Appendix C

Surficial Geology

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REPORT ON THE SURFICIAL GEOLOGY AND TERRAIN OF THE PROPOSED KENNECOTT EAGLE PROJECT



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***Cover Photograph**: View to the southwest of the Yellow Dog Plain from AAA Road, Section 12.*

1.0 INTRODUCTION

In December 2003, Kennecott Minerals Company (”KMC”) retained Golder Associates Inc. (“Golder”) to conduct an Environmental Baseline Study (EBS) of a proposed nickel-copper Eagle Project within the generally flat-lying physiographic area know as the Yellow Dog Plain, Michigamme Township, located in northwestern Marquette County, Michigan. In conjunction with the EBS, during June 2004 Golder conducted an examination of surficial geologic and terrain conditions within an approximate 2-square-mile area surrounding the proposed mining site. Figure 1 shows the location of the study area within the Yellow Dog Plain.

The extent of the surficial geologic study area is shown in Figure 2. Golder’s mapping efforts were concentrated mostly within Sections 11 and 12 of Michigamme Township, on land that has been purchased by KMC or that KMC leases from the State of Michigan. The entire area where Golder conducted its field reconnaissance has been historically logged. Figure 2 shows the current land ownership distribution. Although other aspects of the EBS, such as surface water and groundwater quality monitoring, have been conducted over larger portions of the Yellow Dog Plain, the surficial geologic mapping and terrain analysis focused on the limited areas within which KMC is most likely to conduct subsurface mining operations, and within which it may locate various surface facilities. For this reason, Golder’s field work did not extend south of Sections 11 and 12, toward the Yellow Dog River.

1.1 Background

Golder’s surficial geologic reconnaissance is not the first examination and mapping of the surficial deposits and bedrock geology of this portion of Marquette County. The KMC area of interest is known to be situated on the Yellow Dog Plain, which is depicted on the map of Surficial Geology of Northern Michigan (MDNR, 1987) as a broad sheet of glacial outwash situated between outcropping of bedrock to the south, and glacial ground moraine to the north. Golder’s field reconnaissance of the surficial geology and terrain was intended to verify and provide a higher resolution understanding of the previously mapped distribution of the glacial deposits and the bedrock exposures in the project area.

During the June 2004 field work, Golder collected numerous samples of shallow glacial outwash deposits and documented terrain conditions (e.g., topography, geomorphology, ground cover) by recording digital photographs. Locations were determined through the use of Global Positioning

System (GPS) units. Section 2 presents detailed descriptions of field and laboratory methods that were used to characterize surficial glacial geology. Section 3 describes the results of the surface geology, geomorphology, terrain studies, geochemical analyses of shallow soil samples, and structural analysis of the peridotite bedrock exposure.

1.2 Objectives

Two of the principal objectives of the EBS are to collect data for use in support of future mine feasibility studies by KMC, and to characterize environmental elements relevant to baseline environmental conditions in support of permitting activities. The specific objectives of the surface geologic and terrain analyses include the following:

- Document the types and general geotechnical properties of the geologic materials (e.g., glacial deposits vs. bedrock) that will underlay key features such as buildings, foundations, excavations, conduits, and waste management units.
- Identify and delineate topographic conditions that could have an effect on possible future development. Examples include lineaments, steep terrain, or other visible large-scale feature that could be indicative of particular geologic features.
- Identify on-site glacial deposits that could be of value during construction and operations (e.g., sand, clay).
- Identify areas where ground engineering and future geotechnical borings may be required due to unsuitable substrates (e.g., peat).

2.0 SCOPE AND METHODS OF INVESTIGATION

Golder's field study of surface geology and terrain analysis was preceded by preparation of a work plan (Golder, 2004), a review of available air photos and of geologic references pertaining to the Yellow Dog Plain, including the metalliferous deposits of interest to KMC. Following this review, Dave Regalbuto, C.P.G., and Art Losey of Golder's Lansing, Michigan office conducted on-site work during the interval from June 15 through 18, 2004.

2.1 Literature Review

In order to develop an understanding of the regional bedrock and glacial geologic setting of the Yellow Dog Plain, Golder reviewed existing maps and readily-available publications that were obtained following inquiries at the following entities:

- U.S. Geologic Survey, Bureau of Land Management, and Department of Agriculture;
- Michigan Geologic Survey and Michigan Department of Environmental Quality;
- Michigan State University Center for Remote Sensing;
- Telephone consultations with select university faculty in order to identify pertinent studies that have been completed as theses and/or dissertations;
- Other sources that were identified by Golder's librarian; and
- KMC geologists.

The list of references review by Golder is contained in Section 5.

2.2 Sample Locations

Golder's review of previous geologic mapping efforts indicated that two predominant types of deposits were to be encountered: a) glacial outwash and b) post-glacial organic deposits (e.g., peat) in wetland areas. Based on conceptual layouts of KMC's site operations, the locations of the two peridotites of interest (Eagle and East Eagle), and on KMC and State of Michigan land holdings, Golder conducted its field investigation within most of Sections 11 and 12 of Michigamme Township, as shown in Figures 2 and 5. Golder also included the southernmost 80 acres of Section 2. Waypoints that were established by Arthur Losey and David Regalbuto, respectively, are identified with the prefixes "ABL-" and "DPR-."

As described below, Golder collected samples of glacial outwash at the majority of GPS waypoints. The Figure 5 legend also depicts waypoints where only photographs were taken. Observations were made at a total of 158 waypoints, consisting of DPR-003 through DPR-069 and ABL-003 through ABL-093.

2.2.1 Glacial Outwash

Golder utilized Garmin Legend GPS units to establish sample locations and follow north-south and/or east-west traverses during the field reconnaissance. Working in a general east-to-west configuration, Golder established as the origin (i.e., GPS Waypoint 1) a location in the southern half of Section 12 along AAA Road, where it parallels the southern boundary of Section 12. Both investigators then proceeded to a turning point approximately 300 feet east/west of the origin (Waypoint 2) before preceding north approximately 300 feet to the first sample point (Waypoint 3). Subsequent sample locations in the traverses were set at intervals of approximately 9 seconds of longitude, and 6 seconds of latitude, yielding a grid (not including wetlands) consisting of waypoints located approximately 600 feet on center. Golder traversed but did not collect glacial outwash samples within an 80-acre parcel in the east half of Section 12, which is owned neither by KMC nor the State of Michigan. Glacial outwash samples were collected at 135 of the 158 waypoints.

2.2.2 Post-Glacial Wetlands

Because KMC has not proposed to construct in wetlands, and because Golder subcontracted with Wetland and Coastal Resources (WCR) of Lansing, Michigan to delineate wetlands, Golder expressly did not extend its traverses into wetlands. During its field work, which also included various ecologic aspects of the EBS, WCR circumnavigated the on-site wetlands, leaving boundary markers that KMC subsequently surveyed.

2.3 Sample Collection

Golder collected a sample of the surficial glacial outwash stratum at the selected waypoints shown on Figure 5. Because Golder observed that the combined thickness of the uppermost humic and weathered portion of the soil profile is typically no more than 8 to 12 inches, samples were acquired with shovels in lieu of hand augers, as shovels worked more rapidly and provided better exposure to the soils below the weathered zone. At each location, Golder advanced the hole past the humic and densely rooted horizons, and retained approximately 500 grams of soil in an airtight bag after

removing excess head space. The samples were then described in accordance with the Unified Soil Classification System (USCS). Soil color was visually described using the Munsell color chart to the protocol described in Section 2.4. Each sample bag was labeled with the sample location and collector ID, the project number, and date using indelible ink. The samples were transported to the Golder Lansing office for further Quality Assurance/Control checks (see Section 2.4) regarding description and classification.

2.4 Quality Assurance and Control

In order to qualitatively and quantitatively check the accuracy of the glacial outwash sample descriptions and USCS classifications, Golder conducted the followed QA/QC procedures:

- Golder submitted 12 samples from across the study area to Golder-Lansing's geotechnical laboratory for measurements of grain size distribution using ASTM Method D-422. These results were used to quantitatively determine the USCS classification for the samples.
- Using these laboratory measurements, Golder re-examined the other bagged samples to determine whether, based on a tactile and visual basis, the USCS designation should be revised. For example, some samples that were originally classified as a poorly graded sand with silt (SP-SM) were re-classified as a poorly graded sand (SP). During this QA/QC check, Golder also performed a visual check of the Munsell color designations. In an effort to eliminate bias, Ms. Tiffany D. Johnson, P.E., a geologic engineer in Golder's Lansing office, re-examined samples that Dave Regalbuto collected. Dave Regalbuto re-examined the samples that Art Losey collected. These checks resulted in a minority of sample descriptions being modified with different hues of the reddish brown color, and a number of USCS classifications were modified as described above.

2.5 Geochemical Analyses

In an effort to examine generalized site-specific concentrations of select heavy metals of interest, Golder submitted a total of 26 samples of shallow glacial outwash soil to the ALS Chemex laboratory in Thunder Bay, Ontario for laboratory analysis of soil pH and 48 naturally-occurring metals. The sample locations were selected by Mr. Ware from an area in the northwest quarter of Section 12 that encompasses and extends north from the peridotite outcrop, within which KMC anticipates that above-ground ancillary facilities will be constructed.

Not including mercury, the metals were analyzed via Inductively-Coupled Plasma/Mass Spectroscopy (ICP/MS), following digestion in a hydrofluoric acid bath. Mercury was analyzed via the Cold Vapor method. Appendix D includes the laboratory reports. The following metals were analyzed:

Aluminum	Copper	Molybdenum	Tantalum
Antimony	Gallium	Sodium	Tellurium
Arsenic	Germanium	Nickel	Thallium
Barium	Hafnium	Niobium	Thorium
Beryllium	Indium	Phosphorus	Tin
Bismuth	Iron	Potassium	Titanium
Calcium	Lawrencium	Rhenium	Tungsten
Cadmium	Lead	Rubidium	Uranium
Cerium	Lithium	Selenium	Vanadium
Cesium	Magnesium	Silver	Yttrium
Chromium	Manganese	Strontium	Zinc
Cobalt	Mercury	Sulfur	Zirconium

2.6 Terrain Analysis

Golder's terrain analysis efforts began with a review of topographic maps and aerial photographic stereo pairs, in order to identify areas of interest that merited field reconnaissance and photographic documentation. During the surface geology traverses, Golder recorded digital photographs oriented north, east, south, and west at each waypoint shown on Figure 5, including the features of interest that were discerned from the topographic maps and air photos. A set of the digital photos is contained in Appendix A.

2.7 Bedrock Structural Analysis

In conjunction with the terrain and surface geology analysis, Golder examined the peridotite bedrock exposure for the purpose of documenting structural features such as fracture density and orientation that could affect groundwater movement or construction within this portion of the bedrock. Fracture orientations (i.e., dip angle relative to vertical; dip orientation relative to North) were measured using a Brunton compass. Measurements were recorded manually in a field notebook. These surface measurements were in turn compared to the orientation of the subsurface fracturing, or "discontinuities" in bedrock cores that are described in the geotechnical study (Golder, 2005) that

Golder performed in conjunction with the EBS. Golder recorded the locations where surface observations were made in June 2004 using the GPS units as described in Section 2.1. Digital photographs were recorded at some of these locations.

3.0 RESULTS

3.1 Geologic Setting

The proposed Eagle Project is situated on a sequence of unconsolidated glacial deposits that overlie Precambrian metamorphic bedrock. The distribution of glacial and bedrock formations in this region of the Upper Peninsula is depicted in Figures 3 and 4, respectively. During the EBS, KMC retained the North Jackson Company (NJC) to conduct a drilling and monitor well installation program for the purpose of characterizing groundwater occurrence and movement in both types of formations. KMC also retained STS Consultants ("STS") in Marquette, MI to map the depth to bedrock between the two peridotites using geophysical methods. The reader should refer to the NJC and STS Stage 2 reports for detailed information on the subsurface geology and hydraulic properties of the KMC site. Section 3.1 provides a brief description of the geologic setting.

3.1.1 Bedrock and Structural Geology

As depicted on the *Geologic Map of Precambrian Rocks, Southern Lake Superior Region, Wisconsin and Northern Michigan, (Map I-2185)* (USGS, 1990) the entire Yellow Dog Plain is underlain by Precambrian metamorphosed sedimentary rocks - predominantly black slate and argillite - belonging to the Michigamme Formation of Archean Age "X" (i.e., *ca*. 2 billion years). In this area, the Michigamme Formation is in contact with older and more erosionally resistant granitic, gneissic, and greenstone rocks (Precambrian "W," *ca*. 2.5 billion years) to the north and south. To the north, the erosional remnants of these rocks form the easternmost extent of the Huron Mountains. To the south, the rocks form the highlands that belong to the Northern Complex of the Marquette geologic district (Photo 1).

Structurally, the Michigamme Formation was deposited in the Baraga Basin along the former continental margin. These sedimentary rocks were later metamorphosed regionally during the Penokean orogeny around 1.9 billion years ago (MDNR, 1979). During the 1960s and 1970s, gravity and magnetic surveys of the Yellow Dog Plain identified an east-west linear anomaly within which the peridotite outcrops are situated. Recent investigators have concluded that this linear trend is a failed continental rift approximately 1.1 billion years old (USGS, 1997), that is also responsible for the deposition of extrusive igneous and volcanoclastic formations that underlay the Keweenaw Peninsula. Although the rift is believed to be continuous between Kansas and Michigan, bedrock

exposures along the rift, such as the peridotites at the KMC site, are found only in the Lake Superior region. A view of the east peridotite exposure is shown in Photo 2, Appendix A.

3.1.2 Glacial Geology

The map of Surficial Geology of Northern Michigan (MDNR, 1987) indicates that the Yellow Dog Plain is a broad, flat sheet of Pleistocene (i.e., *ca*. 10,000 years old) glacial outwash situated between outcroppings of the Precambrian bedrock to the south, and glacial ground moraine to the north. Golder's site-specific surface geology investigation confirms this map.

NJC's drilling program indicates that the surficial outwash deposit is in turn underlain by successively older glacial deposits of finer-grained outwash (e.g., silty sand and silt), fine-grained glacial till, and coarse-grained glacial till. The maximum thickness of the glacial deposits is reported by other investigators to be in excess of 200 feet (USGS, 1981). Not all of the glacial strata are present where the depth to bedrock is shallowest. As with the hydrogeologic characteristics of the KMC site, the reader is referred to NJC's Stage 2 report for a detailed account of the glacial geologic profile.

3.2 Surficial Geological Conditions

The results of Golder's reconnaissance, along with WCR's field reconnaissance of wetland boundaries, are shown on Figure 5. Each waypoint indicates the location number, and whether a soil and/or digital photograph were collected.

3.2.1 Glacial Outwash

Golder's visual and laboratory USCS classifications are summarized in Table 1, including a visually-determined Munsell colors. The laboratory measurements of grain size distribution are summarized in Table 2. Grain size distribution curves are contained in Appendix C.

Sandy outwash was encountered at every waypoint where samples were collected. The visual and laboratory classifications indicate the majority of the soil samples fall into a classification of Poorly Graded Sand (SP), along with a minority of samples that include:

- Poorly Graded Sand with Silt (SP-SM);

- Silty Sand (SM);
- Well Graded Sand (SW);
- Poorly/Well Graded Sand with Gravel.

The laboratory measurements indicate that nine of the ten samples analyzed contained over 50 percent fine sand, and less than 5 percent silt. Visually, a minority of the samples also contain a small fraction of cobbles, of a nominal diameter that exceeds the USCS designation of 3 inches for coarse gravel. Such cobbles are ubiquitous where the glacial outwash deposits are exposed along the site's unpaved roads and on erosional surfaces.

Golder's field observations indicate that below a depth of around 1 foot, the fine sandy outwash is typically dense, of varying degrees of reddish brown hue (e.g., 5YR 3/4 – 5YR 5/4) with induration (i.e., heavy cementation of grains) common. The indurated deposits typically show a darker reddish color, which Golder interprets as an abundance of iron oxide cement derived from leaching under low-pH conditions in former root zones, as described in Section 3.5. All of the study area soil samples that were subjected to laboratory analysis for metals are characteristically associated with acidic (i.e., pH <7) conditions. The area around the outcrop as demonstrated in these results has naturally elevated levels of metals and acidic conditions in the soil due to the presence of naturally occurring sulfide minerals and their weathering products. The acidic sandy soil is conducive to the growth of the abundant blueberries that are harvested on the Yellow Dog Plain.

The small fraction of fines in the outwash samples, combined with the flat topography (see Sections 3.3 and 3.4) indicate that the ground surface should be expected to exhibit a rapid infiltration rate. This observation is consistent with a previous assessment of the hydrology of this portion of Marquette County (USGS, 1981). The widespread occurrence of this sandy outwash indicates that essentially all precipitation in the outwash-covered areas that doesn't evaporate or transpire reaches groundwater as recharge, and discharges to either the Salmon Trout or Yellow Dog Rivers, or to one of the several ephemeral springs and creeks located along the northern slope of the Yellow Dog Plain, where the glacial deposits overlay the southern flank of the Huron Mountains.

3.2.2 Glacial Deposits Suitable as Possible Construction Materials

Golder's observations indicate that outside wetland areas, predominantly poorly-graded fine sand (SP) underlies most of the study area. Some exceptions are where well-graded sand and mixtures of

sand and gravel were encountered. Where SP soils were observed, however, they frequently contain small percentages of fine and coarse gravel. Some also contain cobbles (i.e., >3 inches nominal diameter). In this manner, the ubiquitous fine sand may not be suitable for use for specific engineering applications where a consistent grain size range is necessary. For situations where fine-grained granular materials are to be used, but coarse-grained materials cannot be tolerated, the stock materials will likely need to be screened or graded.

Golder did not observe surface deposits of well sorted gravels, as sometimes occur within glacial outwash sequences. If specific grain sizes of gravel material are needed, it would either have to be imported, or produced on-Site by grading the existing outwash deposits.

3.2.3 Post-Glacial Wetlands and Organic Soils

Figure 5 depicts the extent of organic soils that are typical of wetland environments. Within Sections 11 and 12, these occur predominantly along the banks of the Salmon Trout River (Photos 3 and 4); although a few smaller wetlands were encountered in the southern half of Section 11. Because WCR was responsible for wetland delineation during the EBS, Golder did not collect samples of the organic soils.

3.3 Geomorphology

Geomorphology ("earth form") is the study of the manners in which combinations of geologic process over time have led to current land forms. The various processes may include deposition of different types of rocks and formations (e.g., igneous, sedimentary), tectonic uplift and faulting, erosion, and, in the case of Michigan's Upper Peninsula, multiple advances of glaciers. The following sections describe the geomorphology the region surrounding the Yellow Dog Plain, and the proposed KMC mining site.

3.3.1 Regional Geomorphology

The predominantly east-west-oriented Yellow Dog Plain, which is formed from flat-lying glacial deposits, is situated between two prominent areas of exposed bedrock. To the north are the Huron Mountains, and to the south are even higher "mountains" (Photo 1) that belong to the northern Marquette geologic complex. An examination of the bedrock and glacial geologic maps (Figures 3 and 4, respectively) of this portion of the Upper Peninsula indicate that the location and orientation of

the Yellow Dog Plain generally coincide with those of the underlying bedrock, the Michigamme Formation. Previous investigators have inferred that the Michigamme Formation was deposited in a structural trough that formed along the ancient continental boundary approximately 2 billion years ago.

As described in Section 3.1.1, the Michigamme Formation is composed of metamorphosed sedimentary rocks (i.e., "metasedimentary"). Although metamorphism of sedimentary rocks typically leads to a resultant metamorphic rock that is harder than the original sedimentary formation (e.g., shale is metamorphosed to slate), the Michigamme Formation is less hard than the granitic and metamorphosed igneous rocks that form the mountains to the north and south. Due to the difference in resistance, the Michigamme Formation is more easily eroded than the surrounding granitic highlands.

Golder surmises that the Yellow Dog Plain formed as glacial materials were preferentially deposited over the eroded Michigamme Formation, the surface of which is low relative to the granitic terrain to the south and north. The regionally flat surface of the Yellow Dog Plain is the result of glacial melt water having deposited the upper stratum of fine sandy outwash in a nearly level configuration. Within the study area, the peridotite exposures, being resistant igneous intrusive bodies into the Michigamme Formation, have in turn preferentially withstood erosion during the last glacial advance, and as such remain exposed at and above (Photo 2) the level of the glacial outwash plain. As discussed below, glacial melt water and post-glacial erosion has resulted in local geomorphologic features that have been incised into this outwash plain.

3.3.2 Local Geomorphology

As shown by the topographic contours in Figures 1 and 5, and in the photographs associated with Golder's terrain analysis (see Section 3.4, below), the geomorphology of the study area, including the area north of the peridotite bedrock exposure in Section 12, exhibits much of the same flat-lying topography that is characteristic of most of the Yellow Dog Plain. North and east of the east peridotite bedrock exposure in the northwest quarter of Section 12, the terrain is effectively flat, encompassing a small internally-draining area, with an overall gradual slope toward the south, southwest, and southeast. The area northeast of the east peridotite exposure lies within the Yellow Dog watershed; the area north and northwest of the exposure is within the Salmon Trout watershed.

Within the study area, the geomorphologic features of note are the moderate to steep terraces that formed due to post-glacial melt waters and modern erosion along the Salmon Trout River in Section 11, and due to glacial melt waters in southern portion of Section 12. Prominent terraces (Photos 5 and 6) occur on either side of the Salmon Trout River in Section 11. Although the overall topographic slope in the study area is gradually from north to south, the Salmon Trout is thought to have reached its present configuration beginning as a large seep within the northern slope of the Yellow Dog Plain, progressively eroding in a general north-to-south direction into the unconsolidated outwash stratum, forming the terraces along both sides of the river.

Golder observed one other notable topographic feature, a glacial melt water erosional terrace located in the southwest quarter of Section 12 (Photos 11 and 12), that extends from the Yellow Dog River watershed northward into the southeast quarter of Section 12 (Photos 13 and 14), and that is equal in elevation to the terraces along the Salmon Trout River. In the southeast quarter of Section 12, the topographic gradient on the north side of this "trough" is less steep than on the south side. Wetland conditions were observed in this topographic low feature at and south of waypoints DPR-019 and DPR-033.

Farther to the south, beyond the surface geology study area, the Yellow Dog River flows from west to east along the southern boundary of the Yellow Dog Plain, being bounded by the granitic highlands to the south. At the eastern extent of the Yellow Dog Plain, the river continues to erode downward through the glacial deposits, just as the Salmon Trout erodes into the northern boundary of the plain.

3.4 Terrain Analysis

In addition to assessing the geomorphologic features of the study area, Golder recorded numerous digital photographs at each of the waypoints in order to document baseline physiographic and surface conditions in conjunction with the EBS. A total of 14 photographs depicting the terrain in Sections 11 and 12 is contained in Appendix A. Historical aerial photographs as digitally scanned prints are presented in Appendix B. The following sections describe Golder's observations regarding land use and resulting terrain conditions during the June 2004 field reconnaissance.

