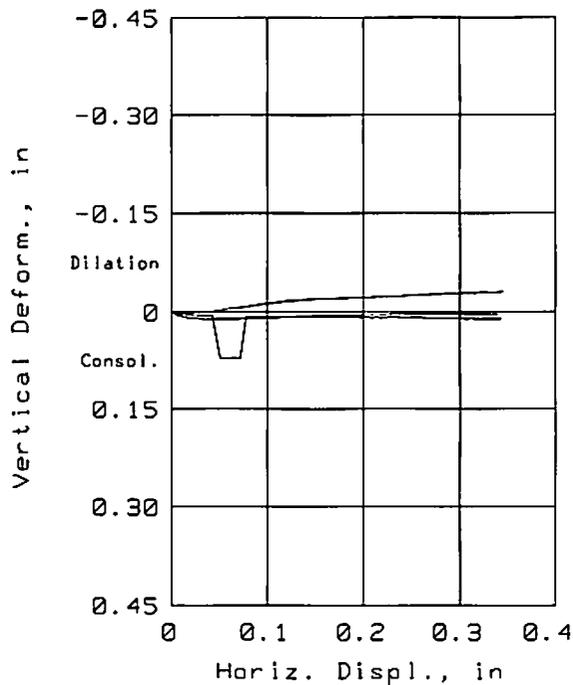
SAMPLE LOCATION: 310@3

PROJ. NO.: 7645.5.001.01

DATE: 2/13/07

DIRECT SHEAR TEST REPORT

ENGEO, INCORPORATED



SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	23.2	31.2	29.2
	DRY DENSITY, pcf	101.3	92.4	94.3
	SATURATION, %	94.2	102.2	100.2
	VOID RATIO	0.665	0.824	0.787
	DIAMETER, in	2.42	2.42	2.42
AT TEST	HEIGHT, in	1.00	1.00	1.00
	WATER CONTENT, %	23.9	31.1	28.0
	DRY DENSITY, pcf	101.8	94.8	98.1
	SATURATION, %	98.4	107.8	105.5
	VOID RATIO	0.655	0.779	0.718
NORMAL STRESS, psf	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	0.99	0.98	0.96
	500	1000	2000	
	FAILURE STRESS, psf	1171	1149	1794
	DISPLACEMENT, in	0.08	0.14	0.34
ULTIMATE STRESS, psf	DISPLACEMENT, in			
	Strain rate, %/min	0.16	0.13	0.12

SAMPLE TYPE: In situ
 DESCRIPTION: Brown silty clay
 (CL)

SPECIFIC GRAVITY= 2.7
 REMARKS: Assumed Specific
 Gravity

CLIENT:
 PROJECT: Idaho Maryland Mine Reopen

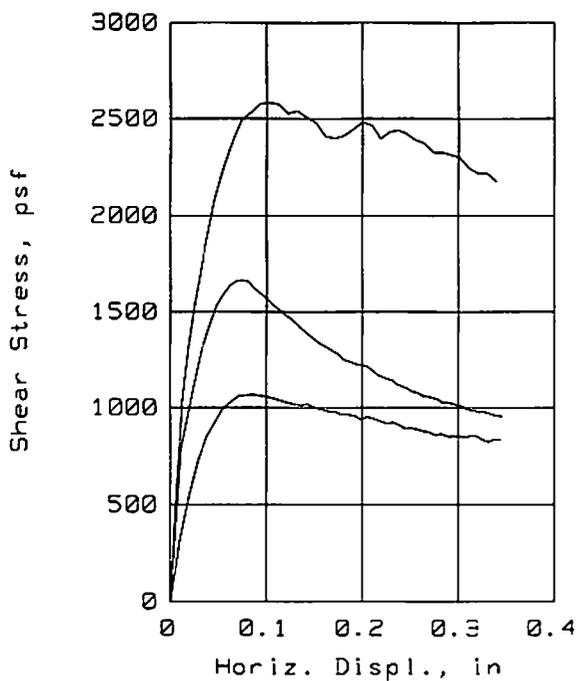
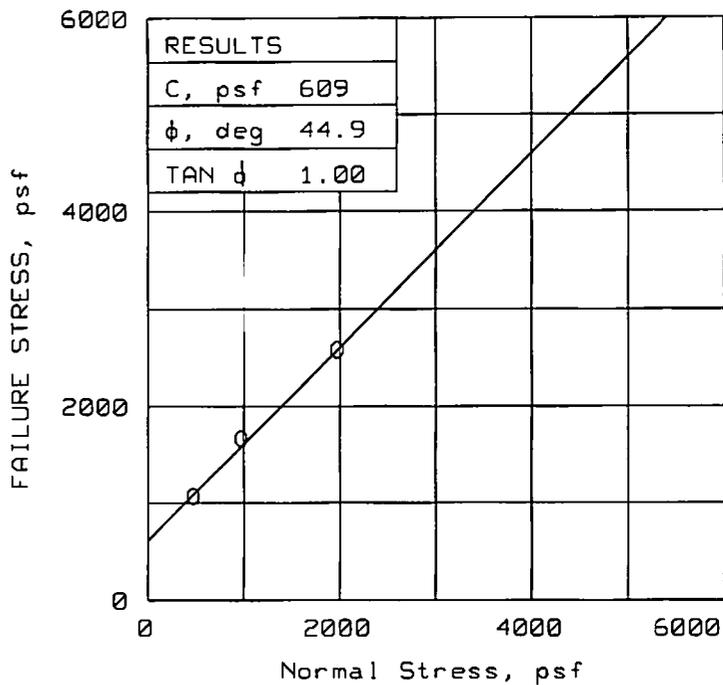
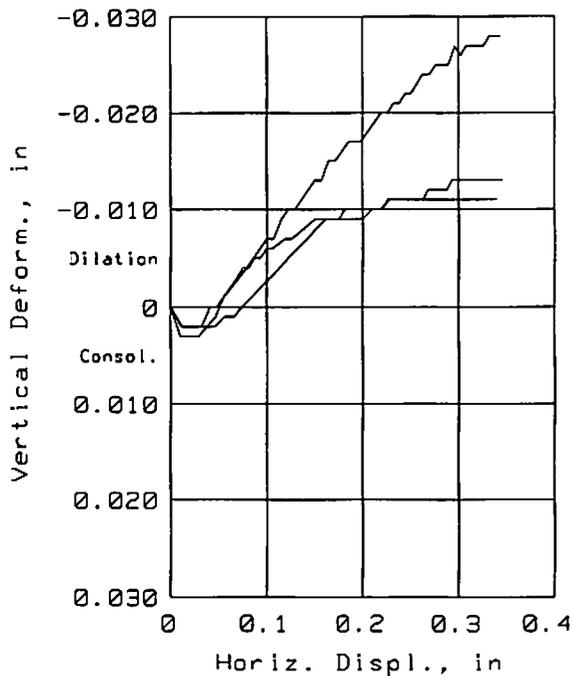
SAMPLE LOCATION: B20@25.5

PROJ. NO.: 7645.5.001.01 DATE: 2/5/07

DIRECT SHEAR TEST REPORT

ENGE0, INCORPORATED

Fig. No.: _____



SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	19.2	22.9	21.0
	DRY DENSITY, pcf	100.6	99.7	102.1
	SATURATION, %	76.7	89.5	87.1
	VOID RATIO	0.675	0.691	0.651
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	1.00	1.00	1.00
AT TEST	WATER CONTENT, %	24.1	25.6	24.9
	DRY DENSITY, pcf	100.6	100.3	103.5
	SATURATION, %	96.2	101.7	107.0
	VOID RATIO	0.676	0.680	0.628
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	1.00	0.99	0.99
NORMAL STRESS, psf	500	1000	2000	
FAILURE STRESS, psf	1068	1666	2583	
DISPLACEMENT, in	0.09	0.08	0.10	
ULTIMATE STRESS, psf				
DISPLACEMENT, in				
Strain rate, %/min	0.15	0.12	0.10	

SAMPLE TYPE: In situ
 DESCRIPTION: Reddish brown
 silty clay with fine gravel

SPECIFIC GRAVITY= 2.7
 REMARKS: Assumed Specific
 Gravity

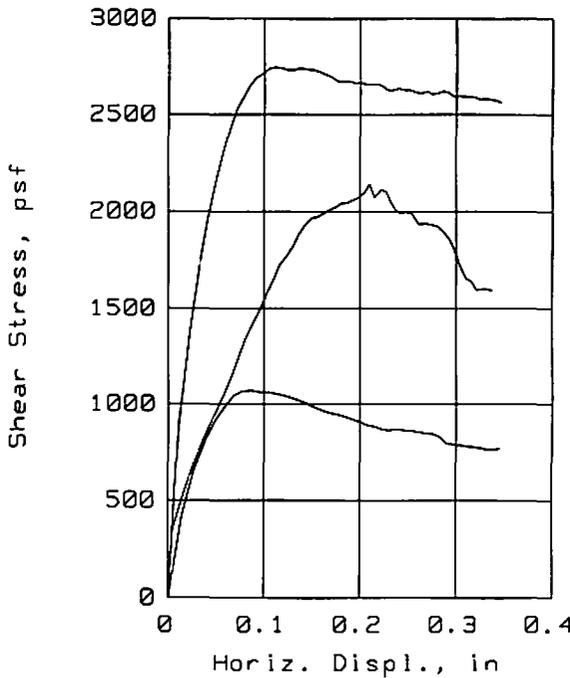
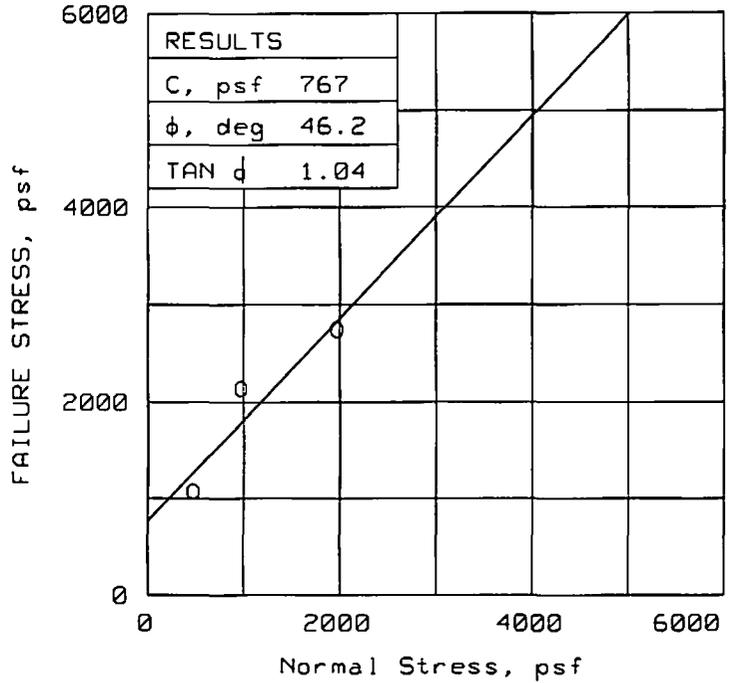
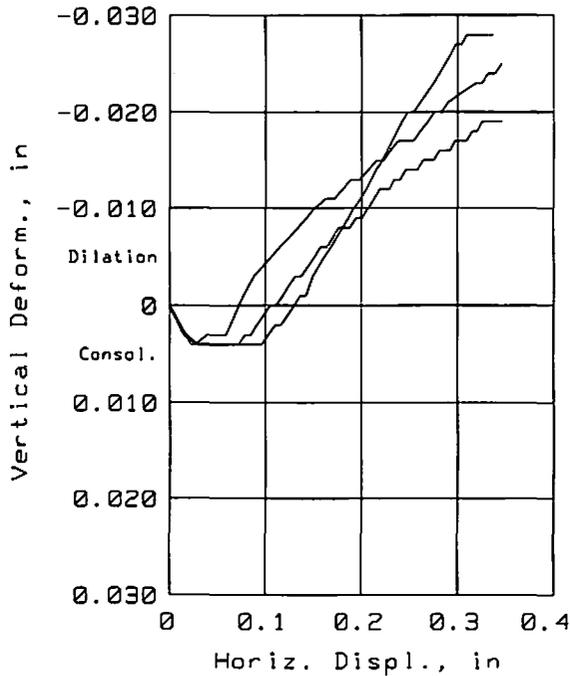
CLIENT:
 PROJECT: Idaho-Maryland Mine Reopen
 SAMPLE LOCATION: B22@16.0

PROJ. NO.: 7645.5.001.01 DATE: 2/12/07

DIRECT SHEAR TEST REPORT

ENGE0, INCORPORATED

Fig. No.: _____



SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	31.5	37.4	37.7
	DRY DENSITY, pcf	80.7	74.7	74.4
	SATURATION, %	78.1	80.4	80.4
	VOID RATIO	1.089	1.255	1.266
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	1.00	1.00	1.00
AT TEST	WATER CONTENT, %	33.7	42.5	39.5
	DRY DENSITY, pcf	81.6	76.5	77.8
	SATURATION, %	85.4	95.2	91.4
	VOID RATIO	1.065	1.205	1.167
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	0.99	0.98	0.96
NORMAL STRESS, psf	500	1000	2000	
FAILURE STRESS, psf	1071	2138	2746	
DISPLACEMENT, in	0.09	0.21	0.11	
ULTIMATE STRESS, psf				
DISPLACEMENT, in				
Strain rate, %/min	0.14	0.15	0.13	

SAMPLE TYPE: In situ
 DESCRIPTION: Gray silty sand
 with organics (wood pulp)

SPECIFIC GRAVITY= 2.7
 REMARKS: Assumed Specific
 Gravity

CLIENT:
 PROJECT: Idaho-Maryland Mine Reopen

SAMPLE LOCATION: B23@7.5

PROJ. NO.: 7645.5.001.01 DATE: 2/13/07

DIRECT SHEAR TEST REPORT

ENGE0, INCORPORATED

Fig. No.: _____

**EXPANSION INDEX TEST REPORT
ASTM D 4829**

PROJECT NAME: Idaho-Maryland Mine Reopen

REPORT DATE: 2/15/07

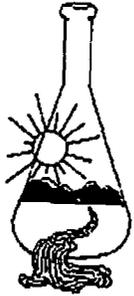
PROJECT NO. 7645.5.001.01

TESTED BY: SEL

Sample ID	Soil Description	Initial Dry Density (pcf)	Initial Moisture Content (%)	Final Moisture Content (%)	Expansion Index
B12@3	Gray Silt (ML)	97.2	12	31.4	68
B26@3.5	Reddish brown sandy silt (ML)	82.1	16	40.4	38
B28@0	Reddish brown silty clay with fine sand (CL)	101.5	10.5	25.9	68
TP15@0	Reddish brown silty clay with sand (CH)	100.3	11.2	29.3	82
TP18@1.5	Gray silty clay (CL)	96.2	12	30.4	54
TP19@2	Light gray silt (ML)	94.2	18.0	38.2	136

CLASSIFICATION OF EXPANSIVE SOIL

Expansion Index	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High



Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engco Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager *RO*

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : TP3 @ 5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49863-99387.