3.4.1 Historical Land Use

Golder's field reconnaissance and review of historical air photos (Appendix B) indicates that all of the upland portions of the study area have been extensively logged since at least the 1930s. The

scope of Golder's terrain analysis did not include research regarding the historical magnitude and precise timing of the logging operations. However, in May 2004 Golder did conduct an informal discussion with Mr. Mark Petrie of the MDEQ's Upper Peninsula District Office regarding site conditions. Mr. Petrie, who has been in this MDEQ office since the mid 1980s, indicated that he is aware that the Yellow Dog Plain has been logged twice since the late 19th century, including the study area. This description agrees with Golder's observations during the June 2004 field work, as described below, and is corroborated by the results of the 2004 archeological investigation for the EBS (BHE, 2004) that includes descriptions of two logging camps that are present on the 1939 aerial photographs in Appendix B of this surficial geology/terrain report.

3.4.2 Current Conditions

As shown in Figure 5, Golder traversed all of the upland areas in Sections 11 and 12 of Michigamme Township, not including wetlands. To better gain an understanding of the local terrain conditions as of June 2004, the reader is referred to the photographs in Appendix A. The photo log in Appendix A also depicts the local terrain, focusing on the geomorphologic features described in Section 3.3, and the terrain north and east of the east peridotite bedrock exposure.

Golder's field reconnaissance indicates that the majority of upland areas traversed have been logged within the past 10 to 20 years. During a typical traverse, Golder encountered abundant remains of branches and stumps that were not included as part of the timber harvest. Within a minority of the areas that were traversed, the wooded areas are in a more mature state of regrowth (e.g., >30 years). As can be seen in many of the photographs, much of the terrain is typically flat-lying, deeply furrowed due to mechanized harvesting and replanting techniques within the sandy outwash soil, and littered with wooden remains from logging. For these reasons, Golder made use, where possible, of the numerous historical and current logging roads to expedite the movement from waypoint to waypoint, including the AAA Road itself. Golder and other EBS investigators noted that logging and other traffic on the AAA Road have resulted in the erosion of loose sandy sediment into the Salmon Trout River, where the road crosses the river in the western portion of Section 11. KMC's replacement of the road culvert at AAA Road and Salmon Trout River has significantly reduced sediment loading to the river.

3.4.3 Terrain and Geotechnical Setting: Northwest Quadrant/Section 12

As shown in Photos 7 through 10, the terrain north, east and west of the east peridotite bedrock exposure is topographically well-suited for the development of the surface facilities. The terrain is essentially flat and has been nearly entirely logged except for the regrown wooded areas immediately north of the bedrock exposure, and along the western boundary of Section 12.

As with all of the upland areas that Golder examined, the northwest quadrant of Section 12 is entirely underlain by fine-grained glacial outwash sand, and sandy soil derived from the outwash. The nearest wetlands (Figure 5) are located along the Salmon Trout River, and in the southwest quadrant of Section 12, also at a distance of approximately 700 meters. For the construction of the surface facilities, Golder anticipates that surrounding the east peridotite exposure, KMC will encounter a well-drained fine sand substrate free of peat or other types of unstable materials. Golder does not anticipate difficulties in excavating into the sandy outwash, as there are no indications of large boulders. KMC may encounter a thin zone of indurated sand (i.e., heavily cemented; see Section 3.1) within 1 to 1.5 feet of the ground surface at some locations (e.g., ABL-026; Table 1). Being that Golder was able to penetrate the indurated sand with shovels, excavating the same materials with earth-moving equipment should not be an obstacle to construction.

3.5 Outwash Sample Geochemistry

Outwash soil sample analytical results are summarized in Table 3, which includes statistical summaries of maximum, minimum, and mean concentrations, along with the standard deviation for each metal. The purpose of the analyses is to gain a preliminary understanding of select naturally-occurring metal concentrations in the shallow subsurface, and determine if the exposed bedrock in Section 12 may have an impact on those metal concentrations.

Results for 11 of the 48 metals are displayed spatially in Figures 6 through 16. These metals include the following:

Arsenic	(Figure 6)
Barium	(Figure 7)
Cadmium	(Figure 8)
Chromium	(Figure 9)
Copper	(Figure 10)
Lead	(Figure 11)
Mercury	(Figure 12)
Nickel	(Figure 13)
Selenium	(Figure 14)
Silver	(Figure 15)
Zinc	(Figure 16)

These 11 metals were selected on the basis of the MDEQ's historical list of 10 common metals of concern regarding the potential for human activities to impact environmental media, plus nickel, which is one of the two primarily metals of interest to KMC at the Eagle site, copper being the other.

Table 3 also includes Statewide Default Background Concentrations that the MDEQ has established for a total of 16 metals, including all of those listed above. These criteria were established by the State of Michigan in an effort to define approximate naturally occurring maximum concentrations that are typical of the entire state. In situations involving the release of heavy metals, the MDEQ accepts these statewide values as appropriate cleanup criteria for unrestricted land use. The MDEQ recognizes that natural site-specific concentrations may exceed statewide averages, in which case corrective action is not required within the areas of elevated concentrations.

Golder's review of the data in Table 3 indicates the following:

- Mean concentrations for the following metals in on-Site soil samples exceed the respective MDEQ Statewide Default Background Concentrations: aluminum, barium, chromium, iron, and selenium.
- Maximum concentrations for the following metals in on-Site soil samples exceed the respective MDEQ Statewide Default Background Concentrations: aluminum, arsenic, barium, cobalt, chromium, iron, lithium, manganese, mercury, potassium, selenium, and zinc.

Together, these observation suggest that local concentrations of metals of concern to the MDEQ are naturally elevated with respect to statewide averages. This is not unexpected, as many of the rock formations from which the local glacial deposits are derived in the Upper Peninsula, and farther north in the Lake Superior basin and Canada, contain metal ores. In addition, the Statewide Default values

incorporate metal concentrations from all four designated glacial lobes (i.e., Lake Superior, Lake Michigan, Lake Erie, and Saginaw Bay), and for all soil textures (sand, silt, clay, peat).

An examination of the spatial distribution of metal concentrations in Figures 6 through 16 does not reveal a discernable trend (i.e., increasing) in concentrations with proximity to the east peridotite bedrock exposure. On the contrary, the highest concentrations for most of the metals tend to occur at two of the locations, ABL-040 and ABL-039, farthest from the exposed bedrock. An examination of the pH values associated with these samples (Table 3 and Figure 17) indicates a strong tendency for maximum metal concentrations to be associated with the samples that exhibited the lowest soil pH, in particular ABL-040, which yielded a minimum pH of 4.2. Of the 26 samples that were analyzed, 25 exhibited pH values less than 5.5, including seven less than 5.0. Five samples exhibited pH values of 4.8 or less. These five samples (less than 20 percent of the total number) collectively yielded the highest concentrations for 23 of the 48 metals tested. The ABL-040 sample alone accounts for 13 of those 23 maximum concentrations. These results suggest that heavy metals tend to accumulate in zones where they have been mobilized from overlying horizons under acidic conditions in the root zone. In turn, soil pH is influenced by root density, species, and age of the forest cover, especially with respect to coniferous species.

3.6 Bedrock Structure

After completing the reconnaissance of the surficial glacial outwash, Golder examined the structure of the east peridotite exposure. On a macroscopic scale, the most prominent structural feature of the exposure is a series of six sub-parallel north-south trending furrows in the rock at intervals of approximately 150 feet. These features are more notable on the south side of the exposure than the north, and are inferred to be glacial erosional features oriented sub-parallel to the ice flow direction. The most prominent and deepest of these furrows is at the west end of the rock (Photo 13).

On a smaller scale, Golder recorded the strike and dip of ten fractures in the peridotite at a total of seven locations, as shown on Figure 2. The measurements are summarized in Table 3. Of the ten measurements, eight of the dip directions are situated between 292º and 022º. This range is consistent with that of one of the two major discontinuity sets (i.e., J2; range: 295º - 021º) that Golder (2005) discerned from the subsurface cores. Dip angles within this set of eight fractures are more variable (35º to 90º degrees) than the J2 set (70º to 87º), although Golder's visual observations elsewhere on the bedrock exposure indicate that much of the surficial fracturing is high angle (e.g., >70 º). In general, Golder observed the bedrock surface to be fractured, with spacings between

fractures on the order of 3 to 16 feet (approximately 1 to 5 meters). The fractures are best seen along the southern flank of the rock.

4.0 CONCLUSIONS

Golder's surface geology and terrain analysis, including laboratory analysis of select metal constituents in glacial outwash samples, have yielded the conclusions summarized below.

4.1 Geologic Conditions

1. The Yellow Dog Plain is a broad, flat sheet of Quaternary (i.e., *ca*. 10,000 years old) glacial outwash that is underlain by the metasedimetary Michigamme Formation, and that is situated between outcroppings of granitic Precambrian bedrock to the north and south.

2. Sandy outwash was encountered at every waypoint where samples were collected. A majority of the soil samples fall into a classification of Poorly Graded Sand (SP), along with a minority of samples that include:

   - Poorly Graded Sand with Silt (SP-SM);
   - Silty Sand (SM);
   - Well Graded Sand (SW);
   - Poorly/Well Graded Sand with Gravel.

3. The laboratory measurements indicate that nine of the ten samples analyzed contained over 50 percent fine sand, and less than 5 percent silt. Cobbles are ubiquitous where the outwash is exposed along the site's unpaved roads and on erosional surfaces. Below a depth of approximately 1 foot, the fine sandy outwash is typically dense, of varying degrees of reddish brown hue (e.g., 5YR 3/4 – 5YR 5/4) with induration common.

4. The small fraction of fines in the outwash indicates that the ground surface should be expected to exhibit a rapid infiltration rate. The widespread occurrence of this sandy outwash indicates that essentially all precipitation in the outwash-covered areas that doesn't evaporate or transpire reaches groundwater as recharge.

5. The fine sand at the ground surface commonly contains small percentages of gravel and cobbles. This fine sand therefore may not be suitable for use for specific engineering applications where a consistent grain size range is necessary, due to small fractions of gravel and cobbles in many of the samples. For situations where fine-grained granular materials are to be used, but coarse-grained materials cannot be tolerated, the stock materials will likely need to be screened or graded.

4.2 Geomorphology

1. Regionally, the Yellow Dog Plain formed as glacial materials were preferentially deposited over the Michigamme Formation, the surface of which is low relative to the granitic terrain to the south and north. The regionally flat surface of the

Yellow Dog Plain is the result of glacial melt water having deposited the upper stratum of fine sandy outwash in a nearly level configuration. Within the study area, the two peridotite exposures, being resistant igneous intrusive bodies into the Michigamme Formation, have withstood erosion during the last glacial advance, remaining exposed at and above the peridotite outcrops the level of the glacial outwash plain.

2. Within the surface geology study area, the geomorphologic features of note are the moderate to steep terraces that formed in Section 11 due post-glacial melt waters and modern erosion along the Salmon Trout River, and due to glacial melt waters in the southern portion of Section 12. Neither feature will impede development of conceptual mining facilities above ground in the northwest quadrant of Section 12.

4.3 Terrain

1. According to the MDEQ, the Yellow Dog Plain has been logged twice since the late 19th century. A 2004 archeological study (BHE, 2004) documented two historical logging camps within the study area dating from as early as 1939. Golder's field reconnaissance indicates that the majority of the surface geology study area has been logged within the past 10 to 20 years. Golder encountered ubiquitous remains of branches and stumps that were not included as part of the timber harvest. Some areas exhibit a more mature state of regrowth (e.g., >30 years). Much of the terrain is typically flat-lying and deeply furrowed due to mechanized harvesting and replanting. These logged areas are characterized by numerous historical and current logging loads. Sediment from the AAA Road were observed to be eroding into the Salmon Trout River in Section 11.

The terrain north, east and west of the east peridotite bedrock exposure is topographically well-suited for the development of the surface facilities. The terrain is essentially flat and has been nearly entirely logged. The flat terrain is conducive in terms of minimizing the potential for runoff of possible liquid process wastes.

Based on field observations, Golder anticipates that north of the east peridotite exposure; KMC will encounter a well-drained fine sand substrate free of peat or other types of unstable materials. Golder does not anticipate difficulties in excavating into the sandy outwash, as there are no indications of large boulders. At some locations KMC may encounter a thin zone of indurated sand within 1 to 1.5 feet of the ground surface.

4.4 Outwash Sample Geochemistry

1. Soil pH conditions in the northwest quarter of Section 12 of the study area are naturally acidic. A total of 26 samples that were laboratory-analyzed produced pH values ranging from 4.2 to 6.6 Of the 26 samples tested, 25 exhibited pH values less than 5.5, including seven less than 5.0. These acidic conditions are consistent with and conducive to the abundant growth of blueberries on the sandy soil of the Yellow Dog Plain.

Local concentrations of some heavy metals in study area soil samples are naturally elevated with respect to statewide averages. Mean concentrations exceed MDEQ-published Statewide Default Background Concentration criteria for the following metals: aluminum, barium, chromium, iron, and selenium. Maximum concentrations exceed the same statewide criteria for the following metals: aluminum, arsenic, barium, cobalt, chromium, iron, mercury, lithium, manganese, selenium, and zinc.

Maximum metal concentrations tend to be associated with the lowest soil pH values. Of the 26 samples that were analyzed, five exhibited pH values of 4.8 or less. These five samples collectively yielded the highest concentrations for 23 of the 48 metals tested. The ABL-040 sample alone accounted for 13 of those 23 maximum concentrations. This indicates that these heavy metals tend to accumulate in zones where they have been mobilized from overlying horizons under acidic conditions in the root zone.

4.5 Bedrock Structure

1. The most prominent bedrock feature in the area are the two peridotite outcrops.

A structural feature of the exposure is a series of six sub-parallel north-south trending furrows in the rock at intervals of approximately 150 feet. The deepest of these furrows is at the west end of the rock. These aligned features are inferred to be glacial erosional features oriented sub-parallel to the ice flow direction.

The east peridotite bedrock exposure is fractured; spacing between many of the fractures is on the order of approximately 1 to 5 meters. The range of surficial dip angles is consistent with that of the J2 discontinuity set. Surficial dip angles are more variable than the J2 set, although many of the surficial fracturing is high angle.

5.0 REFERENCES

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TABLES

TABLE 1
SOIL SAMPLE CLASSIFICATIONS
PROPOSED KENNECOTT EAGLE MINE SITE

Location	Soil Type	USCS	Description	Color
ABL-003	SAND	SP	Poorly graded fine sand with little percent of medium course sand, trace gravel, trace amounts of silt, abundant roots, moist, dark reddish brown	5YR 3/4
ABL-004	SAND	SW	Well graded fine to coarse sand, ~10% gravel, trace silt, some roots, damp, dark reddish brown	5YR 3/4
ABL-005	SAND	SP	Poorly graded fine sand with little medium - course sand, tr. gravel, tr. silt, abundant roots, moist, dk. reddish brown	5YR 3/4
ABL-006	SAND	SW	Well graded fine to coarse sand, trace gravel, trace silt, some roots, dry, dark reddish brown	5YR 3/4
ABL-007	SAND	SP	Poorly graded fine/medium sand, ~10% gravel, trace silt, some roots, damp, dark reddish brown	5YR 3/4
ABL-008	SAND	SP	Poorly graded fine sand, trace gravel, trace silt, some roots, damp, dark reddish brown	5YR 3/4
ABL-009	SAND	SP	Poorly graded fine sand, trace silt, damp, dense, dark reddish brown, trace roots	5YR 3/4
ABL-010	SAND	SP-SM*	Poorly graded fine sand, few % silt, damp dense, dark reddish brown, abundant roots	5YR 3/2
ABL-011	SAND	SP	Poorly graded fine sand, trace rounded gravel, trace silt, damp, dense, dark reddish brown, some roots	5YR 3/4
ABL-012	SAND	SP	Poorly graded fine/medium sand, trace silt, damp, dense, dark reddish brown, trace roots	5YR 3/4
ABL-013	SAND	SP	Poorly graded fine/medium sand, ~5% rounded gravel, trace silt, damp, dense, dark reddish brown, some roots	5YR 3/4
ABL-014	SAND	SW	Well graded fine/medium sand, ~30% rounded gravel, trace silt, trace roots, damp, dark reddish brown	5YR 3/4
ABL-015	SAND	SP	Poorly graded fine/medium sand, tr. round gravel, trace silt, damp, dense, indurated, dark reddish brown, tr. roots	5YR 3/4
ABL-016	SAND	SP*	Poorly graded fine/medium sand, trace gravel, trace silt, damp, dense, dark reddish brown, trace roots	5YR 3/4
ABL-017	SAND	SP-SM	Poorly graded fine sand, few % silt, damp, dense, dark reddish brown, trace roots	5YR 3/4
ABL-018	SAND & GRAVEL	SP	Poorly graded fine/medium sand, ~40% subround fn. - crs. gravel, trace silt, trace roots, damp, reddish brown	5YR 5/4
ABL-019	SAND	SW	Well graded fine to coarse sand, trace silt, damp, dense, dark reddish brown, trace roots	5YR 3/4
ABL-020	SAND	SP	Poorly graded, mostly fine sand, tr. med. - coarse sand; tr. silt, tr. clay, reddish brown, dense, moist	5YR 5/4
ABL-021	SAND	SP	Poorly graded fine/medium sand, trace silt, damp, dense, dark reddish brown, trace roots	5YR 3/4
ABL-022	SAND	SP-SM	Poorly graded fine sand, ~5% rounded gravel, few % silt, damp, dense, dark reddish brown, tr. roots	5YR 3/4
ABL-023	SAND	SP	Poorly graded fine sand, v. dense, indurated, tr. rounded fn. gravel, trace silt, sl. damp, dense, reddish brown, tr. roots	5YR 4/4
ABL-024	SAND	SP-SM	Poorly graded fine sand, few % silt, damp, dense, dark reddish brown, trace roots	5YR 3/4
ABL-025	SAND	SP	Poorly graded fine sand, ~5% rounded gravel, trace silt, sl. damp, dense, reddish brown	5YR 4/4
ABL-026	SAND	SP	Poorly graded fine/medium sand, dense, indurated, moist, trace roots, dark reddish brown	5YR 3/4
ABL-027	SAND	SP	Poorly graded medium/fine sand, trace silt, moist, dense, some roots, dark reddish brown	5YR 3/4
ABL-028	SAND	SP	Poorly graded fine sand, ~20% rounded gravel, trace silt, indurated, trace roots, damp, dense, dark reddish brown	5YR 3/4
ABL-029	SAND	SP	Poorly graded fine sand, trace gravel, trace silt, sl. moist, dense, trace roots, reddish brown	5YR 5/4
ABL-030	SAND	SP	Poorly graded medium/fine sand, little coarse sand, tr. silt, moist, dense, some roots, dk. reddish brown	5YR 3/4
ABL-031	SAND	SP	Poorly graded fine/medium sand, dense, moist, trace roots, dark reddish brown	5YR 3/4
ABL-032	SANDY GRAVEL	GW	Gravel, well graded, sub-angular to sub-rounded, with 40 percent fine sand with trace medium to course sand, tr. silt and clay, abundant roots, slightly moist, reddish brown.	5YR 5/4
ABL-033	SAND	SW	Well graded fine/medium sand, ~15% sub-rounded gravel, trace silt, some roots, moist, dark reddish brown	5YR 3/3
ABL-034	SAND	SP	Poorly graded, mostly fine sand, tr. med. - coarse sand; tr. silt, tr. clay, dk. reddish brown, dense, moist	5YR 3/4
ABL-035	SAND	SP	Poorly graded medium/fine sand, trace silt, dry, dense, trace roots, dark reddish brown	5YR 3/4
ABL-036	SAND	SP	Poorly graded, mostly fine sand, tr. med. - coarse sand; tr. silt, tr. clay, tr. roots, reddish brown, dense, moist	5YR 4/4
ABL-037	SAND	SP	Poorly graded, mostly fine sand, tr. med. - coarse sand; tr. silt, tr. clay, tr. subangular fn. gravel, reddish brown, dense, sl. indurated, moist	5YR 4/4
ABL-038	SAND	SP	Poorly graded, mostly fine sand, tr. med. - coarse sand; tr. silt, tr. clay, tr. roots, reddish brown, dense, moist	5YR 4/4
ABL-039	SAND	SP	Poorly graded, mostly fine sand, tr. med. - coarse sand; tr. silt, tr. clay, reddish brown, dense, moist, abundant roots	5YR 5/4
ABL-040	SAND	SP	Poorly graded fine sand with trace medium to course sand, few percent sub-rounded gravel, few percent silt and clay, abundant roots, moist, dk. reddish brown	5YR 3/4
ABL-041	SILTY SAND	SM	Poorly graded fine silty sand with few percent of medium to course sand, few percent sub-rounded gravel, few percent of silt and clay, abundant roots, moist, dk. reddish brown	5YR 3/4
ABL-043	SAND	SP-SM	Poorly graded fine sand with few percent of med. - crs. sand, few percent sub-angular to sub-rounded gravel, some cobbles, trace amounts of silt and clay, abundant roots, moist, dk. reddish brown	5YR 3/4
ABL-044	SAND	SP	Poorly graded fine sand, tr. silt, dense, indurated, trace fn. round gravel, dry, trace roots, dark reddish brown	5YR 3/3
ABL-045	SAND	SP*	Poorly graded, mostly fine sand, tr. med. - coarse sand; tr. silt, tr. clay, tr. subang. - subround fn. gravel, tr. roots, dk. reddish brown, dense, moist	5YR 3/4
ABL-046	SAND	SP	Poorly graded, fine sand with trace medium to course sand, few percent sub-rounded and sub-angular gravel, trace amounts of silt and clay, abundant roots, moist reddish brown	5YR 4/4
ABL-047	SAND	SP	Poorly graded, mostly fine sand, tr. med. - coarse sand; tr. silt, tr. clay, tr. subround fn. gravel, reddish brown, dense, moist	5YR 4/4
ABL-048	SAND	SP	Poorly graded medium/fine sand, trace silt, moist, dense, trace roots, reddish brown	5YR 4/4
ABL-049	SAND	SP	Poorly graded fine sand with trace medium sand, trace sub-rounded gravel, trace silt, abundant roots, moist, reddish brown	5YR 4/3

Note: Asterisk (*) indicates laboratory measurement by ASTM Method D-422.