EVALUATION FOR SOIL CORROSION

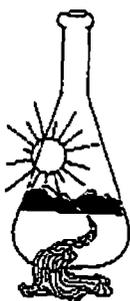
Soil pH	7.53		
Minimum Resistivity	0.83	ohm-cm (x1000)	
Chloride	5.9 ppm	00.00059	%
Sulfate	113.4 ppm	00.01134	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557



Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : TP18 @ 1.5'

Thank you for your business.

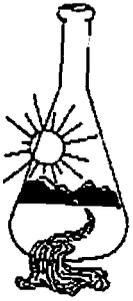
* For future reference to this analysis please use SUN # 49863-99388.

EVALUATION FOR SOIL CORROSION

Soil pH	8.15		
Minimum Resistivity	5.90	ohm-cm (x1000)	
Chloride	14.2 ppm	00.00142	%
Sulfate	30.4 ppm	00.00304	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422



Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B24 @ 3.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49863-99389.

EVALUATION FOR SOIL CORROSION

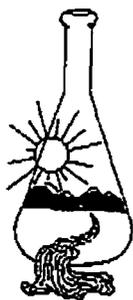
Soil pH	6.16		
Minimum Resistivity	2.95	ohm-cm	(x1000)
Chloride	11.3 ppm	00.00113	%
Sulfate	12.6 ppm	00.00126	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557



Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B25 @ 0.

Thank you for your business.

* For future reference to this analysis please use SUN # 49863-99390.

EVALUATION FOR SOIL CORROSION

Soil pH	5.60		
Minimum Resistivity	5.36	ohm-cm (x1000)	
Chloride	16.1 ppm	00.00161	%
Sulfate	0.8 ppm	00.00008	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422



Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager *ROH*

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B27 @ 0.
Thank you for your business.

* For future reference to this analysis please use SUN # 49863-99391.

EVALUATION FOR SOIL CORROSION

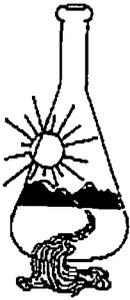
Soil pH	6.09		
Minimum Resistivity	5.90	ohm-cm (x1000)	
Chloride	9.6 ppm	00.00096	%
Sulfate	4.5 ppm	00.00045	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557



Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engco Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager *CA*

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B28 @ 6.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49863-99392.

EVALUATION FOR SOIL CORROSION

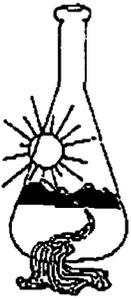
Soil pH	7.77		
Minimum Resistivity	3.22	ohm-cm (x1000)	
Chloride	12.6 ppm	00.00126	%
Sulfate	5.5 ppm	00.00055	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557



Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Olyphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B29 @ 3'.
Thank you for your business.

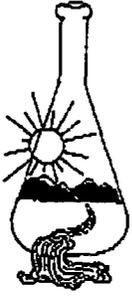
* For future reference to this analysis please use SUN # 49863-99393.

EVALUATION FOR SOIL CORROSION

Soil pH	7.28		
Minimum Resistivity	4.29	ohm-cm (x1000)	
Chloride	7.6 ppm	00.00076	%
Sulfate	1.6 ppm	00.00016	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422



Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B12 @ 10'.
Thank you for your business.

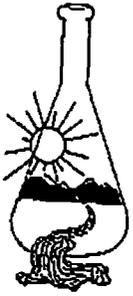
* For future reference to this analysis please use SUN # 49863-99394.

EVALUATION FOR SOIL CORROSION

Soil pH	6.96		
Minimum Resistivity	2.95	ohm-cm (x1000)	
Chloride	4.2 ppm	00.00042	%
Sulfate	42.2 ppm	00.00422	%

METHODS

pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422



Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B5 @ 3'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49864-99395.

EVALUATION FOR SOIL CORROSION

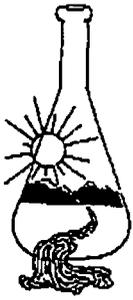
Soil pH	7.62		
Minimum Resistivity	2.68	ohm-cm (x1000)	
Chloride	4.6 ppm	00.00046	%
Sulfate	32.9 ppm	00.00329	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557



Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager *GH*

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B8 @ 3'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49864-99396.

EVALUATION FOR SOIL CORROSION

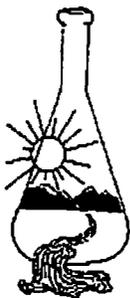
Soil pH	7.02		
Minimum Resistivity	0.88	ohm-cm (x1000)	
Chloride	8.5 ppm	00.00085	%
Sulfate	206.2 ppm	00.02062	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557



Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney *RH*
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B28 @ 2'.

Thank you for your business.

* For future reference to this analysis please use SUN # 49864-99397.

EVALUATION FOR SOIL CORROSION

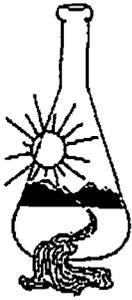
Soil pH	6.54		
Minimum Resistivity	3.48	ohm-cm (x1000)	
Chloride	6.3 ppm	00.00063	%
Sulfate	5.7 ppm	00.00057	%

METHODS

pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557



Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B9 @ 6'.
Thank you for your business.

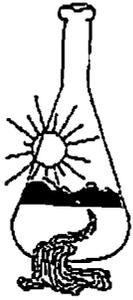
* For future reference to this analysis please use SUN # 49864-99398.

EVALUATION FOR SOIL CORROSION

Soil pH	6.93		
Minimum Resistivity	2.95	ohm-cm (x1000)	
Chloride	8.2 ppm	00.00082	%
Sulfate	69.0 ppm	00.00690	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422



Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 764S.5.001.01 Site ID : B22 @ 10.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49864-99399.

EVALUATION FOR SOIL CORROSION

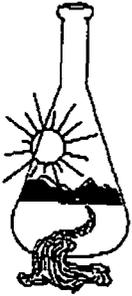
Soil pH	6.77		
Minimum Resistivity	6.97	ohm-cm (x1000)	
Chloride	12.2 ppm	00.00122	%
Sulfate	5.9 ppm	00.00059	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557



Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney *RO*
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B20 @ 1.5'.
Thank you for your business.

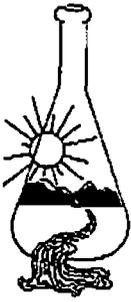
* For future reference to this analysis please use SUN # 49864-99400.

EVALUATION FOR SOIL CORROSION

Soil pH	8.05		
Minimum Resistivity	4.56	ohm-cm (x1000)	
Chloride	8.1 ppm	00.00081	%
Sulfate	25.9 ppm	00.00259	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422



Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B30 @ 1'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49864-99401.

EVALUATION FOR SOIL CORROSION

Soil pH	7.26		
Minimum Resistivity	3.48	ohm-cm (x1000)	
Chloride	8.4 ppm	00.00084	%
Sulfate	27.7 ppm	00.00277	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

APPENDIX C

Logs of Subsurface Investigation by Idaho Maryland Mining Corporation

**Idaho-Maryland Mining Corp.
Tailings Sampling Program**

October, 2005

Samples taken and logged by Grady Wilson
Supervised by: B. Pease
Sample method: Backhoe, shovel

- IdT3-1 Took composite sample of loose light brown sand 18 inches deep above decomposed Gabbro bedrock contact. Took bedrock sample. 1.5'
- IdT3-2b.30" Took 1st sample @ 48 inches in soft tan colored sand.
IdT3-2b.75" Took 2nd sample @ 75 inches in sandy gray clay layers.
Soil contact @ 76 inches. 6.3'
- IdT3-3 Took composite sample @ 30 inches in light olive gray layers of sandy clay. 2.4'
- IdT3-4b.42" Took sample @ 42 inches in layers of dark gray sandy clay.
IdT3-4b.78" Took 2nd sample @ soil contact in light brown loose sand 78 inches. 6.5'
- IdT3-5 sampled gray sandy clay layers @ 27 inches. 2.2'
- IdT3-6 Took composite sample of olive gray sandy clay layers @ 31 inches. 2.6'
- IdT3-7 Took sample of dark gray sandy clay @ 30 inches.
Decomposed Gabbro bedrock contact 31 inches. 2.6'
- IdT3-8.46" Took sample at 46 inches in layers of gray sandy clay.
IdT3-8.84" Took 2nd sample @ 84 inches in gray sandy clay. 7.0
Soil contact @ 85 inches.
- IdT3-9b.44" Took first sample at 44 inches in soft sandy tailings.
IdT3-9b.99" Took 2nd sample @ 99 inches in moist gray clay. 93 inches of pit is soft tan sand with six-inch layer of clay at dark brown soil contact. 7.7
- IdT3-10b.44" Took first sample at 44 inches in soft white sandy tailings.
IdT3-10b.75" Took second sample at 75 inches in wet gray silty clay.
IdT3-10b.115" Took third sample at 115 inches in wet gray sandy clay.
Soil contact at 116 inches. 9.6'
- IdT4-1 Took sample at soil contact in loose gray tailings 18 inches deep.
Soil contact at 36 inches. 3.0
- IdT4-2 Took sample at 12 inches deep in dry tan sandy clay layers.
Soil contact at 30 inches. 2.4'

- IdT4-3b.30" 1st sample @ 30 inches in soft gray sand.
 IdT4-3b58" 2nd sample @ soil contact 58 inches.
 Took bedrock sample 60 inches 5.0'
- IdT4-4b.36" Took 1st sample @ 36 inches in soft tan sand.
 IdT4-4b.76" Took 2nd sample @ 76 inches in moist olive gray clay strata.
 Soil contact @ 77 inches. 6.4'
- IdT4-5 Took sample @ 27 inches in soft yellowish gray sand. 2.2'
- IdT4-6 Took sample @ 28 inches in soft white sand. 2.2'
- IdT4-7 took sample @ 30 inches in soft gray sand. 2.5'
- IdT4-8 Took sample @ 18 inches in soft tan sand. 1.5'
- IdT4-9b.28" Took 1st sample @ 28 inches in layers of dry yellowish gray sandy clay.
 IdT4-9b.77" Took 2nd sample @ 77 inches in moist yellow gray clay.
 Red Soil contact @ 78 inches. 6.5'
- IdT4-10.28" Took composite sample @ 28 inches in multicolored layers of tan, rust colored sand. Gray and black colored clay.
 IdT4-10.53" Took 2nd sample @ 53 inches in moist gray clay with black strata.
 Took bedrock sample of decomposed dark green andisite @ 68 inches. 5.6
- IdT4-11 Dug 18 inches in topsoil before hitting and sampling 6 inches of tailings + organic material, then hitting the toe of the rock dam and not able to dig further abandoned this site. 2.0'
- IdT4-12 Took composite sample of light reddish brown dirt at 12 inches above loose dump fill. (Might not even be tailings). 1.0'
- IdT5-1 Hit bedrock at 5 inches did not sample less than 5 inches of tailings. 0.5'
- IdT5-2b Took composite sample @ 36 inches in sandy light brown tailings.
 Decomposed bedrock @ 60 inches. Only took one sample at this site. 5.0'
- IdT1-1b took composite sample @ 12 inches of rust and black colored tailings.
 Approximately 12 inches of fill then bedrock @ 20 inches. 1.6'
- IdT2-1b.30" Took composite sample @ 30 inches in multi colored layers of soft sand black, rust & tan in small tailings mound near broken pipe line.
 IdT2-1b..75" Took 2nd composite sample @ 59 inches in soft tan colored sand.
 Red soil contact @ 5 feet. 5.0'

IdT3-11

Took sample @ 36 inches in composite of soft tan sand and moist gray clay.

Took 2nd sample of wet gray clay @ 8 feet in 5 foot layer.

Took 3rd sample of wet gray sand @ 120 inches above soil contact. 10.0'

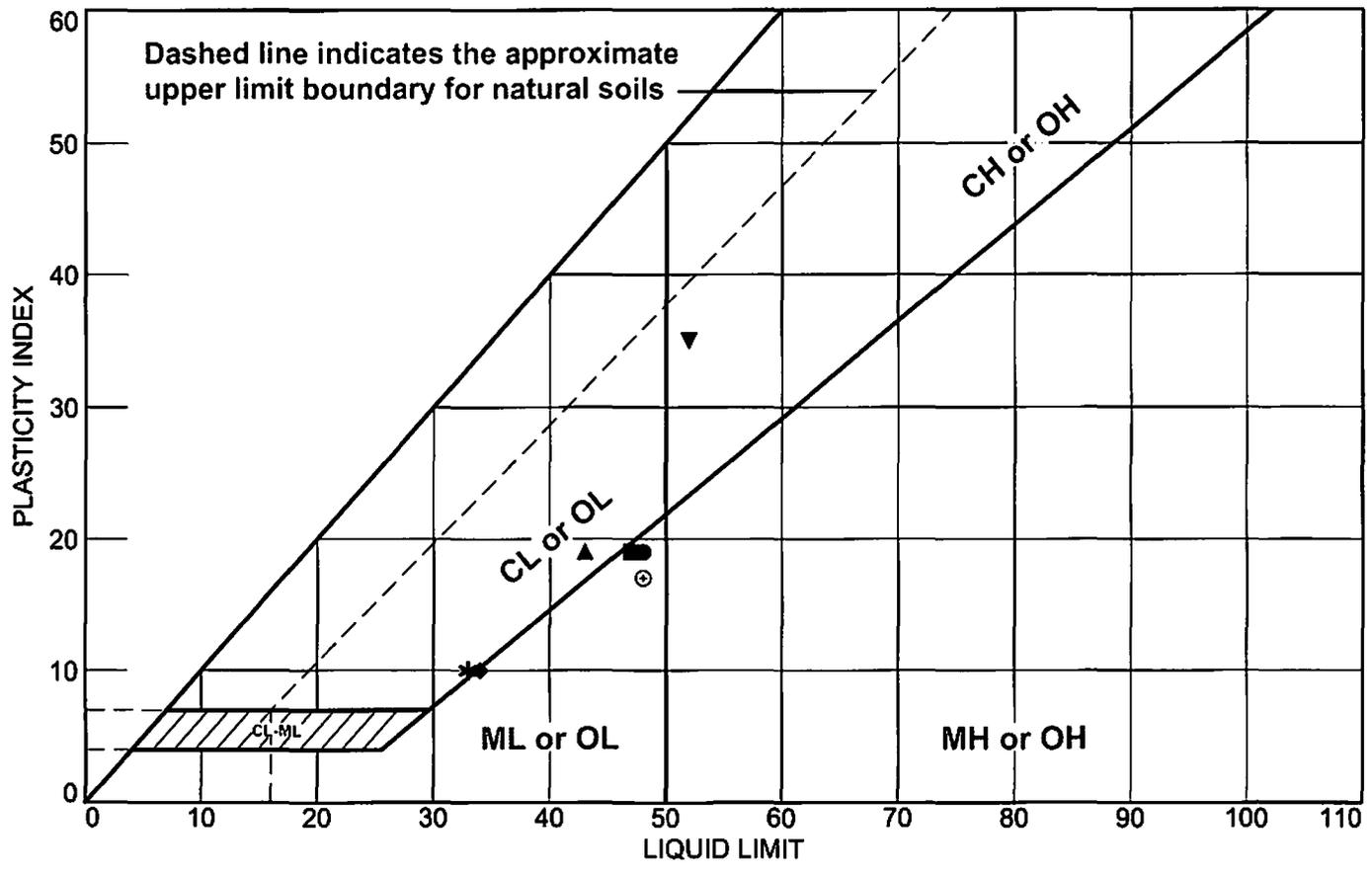
APPENDIX D

Previous Laboratory Testing

ENGEO (2007)

APPENDIX B
LABORATORY TEST DATA

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	GEX	B22@21	21 feet		29	48	19	ML
■	GEX	B23@3.5	3 1/2 feet		28	47	19	ML
▲	GEX	B28@0	Surface		24	43	19	CL
◆	GEX	TP2@1	1 feet		24	34	10	ML
▼	GEX	TP15@0	Surface		17	52	35	CH
*	GEX	TP17@2	2 feet		23	33	10	CL
⊙	GEX	TP19@2	2 feet		31	48	17	ML

ENGEO, Inc.

Rocklin, CA

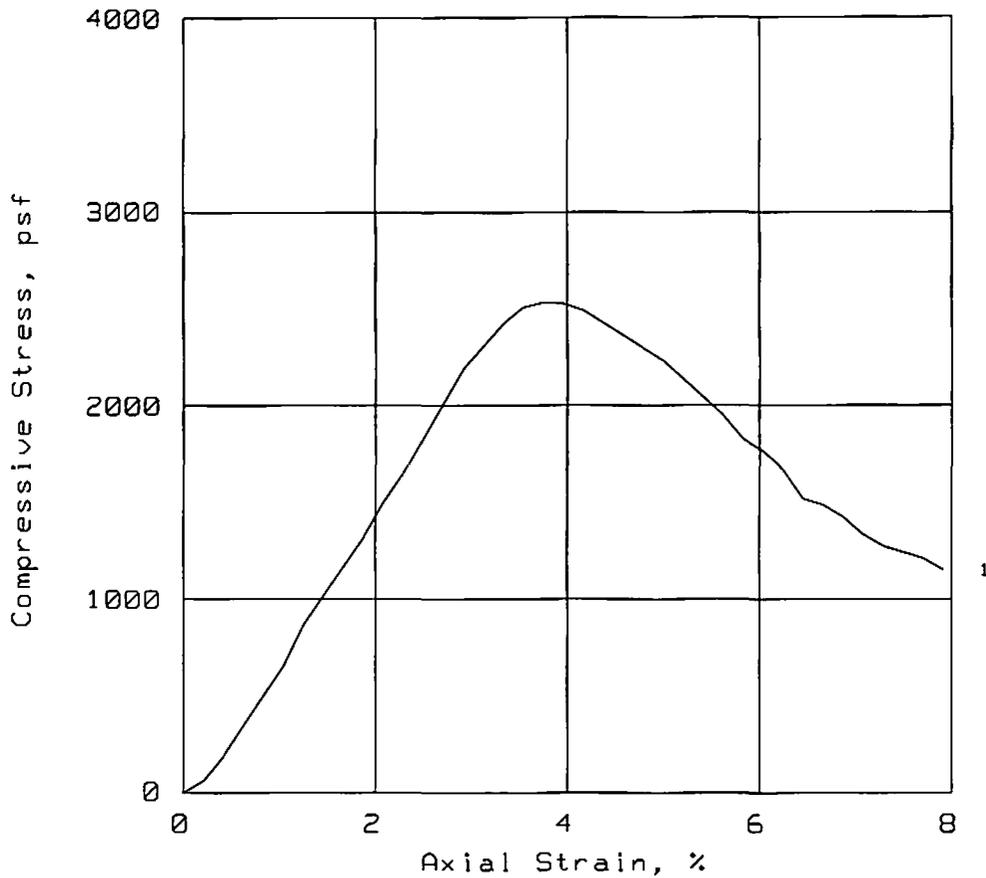
Client:

Project: Idaho-Maryland Mine Reopening

Project No.: 7645.5.001.01

Figure

UNCONFINED COMPRESSION TEST



SAMPLE NO.:	1			
Unconfined strength, psf	2531			
Undrained shear strength, psf	1266			
Failure strain, %	3.8			
Strain rate, %/min	2.79			
Water content, %	13.6			
Wet density, pcf	121.2			
Dry density, pcf	106.7			
Saturation, %	65.6			
Void ratio	0.5510			
Specimen diameter, in	2.42			
Specimen height, in	4.80			
Height/diameter ratio	1.98			

Description: Brown silty sand (SM)

GS= 2.65

Type: In situ

Project No.: 7645.5.001.01

Date: 2/2/07

Remarks:

Assumed Specific

Gravity

Client:

Project: Idaho-Maryland Mine Reopening

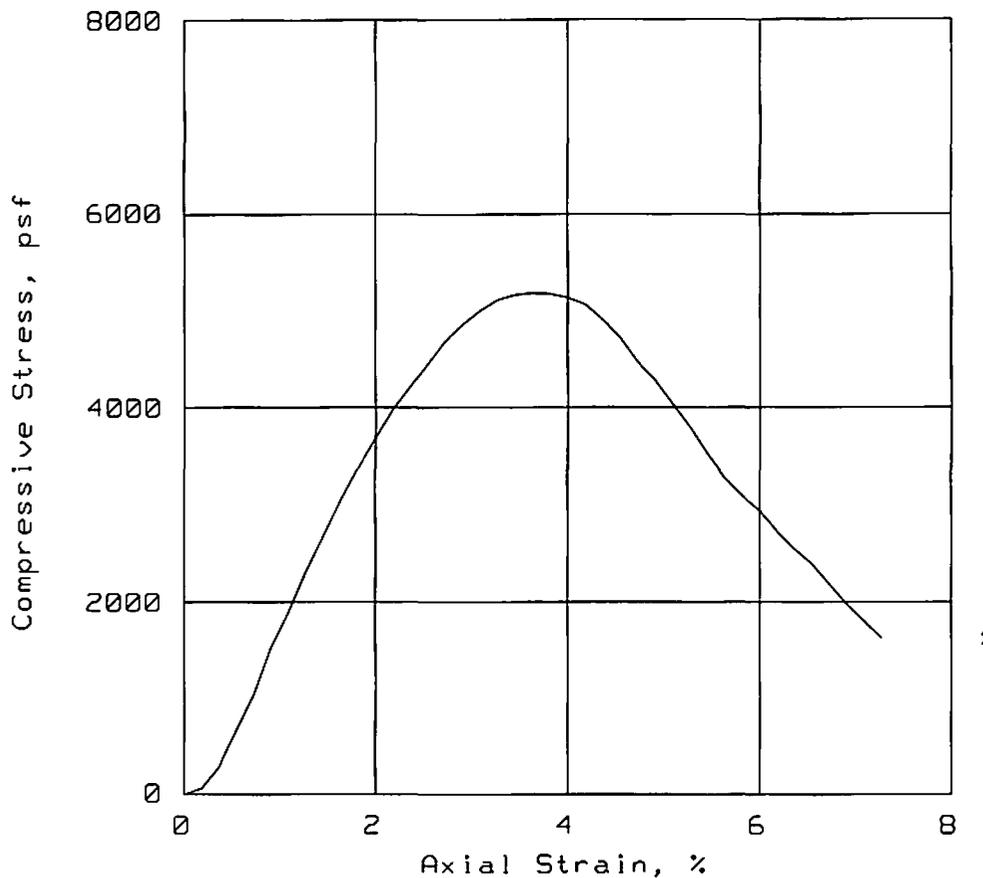
Location: B20@10.5

UNCONFINED COMPRESSION TEST

ENGE0, INCORPORATED

Fig. No.: _____

UNCONFINED COMPRESSION TEST



SAMPLE NO.:	1			
Unconfined strength, psf	5189			
Undrained shear strength, psf	2595			
Failure strain, %	3.6			
Strain rate, %/min				
Water content, %	21.7			
Wet density, pcf	120.9			
Dry density, pcf	99.3			
Saturation, %	86.4			
Void ratio	0.6657			
Specimen diameter, in	2.42			
Specimen height, in	5.50			
Height/diameter ratio	2.27			

Description: Reddish brown Silty clay (CL)

GS= 2.65

Type: In situ

Project No.: 7645.5.001.01

Date: 2/2/07

Remarks:

1/2 clay and 1/2 silt

Client:

Project: Idaho-Maryland Mine Reopening

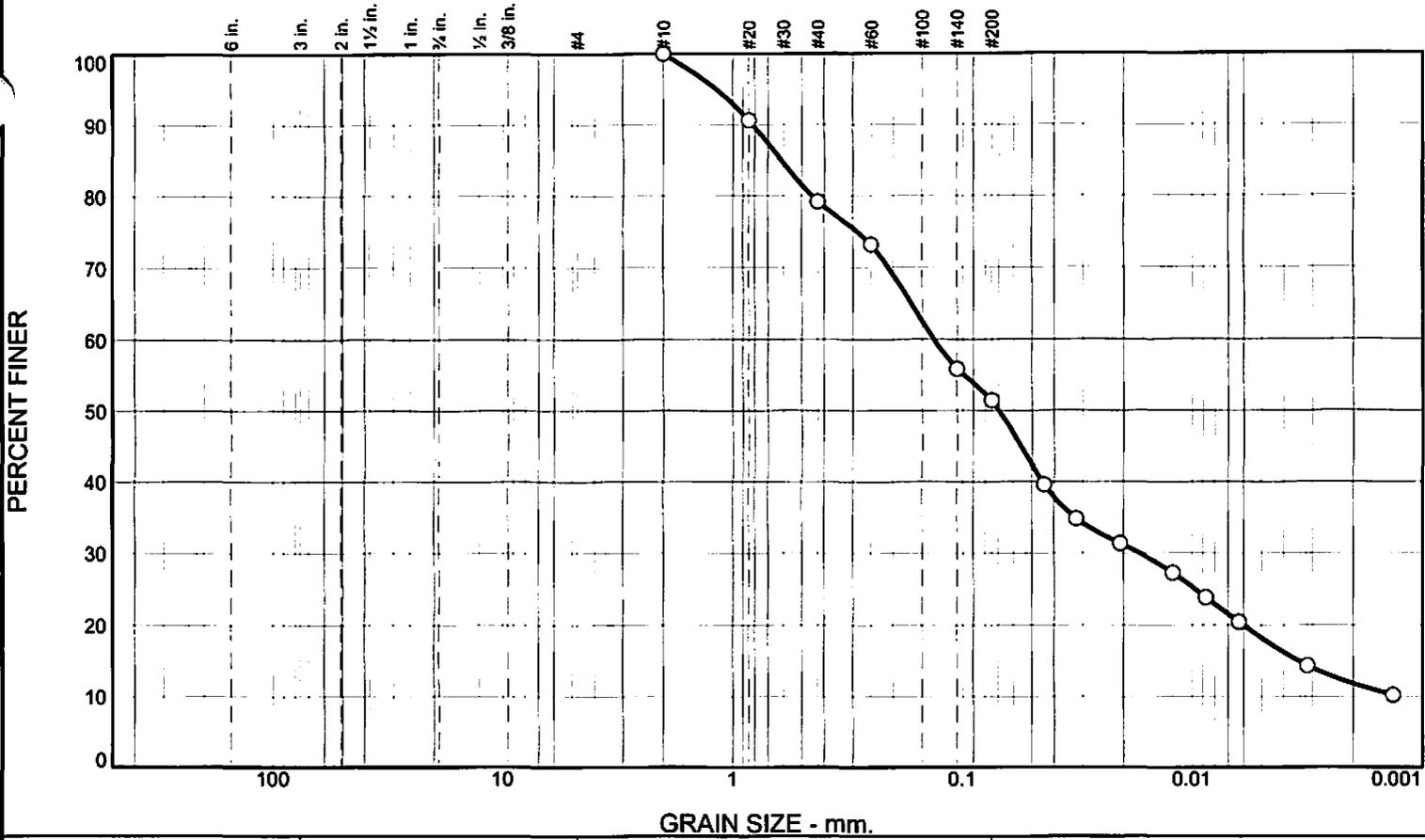
Location: B22@15.5

UNCONFINED COMPRESSION TEST

ENGEО, INCORPORATED

Fig. No.: _____

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	20.8	27.8	39.6	11.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	90.6		
#40	79.2		
#60	73.2		
#140	55.9		
#200	51.4		

Soil Description
 Reddish brown sandy silt

Atterberg Limits (ASTM D 4318)
 PL= _____ LL= _____ PI= _____

Classification
 USCS= ML AASHTO= _____

Coefficients
 D₈₅= 0.6135 D₆₀= 0.1334 D₅₀= 0.0694
 D₃₀= 0.0169 D₁₅= 0.0034 D₁₀= _____
 C_u= _____ C_c= _____

Date Tested: _____ Tested By: _____

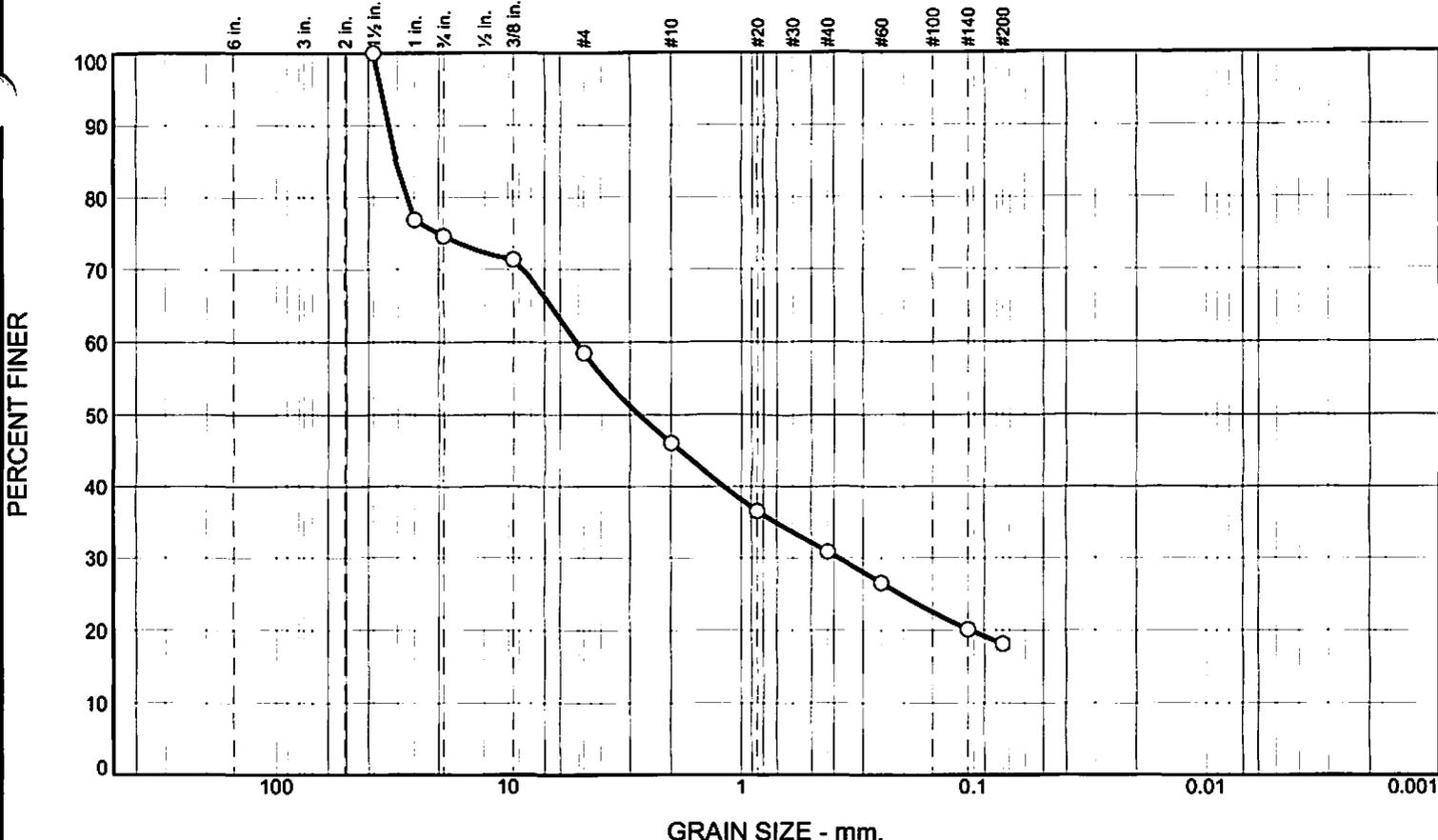
Remarks

* (no specification provided)