TABLE 1
SOIL SAMPLE CLASSIFICATIONS
PROPOSED KENNECOTT EAGLE MINE SITE

ABL-050	SAND	SP	Poorly graded fine sand with trace medium to course sand, trace sub-rounded gravel, trace silt, abundant roots, moist, reddish brown	5YR 4/4
ABL-051	SAND	SP*	Poorly graded medium/fine sand, trace silt, moist, dense, trace roots, reddish brown	5YR 4/4
ABL-052	SAND	SP	Poorly graded medium/fine sand, trace silt, moist, dense, some roots, reddish brown	5YR 3/4
ABL-053	SAND	SP	Poorly graded fine/medium sand, ~5% rounded gravel, trace silt, dry, dense, dark reddish brown, some roots	5YR 3/4
ABL-054	SAND	SP	Poorly graded fine/medium sand, dry, strongly indurated, some roots, reddish brown	5YR 5/4
ABL-055	SAND	SP	Poorly graded, mostly fine sand, tr. med. - coarse sand; tr. silt, dk. reddish brown, dense, moist	5YR 3/4
ABL-056	SAND	SP	Poorly graded medium/fine sand, trace silt, moist, dense, abundant roots, dark reddish brown	5YR 3/3
ABL-057	SAND	SP-SM	Poorly graded, mostly fine sand, tr. med. - coarse sand; few % silt, tr. clay, ~ 15% subang. - subround fn. gravel, reddish brown, dense, indurated, moist	5YR 4/4
ABL-058	SAND	SW-SM	Well graded sand, fine to coarse, few % silt, few % fine gravel, moist, abundant roots, dark reddish brown	5YR 3/2
ABL-059	SAND	SP	Poorly graded fine/medium sand, trace rounded gravel, trace silt, dry, dense, reddish brown, trace roots	5YR 5/3
ABL-060	GRAVEL	GW	Well graded, round - subround, fn. - crs., with appx. 40 percent fn. - crs. sand, tr. silt, tr. clay, tr. roots, reddish brown, dense, moist	5YR 4/4
ABL-061	SAND	SP	Poorly graded medium/fine sand, trace silt, tr. fine gravel, moist, dense, abundant roots, reddish brown	5YR 5/4
ABL-062	SAND	SP	Poorly graded, mostly fine, tr. med. - coarse sand; tr. silt, sl. indurated, reddish brown, dense, moist	5YR 4/4
ABL-064	SAND	SP	Poorly graded fine sand with a little medium to course sand, few percent sub-angular gravel, trace silt and clay, abundant roots, sl. moist, reddish brown	5YR 5/3
ABL-065	SAND	SP	Poorly graded, mostly fine sand, tr. med. - coarse sand; tr. silt, tr. clay, tr. fn. gravel., occ. cobble, indurated, reddish brown, v. dense, sl. moist	5YR 4/4
ABL-066	SAND	SP	Poorly graded fine sand with few % medium to course sand, trace silt, moist, dense, dk. reddish brown	5YR 3/4
ABL-067	SAND	SP	Poorly graded fine sand with few % medium to course sand, trace silt, tr. rounded fine gravel, moist, dense, dk. reddish brown	5YR 3/3
ABL-068	SAND	SP	Poorly graded fine/medium sand, tr. silt, dense, moist, trace roots, dark reddish brown	5YR 3/3
ABL-069	SAND	SP	Poorly graded, mostly fine sand, few % med. - coarse sand; reddish brown, sl. dense, v. moist	5YR 5/3
ABL-070	SAND	SP-SM	Poorly graded fine/medium sand, few % silt, dense, damp, some roots, dark reddish brown	5YR 3/4
ABL-071	SAND	SP	Poorly graded fine/medium sand, tr. silt, dense to sl. indurated, moist, abundant roots, reddish brown	5YR 4/4
ABL-072	SAND	SP	Poorly graded fine/medium sand, few % silt, dense, damp, some roots, reddish brown	5YR 5/4
ABL-073	SAND	SP*	Poorly graded fine/medium sand, tr. silt dense, dry, trace roots, dark reddish brown	5YR 3/3
ABL-074	SAND	SP	Poorly graded fine/medium sand, tr. silt, tr. rounded fine gravel, dense, indurated, moist, trace roots, dark reddish brown	5YR 3/4
ABL-075	SAND	SP	Poorly graded, mostly fine sand, tr. med. - coarse sand; tr. silt, few % fn. - crs. gravel, occ. cobbles 3 - 4 inches diam., v. dk. reddish brown, dense, indurated, moist	5YR 2/4
ABL-076	SAND	SP	Poorly graded fine/medium sand, trace silt, damp, dense, reddish brown, trace roots	5YR 4/4
ABL-077	SAND	SW	Well graded, fine - coarse; tr. silt, few % round fine - crs. gravel, reddish brown, dense, sl. moist, some roots	5YR 4/4
ABL-078	SAND	SP	Poorly graded fine/medium sand, tr. silt, dense, indurated, moist, trace roots, dark reddish brown	5YR 4/4
ABL-079	SAND	SP	Poorly graded fine/medium sand, tr. silt, v. dense, occ. indurated, moist, trace roots, reddish brown	5YR 4/3
ABL-080	SAND	SP	Poorly graded fine/medium sand, tr. silt, v. dense, occ. indurated, sl. moist, trace roots, reddish brown	5YR 5/3
ABL-081	SAND	SP-SM	Poorly graded fine sand with trace medium to course sand, trace sub-rounded gravel, few % silt, abundant roots, moist, reddish brown	5YR 4/3
ABL-082	SAND	SP*	Poorly graded, mostly fine sand, tr. med. - coarse sand; tr. silt, tr. clay, tr. round fn. gravel, reddish brown, dense, sl. moist	5YR 4/4
ABL-083	SAND	SP	Poorly graded fine/medium sand, trace silt, tr. rounded fine gravel, moist, dense, dark reddish brown, abundant roots	5YR 3/4
ABL-084	SAND	SP	Poorly graded fine/medium sand, trace silt, trace roots, moist, indurated, dark reddish brown	5YR 3/2
DPR-003	SAND	SP	Poorly graded fine sand, trace amounts of coarse sand, trace silt, ~5% organic material (roots), dry, dark reddish brown	5YR 3/4
DPR-004	SAND	SP	Poorly graded fine sand, trace amounts of coarse sand, trace silt, moist, dark reddish brown	5YR 3/3
DPR-005	SAND	SP	Poorly graded fine sand with little percent of medium course sand, few percent subangular gravel, trace amounts of silt and clay, abundant roots, moist, dark reddish brown	5YR 3/4
DPR-006	SAND	SP	Poorly graded fine sand, trace amounts of coarse sand, trace amounts of silt, moist, dark reddish brown	5YR 3/3
DPR-007	SAND	SP	Poorly graded fine sand with little percent of medium course sand, trace rounded gravel, trace amounts of silt and clay, moist, dark reddish brown	5YR 3/4
DPR-008	SAND	SP	Poorly graded fine sand with little percent of medium course sand, trace rounded gravel, trace amounts of silt and clay, moist, dark reddish brown	5YR 3/4
DPR-009	SAND	SP	Poorly graded fine sand with little percent of medium course sand, few percent subangular gravel, trace amounts of silt and clay, moist, dark reddish brown	5YR 3/4
DPR-010	SAND	SP	Poorly graded fine sand with little percent of medium course sand, trace subangular gravel, trace amounts of silt and clay, moist, dark reddish brown	5YR 3/4
DPR-011	SAND	SP	Poorly graded fine sand with little percent of medium course sand, trace amounts of silt and clay, trace roots, Moist Dark Reddish Brown	5YR 3/4
DPR-012	SAND	SP	Poorly graded fine sand, trace amounts of coarse sand, trace silt, moist, reddish brown	5YR 4/4
DPR-013	SAND	SP	Poorly graded fine sand with little percent of medium course sand, few percent subangular gravel, trace amounts of silt and clay, moist, dark reddish brown	5YR 3/4
DPR-014	SAND	SP*	Poorly graded fine sand with little percent of medium course sand, few percent subangular gravel, trace amounts of silt and clay, moist, dark reddish brown	5YR 3/4
DPR-015	SAND	SP	Poorly graded sand, ~15% rounded gravel, trace silt, trace roots, dry, dark reddish brown	5YR 3/3

Note: Asterisk (*) indicates laboratory measurement by ASTM Method D-422.

TABLE 1
SOIL SAMPLE CLASSIFICATIONS
PROPOSED KENNECOTT EAGLE MINE SITE

DPR-017	SAND	SP	Poorly graded sand, ~15% rounded gravel, trace silt, trace roots, moist, dark reddish brown	5YR 3/4
DPR-018	SAND	SP	Poorly graded sand, ~15% rounded gravel, trace silt, trace roots, moist, dark reddish brown	5YR 3/4
DPR-019	SAND	SP	Poorly graded, mostly fine, tr. med - coarse sand; indurated, tr. fine rounded gravel, tr. silt, tr. clay, dk. reddish brown, dense, moist	5YR 3/4
DPR-020	SAND	SP*	Poorly graded, mostly fine, tr. med - coarse sand; tr. silt, tr. clay, reddish brown, dense, moist	5YR 4/4
DPR-021	SAND	SP-SM	Poorly graded, mostly fine, tr. med - coarse sand; few % silt, tr. clay, tr. subround. fine - crs. gravel,tr. roots, reddish brown, dense, moist	5YR 4/4
DPR-022	SAND	SP	Poorly graded, mostly fine, tr. med - coarse sand; tr. silt, tr. clay, reddish brown, dense, moist	5YR 4/4
DPR-023	SAND	SP	Poorly graded, mostly fine, tr. med - coarse sand; tr. silt, tr. clay, reddish brown, dense, moist	5YR 5/4
DPR-024	SAND	SP	Poorly graded, mostly fine, tr. med - coarse sand; tr. silt, tr. clay, tr. subrnd. fine gravel, reddish brown, dense, moist	5YR 5/4
DPR-025	SAND	SP	Poorly graded, mostly fine, tr. med - coarse sand; tr. silt, tr. clay, tr. sub-ang. - subrnd. fine gravel, reddish brown, dense, moist	5YR 5/4
DPR-026	SAND	SP	Poorly graded, mostly fine, tr. med - coarse sand; tr. silt, tr. clay, reddish brown, dense, moist	5YR 5/4
DPR-027	SAND	SP	Poorly graded, mostly fine, tr. med - coarse sand; tr. silt, tr. clay, reddish brown, dense, moist	5YR 4/4
DPR-028	SAND	SP	Poorly graded, mostly fine, tr. med - coarse sand; tr. silt, tr. clay, reddish brown, dense, moist	5YR 4/4
DPR-032	SAND	SP	Poorly graded, mostly fine, tr. med - coarse sand; tr. silt, tr. clay, dk. reddish brown, dense, v. moist	5YR 2.5/2
DPR-034	SAND	SP	Poorly graded, mostly fine, tr. med - coarse sand; tr. silt, tr. clay, occ. small cobble, reddish brown, dense, moist	5YR 4/4
DPR-035	SAND	SW	Well graded, mostly fine, some fine - coarse sand; tr. silt, tr. clay, reddish brown, dense, moist	5YR 4/4
DPR-037	SAND	SW	Well graded, mostly fine, tr. fine - coarse sand; tr. subround crs. gravel, tr. silt, tr. clay, dk. reddish brown, dense, moist	5YR 3/4
DPR-038	SAND	SW	Well graded, mostly fine - med., little coarse sand; tr. Gravel, tr. silt, tr. clay, dk. reddish brown, dense, moist	5YR 3/4
DPR-039	SAND	SW	Well graded, mostly fine, tr. fine - coarse sand; tr. silt, tr. clay, reddish brown, dense, moist, some roots	5YR 4/4
DPR-040	SAND	SP	Poorly graded, mostly fine, tr. med - coarse sand; indurated, tr. silt, tr. clay, dk. reddish brown, very dense, dry	5YR 3/4
DPR-041	SAND	SP	Poorly graded, mostly fine, tr. med - coarse sand; tr. silt, tr. clay, reddish brown, dense, moist, trace roots	5YR 4/4
DPR-042	SAND	SW	Well graded, mostly fine, tr. fine - coarse sand; few % subround fn. - crs. gravel, tr. silt, tr. clay, dk. reddish brown, dense, moist	5YR 3/4
DPR-043	SAND	SP	Poorly graded, mostly fine, tr. med - coarse sand; tr. subround fn. gravel, tr. silt, tr. clay, reddish brown, dense, moist, trace roots	5YR 4/4
DPR-044	SAND	SP	Poorly graded, mostly fine, tr. med - coarse sand; indurated, trace rounded gravel, tr. silt, tr. clay, reddish brown, dense, moist	5YR 4/4
DPR-045	SAND	SP	Poorly graded sand, mostly fine, trace med - coarse sand; trace silt, dark reddish brown, dense, moist, trace roots	5YR 3/4
DPR-047	SAND & GRAVEL	SW	Well graded fine sand and ~ 30% rounded gravel, trace silt, moist, dark reddish brown	5YR 3/3
DPR-048	SAND	SP	Poorly graded fine sand, ~10% gravel, trace silt, moist, dark reddish brown	5YR 3/4
DPR-049	SAND	SP	Poorly graded, mostly fine, tr. med - coarse sand; tr. round fn. gravel, tr. silt, tr. clay, reddish brown, dense, moist	5YR 4/4
DPR-050	SAND	SP*	Poorly graded fine sand, trace silt, dense, moist, dark reddish brown, trace roots	5YR 3/4
DPR-051	SAND	SP	Poorly graded fine sand, trace silt, dense, moist, dark reddish brown, trace roots	5YR 3/4
DPR-052	SAND	SP	Poorly graded fine sand, ~10% rounded gravel, trace coarse/medium sand, trace silt, moist, dark reddish brown	5YR 3/4
DPR-053	SAND	SP	Poorly graded fine sand, ~10% rounded gravel, trace coarse/medium sand, trace silt, moist, dark reddish brown	5YR 3/4
DPR-054	SAND	SP	Poorly graded fine sand, ~10% rounded gravel, trace coarse/medium sand, trace silt, moist, dark reddish brown	5YR 3/4
DPR-056	SAND	SP*	Poorly graded fine sand, ~10% rounded gravel, trace coarse/medium sand, trace silt, moist, dark reddish brown	5YR 3/3
DPR-057	SAND	SP	Poorly graded fine sand, dense, damp, reddish brown, trace roots	5YR 4/3
DPR-058	SAND	SP	Poorly graded fine sand, ~10% gravel, trace silt, moist, dark reddish brown	5YR 3/3
DPR-061	SAND	SP	Poorly graded fine sand, ~10% gravel, trace silt, moist, dark reddish brown	5YR 3/4
DPR-062	SAND	SP	Poorly graded fine sand, trace gravel, trace silt, moist, dark reddish brown, abundant roots	5YR 3/3
DPR-063	SAND	SW	Well graded sand, ~30% gravel, trace silt, trace medium and coarse sand, dry, dark reddish brown, abundant roots	5YR 3/2
DPR-064	SAND	SW	Well graded sand, ~30% gravel, trace silt, trace medium and coarse sand, dry, dark reddish brown, abundant roots	5YR 3/2
DPR-065	SAND	SW	Well graded sand, ~30% gravel, trace silt, trace medium and coarse sand, dry, dark reddish brown, trace roots	5YR 3/3
DPR-066	SAND	SP	Poorly graded fine/medium sand, trace gravel, trace silt, moist, dark reddish brown	5YR 3/3
DPR-068	SAND	SP	Poorly graded fine/medium sand, trace silt, moist, dark reddish brown	5YR 3/3
DPR-069	SAND	SP	Poorly graded, mostly fine, few % med. - crs. sand, tr. med. - coarse sand; tr. silt, tr. clay, ~5% rounded gravel, dk. reddish brown, dense - v. dense to indurated, moist	5YR 3/4

Note: Asterisk (*) indicates laboratory measurement by ASTM Method D-422.

TABLE 2
GRAIN SIZE DISTRIBUTION MEASUREMENTS
PROPOSED KENNECOTT EAGLE MINE SITE

SAMPLE NUMBER	U.S.C.S. SOIL CLASS	DELIVERED MOISTURE (%)	GRAIN SIZE DISTRIBUTION					
			% Finer 1 1/2"	% FINER 1/2"	% FINER 3/8"	% FINER #4	% FINER #40	% FINER #200
ABL-010 061504	SP-SM	8.7	100.0	100.0	98.9	97.9	71.1	5.6
ABL-016 061504	SP	6.7	100.0	100.0	99.0	98.3	64.1	2.2
ABL-045 061604	SP	8.1	100.0	99.2	98.9	98.0	78.1	3.7
ABL-051 061604	SP	5.4	100.0	100.0	100.0	99.8	74.3	1.6
ABL-073 061604	SP	8.4	100.0	100.0	98.9	95.6	57.6	4.3
ABL-082 061604	SP	5.3	100.0	100.0	99.6	98.9	56.0	2.2
DPR-014 061504	SP	5.4	100.0	100.0	100.0	98.4	34.1	2.2
DPR-020 061604	SP	4.8	100.0	100.0	100.0	99.6	64.7	1.4
DPR-050 061704	SP	6.6	100.0	100.0	100.0	99.4	85.4	2.4
DPR-056 061704	SP	16.8	100.0	100.0	100.0	99.3	65.5	4.9

Notes:
1. Samples collected June 15 - 17, 2004 in Sections 11 and 12.
2. Measurements made at Golder/Lansing. Michigan using ASTM Method D-422.

TABLE 3
SOIL ANALYTICAL RESULTS
PROPSOSED KENNECOTT EAGLE MINE SITE

SAMPLE	pH	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs
LOCATION	S.U.	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
ABL-021	5.2	0.06	4.14	4.5	530	1.11	0.21	0.46	0.12	60.0	6.1	56	1.40
ABL-022	5.1	0.04	3.93	3.1	520	0.79	0.11	0.27	0.07	32.7	3.3	26	1.48
ABL-023	5.2	0.04	4.47	3.8	510	0.84	0.17	0.31	0.08	53.1	4.7	38	1.60
ABL-024	5.1	0.05	4.55	4.1	530	1.04	0.17	0.35	0.09	53.3	6.7	44	1.72
ABL-025	5.4	0.07	4.19	5.2	480	0.92	0.20	0.33	0.10	59.5	7.0	53	1.58
ABL-026	6.6	0.05	4.95	4.9	570	0.56	0.13	0.34	0.07	30.6	4.1	44	1.22
ABL-027	5.2	0.06	4.07	4.2	520	0.56	0.14	0.35	0.08	37.9	5.2	57	0.91
ABL-028	5.4	0.08	4.51	9.0	510	0.62	0.18	0.26	0.09	34.5	4.1	35	1.44
ABL-029	5.4	0.10	4.73	4.1	570	0.68	0.12	0.34	0.09	44.6	5.1	30	1.23
ABL-030	4.8	0.16	5.35	5.3	510	1.04	0.19	0.51	0.11	49.5	9.1	52	1.74
ABL-036	5.1	0.07	4.12	3.9	570	0.53	0.12	0.33	0.06	28.3	4.2	32	0.94
ABL-037	5.0	0.08	4.86	4.4	560	0.85	0.13	0.44	0.10	42.3	6.3	45	1.38
ABL-038	4.6	0.04	4.02	3.1	500	0.63	0.08	0.45	0.07	33.4	4.3	39	0.93
ABL-039	4.9	0.14	4.80	4.9	510	0.88	0.18	0.52	0.12	55.0	8.3	55	1.57
ABL-040	4.2	0.29	5.19	8.6	440	0.87	0.19	0.46	0.27	40.0	9.6	46	1.50
ABL-046	5.3	0.05	4.50	5.2	490	1.14	0.18	0.55	0.15	53.4	8.5	52	1.48
ABL-048	4.6	0.08	4.54	11.3	500	0.83	0.19	0.42	0.12	47.4	6.1	48	1.75
ABL-049	4.8	0.07	4.12	4.2	470	0.86	0.16	0.43	0.12	52.3	6.1	52	1.60
DPR-021	4.9	0.05	3.88	3.1	580	0.54	0.09	0.27	0.07	30.2	4.1	24	1.16
DPR-022	5.3	0.06	3.63	3.3	550	0.59	0.09	0.27	0.06	34.8	4.4	22	1.08
DPR-023	5.2	0.09	3.15	3.5	560	0.55	0.11	0.36	0.08	42.4	3.7	24	0.80
DPR-024	5.2	0.06	3.70	3.2	550	0.66	0.11	0.36	0.07	43.6	5.3	30	0.89
DPR-025	5.3	0.05	4.05	2.9	540	0.70	0.10	0.44	0.06	32.4	5.1	27	0.96
DPR-026	5.4	0.05	3.75	2.7	590	0.56	0.06	0.27	0.05	35.0	4.0	18	0.98
DPR-027	5.1	0.06	4.68	3.8	510	0.77	0.11	0.51	0.07	44.0	5.6	33	0.99
DPR-028	5.3	0.05	3.85	3.0	540	0.62	0.11	0.39	0.07	34.5	5.7	33	0.97
BLANK	NM	<.02	<.01	<.2	<10	<.05	<.01	<.01	<.02	<.01	<.1	<1	<.05
	Michigan Default Background (ppm) (Note 3)												
	-	1.0	0.69	5.8	75	-	-	-	1.2	-	6.8	18	-
	Statistical Analyses												
Mean	5.1	0.08	4.30	4.6	527	0.76	0.14	0.38	0.09	42.5	5.6	39	1.28
Std. Dev.	0.4	0.05	0.52	2.0	37	0.19	0.04	0.09	0.04	9.6	1.7	12	0.31
Maximum	6.6	0.29	5.35	11.3	590	1.14	0.21	0.55	0.27	60.0	9.6	57	1.75
Minimum	4.2	0.04	3.15	2.7	440	0.53	0.06	0.26	0.05	28.3	3.3	18	0.80

Notes:
1. Samples collected by Golder Associates Inc., June 15 - 17, 2004.
2. Samples analyzed by ALS Chemex, Thunder Bay, Ontario.
3. Michigan Act 451, Part 201, Rule 746 Table 2 (Statewide Default Background Concentrations)
4. Element Abbreviations:

Ag:	Silver	Be:	Beryllium	Ce:	Cerium
Al:	Aluminum	Bi:	Bismuth	Co:	Cobalt
As:	Arsenic	Ca:	Calcium	Cr:	Chromium
Ba:	Barium	Cd:	Cadmium	Cs:	Cesium