Sample No.: B4@3 Source of Sample: GEX Date Sampled: _____
 Location: _____ Elev./Depth: 3 feet
 Checked By: _____ Title: _____

ENGEO, Inc. Rocklin, CA	Client: _____ Project: Idaho-Maryland Mine Reopening Project No: 7645.5.001.01
Figure _____	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	25.4	16.1	12.5	15.1	12.7	18.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	76.9		
.75	74.6		
.375	71.3		
#4	58.5		
#10	46.0		
#20	36.6		
#40	30.9		
#60	26.5		
#140	20.1		
#200	18.2		

Soil Description

Reddish brown sandy gravel with silt

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS= GM AASHTO= _____

Coefficients

D₈₅= 30.4607 D₆₀= 5.1313 D₅₀= 2.7446
 D₃₀= 0.3811 D₁₅= _____ D₁₀= _____
 C_u= _____ C_c= _____

Date Tested: _____ Tested By: _____

Remarks

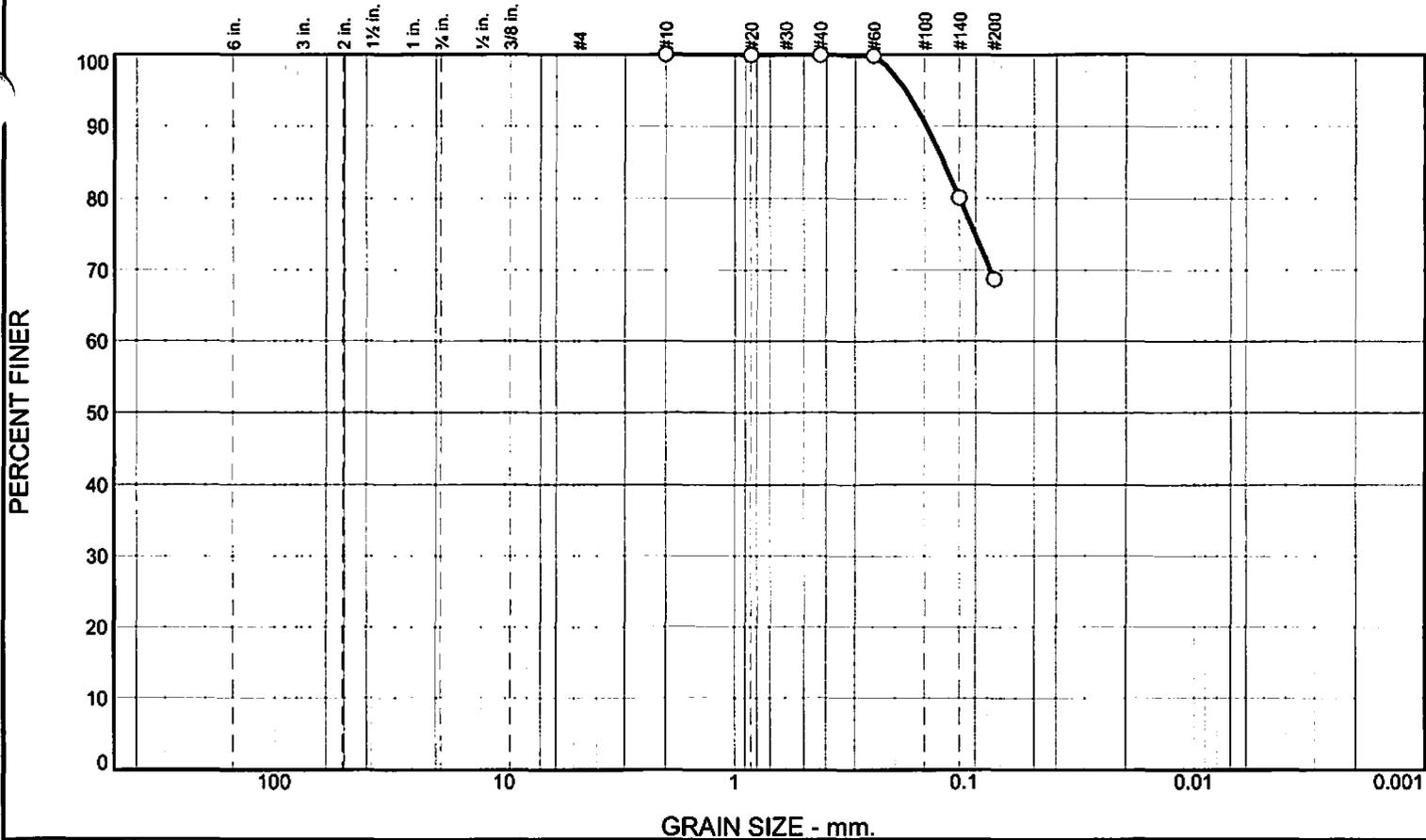
(no specification provided)

Sample No.: B6@1 Source of Sample: GEX Date Sampled: _____
 Location: _____ Title: _____ Elev./Depth: 1 feet
 Checked By: _____

ENGEO, Inc. Rocklin, CA	Client: Project: Idaho-Maryland Mine Reopening Project No: 7645.5.001.01
--	---

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	31.3	68.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	100.0		
#60	99.9		
#140	80.1		
#200	68.7		

Soil Description

Light brown sandy silt

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS= ML AASHTO= _____

Coefficients

D₈₅= 0.1238 D₆₀= _____ D₅₀= _____
 D₃₀= _____ D₁₅= _____ D₁₀= _____
 C_u= _____ C_c= _____

Date Tested: _____ Tested By: _____

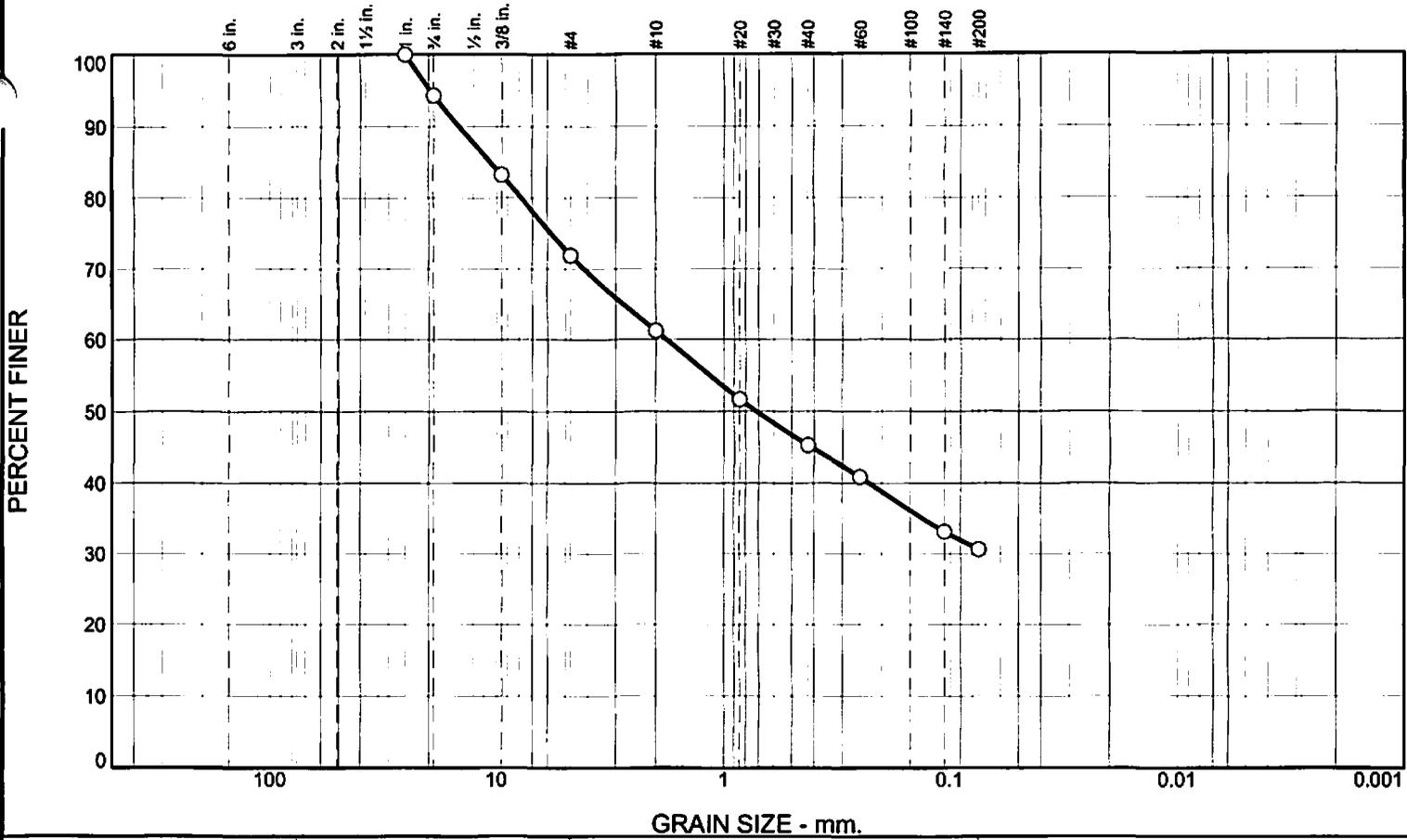
Remarks

* (no specification provided)

Sample No.: B10@5 Source of Sample: GEX Date Sampled: _____
 Location: _____ Title: _____ Elev./Depth: 5 feet
 Checked By: _____

<p>ENGEO, Inc.</p> <p>Rocklin, CA</p>	<p>Client: _____</p> <p>Project: Idaho-Maryland Mine Reopening</p> <p>Project No: 7645.5.001.01</p> <p style="text-align: right;">Figure _____</p>
---	--

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines		Clay
	Coarse	Fine	Coarse	Medium	Fine	Silt		
0.0	5.7	22.4	10.7	15.9	14.7	30.6		

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	94.3		
.375	83.2		
#4	71.9		
#10	61.2		
#20	51.7		
#40	45.3		
#60	40.9		
#140	33.1		
#200	30.6		

Soil Description

Brown silty sand with gravel

Atterberg Limits (ASTM D 4318)

PL= _____ LL= _____ PI= _____

Classification

USCS= _____ AASHTO= _____

Coefficients

D₈₅= 10.6614 D₆₀= 1.7952 D₅₀= 0.7174
 D₃₀= _____ D₁₅= _____ D₁₀= _____
 C_u= _____ C_c= _____

Date Tested: _____ Tested By: _____

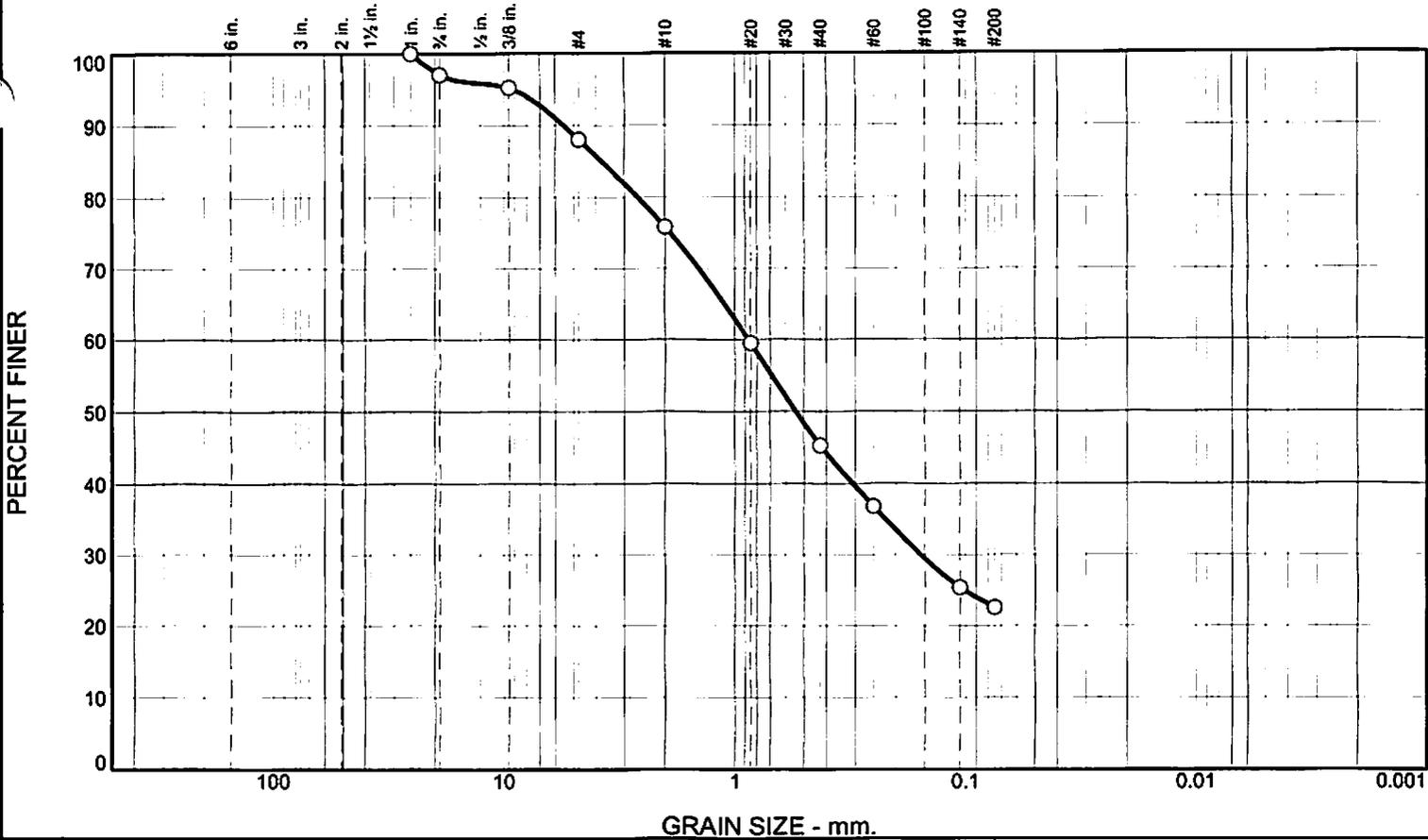
Remarks

* (no specification provided)

Sample No.: B20@7 Source of Sample: Native Date Sampled: 1/23/07
 Location: _____ Title: _____ Elev./Depth: 7 feet
 Checked By: _____

<p>ENGEO, Inc.</p> <p>Rocklin, CA</p>	<p>Client: _____</p> <p>Project: Idaho-Maryland Mine Reopening</p> <p>Project No: 7645.5.001.01</p>
---	--

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines		Clay
	Coarse	Fine	Coarse	Medium	Fine	Silt		
0.0	3.0	8.9	12.2	30.6	22.7	22.6		

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	97.0		
.375	95.3		
#4	88.1		
#10	75.9		
#20	59.5		
#40	45.3		
#60	36.9		
#140	25.4		
#200	22.6		

Soil Description
Reddish brown silty sand with some gravel

Atterberg Limits (ASTM D 4318)
 PL= _____ LL= _____ PI= _____

Classification
 USCS= SM AASHTO= _____

Coefficients
 D₈₅= 3.7619 D₆₀= 0.8712 D₅₀= 0.5431
 D₃₀= 0.1561 D₁₅= _____ D₁₀= _____
 C_u= _____ C_c= _____

Date Tested: _____ Tested By: _____

Remarks

* (no specification provided)

Sample No.: B22@4 Source of Sample: Native

Date Sampled: 1/23/07

Location:

Elev./Depth: 4 feet

Checked By:

Title:

ENGEO, Inc.