TABLE 3
SOIL ANALYTICAL RESULTS
PROPSOSED KENNECOTT EAGLE MINE SITE

SAMPLE	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li	Mg	Mn
LOCATION	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm
ABL-021	8.7	5.84	12.80	0.19	5.1	0.02	0.034	2.27	33.0	7.9	0.25	601
ABL-022	5.6	2.39	10.00	0.13	3.4	0.02	0.021	2.39	15.5	9.0	0.17	231
ABL-023	6.9	3.90	11.85	0.17	5.4	0.03	0.030	2.28	24.9	11.3	0.23	376
ABL-024	7.9	4.28	11.75	0.16	5.2	0.02	0.035	2.39	26.1	11.6	0.26	480
ABL-025	9.5	5.81	12.05	0.20	5.7	0.03	0.038	2.25	27.6	10.8	0.25	560
ABL-026	9.0	3.84	10.70	0.11	4.2	0.07	0.022	2.39	19.8	7.6	0.24	357
ABL-027	8.6	6.76	7.71	0.13	3.8	0.03	0.021	2.38	18.8	5.7	0.26	676
ABL-028	9.5	3.69	12.65	0.14	5.1	0.08	0.029	2.42	19.9	9.5	0.21	447
ABL-029	10.7	3.27	10.90	0.14	5.0	0.06	0.022	2.59	24.5	9.6	0.26	341
ABL-030	13.7	4.95	13.45	0.17	4.9	0.07	0.039	2.23	25.5	15.8	0.38	476
ABL-036	6.8	3.44	7.61	0.10	2.9	0.04	0.019	2.51	18.0	6.2	0.23	367
ABL-037	13.5	4.01	11.45	0.13	5.2	0.05	0.025	2.54	23.0	11.8	0.29	387
ABL-038	6.0	3.81	7.59	0.10	3.3	0.03	0.014	2.25	15.8	5.5	0.26	431
ABL-039	12.9	4.99	13.10	0.16	4.7	0.05	0.032	2.18	32.9	13.4	0.34	476
ABL-040	18.0	4.79	12.80	0.14	4.5	0.15	0.038	1.79	23.8	14.5	0.32	772
ABL-046	11.3	5.42	11.80	0.18	4.0	0.03	0.038	2.17	27.3	11.4	0.36	578
ABL-048	10.2	4.83	13.05	0.18	4.7	0.07	0.032	2.23	26.1	11.0	0.29	494
ABL-049	9.0	4.69	12.05	0.19	3.6	0.05	0.027	2.03	26.2	10.2	0.25	488
DPR-021	7.1	2.35	8.68	0.10	3.3	0.03	0.015	2.65	16.0	7.3	0.19	334
DPR-022	7.9	2.54	8.16	0.11	5.1	0.03	0.016	2.53	19.6	7.3	0.20	318
DPR-023	7.1	2.58	6.80	0.12	3.6	0.01	0.016	2.61	19.0	4.9	0.21	383
DPR-024	8.6	3.46	7.77	0.13	4.6	0.01	0.016	2.56	21.4	6.0	0.24	407
DPR-025	7.6	2.98	8.79	0.11	3.3	0.03	0.015	2.37	17.0	7.1	0.24	317
DPR-026	7.1	1.78	7.33	0.10	2.9	0.03	0.012	2.72	15.0	6.5	0.19	253
DPR-027	11.9	3.46	9.53	0.15	5.2	0.03	0.019	2.20	21.9	8.4	0.28	385
DPR-028	6.5	3.27	8.69	0.12	3.5	0.01	0.016	2.41	18.6	6.8	0.24	374
BLANK	<.2	<.01	0.07	<.05	<.1	NM	<.005	<.01	<.5	<.2	<.01	<5
	Michigan Default Background (ppm) (Note 3)											
	32	0.12	-	-	-	0.13	-	-	-	9.8	-	440
	Statistical Analyses											
Mean	9.3	3.97	10.35	0.14	4.3	0.04	0.025	2.36	22.2	9.1	0.26	435
Std. Dev.	2.9	1.23	2.19	0.03	0.9	0.03	0.009	0.21	5.0	2.9	0.05	126
Maximum	18.0	6.76	13.45	0.20	5.7	0.15	0.039	2.72	33.0	15.8	0.38	772
Minimum	5.6	1.78	6.80	0.10	2.9	0.01	0.012	1.79	15.0	4.9	0.17	231

Notes: 1. Samples collected by Golder Associates Inc., June 15 - 17, 2004.
2. Samples analyzed by ALS Chemex, Thunder Bay, Ontario.
3. Michigan Act 451, Part 201, Rule 746 Table 2 (Statewide Default Background Concentrations)
4. Element Abbreviations:

Cu:	Copper	Hf:	Hafnium	La:	Lanthanum
Fe:	Iron	Hg:	Mercury	Li:	Lithium
Ga:	Gallium	In:	Indium	Mg:	Magnesium
Ge:	Germanium	K:	Potassium	Mn:	Manganese

TABLE 3
SOIL ANALYTICAL RESULTS
PROPSOSED KENNECOTT EAGLE MINE SITE

SAMPLE	Mo	Na	Nb	Ni	P	Pb	Rb	Re	S	Sb	Se	Sn
LOCATION	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
ABL-021	0.91	0.73	12.0	13.0	220	17.6	79.7	<0.002	0.01	1.20	1	2.3
ABL-022	0.59	0.44	6.2	8.6	420	13.3	82.1	<0.002	0.01	0.60	1	1.3
ABL-023	0.80	0.41	8.6	8.9	410	16.6	81.3	<0.002	0.02	0.89	1	1.7
ABL-024	0.88	0.46	10.6	12.6	600	16.8	85.0	<0.002	0.02	1.00	1	1.8
ABL-025	0.97	0.40	11.2	13.1	660	18.2	81.3	<0.002	0.01	1.18	1	2.1
ABL-026	0.76	0.54	8.1	10.0	500	14.0	65.7	<0.002	0.02	0.82	2	1.3
ABL-027	0.63	0.46	8.5	8.6	460	13.4	59.3	<0.002	0.01	0.89	2	1.6
ABL-028	0.99	0.39	8.6	7.8	740	18.3	75.6	<0.002	0.02	0.86	2	1.6
ABL-029	0.72	0.49	8.4	10.8	550	13.8	70.6	<0.002	0.03	0.62	2	1.3
ABL-030	0.94	0.62	10	19.3	560	16.6	78.2	<0.002	0.03	0.93	1	2.0
ABL-036	0.63	0.52	7.7	7.7	370	11.8	56.6	<0.002	0.01	0.74	1	1.4
ABL-037	0.77	0.62	8.7	12.2	460	15.3	79.1	<0.002	0.01	0.73	2	1.4
ABL-038	0.40	0.60	5.8	7.8	420	11.3	58.1	<0.002	0.01	0.55	1	1.1
ABL-039	0.83	0.67	11.7	14.7	490	17.3	74.8	<0.002	0.01	0.86	2	1.7
ABL-040	1.16	0.55	9.9	16.5	960	20.8	59.8	<0.002	0.03	0.92	3	1.8
ABL-046	0.78	0.63	9.9	18.4	600	16.6	74.4	<0.002	0.01	1.12	1	2.0
ABL-048	0.82	0.54	9.3	13.2	500	16.9	78.1	<0.002	0.01	0.96	1	1.8
ABL-049	0.74	0.56	8.1	10.9	470	15.0	75.7	<0.002	0.02	0.83	1	1.6
DPR-021	0.45	0.41	6.5	7.2	360	12.7	80.3	<0.002	0.01	0.57	1	1.1
DPR-022	0.52	0.41	6.8	8.4	240	12.4	76.8	<0.002	0.01	0.61	1	1.1
DPR-023	0.36	0.39	7.4	6.1	360	12.2	77.0	<0.002	0.01	0.89	1	1.1
DPR-024	0.50	0.47	7.7	8.9	210	13.1	73.3	<0.002	0.01	0.69	1	1.3
DPR-025	0.41	0.66	6.2	9.0	280	12.9	70.3	<0.002	0.01	0.57	1	1.1
DPR-026	0.34	0.41	5.4	7.0	210	11.8	80.8	<0.002	0.01	0.51	1	0.9
DPR-027	0.57	0.68	7.4	10.2	420	14.7	62.4	<0.002	0.01	0.57	2	1.2
DPR-028	0.43	0.53	7.0	16.0	430	12.7	70.7	<0.002	0.01	0.61	1	1.2
BLANK	<.05	<.01	<.1	<.2	<10	<.5	0.3	<.002	<.01	<.05	1	<.2
	Michigan Default Background (ppm) (Note 3)											
	-	-	-	20.0	-	21	-	-	-	-	0.41	-
	Statistical Analyses											
Mean	0.69	0.52	8.4	11.0	458	14.9	73.3	<0.002	0.01	0.80	1	1.5
Std. Dev.	0.22	0.10	1.8	3.6	171	2.5	8.2	<0.002	0.01	0.20	1	0.4
Maximum	1.16	0.73	12.0	19.3	960	20.8	85.0	<0.002	0.03	1.20	3	2.3
Minimum	0.34	0.39	5.4	6.1	210	11.3	56.6	<0.002	0.01	0.51	1	0.9

Notes: 1. Samples collected by Golder Associates Inc., June 15 - 17, 2004.
2. Samples analyzed by ALS Chemex, Thunder Bay, Ontario.
3. Michigan Act 451, Part 201, Rule 746 Table 2 (Statewide Default Background Concentrations)
4. Element Abbreviations:

Mo:	Molybdenum	P:	Phosphorus	S:	Sulfur
Na:	Sodium	Pb:	Lead	Sb:	Antimony
Nb:	Niobium	Rb:	Rubidium	Se:	Selenium
Ni:	Nickel	Re:	Rhenium	Sn:	Tin

TABLE 3
SOIL ANALYTICAL RESULTS
PROPSOSED KENNECOTT EAGLE MINE SITE

SAMPLE	Sr	Ta	Te	Th	Ti	Tl	U	V	W	Y	Zn	Zr
LOCATION	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
ABL-021	122	0.95	<0.05	12.2	0.69	0.46	2.6	160	1.3	17.7	42	160
ABL-022	88	0.49	<0.05	6.5	0.31	0.46	1.4	56	0.6	12.9	29	115
ABL-023	82	0.73	<0.05	9.1	0.50	0.45	2.2	98	0.9	16.2	31	178
ABL-024	89	0.85	0.05	10.1	0.59	0.47	2.2	110	0.9	16.8	33	169
ABL-025	84	0.78	<0.05	9.8	0.66	0.46	2.4	149	1.1	21.0	41	188
ABL-026	83	0.49	<0.05	5.8	0.47	0.35	1.6	97	0.6	15.1	36	167
ABL-027	71	0.57	<0.05	6.2	0.79	0.31	1.7	181	0.7	18.7	45	215
ABL-028	73	0.60	0.05	7.8	0.46	0.44	2.1	86	0.8	14.1	36	157
ABL-029	87	0.55	<0.05	8.6	0.47	0.38	1.8	80	0.6	13.6	32	178
ABL-030	107	0.78	<0.05	9.6	0.54	0.43	2.2	124	0.9	17.6	58	159
ABL-036	80	0.48	<0.05	5.0	0.45	0.30	1.4	84	0.7	14.1	29	116
ABL-037	111	0.54	<0.05	8.6	0.44	0.46	2.0	99	0.7	13.1	36	211
ABL-038	89	0.47	<0.05	13.5	0.43	0.27	1.3	88	0.4	11.5	44	159
ABL-039	121	2.72	<0.05	10.5	0.53	0.45	2.1	126	0.9	14.8	47	168
ABL-040	101	0.61	0.05	9.2	0.52	0.40	2.0	118	0.9	13.4	68	182
ABL-046	115	0.77	<0.05	9.1	0.59	0.41	2.1	135	1.1	21.6	42	119
ABL-048	100	0.71	<0.05	10.6	0.57	0.45	2.0	125	0.8	16.5	41	146
ABL-049	105	0.63	<0.05	9.2	0.47	0.42	1.8	117	1.7	16.0	35	116
DPR-021	75	0.44	<0.05	5.1	0.35	0.46	1.4	56	0.6	10.5	32	132
DPR-022	77	0.41	<0.05	6.1	0.41	0.43	1.6	63	0.5	10.9	23	191
DPR-023	79	0.47	<0.05	5.4	0.46	0.40	1.4	62	0.7	13.0	16	143
DPR-024	82	0.54	<0.05	6.5	0.50	0.37	1.8	84	0.6	14.4	23	178
DPR-025	113	0.44	<0.05	4.8	0.36	0.37	1.3	69	0.5	9.5	21	126
DPR-026	74	0.35	<0.05	4.3	0.28	0.44	1.3	40	0.5	13.1	18	113
DPR-027	115	0.51	<0.05	9.2	0.42	0.34	1.9	80	0.5	13.2	29	185
DPR-028	92	0.47	<0.05	5.5	0.39	0.37	1.4	76	0.6	11.7	25	131
BLANK	<.2	<.05	<.05	<.2	<.005	<.02	<.1	<1	<.1	<.1	<2	<.5
	Michigan Default Background (ppm) (Note 3)											
	-	-	-	-	-	-	-	-	-	-	47	-
	Statistical Analyses											
Mean	93	0.67	0.05	8.0	0.48	0.41	1.8	99	0.8	14.7	35	158
Std. Dev.	16	0.44	0	2.4	0.12	0.06	0.4	35	0.3	3.0	12	30
Maximum	122	2.72	0.05	13.5	0.79	0.47	2.6	181	1.7	21.6	68	215
Minimum	71	0.35	0.05	4.3	0.28	0.27	1.3	40	0.4	9.5	16	113

Notes: 1. Samples collected by Golder Associates Inc., June 15 - 17, 2004.
2. Samples analyzed by ALS Chemex, Thunder Bay, Ontario.
3. Michigan Act 451, Part 201, Rule 746 Table 2 (Statewide Default Background Concentrations)
4. Element Abbreviations:

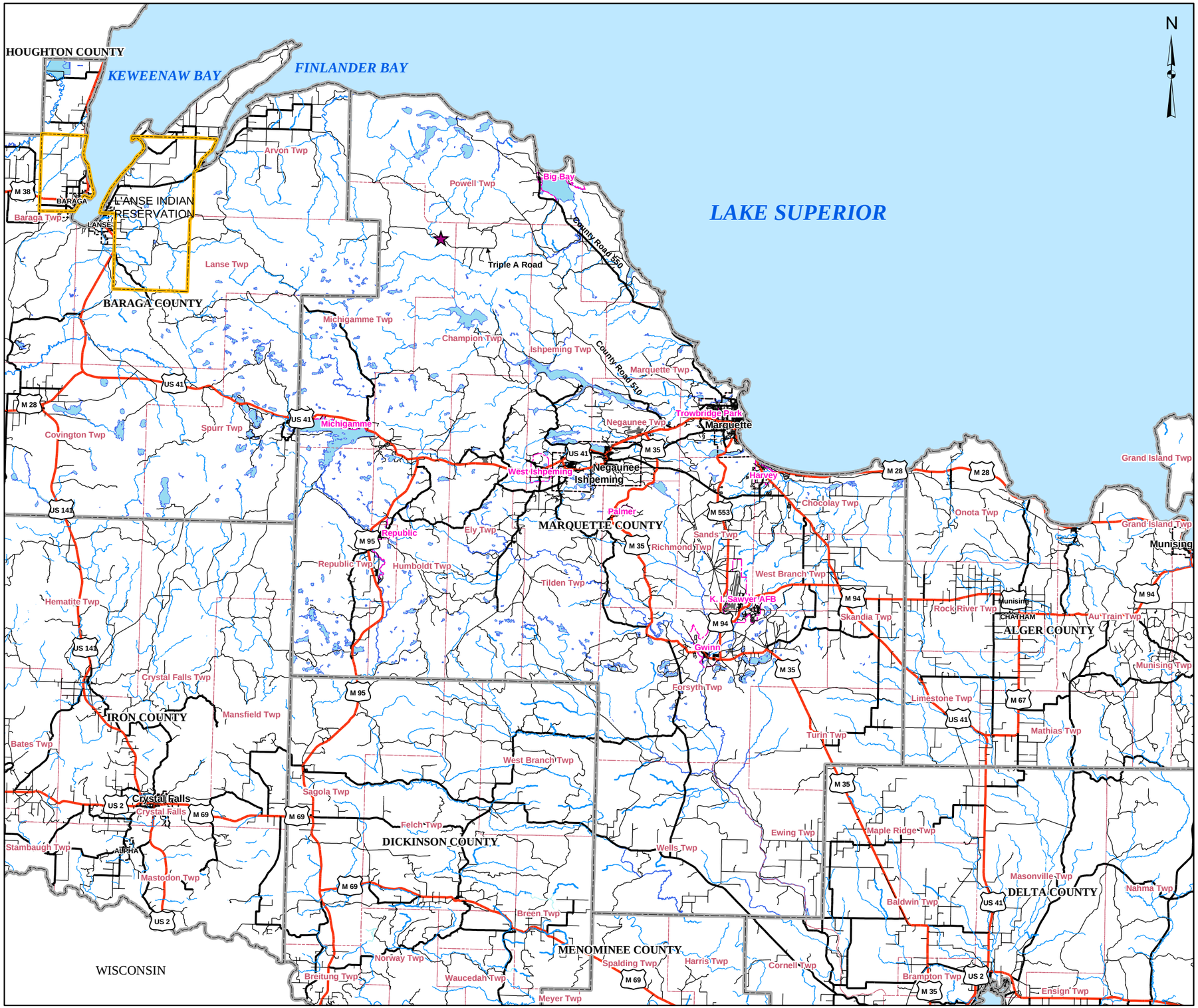
Sr:	Strontium	Ti:	Titanium	W:	Tungsten
Ta:	Tantalum	Tl:	Thallium	Y:	Yttrium
Te:	Tellurium	U:	Uranium	Zn:	Zinc
Th:	Thorium	V:	Vanadium	Zr:	Zirconium

TABLE 4
BEDROCK FRACTRURE ORIENTATION MEASUREMENTS
PROPOSED KENNECOTT EAGLE MINE SITE

Location	Dip	Dip Direction
ABL-085	90°	294°
ABL-086	79°	335°
ABL-087	63°	317°
ABL-089	36°	311°
ABL-091	35°	022°
	80°	088°
ABL-092	50°	020°
	78°	292°
ABL-093	79°	046°
	54°	338°

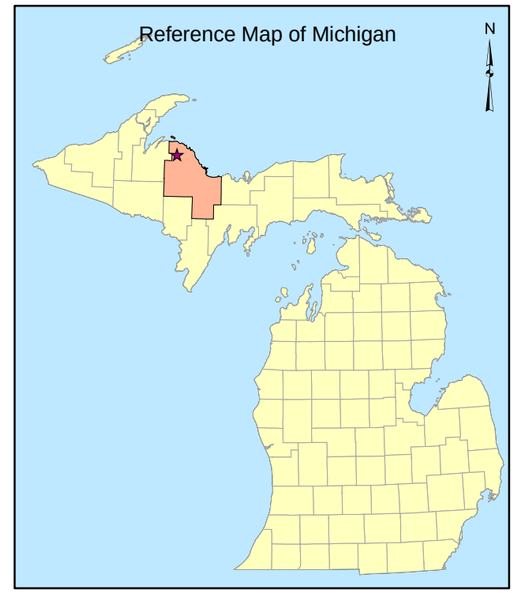
Notes:
1. Measurements performed June 18, 2004 on Eagle East peridotite exposure.

FIGURES



LEGEND

- PROPOSED EAGLE PROJECT
- US HIGHWAY
- COUNTY ROAD
- MINOR ROAD
- AIRPORT
- HYDROGRAPHY
- MUNICIPAL BOUNDARY
- CENSUS DESIGNATED PLACE
- TOWNSHIP
- COUNTY
- INDIAN RESERVATION



REFERENCE

Digital data provided by Michigan Center for Geographic Information (CGI) (http://www.michigan.gov/cgi) and ESRI.
Datum: NAD 83 Projection: Michigan GeoRef (Meters)

10 5 0 10
SCALE: 1:500,000 MILES

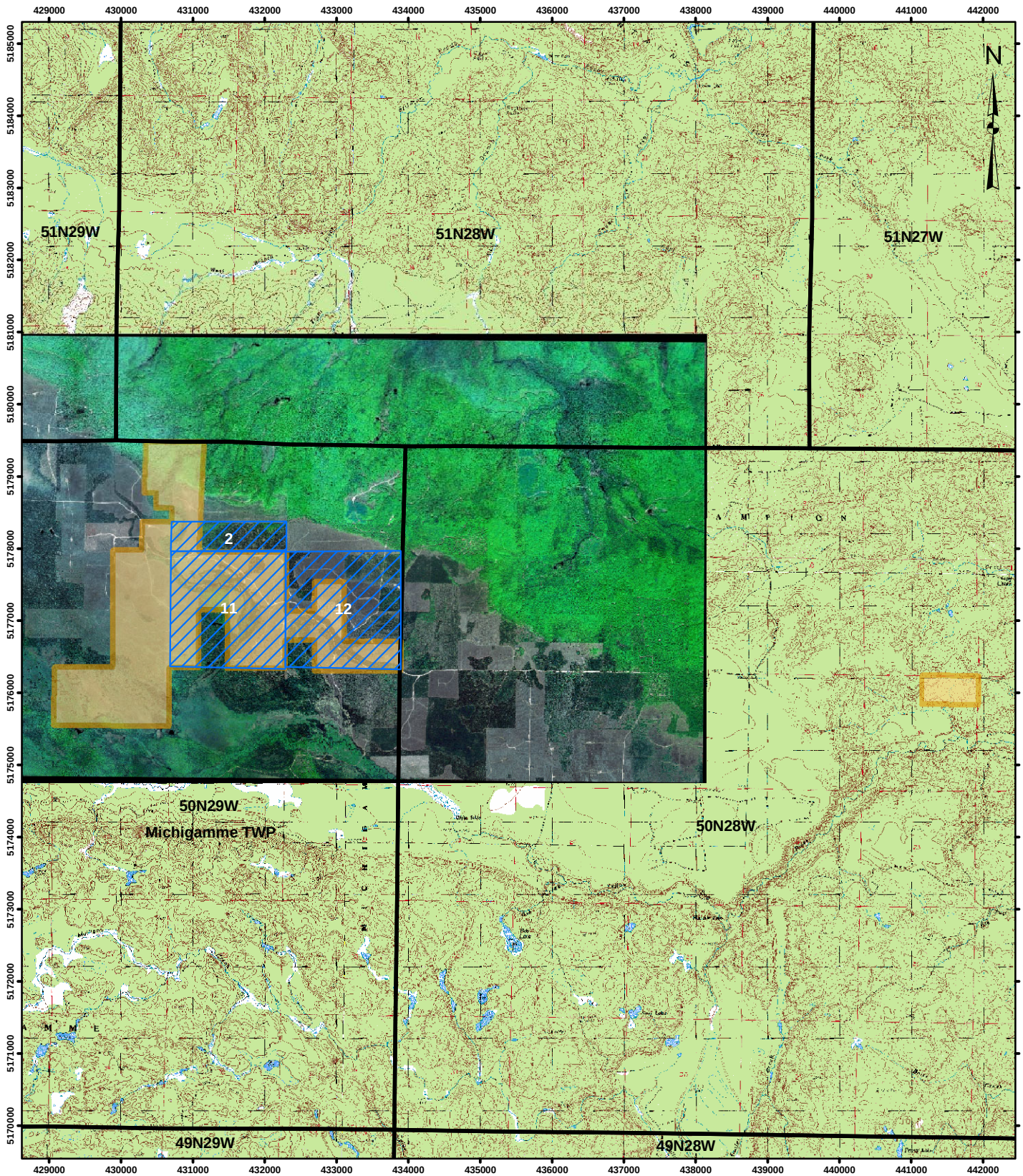
PROJECT
Kennecott Minerals
EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT MINERALS COMPANY

TITLE
SITE LOCATION MAP

Golder Associates

PROJECT No. 033-2156C			SCALE: 1:500,000	REV. 0
DESIGN	KG	19 Aug. 2004	**FIGURE: 1**	
GIS	TN	24 Aug. 2004		
CHECK	KG	24 Aug. 2004		
REVIEW	JM	25 Aug. 2004		

I:/2003/033-2156/mapping/MXD/Soils/Site_location_11x17.mxd



LEGEND

- KENNECOTT OWNED
- STUDY AREA (LABELLED WITH SECTION)

REFERENCE

Quickbird satellite imagery provided by Digital Globe Inc. DRG provided by Michigan DNR.
Datum: NAD 83 Projection: UTM Zone 16

PROJECT

Kennecott Minerals

EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT MINERALS COMPANY

TITLE

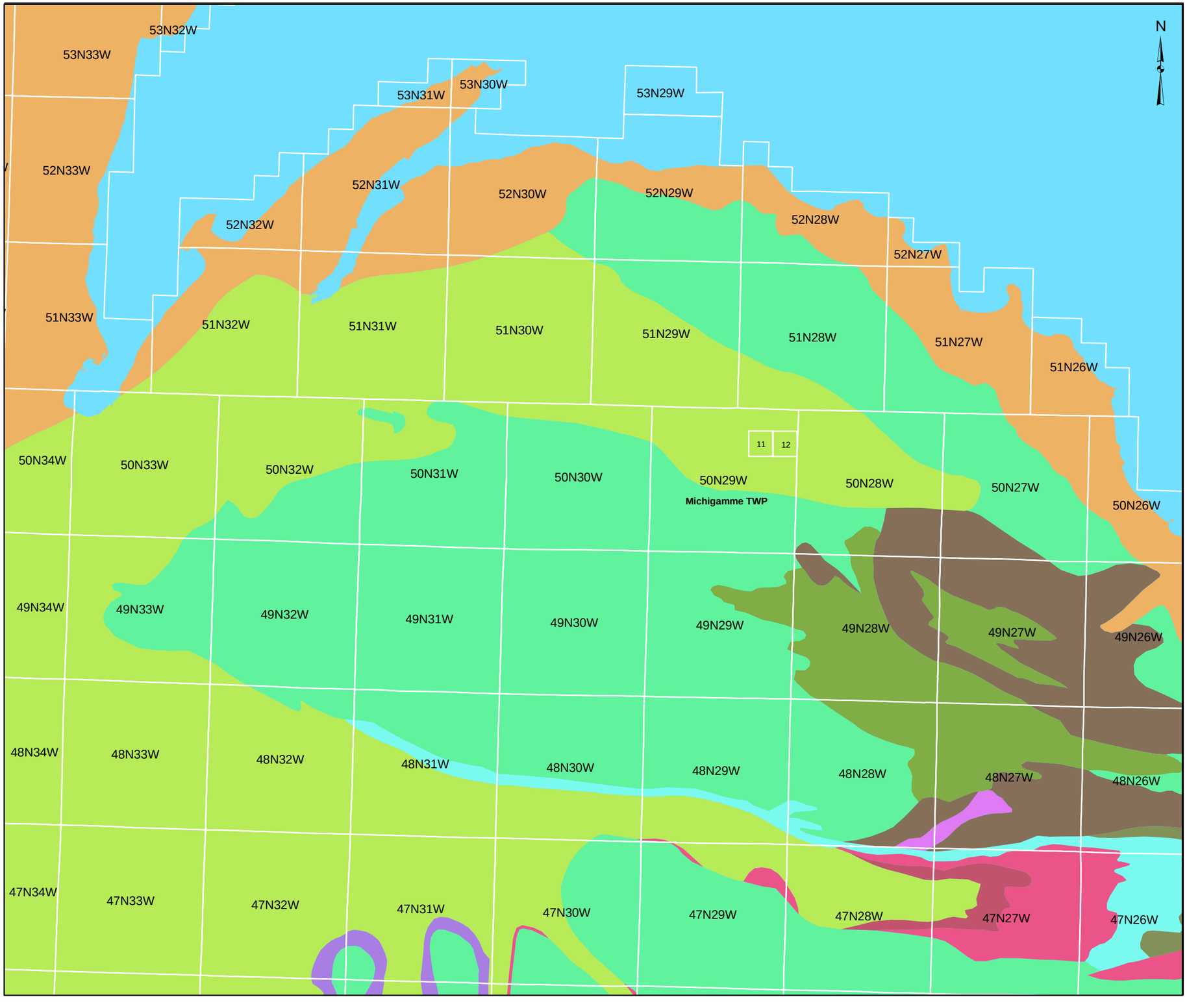
STUDY AREA MAP

Golder Associates

PROJECT No. 033-2156c			SCALE AS SHOWN	REV. 0
DESIGN	DR	16 Dec. 2004		
GIS	TN	21 Dec. 2004		
CHECK	JM	21 Dec. 2004		
REVIEW				

FIGURE: 2

I:\2003\033-2156\mapping\MXD\Soils\study_area_8.5x11.mxd



LEGEND

1987 BEDROCK GEOLOGY

- ARCHEAN GRANITE & GNEISSIC
- ARCHEAN ULTRAMAFIC
- ARCHEAN VOLCANIC & SEDIMENTARY
- CHOCOLAY GROUP
- GOODRICH QUARTZITE
- HEMLOCK FORMATION
- JACOBSVILLE SANDSTONE
- MICHIGAMME FORMATION
- NEGAUNEE IRON FORMATION
- OAK BLUFF FORMATION
- SIAMO SLATE & AJIBIK QUARTZITE

REFERENCE

Digital data provided by Michigan Center for Geographic Information (CGI) (http://www.michigan.gov/cgi).
Datum: NAD 83 Projection: Michigan State Plane (LCC)

5 0 5
SCALE 1:250,000 MILES

PROJECT

Kennecott Minerals

EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT CANADA EXPLORATION

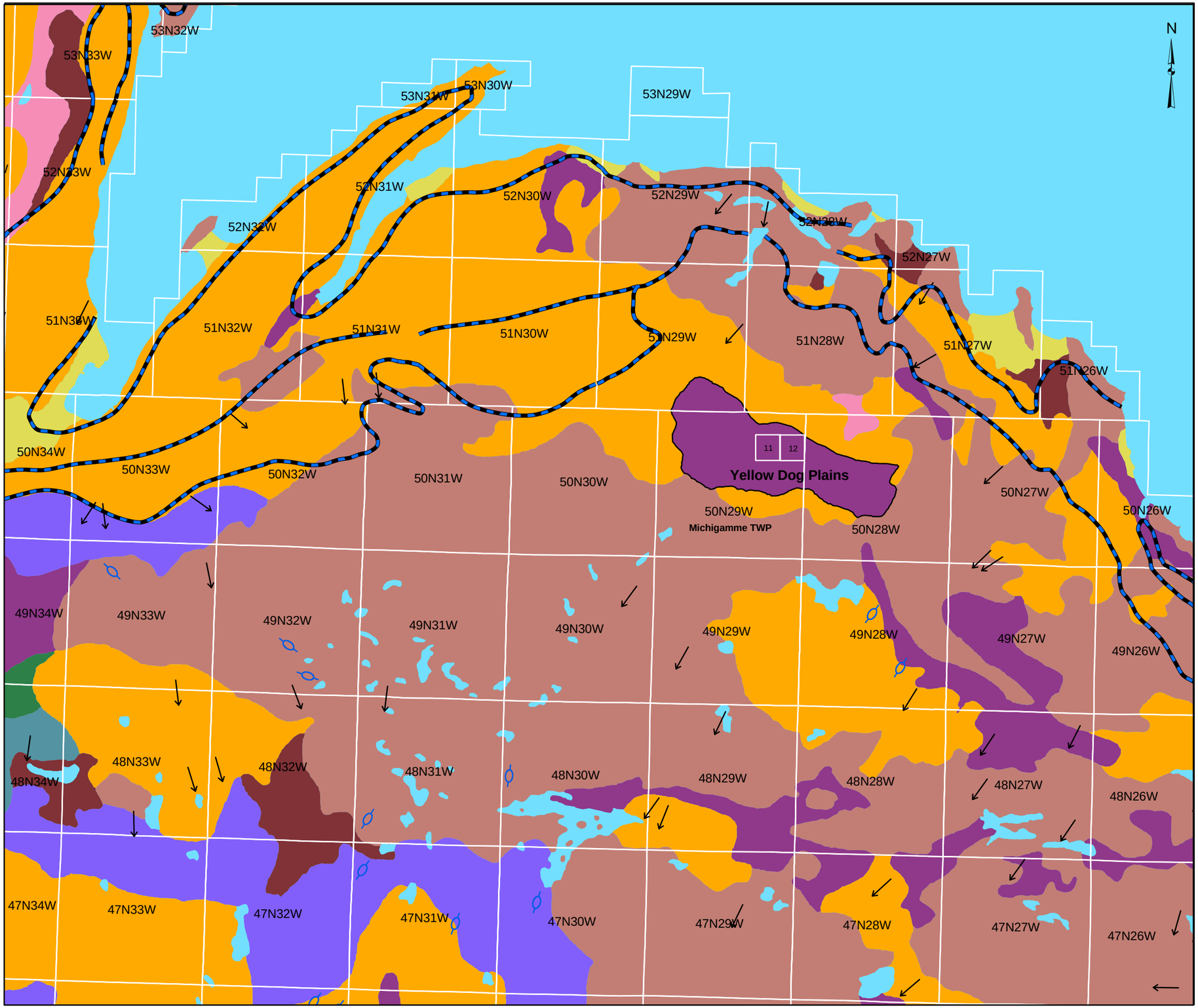
TITLE

BEDROCK GEOLOGY IN THE REGIONAL STUDY AREA

Golder Associates

PROJECT No. 033-2156C			SCALE AS SHOWN	REV. 0
DESIGN	DR	16 Dec. 2004	FIGURE: 3	
GIS	TN	21 Dec. 2004		
CHECK	JM	21 Dec. 2004		
REVIEW				

I:/2003/033-2156C/mapping/mxd/Soils/BedrockGeology_RSA_11x17_dec2004.mxd



LEGEND

1982 Quaternary Geology Features

- DRUMLINS
- ESKERS
- SHORELINE
- SINKHOLES
- STRIATIONS/GROOVES
- YELLOW DOG PLAINS

1982 Quaternary Geology

- Coarse-textured glacial till
- End moraines of coarse-textured till
- End moraines of fine-textured till
- End moraines of medium-textured till
- Fine-textured glacial till
- Medium-textured glacial till
- Thin to discontinuous glacial till over bedrock
- Glacial outwash sand and gravel and postglacial alluvium
- Ice-contact outwash sand and gravel
- Lacustrine sand and gravel
- Lacustrine clay and silt
- Dune sand
- Peat and muck
- Postglacial alluvium
- Exposed bedrock surfaces
- Artificial fill
- Water

REFERENCE

Digital data provided by Michigan Center for Geographic Information (CGI) (http://www.michigan.gov/cgi).
Datum: NAD 83 Projection: Michigan State Plane (LCC)

5 0 5
SCALE 1:250,000 MILES

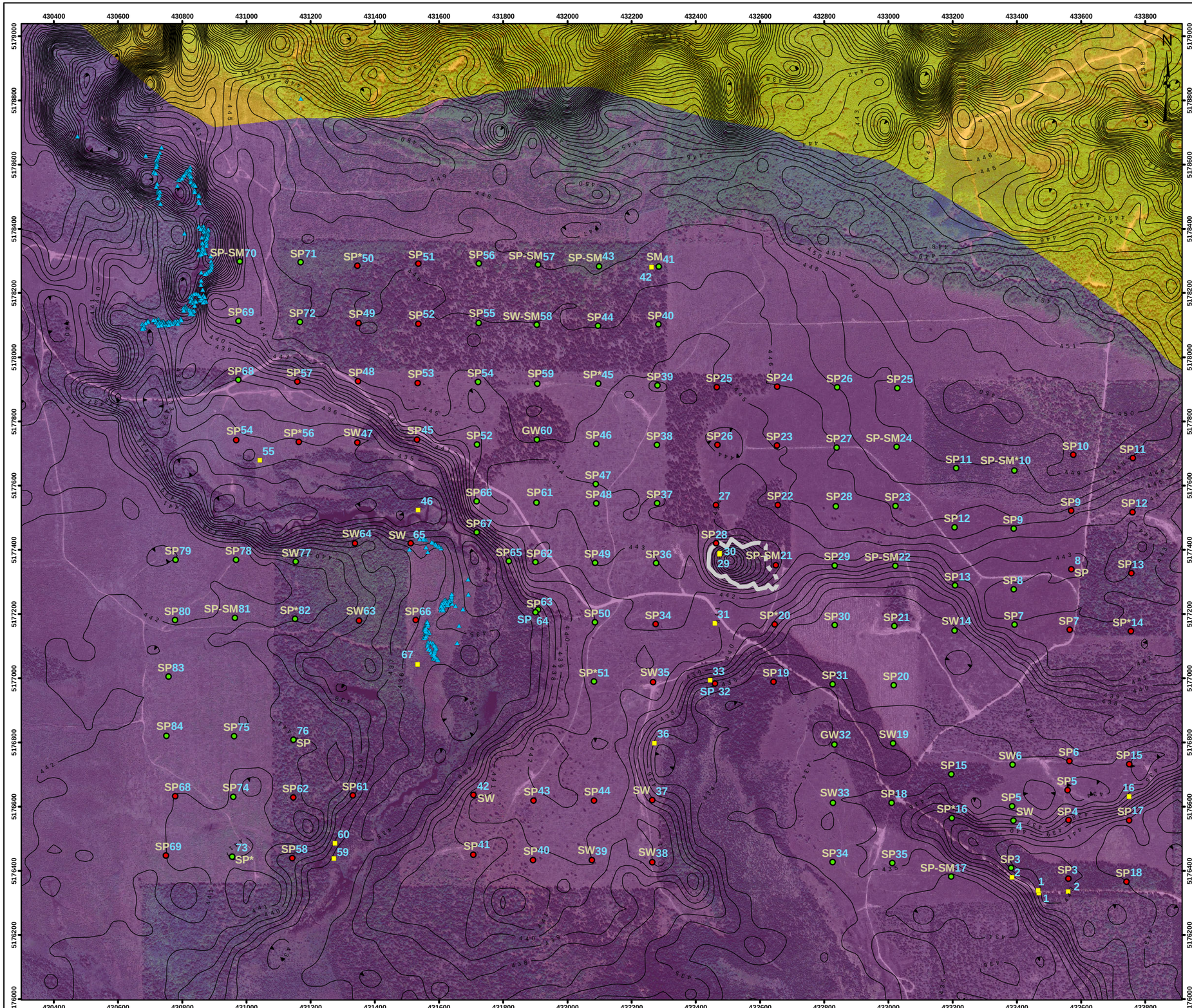
PROJECT
Kennecott Minerals
EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT CANADA EXPLORATION

TITLE
QUATERNARY GEOLOGY IN THE REGIONAL STUDY AREA

Golder Associates

PROJECT No. 033-2156C			SCALE AS SHOWN	REV. 0
DESIGN	DR	16 Dec. 2004	FIGURE: 4	
GIS	TN	21 Dec. 2004		
CHECK	JM	21 Dec. 2004		
REVIEW				

I:/2003/033-2156C/mapping/mxd/Soils/Quat_Geology_RSA_11x17_dec2004.mxd



LEGEND

- Soil Sample Site (waypoint established by Art Losey)
- Soil Sample Site (waypoint established by Dave Regalbuto)
- Photo Location (no soil samples collected)
- Wetland Waypoint
- Eagle East Peridotite Outline (dashed where inferred)
- Elevation Contour (meters)

1982 Quaternary Geology

- Coarse-textured Glacial Till
- Glacial Outwash Sand, Gravel and Postglacial Alluvium

USCS Symbol — SP 36 — Waypoint Number

REFERENCE

Digital data provided by Michigan Center for Geographic Information (CGI) (http://www.michigan.gov/cgi). Waypoints for soils sample sites and photo locations provided by Golder Associates Inc. in Lansing, MI. Wetland locations provided by Kennecott Minerals.
Datum: NAD 83 Projection: UTM Zone 16

1,000 0 1,000
SCALE: 1:12,000 FEET

PROJECT
Kennecott Minerals
EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT CANADA EXPLORATION

TITLE

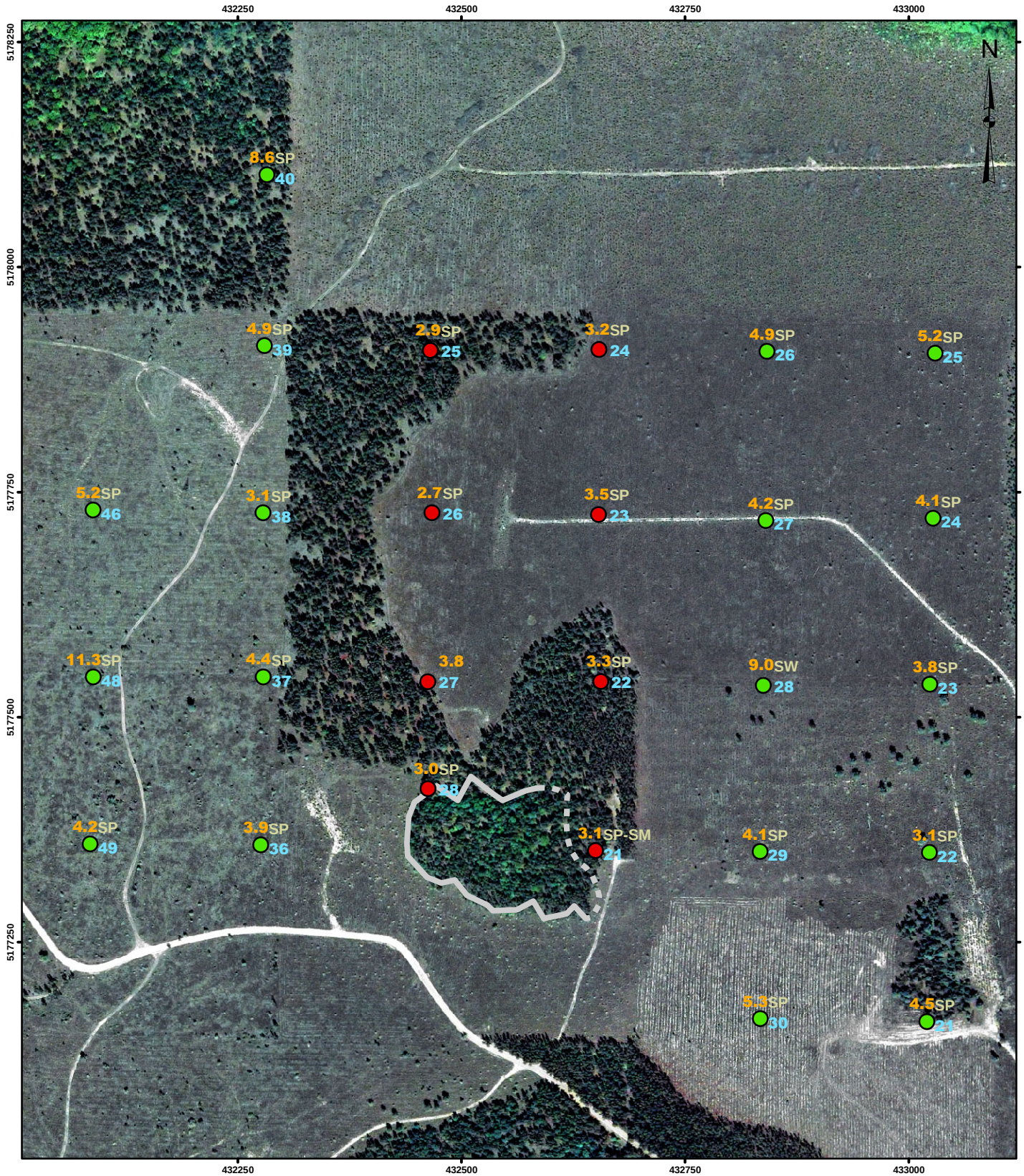
SURFACE GEOLOGY MAP

Golder Associates

PROJECT No. 033-2156C			SCALE AS SHOWN	REV. 0
DESIGN	DR	16 Nov. 2004		
GIS	TN	21 Dec. 2004		
CHECK	JM	21 Dec. 2004		
REVIEW				

FIGURE: 5

I:/2003/033-2156C/mapping/mxd/Soils/Soils_Quat_Geology_11x17.mxd



LEGEND

- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY ART LOSEY)
- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY DAVE REGALBUTO)
- EAGLE EAST PERIDOTITE OUTLINE (DASHED WHERE INFERRED)

Arsenic Concentration (ppm) — 3.9 SP — USCS Symbol
36 — Waypoint Number

400 0 400
SCALE: 1:6,000 FEET

REFERENCE

Imagery provided by Digital Globe. Waypoints for soil sample sites and photo locations provided by Golder Associates Inc. in Lansing, MI.
Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 16

PROJECT
Kennecott Minerals
EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT MINERALS COMPANY

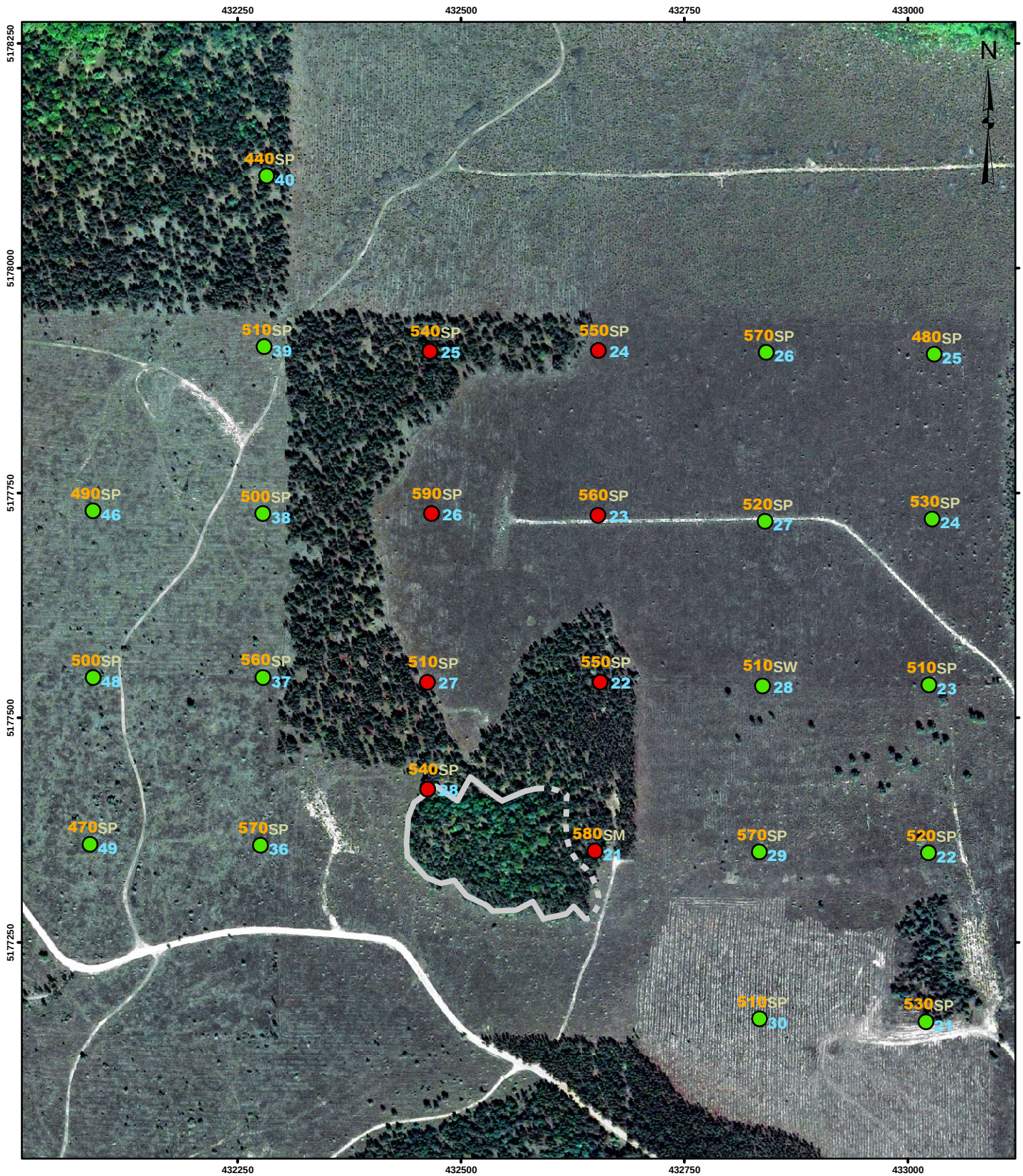
TITLE
SOIL ARSENIC CONCENTRATION MAP

Golder Associates

PROJECT No. 033-2156c			SCALE AS SHOWN	REV. 0
DESIGN	DR	10 Dec. 2004		
GIS	TN	23 Mar. 2004		
CHECK	JM	23 Mar. 2004		
REVIEW				