Client:

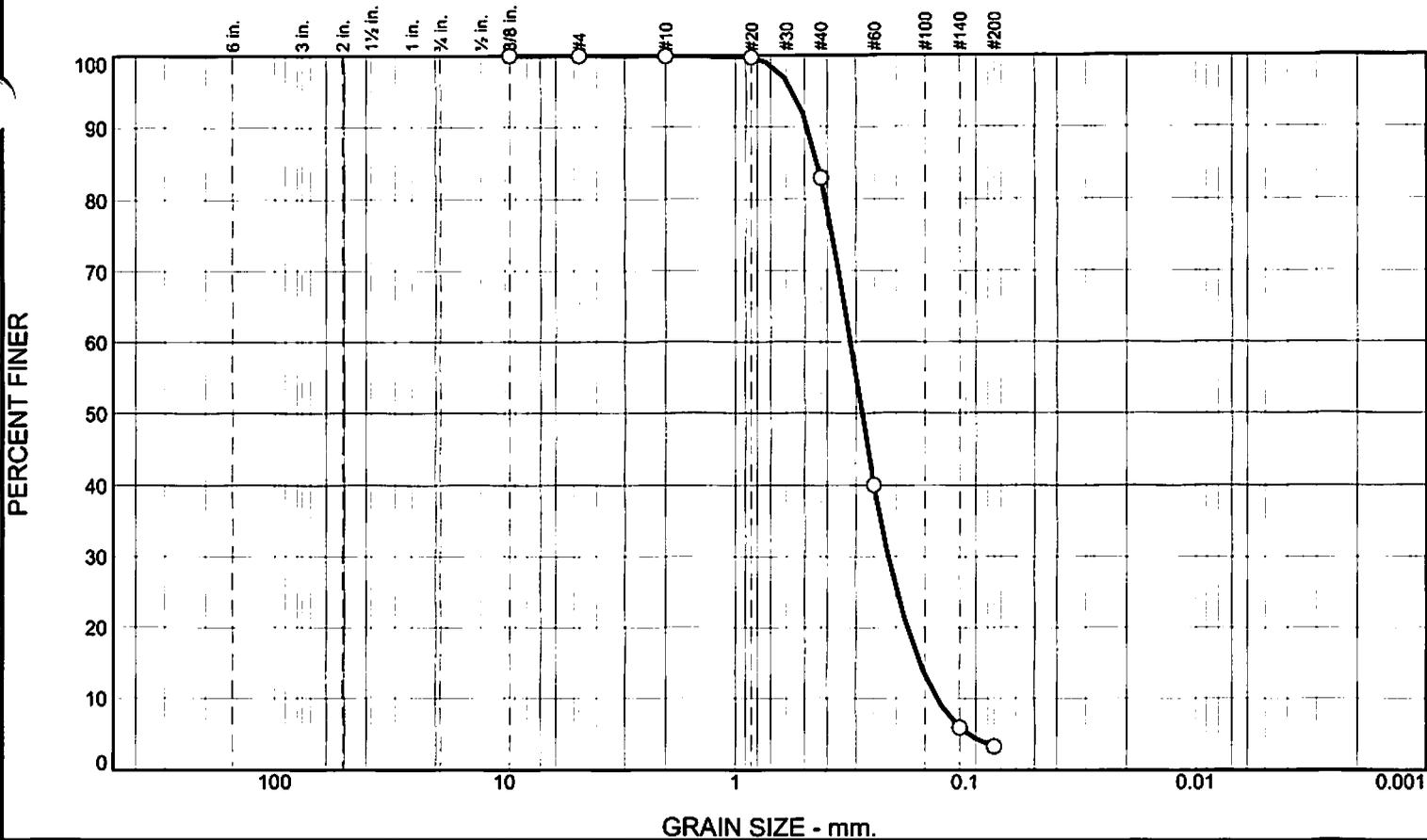
Rocklin, CA

Project: Idaho-Maryland Mine Reopening

Project No: 7645.5.001.01

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	17.0	79.6	3.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	100.0		
#10	99.9		
#20	99.7		
#40	82.9		
#60	40.0		
#140	5.9		
#200	3.3		

Soil Description

Gray sand

Atterberg Limits (ASTM D 4318)
 PL= LL= PI=

Classification
 USCS= SP AASHTO=

Coefficients
 D₈₅= 0.4399 D₆₀= 0.3170 D₅₀= 0.2826
 D₃₀= 0.2160 D₁₅= 0.1577 D₁₀= 0.1330
 C_u= 2.38 C_c= 1.11

Date Tested: Tested By:

Remarks

* (no specification provided)

Sample No.: B23@26 Source of Sample: GEX
 Location:
 Checked By: Title:

Date Sampled:
 Elev./Depth: 26 feet

ENGEO, Inc.

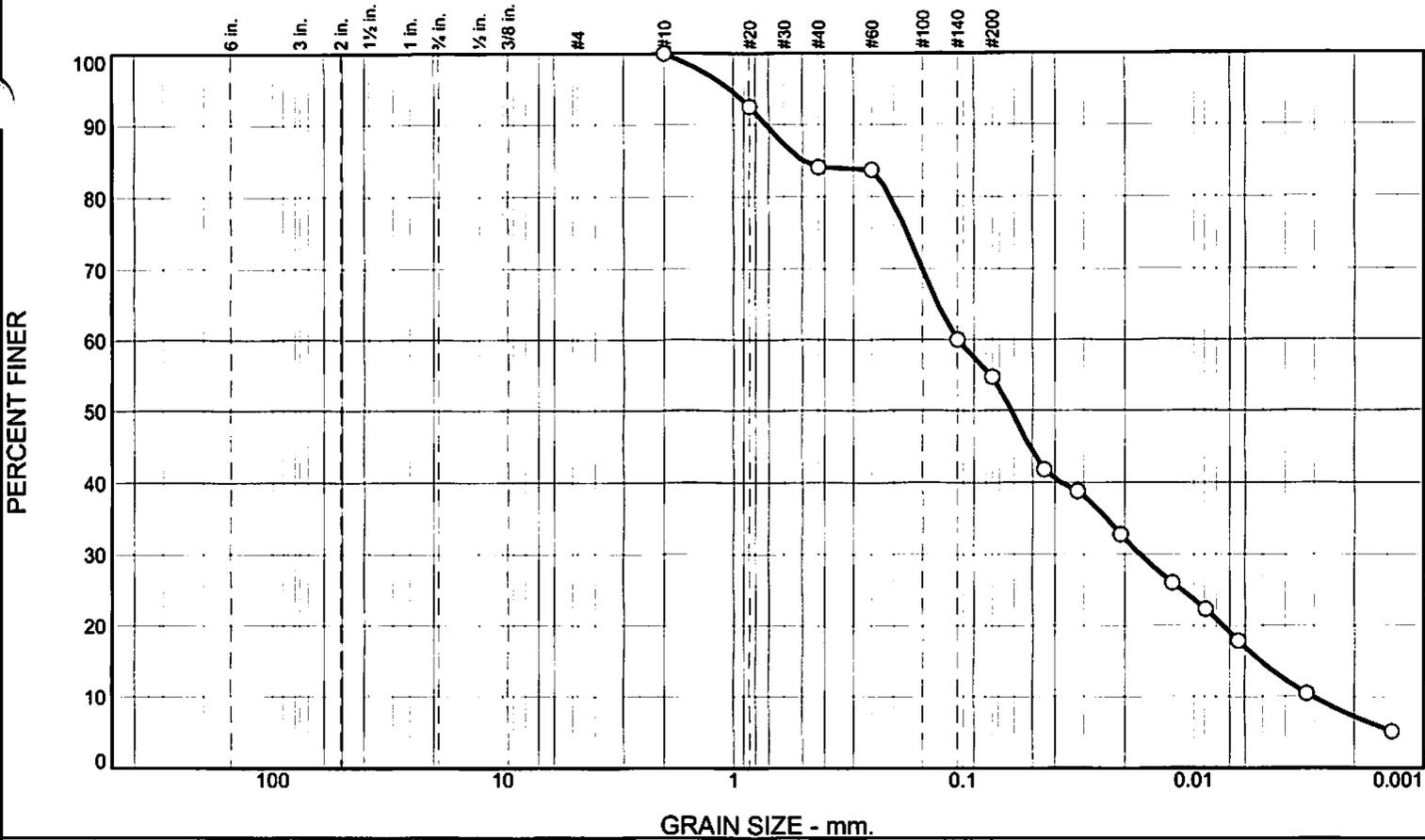
Rocklin, CA

Client:
 Project: Idaho-Maryland Mine Reopening

Project No: 7645.5.001.01

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	15.9	29.4	47.5	7.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	92.5		
#40	84.1		
#60	83.7		
#140	60.0		
#200	54.7		

Soil Description
 Reddish brown sandy silt

Atterberg Limits (ASTM D 4318)
 PL= LL= PI=

Classification
 USCS= ML AASHTO=

Coefficients
 D₈₅= 0.4987 D₆₀= 0.1061 D₅₀= 0.0618
 D₃₀= 0.0171 D₁₅= 0.0051 D₁₀= 0.0030
 C_u= 34.87 C_c= 0.91

Date Tested: Tested By:

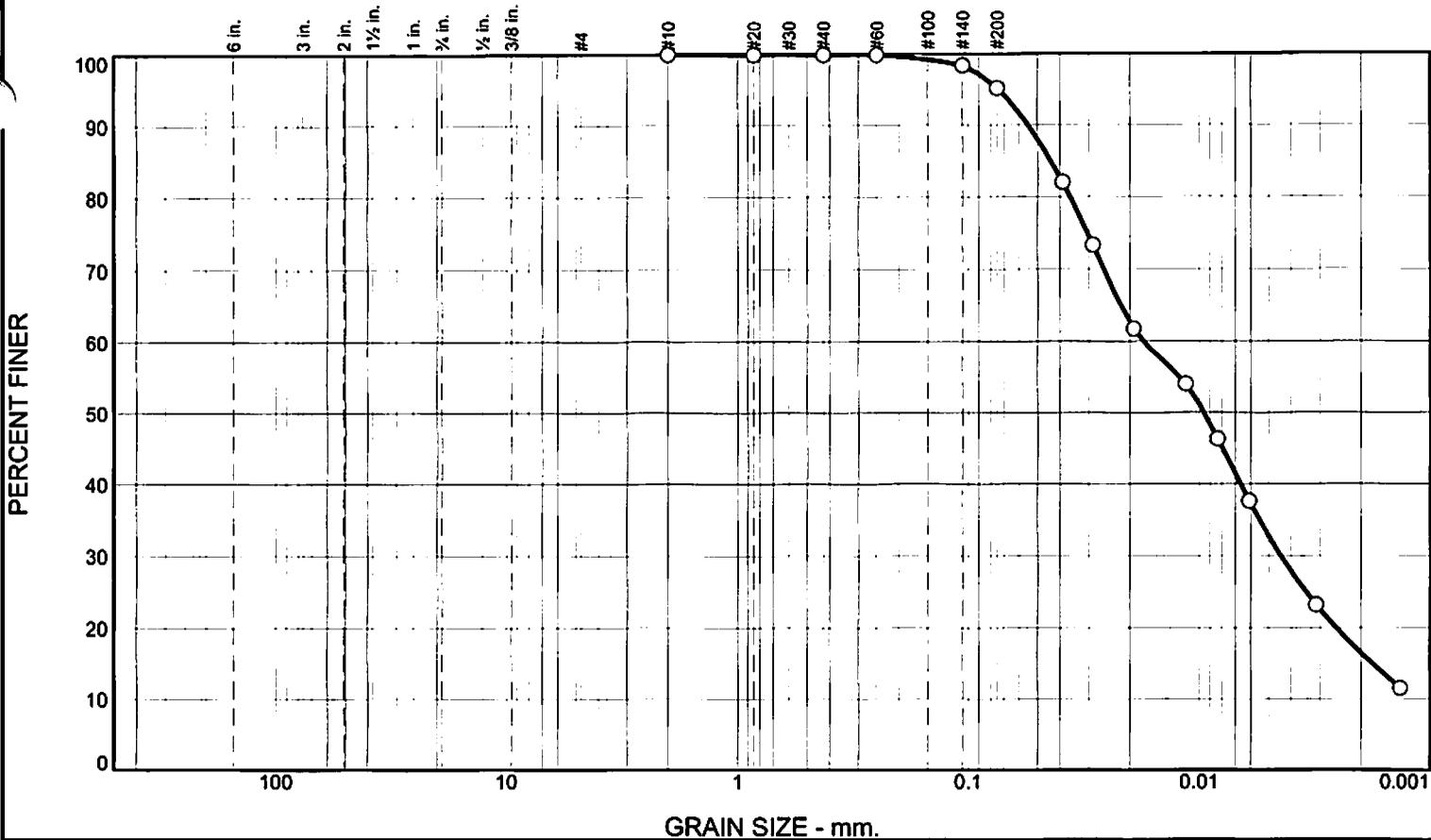
Remarks

* (no specification provided)

Sample No.: B26@3.5 Source of Sample: GEX Date Sampled: Elev./Depth:
 Location: Title:
 Checked By: Title:

<p>ENGEO, Inc.</p> <p>Rocklin, CA</p>	<p>Client:</p> <p>Project: Idaho-Maryland Mine Reopening</p> <p>Project No: 7645.5.001.01</p> <p style="text-align: right;">Figure</p>
---	--

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	4.7	78.7	16.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	99.9		
#60	99.9		
#140	98.4		
#200	95.2		

Soil Description

Gray silty clay

Atterberg Limits (ASTM D 4318)

PL= 24 LL= 34 PI= 10

Classification

USCS= CL AASHTO= A-4(10)

Coefficients

D₈₅= 0.0439 D₆₀= 0.0175 D₅₀= 0.0096
 D₃₀= 0.0044 D₁₅= 0.0018 D₁₀=
 C_u= C_c=

Date Tested: Tested By:

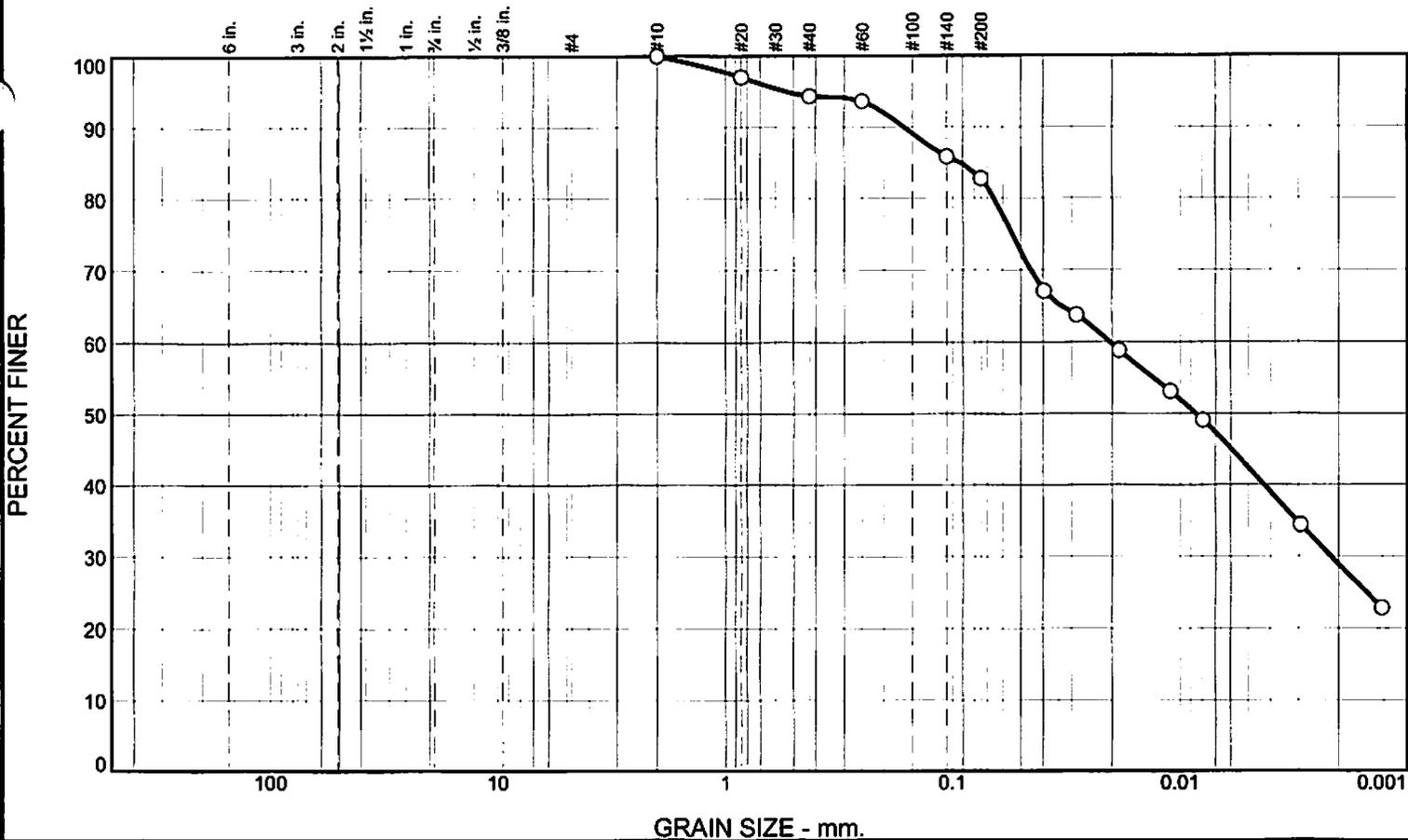
Remarks

* (no specification provided)

Sample No.: TP2@1 Source of Sample: GEX Date Sampled:
 Location: Elev./Depth: 1 feet
 Checked By: Title:

ENGEO, Inc. Rocklin, CA	Client: Project: Idaho-Maryland Mine Reopening Project No: 7645.5.001.01
Figure	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	5.6	11.6	53.9	28.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	97.1		
#40	94.4		
#60	93.7		
#140	85.8		
#200	82.8		

Soil Description
 Reddish brown silty clay with sand

Atterberg Limits (ASTM D 4318)
 PL= 17 LL= 52 PI= 35

Classification
 USCS= CH AASHTO= A-7-6(29)

Coefficients
 D₈₅= 0.0929 D₆₀= 0.0204 D₅₀= 0.0085
 D₃₀= 0.0022 D₁₅= D₁₀=
 C_u= C_c=

Date Tested: Tested By:
 Remarks

* (no specification provided)

Sample No.: TP15@0 Source of Sample: GEX Date Sampled:
 Location: Elev./Depth: Surface
 Checked By: Title:

ENGEO, Inc. Rocklin, CA	Client: Project: Idaho-Maryland Mine Reopening Project No: 7645.5.001.01
--	--

Figure

**R-VALUE TEST DATA
CAL-301**

PROJECT NAME: Idaho-Maryland Mine Reopen

REPORT DATE: 2/12/07

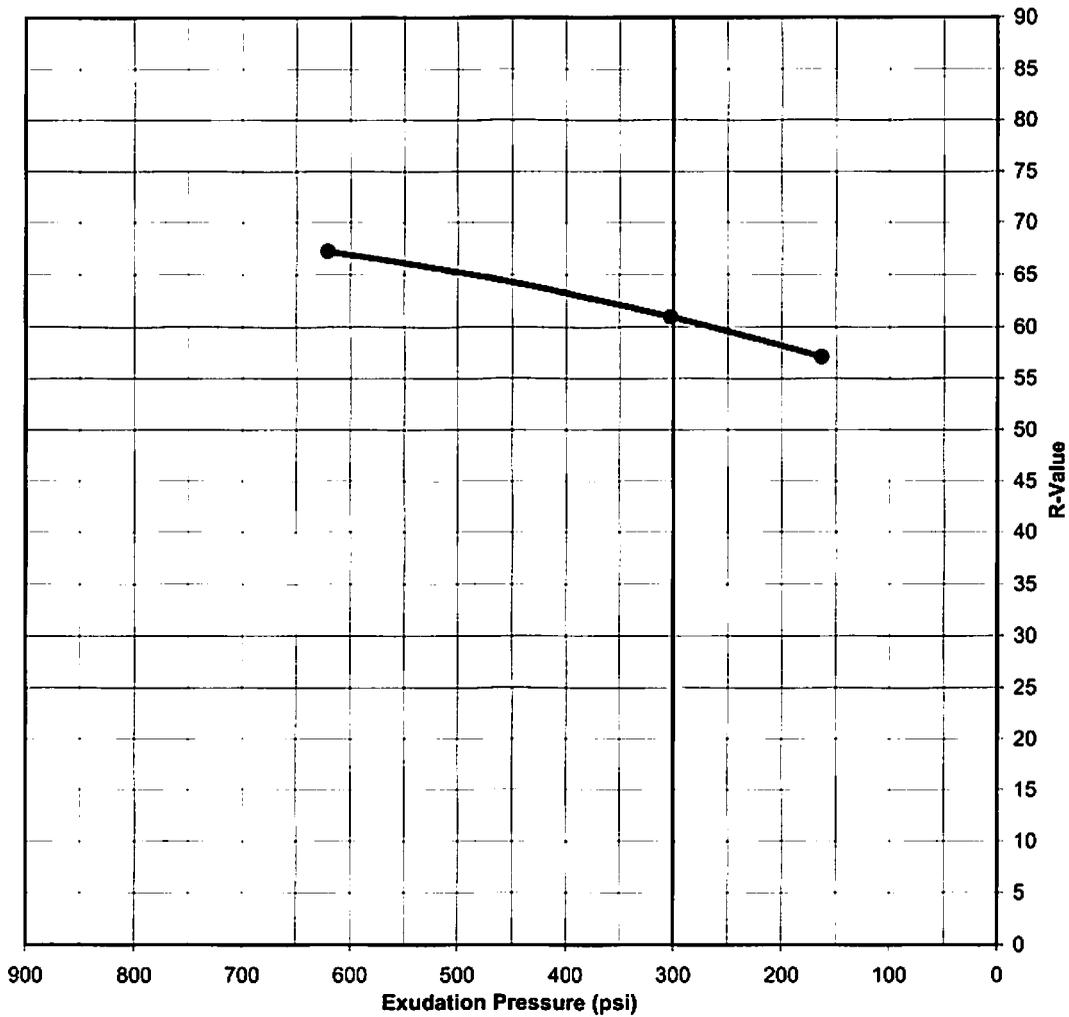
PROJECT NO. 7645.5.001.01

TESTED BY: SEL

SAMPLE LOCATION: B11@0-1

SAMPLE DATE: Unknown

SAMPLE DESCRIPTION:



Specimen	A	B	C
Exudation Pressure, p.s.i.	621	302	163
Expansion dial (.0001")	92	67	58
Expansion Pressure, p.s.f.	398	290	251
Resistance Value, "R"	67	61	57
% Moisture at Test	19.7	20.6	21.6
Dry Density at Test, p.c.f.	101.5	98.0	97.7
"R" Value at 300 p.s.i., Exudation Pressure	62		