FIGURE: 6

I:\2003\033-2156\mapping\MXD\SoilsVAs_soilgeochem_rev1.mxd



LEGEND

- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY ART LOSEY)
- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY DAVE REGALBUTO)
- EAGLE EAST PERIDOTITE OUTLINE (DASHED WHERE INFERRED)

Barium Concentration (ppm) — 3.9 SP — USCS Symbol
36 — Waypoint Number

400 0 400
SCALE: 1:6,000 FEET

REFERENCE

Imagery provided by Digital Globe. Waypoints for soil sample sites and photo locations provided by Golder Associates Inc. in Lansing, MI.
Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 16

PROJECT
Kennecott Minerals
EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT MINERALS COMPANY

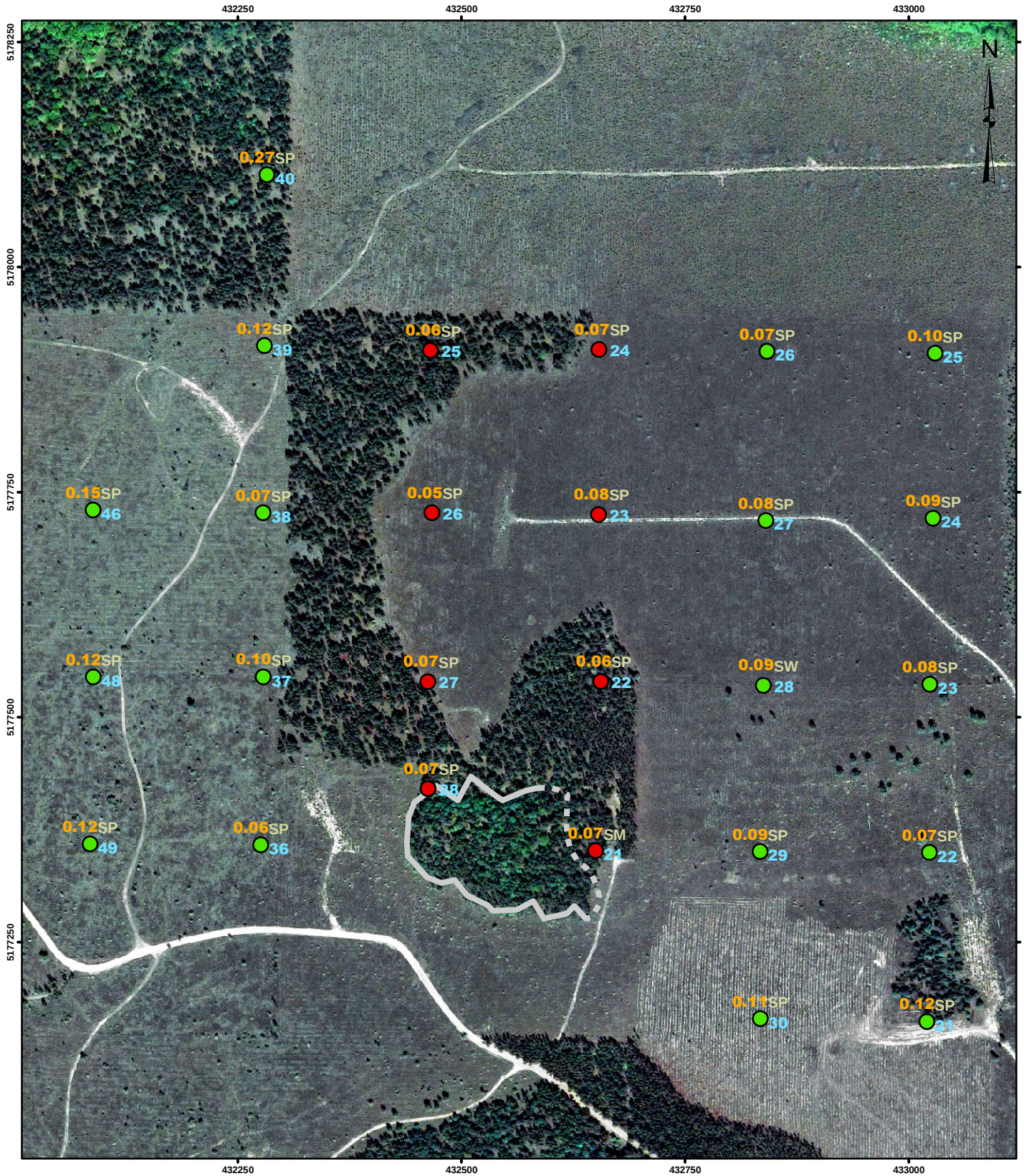
TITLE
SOIL BARIUM CONCENTRATION MAP

Golder Associates

PROJECT No. 033-2156c			SCALE AS SHOWN	REV. 0
DESIGN	DR	10 Dec. 2004		
GIS	TN	23 Mar. 2004		
CHECK	JM	23 Mar. 2004		
REVIEW				

FIGURE: 7

I:\2003\033-2156\mapping\MXD\Soils\Ba_soilgeochem_rev1.mxd



LEGEND

- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY ART LOSEY)
- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY DAVE REGALBUTO)
- EAGLE EAST PERIDOTITE OUTLINE (DASHED WHERE INFERRED)

Cadmium Concentration (ppm) — 3.9 SP — USCS Symbol
36 — Waypoint Number

400 0 400
SCALE: 1:6,000 FEET

REFERENCE

Imagery provided by Digital Globe. Waypoints for soil sample sites and photo locations provided by Golder Associates Inc. in Lansing, MI.
Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 16

PROJECT
Kennecott Minerals
EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT MINERALS COMPANY

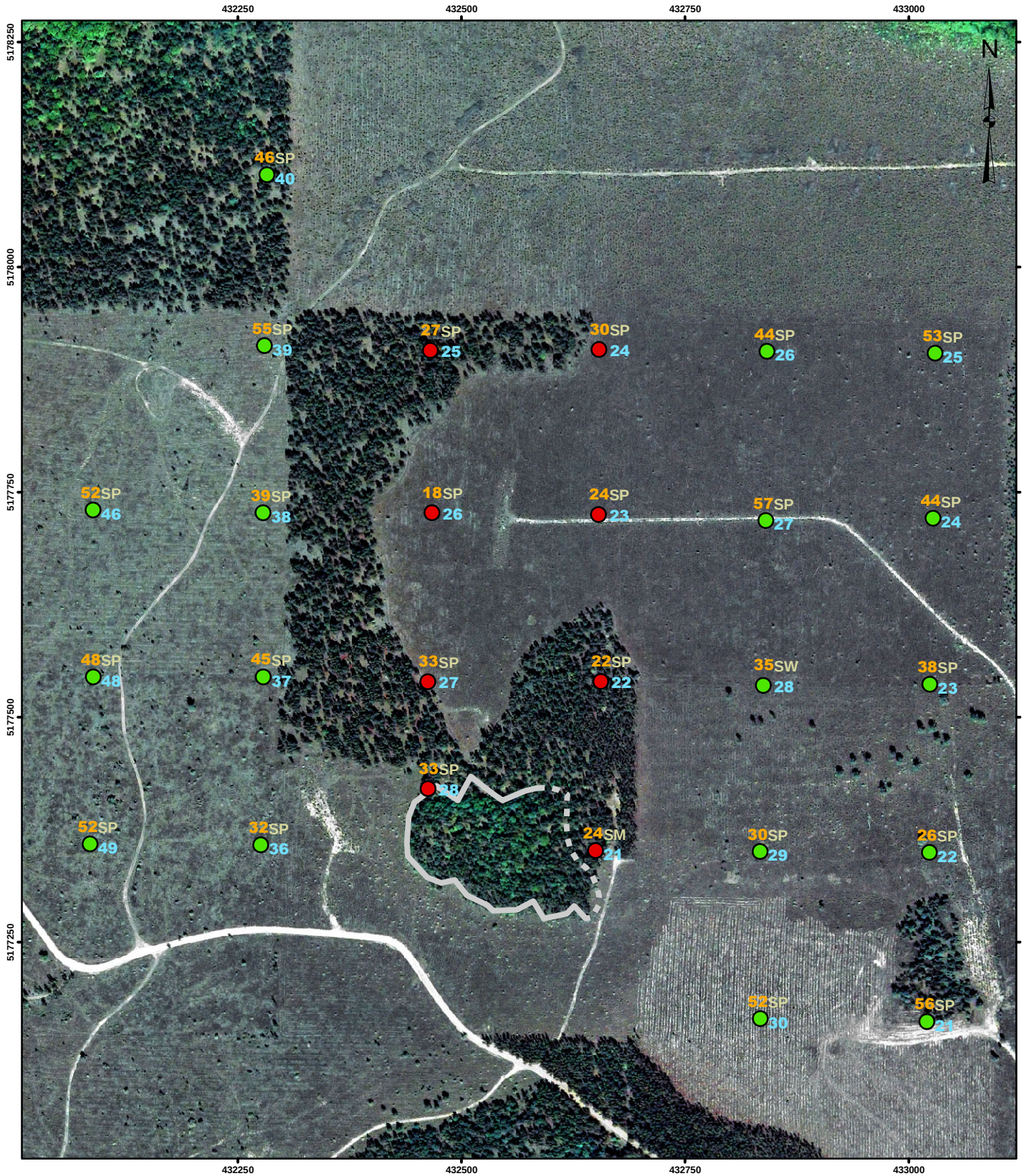
TITLE
SOIL CADMIUM CONCENTRATION MAP

Golder Associates

PROJECT No. 033-2156c			SCALE AS SHOWN	REV. 0
DESIGN	DR	10 Dec. 2004		
GIS	TN	23 Mar. 2004		
CHECK	JM	23 Mar. 2004		
REVIEW				

FIGURE: 8

I:\2003\033-2156\mapping\MXD\Soils\Cd_soilgeochem_rev1.mxd



LEGEND

- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY ART LOSEY)
- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY DAVE REGALBUTO)
- EAGLE EAST PERIDOTITE OUTLINE (DASHED WHERE INFERRED)

Chromium Concentration (ppm) — 3.9 SP — USCS Symbol
36 — Waypoint Number

400 0 400
SCALE: 1:6,000 FEET

REFERENCE

Imagery provided by Digital Globe. Waypoints for soil sample sites and photo locations provided by Golder Associates Inc. in Lansing, MI.
Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 16

PROJECT
Kennecott Minerals
EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT MINERALS COMPANY

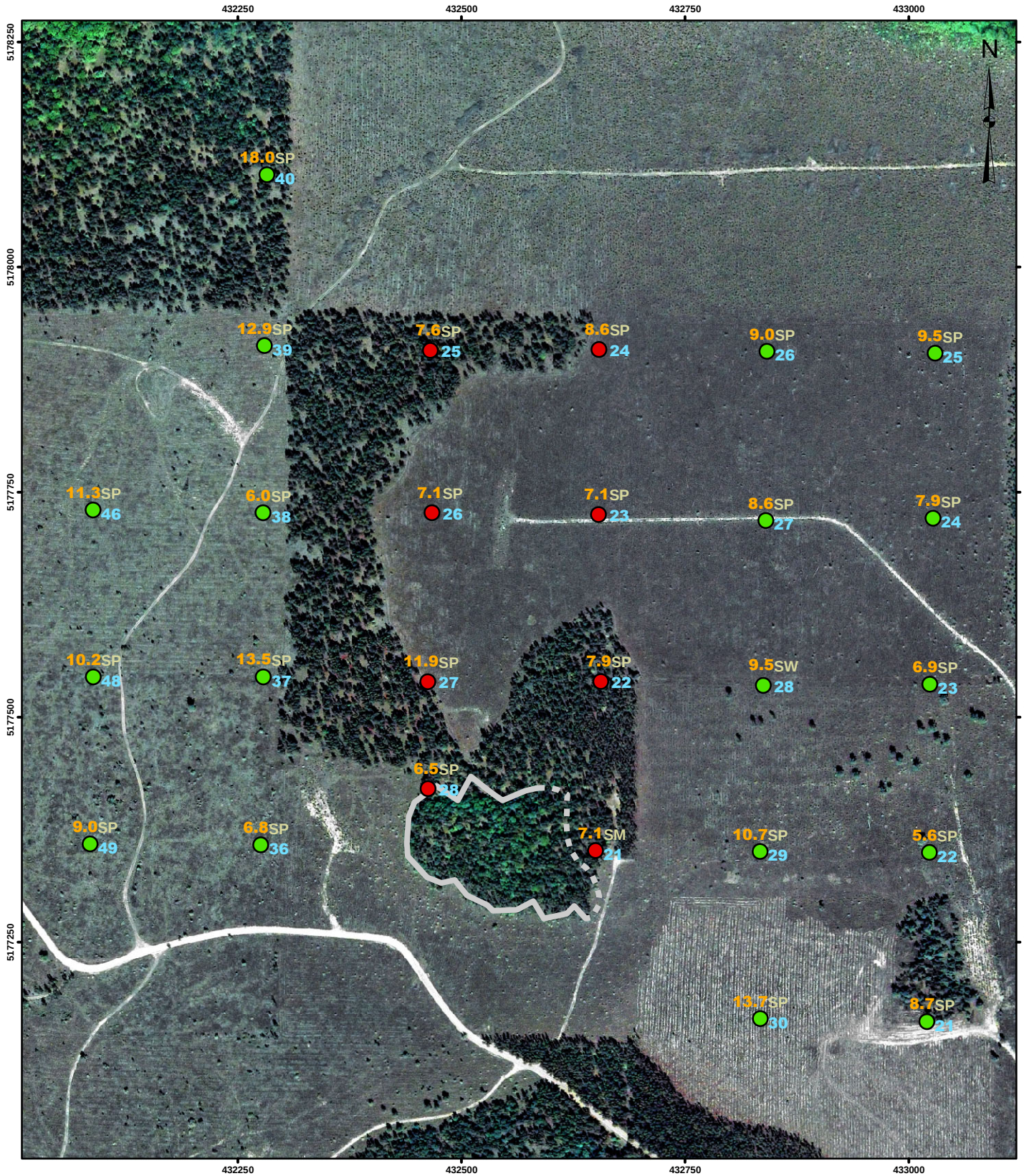
TITLE
SOIL CHROMIUM CONCENTRATION MAP

Golder Associates

PROJECT No. 033-2156c			SCALE AS SHOWN	REV. 0
DESIGN	DR	10 Dec. 2004		
GIS	TN	23 Mar. 2004		
CHECK	JM	23 Mar. 2004		
REVIEW				

FIGURE: 9

I:\2003\033-2156\mapping\MXD\Soils\Cr_soilgeochem_rev1.mxd



LEGEND

- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY ART LOSEY)
- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY DAVE REGALBUTO)
- EAGLE EAST PERIDOTITE OUTLINE (DASHED WHERE INFERRED)

Copper Concentration (ppm) — 3.9 SP — USCS Symbol
36 — Waypoint Number

400 0 400
SCALE: 1:6,000 FEET

REFERENCE

Imagery provided by Digital Globe. Waypoints for soil sample sites and photo locations provided by Golder Associates Inc. in Lansing, MI.
Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 16

PROJECT
Kennecott Minerals
EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT MINERALS COMPANY

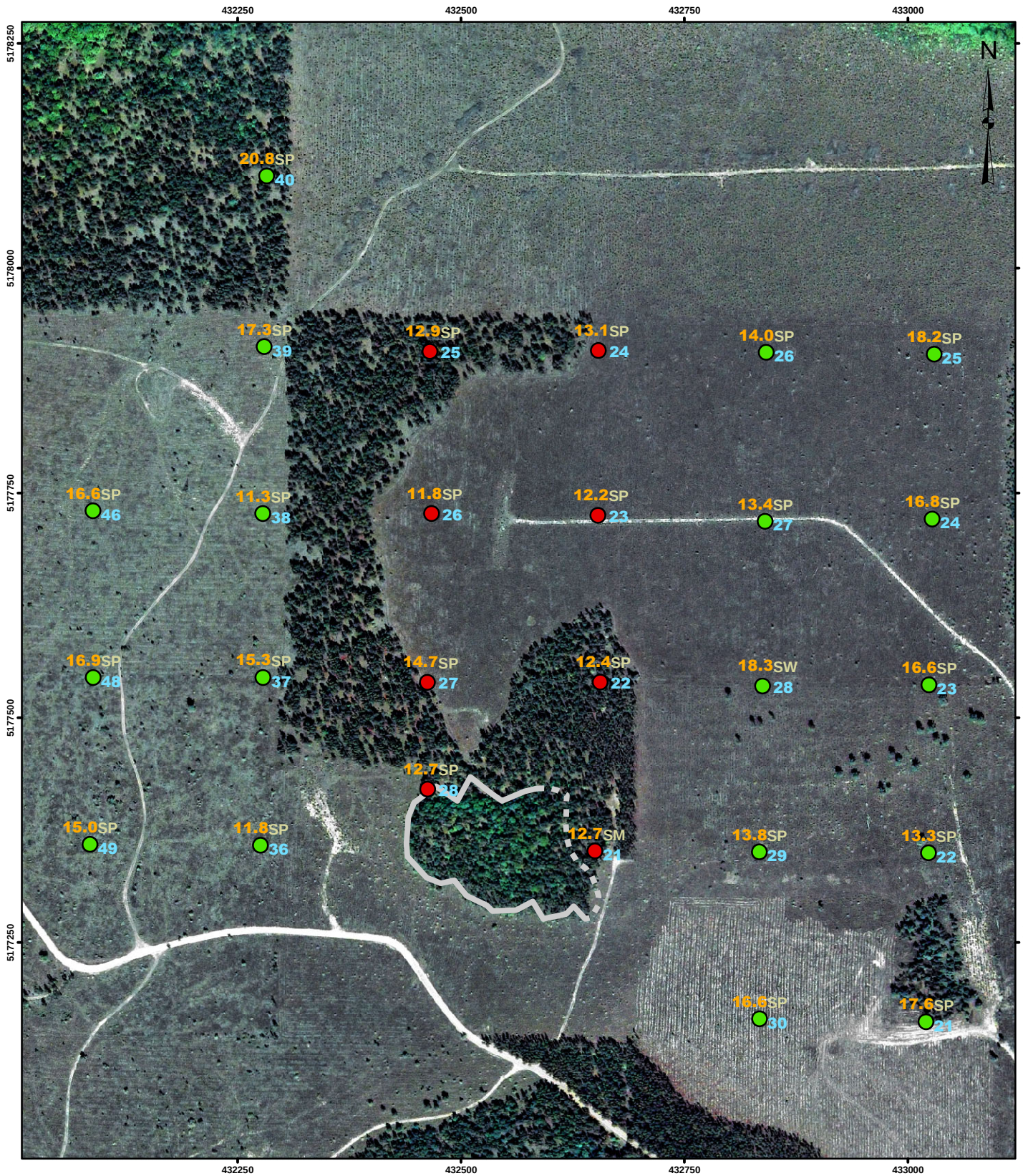
TITLE
SOIL COPPER CONCENTRATION MAP

Golder Associates

PROJECT No. 033-2156c			SCALE AS SHOWN	REV. 0
DESIGN	DR	10 Dec. 2004		
GIS	TN	23 Mar. 2004		
CHECK	JM	23 Mar. 2004		
REVIEW				

FIGURE: 10

I:\2003\033-2156\mapping\MXD\Soils\Cu_soilgeochem_rev1.mxd



LEGEND

- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY ART LOSEY)
- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY DAVE REGALBUTO)
- EAGLE EAST PERIDOTITE OUTLINE (DASHED WHERE INFERRED)

Lead Concentration (ppm) — 3.9 SP — USCS Symbol
36 — Waypoint Number

400 0 400
SCALE: 1:6,000 FEET

REFERENCE

Imagery provided by Digital Globe. Waypoints for soil sample sites and photo locations provided by Golder Associates Inc. in Lansing, MI.
Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 16

PROJECT
Kennecott Minerals
EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT MINERALS COMPANY

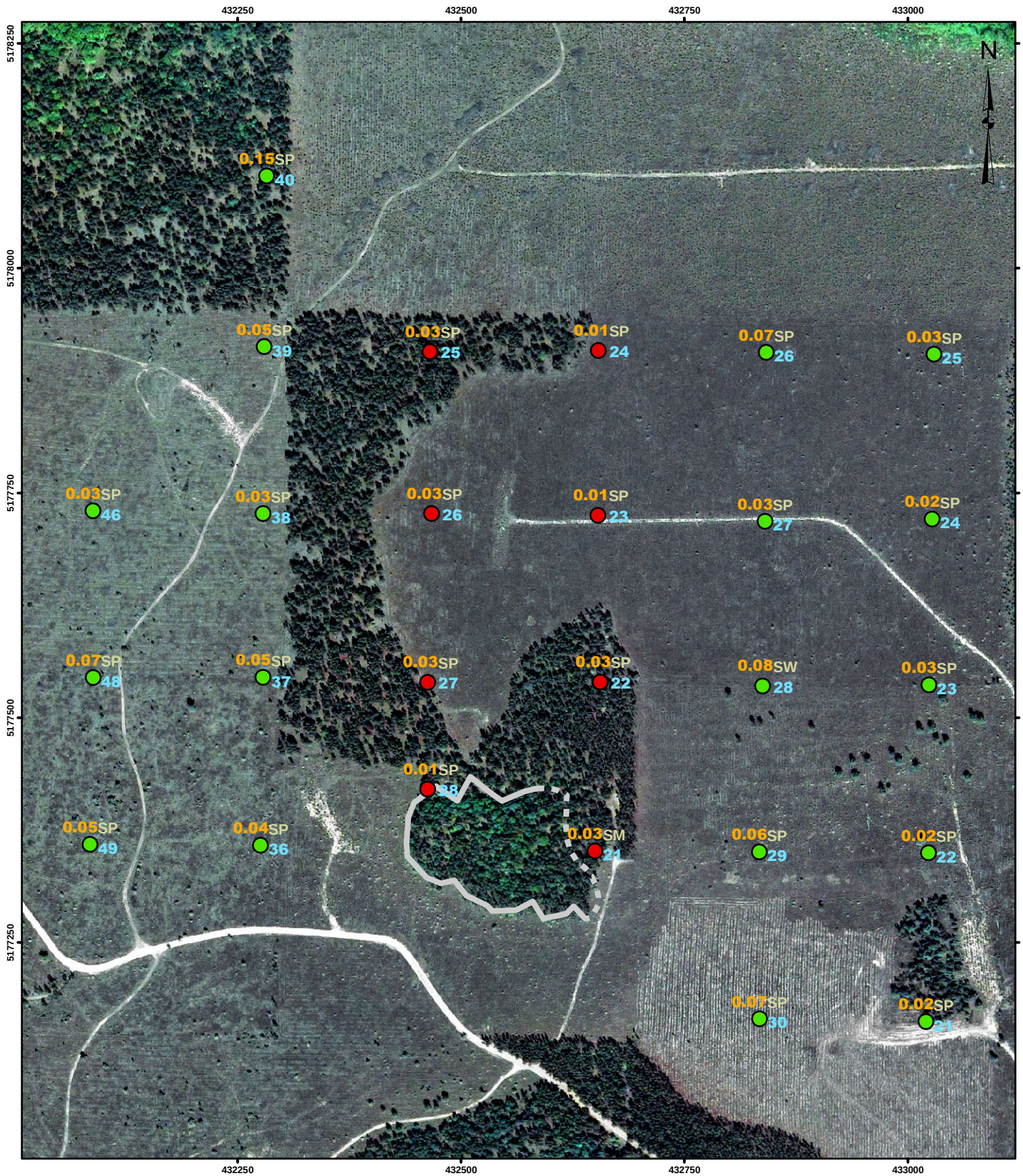
TITLE
SOIL LEAD CONCENTRATION MAP

Golder Associates

PROJECT No. 033-2156c			SCALE AS SHOWN	REV. 0
DESIGN	DR	10 Dec. 2004		
GIS	TN	23 Mar. 2004		
CHECK	JM	23 Mar. 2004		
REVIEW				