**R-VALUE TEST DATA
CAL-301**

PROJECT NAME: Idaho-Maryland Mine Reopen

REPORT DATE: 2/13/07

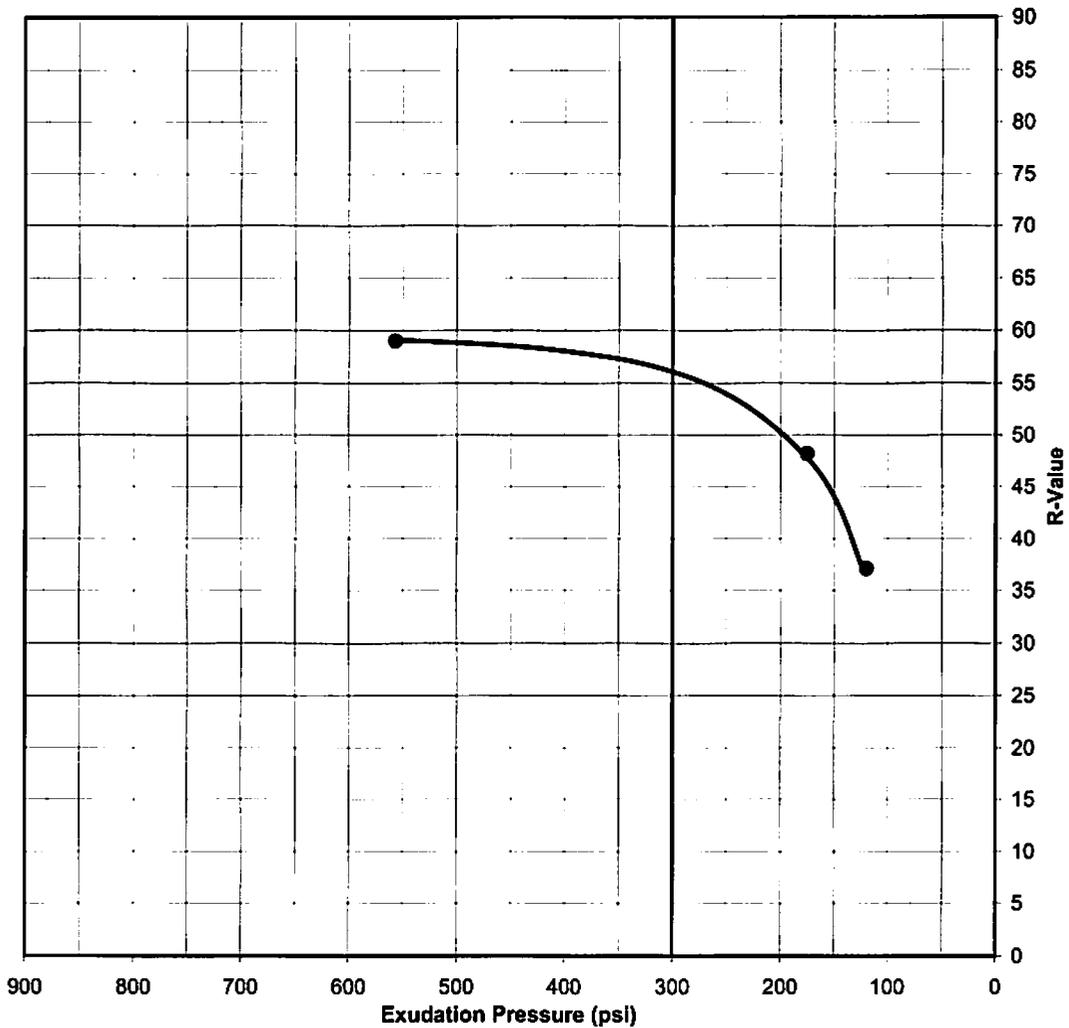
PROJECT NO. 7645.5.001.01

TESTED BY: SEL

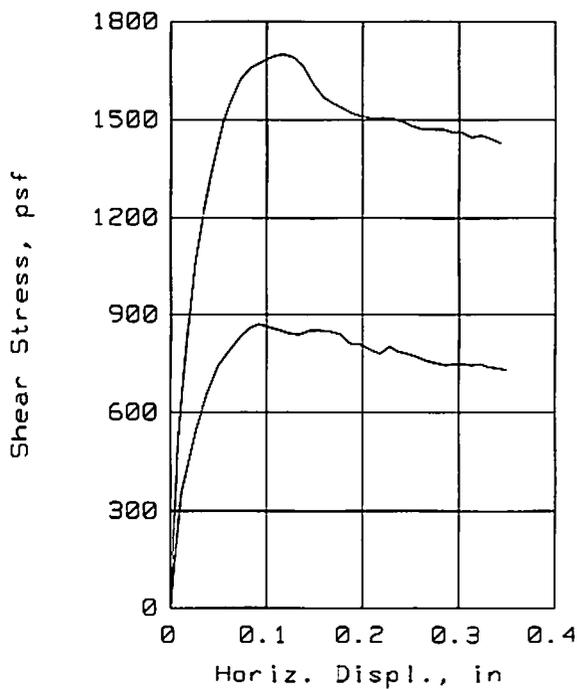
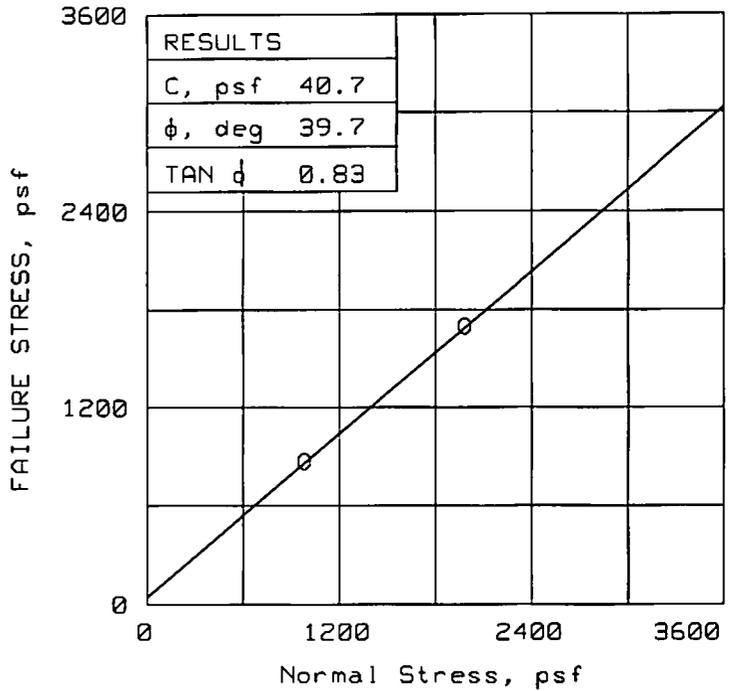
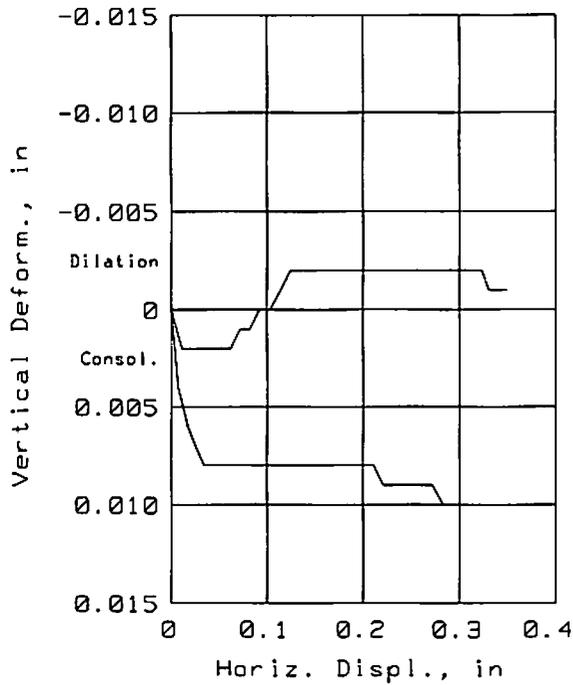
SAMPLE LOCATION: B12-Bulk 0-1'

SAMPLE DATE: 2/1/07

SAMPLE DESCRIPTION: Gray very fine grained sand (SP)



Specimen	A	B	C
Exudation Pressure, p.s.i.	557	175	119
Expansion dial (.0001")	105	79	47
Expansion Pressure, p.s.f.	455	342	204
Resistance Value, "R"	59	48	37
% Moisture at Test	14.7	15.1	15.9
Dry Density at Test, p.c.f.	114.3	113.0	112.3
"R" Value at 300 p.s.i., Exudation Pressure	57		



SAMPLE NO.:		1	2
INITIAL	WATER CONTENT, %	43.9	25.8
	DRY DENSITY, pcf	85.0	95.1
	SATURATION, %	120.5	90.1
	VOID RATIO	0.984	0.773
	DIAMETER, in	2.42	2.42
	HEIGHT, in	1.00	1.00
AT TEST	WATER CONTENT, %	42.5	25.5
	DRY DENSITY, pcf	88.1	98.2
	SATURATION, %	125.5	96.2
	VOID RATIO	0.913	0.716
	DIAMETER, in	2.42	2.42
	HEIGHT, in	0.96	0.97
	NORMAL STRESS, psf	1000	2000
	FAILURE STRESS, psf	870	1700
	DISPLACEMENT, in	0.09	0.12
	ULTIMATE STRESS, psf		
	DISPLACEMENT, in		
	Strain rate, %/min	0.21	0.11

SAMPLE TYPE: In situ
 DESCRIPTION: Gray and brown silt and brown sandy silt

SPECIFIC GRAVITY= 2.7
 REMARKS: Assumed Specific Gravity; Pt A - silt
 Pt B - sandy silt

Fig. No.: _____

CLIENT:

PROJECT: Idaho-Maryland Mine

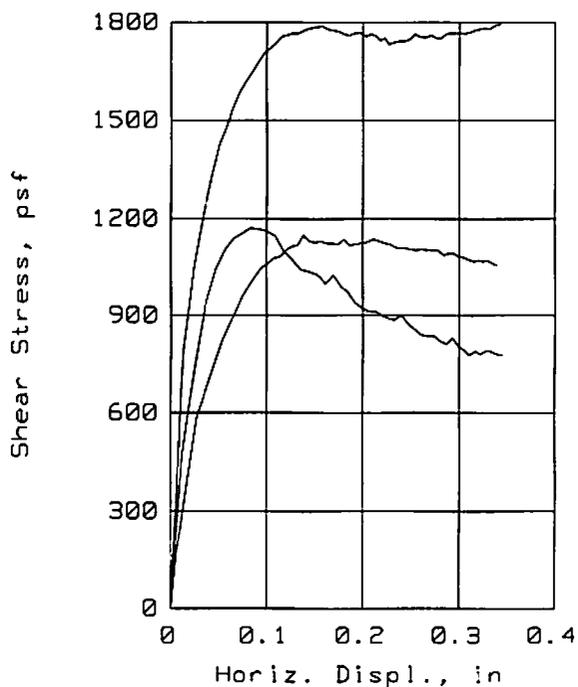
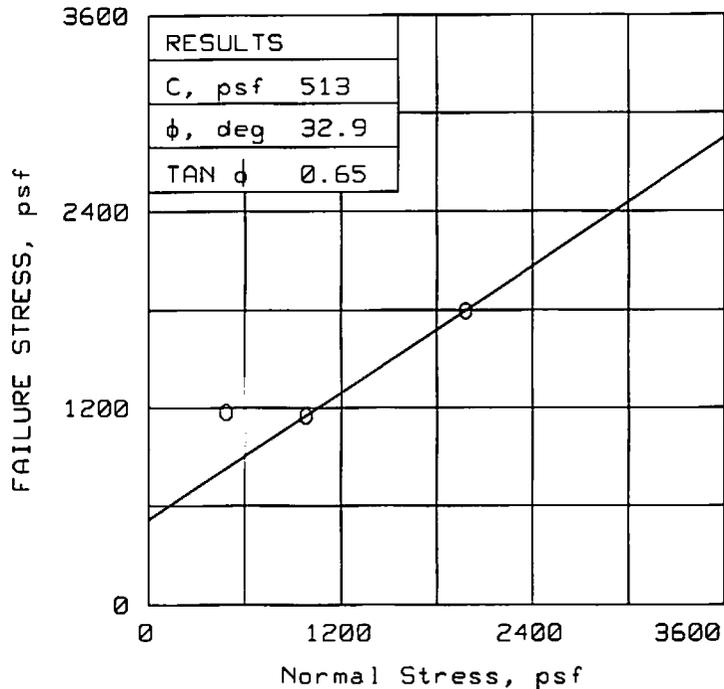
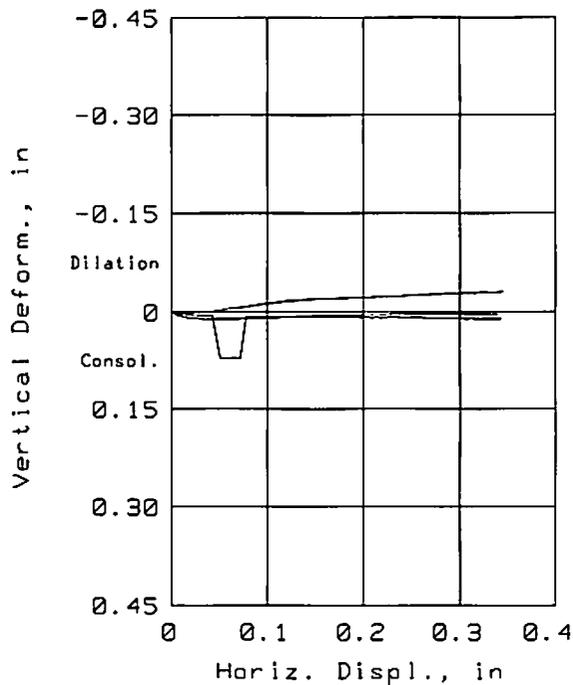
SAMPLE LOCATION: 310@3

PROJ. NO.: 7645.5.001.01

DATE: 2/13/07

DIRECT SHEAR TEST REPORT

ENGEO, INCORPORATED



SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	23.2	31.2	29.2
	DRY DENSITY, pcf	101.3	92.4	94.3
	SATURATION, %	94.2	102.2	100.2
	VOID RATIO	0.665	0.824	0.787
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	1.00	1.00	1.00
AT TEST	WATER CONTENT, %	23.9	31.1	28.0
	DRY DENSITY, pcf	101.8	94.8	98.1
	SATURATION, %	98.4	107.8	105.5
	VOID RATIO	0.655	0.779	0.718
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	0.99	0.98	0.96
NORMAL STRESS, psf		500	1000	2000
FAILURE STRESS, psf		1171	1149	1794
DISPLACEMENT, in		0.08	0.14	0.34
ULTIMATE STRESS, psf				
DISPLACEMENT, in				
Strain rate, %/min		0.16	0.13	0.12

SAMPLE TYPE: In situ
 DESCRIPTION: Brown silty clay
 (CL)

SPECIFIC GRAVITY= 2.7
 REMARKS: Assumed Specific
 Gravity

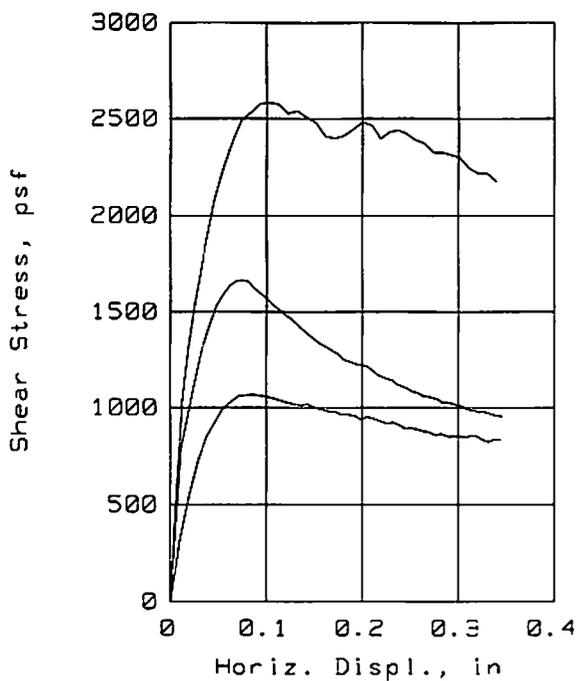
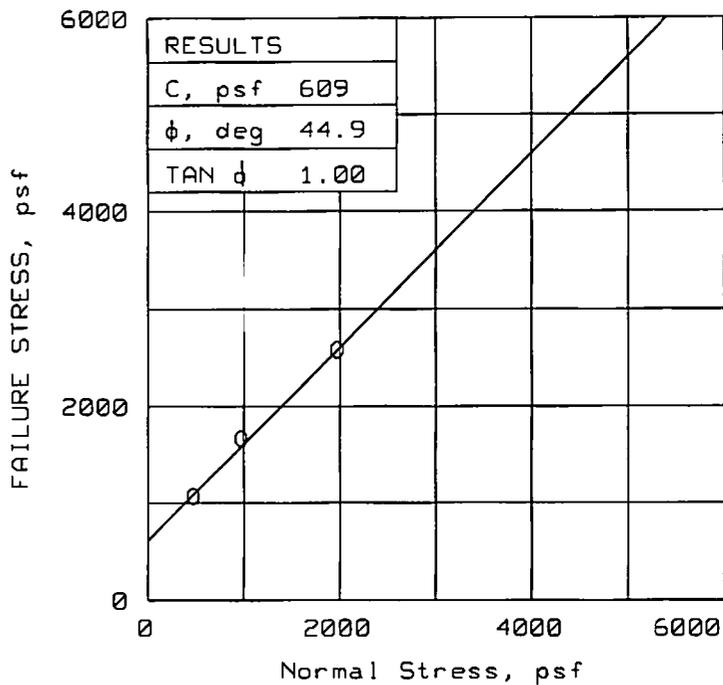
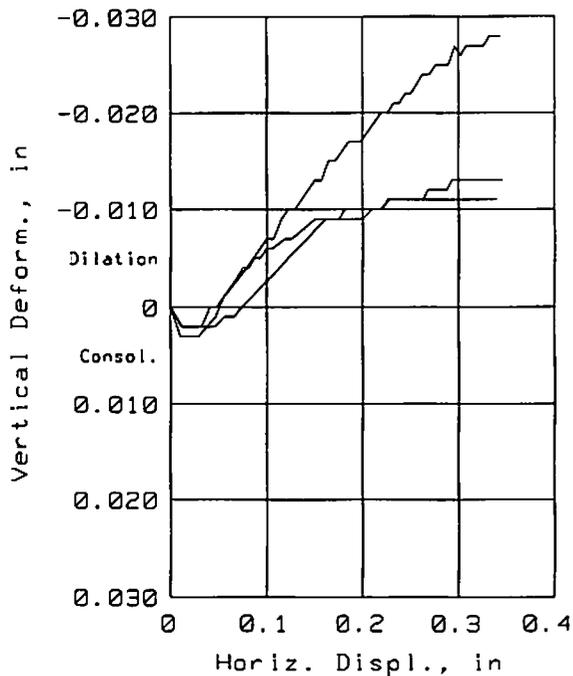
CLIENT:
 PROJECT: Idaho Maryland Mine Reopen
 SAMPLE LOCATION: B20@25.5