FIGURE: 11

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LEGEND

- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY ART LOSEY)
- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY DAVE REGALBUTO)
- EAGLE EAST PERIDOTITE OUTLINE (DASHED WHERE INFERRED)

Mercury Concentration (ppm) — 3.9 SP — USCS Symbol
36 — Waypoint Number

400 0 400
SCALE: 1:6,000 FEET

REFERENCE

Imagery provided by Digital Globe. Waypoints for soil sample sites and photo locations provided by Golder Associates Inc. in Lansing, MI.
Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 16

PROJECT
Kennecott Minerals
EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT MINERALS COMPANY

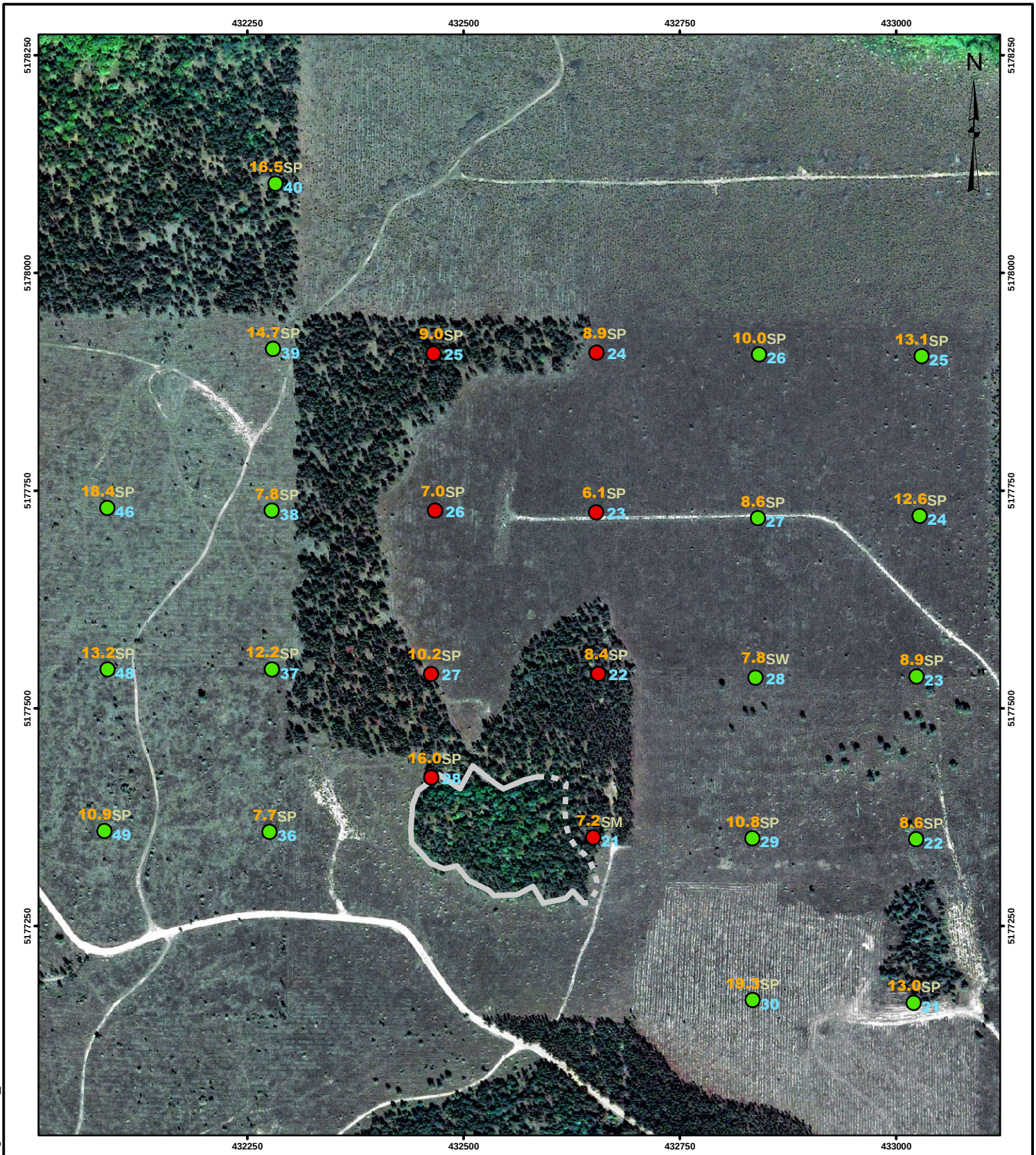
TITLE
SOIL MERCURY CONCENTRATION MAP

Golder Associates

PROJECT No. 033-2156c			SCALE AS SHOWN	REV. 0
DESIGN	DR	10 Dec. 2004		
GIS	TN	23 Mar. 2004		
CHECK	JM	23 Mar. 2004		
REVIEW				

FIGURE: 12

I:\2003\033-2156\mapping\MXD\Soils\Hg_soilgeochem_rev1.mxd



LEGEND

- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY ART LOSEY)
- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY DAVE REGALBUTO)
- EAGLE EAST PERIDOTITE OUTLINE (DASHED WHERE INFERRED)

Nickel Concentration (ppm) — 3.9 SP — USCS Symbol
36 — Waypoint Number

400 0 400
SCALE: 1:6,000 FEET

REFERENCE

Imagery provided by Digital Globe. Waypoints for soil sample sites and photo locations provided by Golder Associates Inc. in Lansing, MI.
Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 16

PROJECT
Kennecott Minerals
EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT MINERALS COMPANY

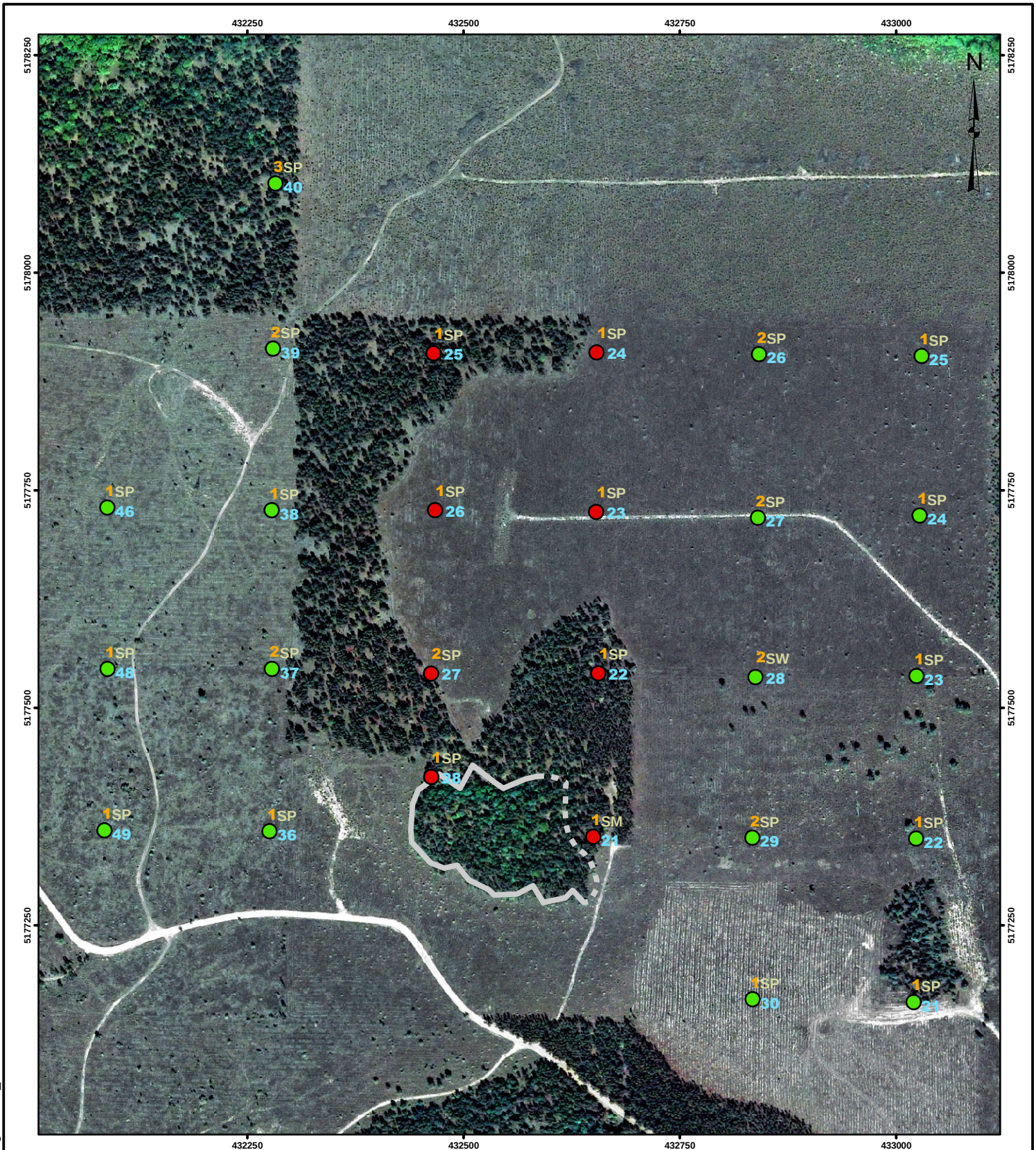
TITLE
SOIL NICKEL CONCENTRATION MAP

Golder Associates

PROJECT No. 033-2156c			SCALE AS SHOWN	REV. 0
DESIGN	DR	10 Dec. 2004		
GIS	TN	23 Mar. 2004		
CHECK	JM	23 Mar. 2004		
REVIEW				

FIGURE: 13

I:\2003\033-2156\mapping\MXD\Soils\Ni_soilgeochem_rev1.mxd



LEGEND

- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY ART LOSEY)
- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY DAVE REGALBUTO)
- EAGLE EAST PERIDOTITE OUTLINE (DASHED WHERE INFERRED)

Selenium Concentration (ppm) — 3.9 SP — USCS Symbol
36 — Waypoint Number

REFERENCE

Imagery provided by Digital Globe. Waypoints for soil sample sites and photo locations provided by Golder Associates Inc. in Lansing, MI.
Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 16

PROJECT
Kennecott Minerals
EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT MINERALS COMPANY

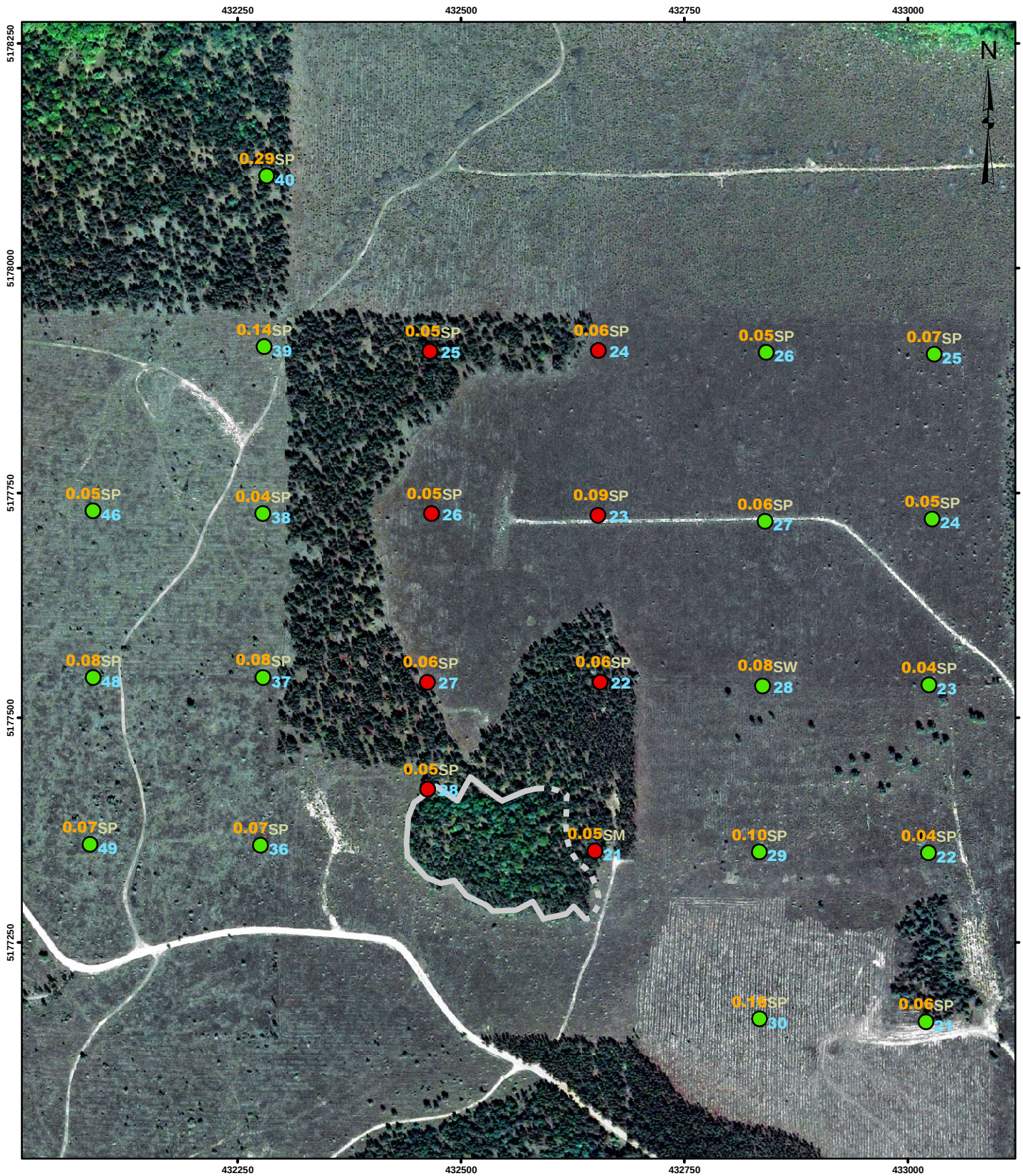
TITLE
SOIL SELENIUM CONCENTRATION MAP

Golder Associates

PROJECT No. 033-2156c			SCALE AS SHOWN	REV. 0
DESIGN	DR	10 Dec. 2004		
GIS	TN	23 Mar. 2004		
CHECK	JM	23 Mar. 2004		
REVIEW				

FIGURE: 14

I:\2003\033-2156\mapping\MXD\Soils\Se_soilgeochem_rev1.mxd



LEGEND

- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY ART LOSEY)
- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY DAVE REGALBUTO)
- EAGLE EAST PERIDOTITE OUTLINE (DASHED WHERE INFERRED)

Silver Concentration (ppm) — 3.9 SP — USCS Symbol
36 — Waypoint Number

400 0 400
SCALE: 1:6,000 FEET

REFERENCE

Imagery provided by Digital Globe. Waypoints for soil sample sites and photo locations provided by Golder Associates Inc. in Lansing, MI.
Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 16

PROJECT
Kennecott Minerals
EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT MINERALS COMPANY

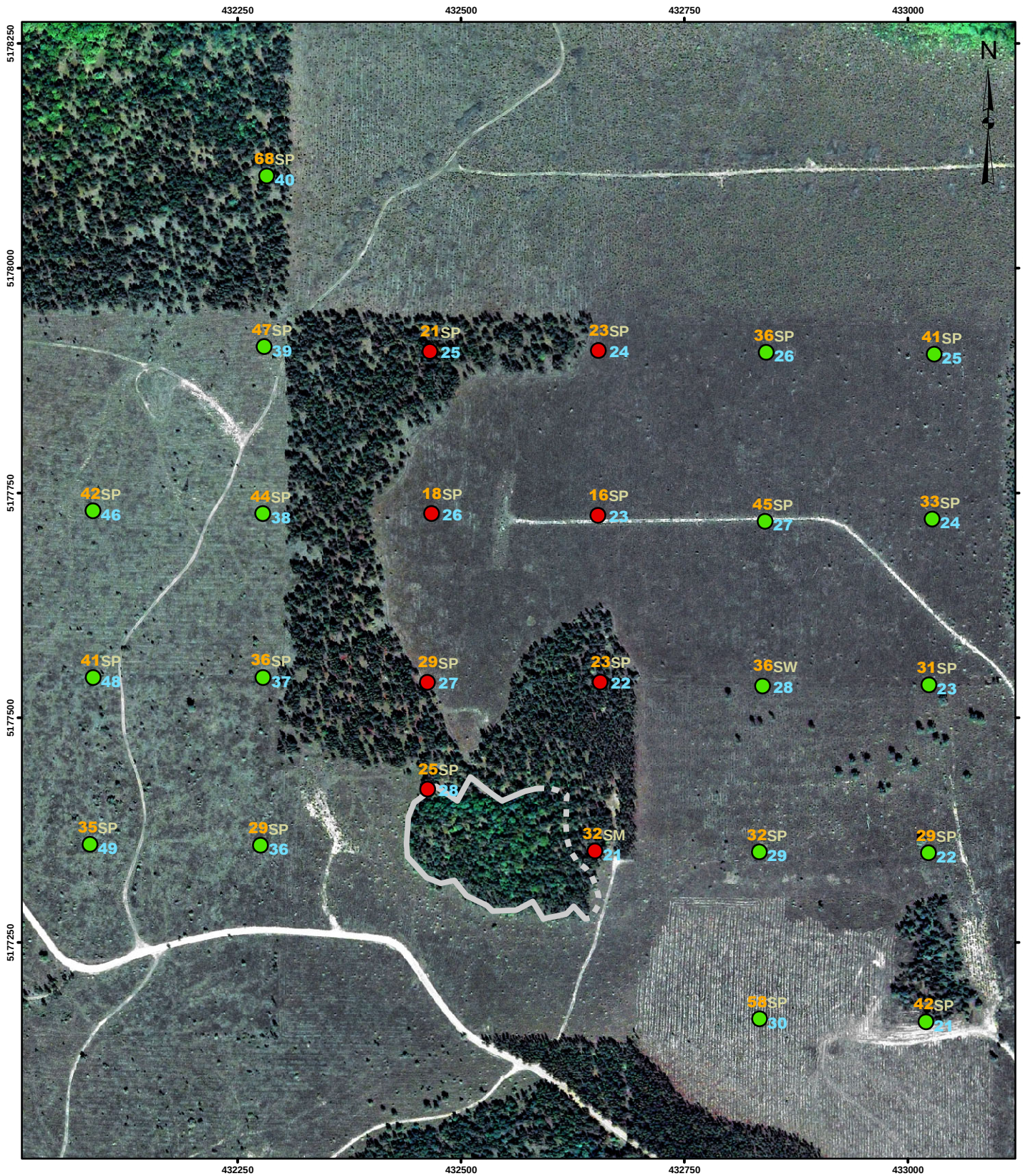
TITLE
SOIL SILVER CONCENTRATION MAP

Golder Associates

PROJECT No. 033-2156c			SCALE AS SHOWN	REV. 0
DESIGN	DR	10 Dec. 2004		
GIS	TN	23 Mar. 2004		
CHECK	JM	23 Mar. 2004		
REVIEW				

FIGURE: 15

I:\2003\033-2156\mapping\MXD\SoilsAg_soilgeochem_rev1.mxd



LEGEND

- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY ART LOSEY)
- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY DAVE REGALBUTO)
- EAGLE EAST PERIDOTITE OUTLINE (DASHED WHERE INFERRED)

Zinc Concentration (ppm) — 3.9 SP — USCS Symbol
36 — Waypoint Number

400 0 400
SCALE: 1:6,000 FEET

REFERENCE

Imagery provided by Digital Globe. Waypoints for soil sample sites and photo locations provided by Golder Associates Inc. in Lansing, MI.
Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 16

PROJECT
Kennecott Minerals
EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT MINERALS COMPANY

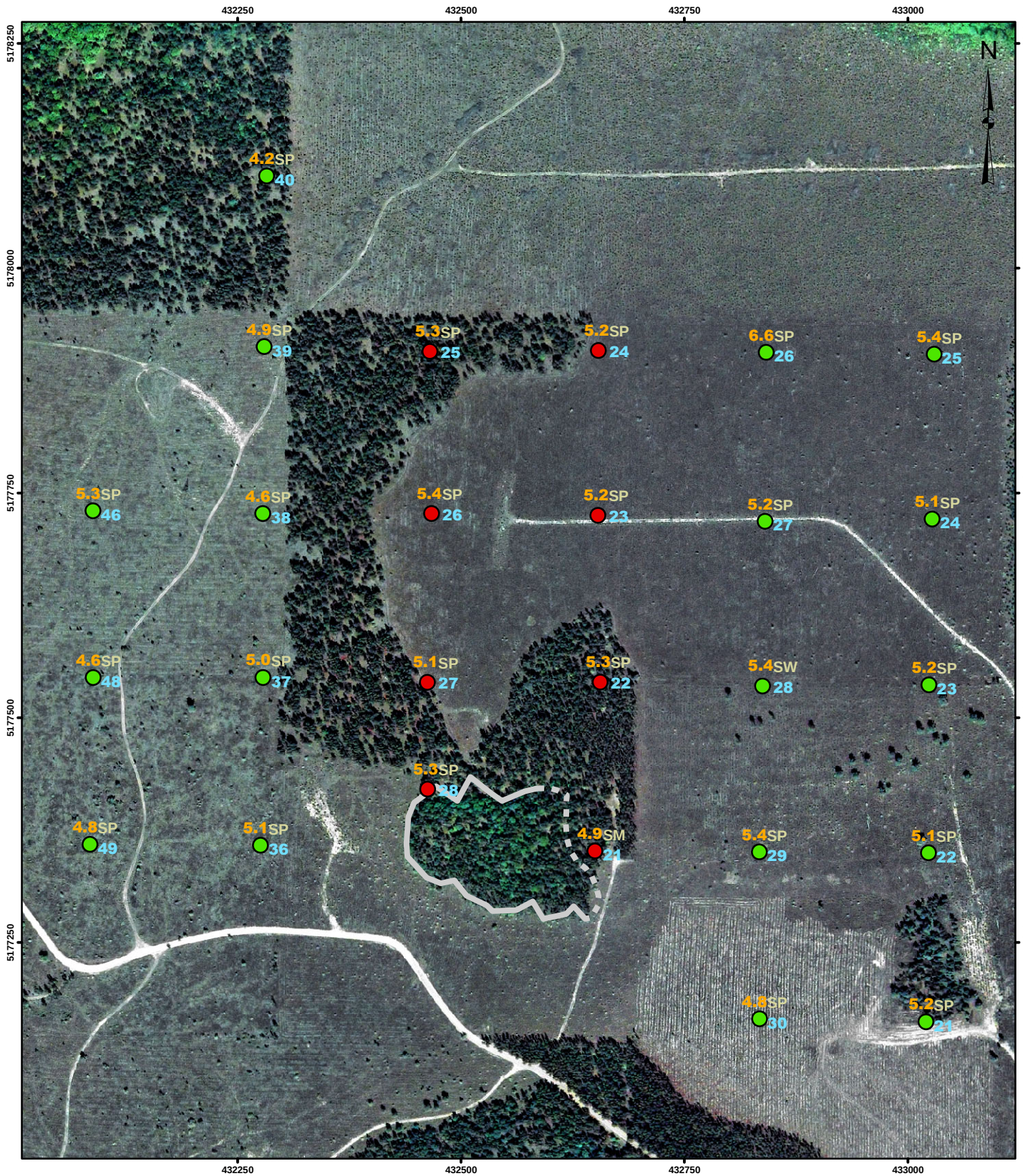
TITLE
SOIL ZINC CONCENTRATION MAP

Golder Associates

PROJECT No. 033-2156c			SCALE AS SHOWN	REV. 0
DESIGN	DR	10 Dec. 2004		
GIS	TN	23 Mar. 2004		
CHECK	JM	23 Mar. 2004		
REVIEW				

FIGURE: 16

I:\2003\033-2156\mapping\MXD\Soils\Zn_soilgeochem_rev1.mxd



LEGEND

- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY ART LOSEY)
- SOIL SAMPLE SITE (WAYPOINT ESTABLISHED BY DAVE REGALBUTO)
- EAGLE EAST PERIDOTITE OUTLINE (DASHED WHERE INFERRED)

pH — 3.9 SP — USCS Symbol
36 — Waypoint Number

400 0 400
SCALE: 1:6,000 FEET

REFERENCE

Imagery provided by Digital Globe. Waypoints for soil sample sites and photo locations provided by Golder Associates Inc. in Lansing, MI.
Datum: NAD 83 Projection: Transverse Mercator Coordinate System: UTM Zone 16

PROJECT
Kennecott Minerals
EAGLE PROJECT
BASELINE ENVIRONMENTAL STUDY
KENNECOTT MINERALS COMPANY

TITLE
SOIL pH MAP

Golder Associates

PROJECT No. 033-2156c			SCALE AS SHOWN	REV. 0
DESIGN	DR	10 Dec. 2004		
GIS	TN	23 Mar. 2004		
CHECK	JM	23 Mar. 2004		
REVIEW				

FIGURE: 17

I:\2003\033-2156\mapping\MXD\Soils\pH_soil_rev1.mxd

APPENDIX A

JUNE 2004 PHOTOGRAPHS



Photograph 1 (ABL090SW) – View from the west end of the Eagle East peridotite, of the Yellow Dog Plain showing granitic highlands to the south and logged area in foreground..