PROJ. NO.: 7645.5.001.01 DATE: 2/5/07

DIRECT SHEAR TEST REPORT

ENGE0, INCORPORATED

Fig. No.: _____



SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	19.2	22.9	21.0
	DRY DENSITY, pcf	100.6	99.7	102.1
	SATURATION, %	76.7	89.5	87.1
	VOID RATIO	0.675	0.691	0.651
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	1.00	1.00	1.00
AT TEST	WATER CONTENT, %	24.1	25.6	24.9
	DRY DENSITY, pcf	100.6	100.3	103.5
	SATURATION, %	96.2	101.7	107.0
	VOID RATIO	0.676	0.680	0.628
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	1.00	0.99	0.99
NORMAL STRESS, psf	500	1000	2000	
FAILURE STRESS, psf	1068	1666	2583	
DISPLACEMENT, in	0.09	0.08	0.10	
ULTIMATE STRESS, psf				
DISPLACEMENT, in				
Strain rate, %/min	0.15	0.12	0.10	

SAMPLE TYPE: In situ
 DESCRIPTION: Reddish brown
 silty clay with fine gravel

SPECIFIC GRAVITY= 2.7
 REMARKS: Assumed Specific
 Gravity

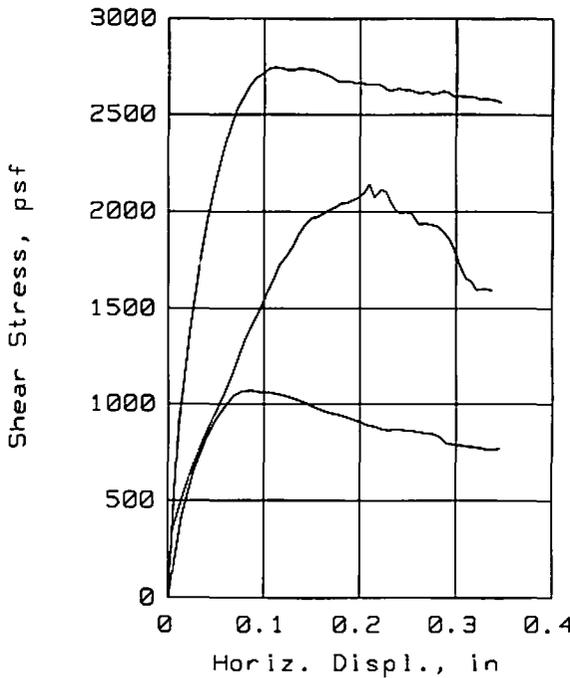
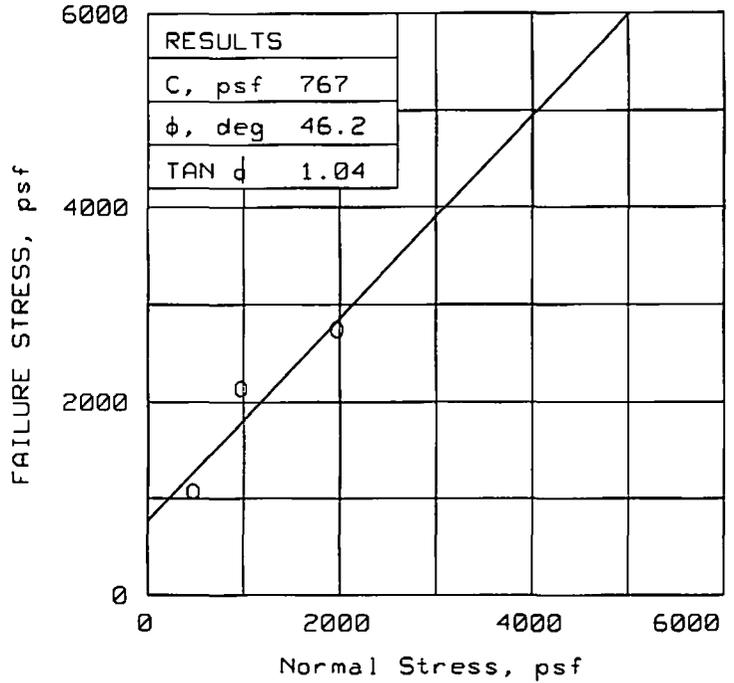
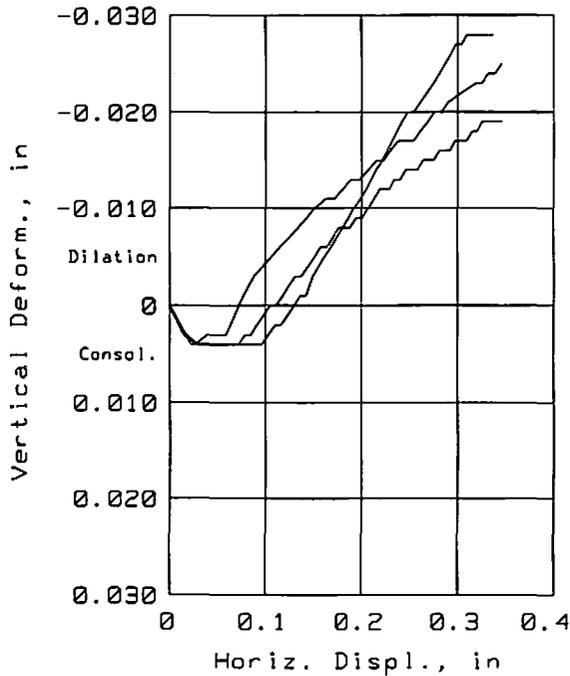
CLIENT:
 PROJECT: Idaho-Maryland Mine Reopen
 SAMPLE LOCATION: B22@16.0

PROJ. NO.: 7645.5.001.01 DATE: 2/12/07

DIRECT SHEAR TEST REPORT

ENGEO, INCORPORATED

Fig. No.: _____



SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	31.5	37.4	37.7
	DRY DENSITY, pcf	80.7	74.7	74.4
	SATURATION, %	78.1	80.4	80.4
	VOID RATIO	1.089	1.255	1.266
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	1.00	1.00	1.00
AT TEST	WATER CONTENT, %	33.7	42.5	39.5
	DRY DENSITY, pcf	81.6	76.5	77.8
	SATURATION, %	85.4	95.2	91.4
	VOID RATIO	1.065	1.205	1.167
	DIAMETER, in	2.42	2.42	2.42
	HEIGHT, in	0.99	0.98	0.96
NORMAL STRESS, psf	500	1000	2000	
FAILURE STRESS, psf	1071	2138	2746	
DISPLACEMENT, in	0.09	0.21	0.11	
ULTIMATE STRESS, psf				
DISPLACEMENT, in				
Strain rate, %/min	0.14	0.15	0.13	

SAMPLE TYPE: In situ
 DESCRIPTION: Gray silty sand
 with organics (wood pulp)

SPECIFIC GRAVITY= 2.7
 REMARKS: Assumed Specific
 Gravity

CLIENT:

PROJECT: Idaho-Maryland Mine Reopen

SAMPLE LOCATION: B23@7.5

PROJ. NO.: 7645.5.001.01

DATE: 2/13/07

DIRECT SHEAR TEST REPORT

ENGEO, INCORPORATED

Fig. No.: _____

**EXPANSION INDEX TEST REPORT
ASTM D 4829**

PROJECT NAME: Idaho-Maryland Mine Reopen

REPORT DATE: 2/15/07

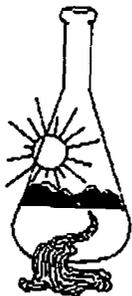
PROJECT NO. 7645.5.001.01

TESTED BY: SEL

Sample ID	Soil Description	Initial Dry Density (pcf)	Initial Moisture Content (%)	Final Moisture Content (%)	Expansion Index
B12@3	Gray Silt (ML)	97.2	12	31.4	68
B26@3.5	Reddish brown sandy silt (ML)	82.1	16	40.4	38
B28@0	Reddish brown silty clay with fine sand (CL)	101.5	10.5	25.9	68
TP15@0	Reddish brown silty clay with sand (CH)	100.3	11.2	29.3	82
TP18@1.5	Gray silty clay (CL)	96.2	12	30.4	54
TP19@2	Light gray silt (ML)	94.2	18.0	38.2	136

CLASSIFICATION OF EXPANSIVE SOIL

Expansion Index	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High



Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engco Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager *RO*

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : TP3 @ 5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49863-99387.

EVALUATION FOR SOIL CORROSION

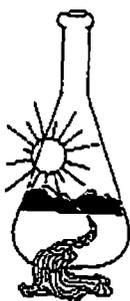
Soil pH	7.53		
Minimum Resistivity	0.83	ohm-cm (x1000)	
Chloride	5.9 ppm	00.00059	%
Sulfate	113.4 ppm	00.01134	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557



Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : TP18 @ 1.5'.

Thank you for your business.

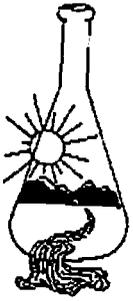
* For future reference to this analysis please use SUN # 49863-99388.

EVALUATION FOR SOIL CORROSION

Soil pH	8.15		
Minimum Resistivity	5.90	ohm-cm (x1000)	
Chloride	14.2 ppm	00.00142	%
Sulfate	30.4 ppm	00.00304	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422



Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B24 @ 3.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49863-99389.

EVALUATION FOR SOIL CORROSION

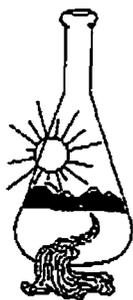
Soil pH	6.16		
Minimum Resistivity	2.95	ohm-cm	(x1000)
Chloride	11.3 ppm	00.00113	%
Sulfate	12.6 ppm	00.00126	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557



Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:

Location : 7645.5.001.01 Site ID : B25 @ 0.

Thank you for your business.

* For future reference to this analysis please use SUN # 49863-99390.

EVALUATION FOR SOIL CORROSION

Soil pH	5.60		
Minimum Resistivity	5.36	ohm-cm (x1000)	
Chloride	16.1 ppm	00.00161	%
Sulfate	0.8 ppm	00.00008	%

METHODS

pH and Min. Resistivity CA DOT Test #643

Sulfate CA DOT Test #417, Chloride CA DOT Test #422



Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager *ROH*

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B27 @ 0.
Thank you for your business.

* For future reference to this analysis please use SUN # 49863-99391.

EVALUATION FOR SOIL CORROSION

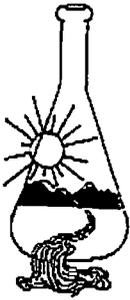
Soil pH	6.09		
Minimum Resistivity	5.90	ohm-cm (x1000)	
Chloride	9.6 ppm	00.00096	%
Sulfate	4.5 ppm	00.00045	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557



Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engco Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager *CA*

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B28 @ 6.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49863-99392.

EVALUATION FOR SOIL CORROSION

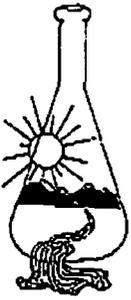
Soil pH	7.77		
Minimum Resistivity	3.22	ohm-cm (x1000)	
Chloride	12.6 ppm	00.00126	%
Sulfate	5.5 ppm	00.00055	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557



Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Olyphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B29 @ 3'.
Thank you for your business.

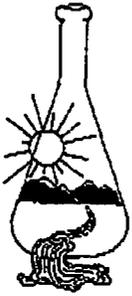
* For future reference to this analysis please use SUN # 49863-99393.

EVALUATION FOR SOIL CORROSION

Soil pH	7.28		
Minimum Resistivity	4.29	ohm-cm (x1000)	
Chloride	7.6 ppm	00.00076	%
Sulfate	1.6 ppm	00.00016	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422



Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B12 @ 10'.
Thank you for your business.

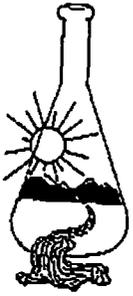
* For future reference to this analysis please use SUN # 49863-99394.

EVALUATION FOR SOIL CORROSION

Soil pH	6.96		
Minimum Resistivity	2.95	ohm-cm (x1000)	
Chloride	4.2 ppm	00.00042	%
Sulfate	42.2 ppm	00.00422	%

METHODS

pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422



Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B5 @ 3'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49864-99395.

EVALUATION FOR SOIL CORROSION

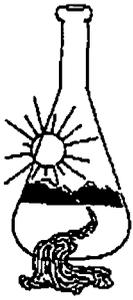
Soil pH	7.62		
Minimum Resistivity	2.68	ohm-cm (x1000)	
Chloride	4.6 ppm	00.00046	%
Sulfate	32.9 ppm	00.00329	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557



Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager *ROH*

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B8 @ 3'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49864-99396.

EVALUATION FOR SOIL CORROSION

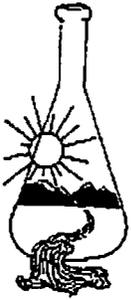
Soil pH	7.02		
Minimum Resistivity	0.88	ohm-cm (x1000)	
Chloride	8.5 ppm	00.00085	%
Sulfate	206.2 ppm	00.02062	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557



Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney *RH*
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B28 @ 2'.

Thank you for your business.

* For future reference to this analysis please use SUN # 49864-99397.

EVALUATION FOR SOIL CORROSION

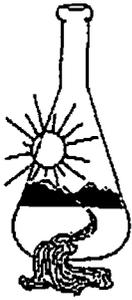
Soil pH	6.54		
Minimum Resistivity	3.48	ohm-cm (x1000)	
Chloride	6.3 ppm	00.00063	%
Sulfate	5.7 ppm	00.00057	%

METHODS

pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557



Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B9 @ 6'.
Thank you for your business.

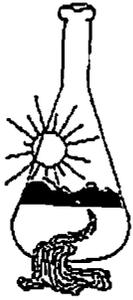
* For future reference to this analysis please use SUN # 49864-99398.

EVALUATION FOR SOIL CORROSION

Soil pH	6.93		
Minimum Resistivity	2.95	ohm-cm (x1000)	
Chloride	8.2 ppm	00.00082	%
Sulfate	69.0 ppm	00.00690	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422



Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 764S.5.001.01 Site ID : B22 @ 10.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49864-99399.

EVALUATION FOR SOIL CORROSION

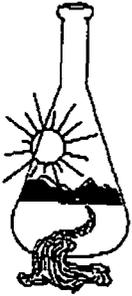
Soil pH	6.77		
Minimum Resistivity	6.97	ohm-cm (x1000)	
Chloride	12.2 ppm	00.00122	%
Sulfate	5.9 ppm	00.00059	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557



Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B20 @ 1.5'.
Thank you for your business.

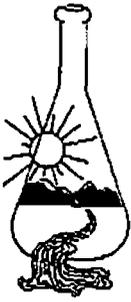
* For future reference to this analysis please use SUN # 49864-99400.

EVALUATION FOR SOIL CORROSION

Soil pH	8.05		
Minimum Resistivity	4.56	ohm-cm (x1000)	
Chloride	8.1 ppm	00.00081	%
Sulfate	25.9 ppm	00.00259	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422



Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/13/2007
Date Submitted 02/09/2007

To: Mike Turner
Engeo Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 7645.5.001.01 Site ID : B30 @ 1'.
Thank you for your business.

* For future reference to this analysis please use SUN # 49864-99401.

EVALUATION FOR SOIL CORROSION

Soil pH	7.26		
Minimum Resistivity	3.48	ohm-cm (x1000)	
Chloride	8.4 ppm	00.00084	%
Sulfate	27.7 ppm	00.00277	%

METHODS

pH and Min. Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422