Photograph 2 (DPR031N) – Eagle East peridotite exposure, as viewd from south of AAA Road.



Photograph 3 (DPR046W) – Salmon Trout River.



Photograph 4 (DPR059S) – Broad wetland surrounding the Salmon Trout River headwater.



Photograph 5 (DPR054E) – Erosional terrace (upper left) along north side of Salmon Trout River.



Photograph 6 (ABL067N) – Erosional terrace along east side of Salmon Trout River.



Photograph 7 (DPR022N) – Nearly level, wooded outwash plain north of the Eagle East exposure; harvested area in background through trees.



Photograph 8 (ABL027W) – Harvested glacial outwash plain northeast of the Eagle East peridotite.



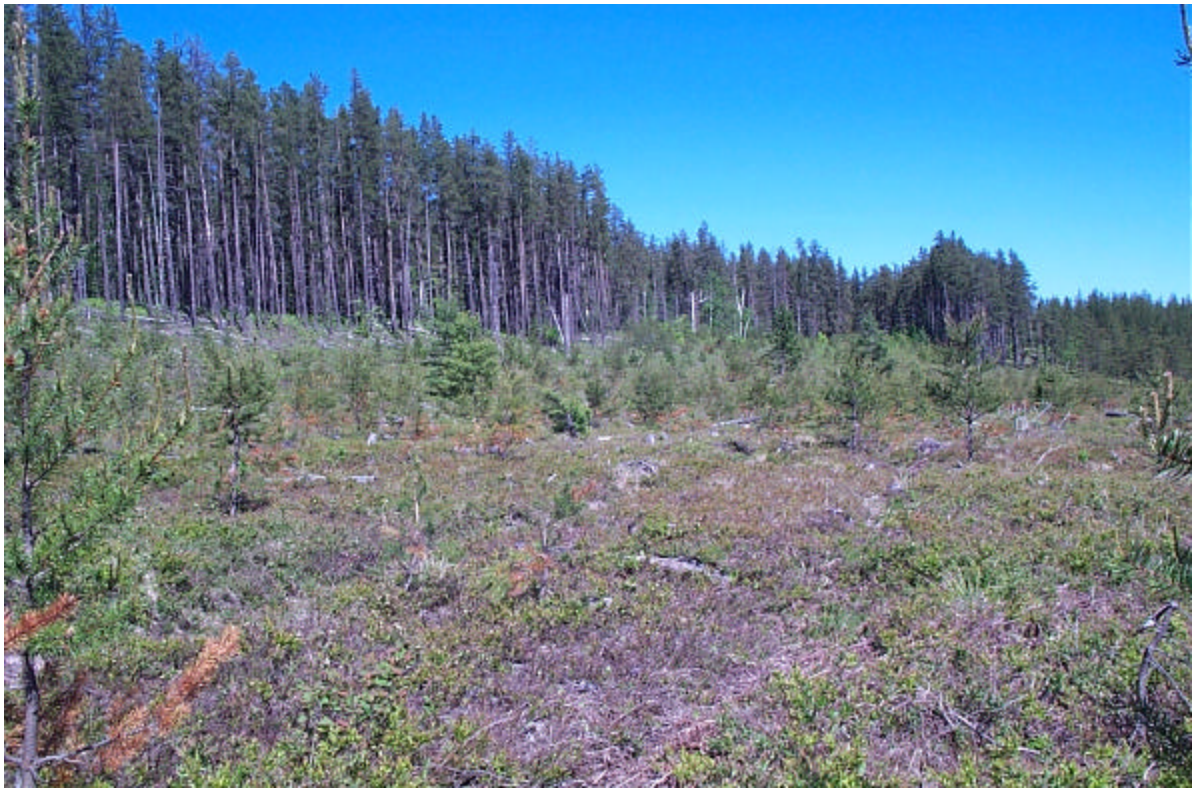
Photograph 9 (DPR024S) – Harvested area on glacial outwash plain north of the Eagle East exposure. Granitic highlands bordering the Yellow Dog Plain visible at upper left.



Photograph 10 (DPR026E) – Looking west across the harvested area shown above in Photo 9.



Photograph 11 (DPR033NW) – Terrace (exposed surface near top of photo) south of AAA Road in southwest quadrant of Section 12.



Photograph 12 (ABL017E) – Terrace south of AAA Road in southeast quadrant of Section 12.



Photograph 13 (DPR04E) – Terrace north of AAA Road in harvested southeast quadrant of Section 12.



Photograph 14 (DPR016S) – Same terrace featured in Photo 13, but viewed from north.



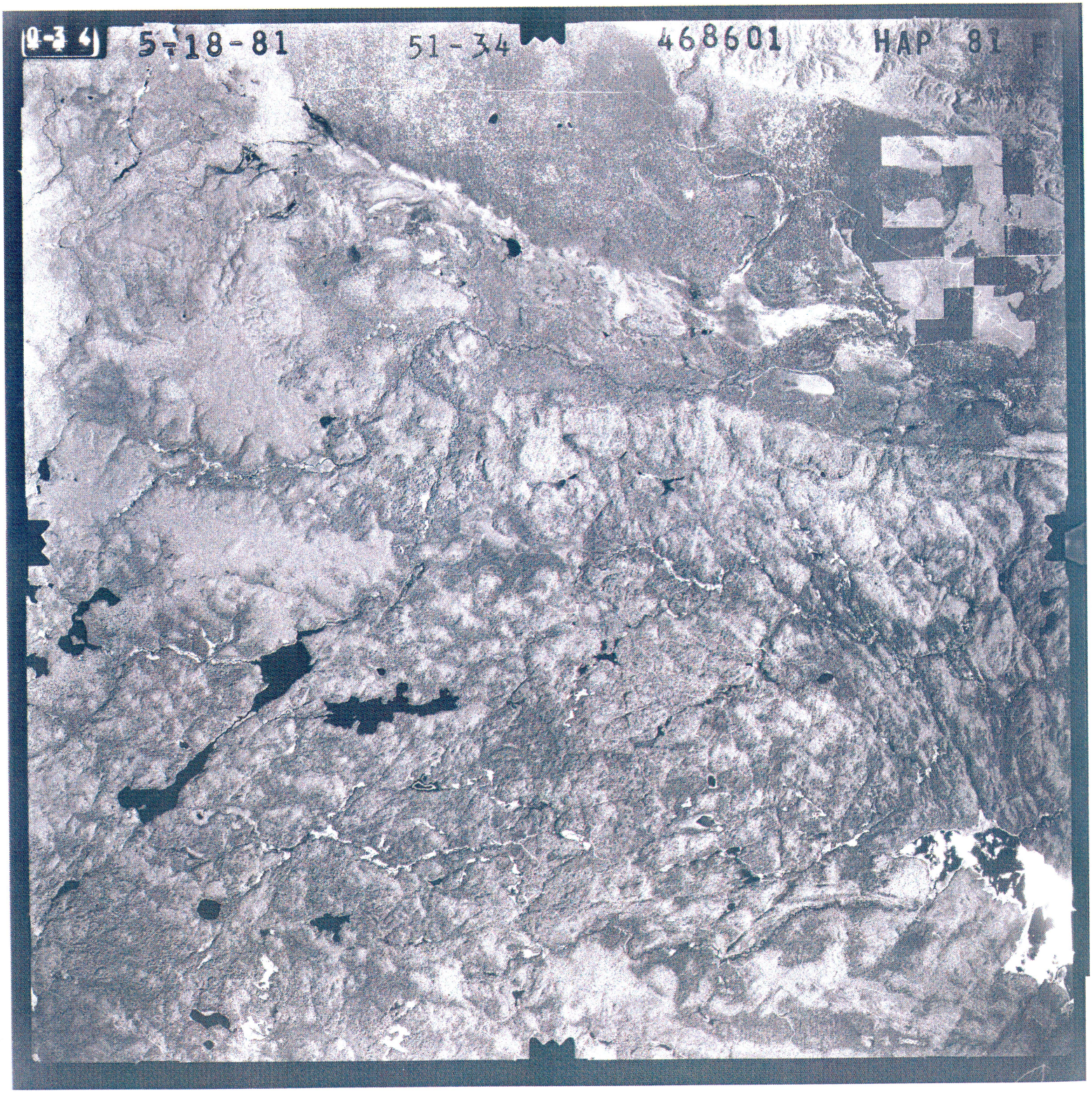
Photograph 15 (DPR029S) – North end of furrow at west end of the Eagle East peridotite.

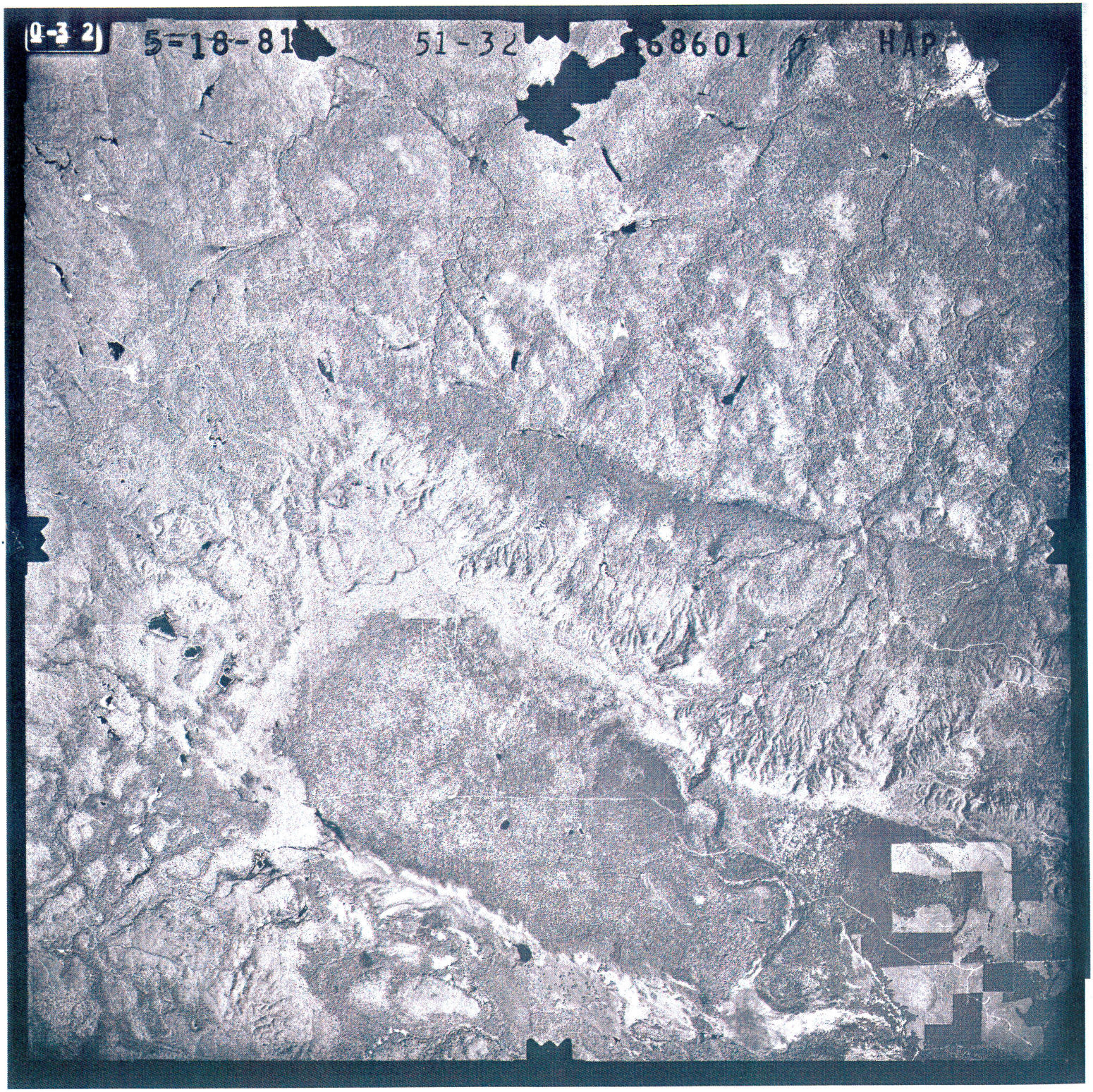


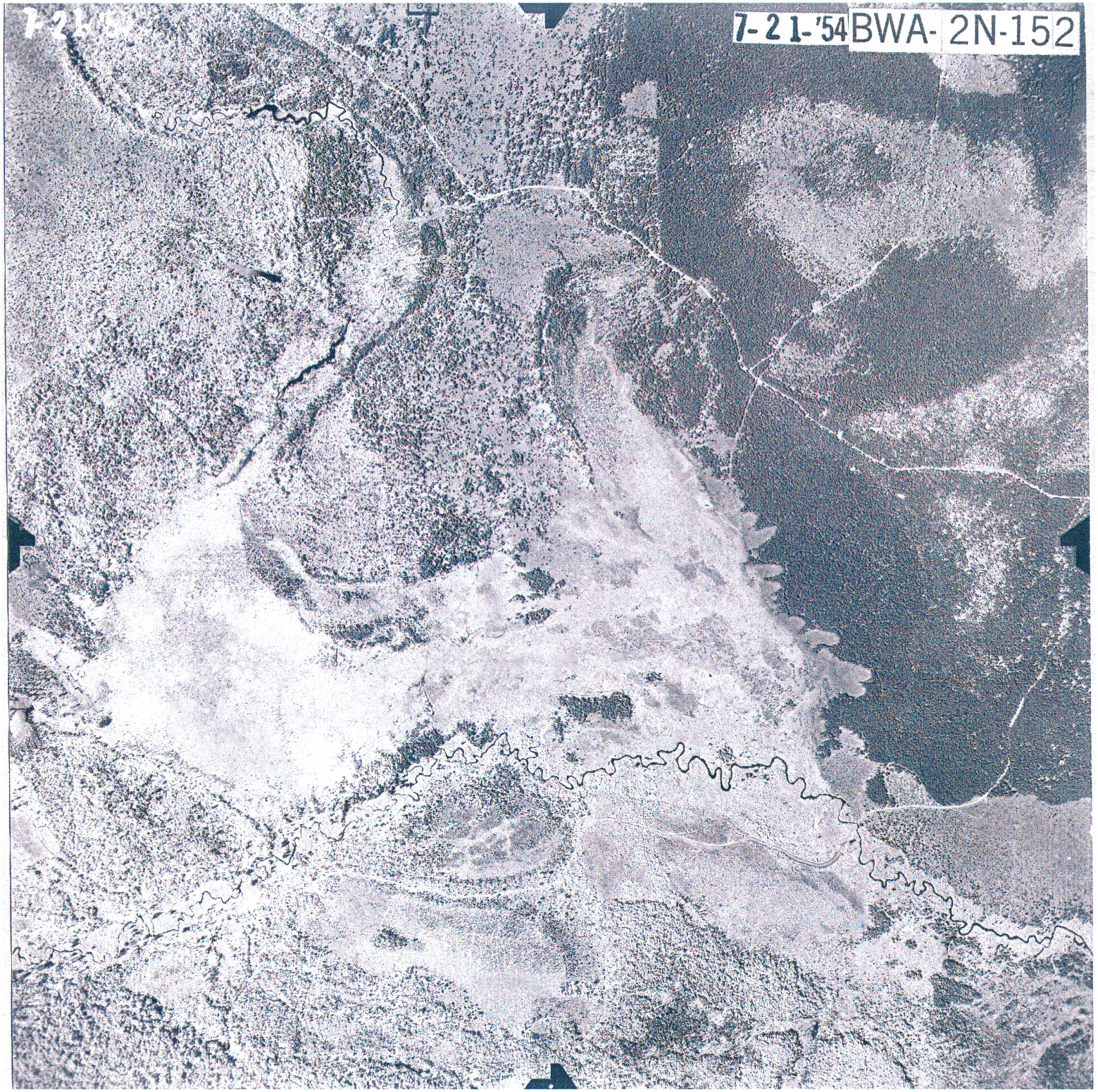
Photograph 16 (ABL087NE) – Another furrow (at left) near west end of the Eagle East exposure.

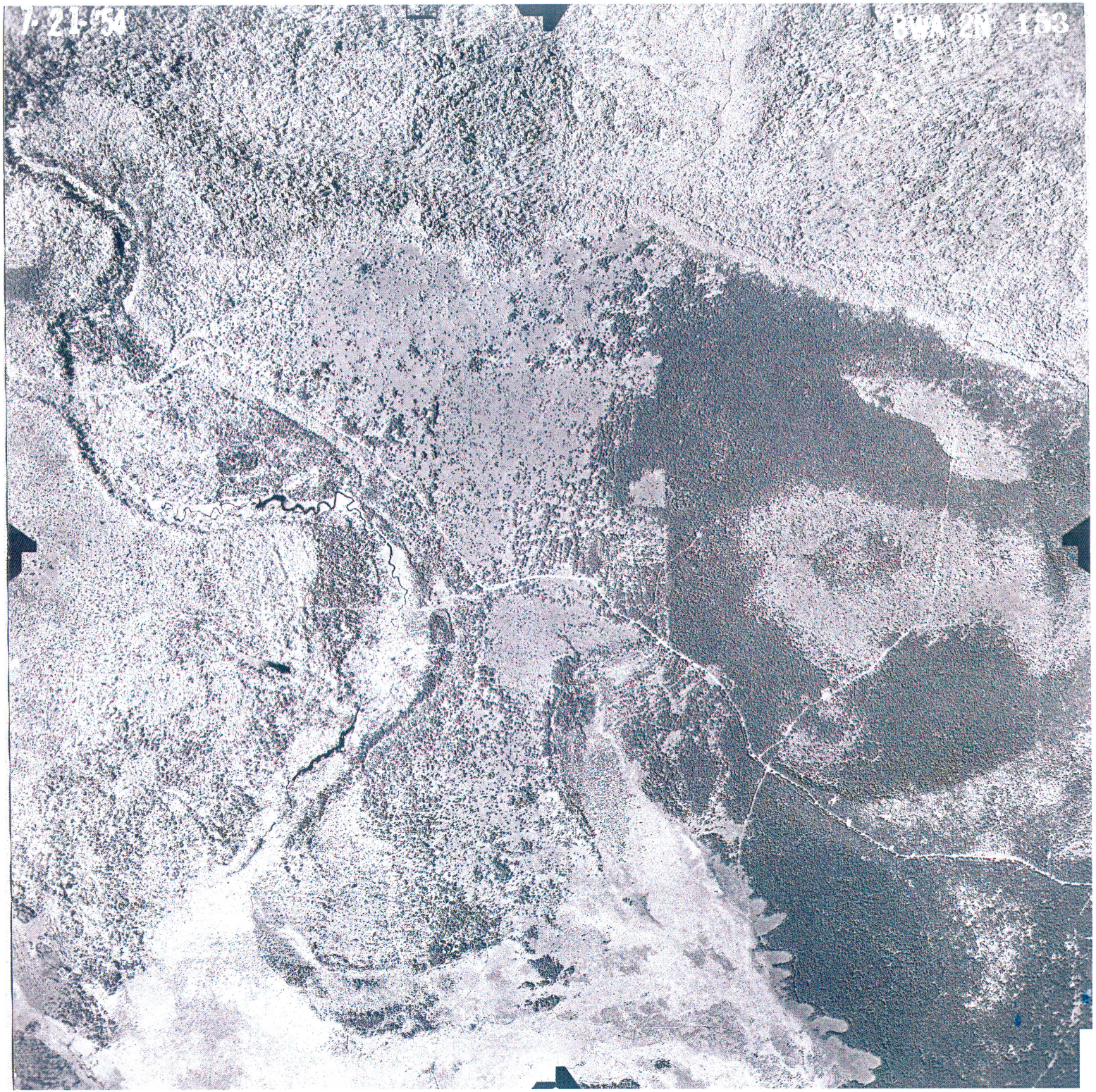
APPENDIX B

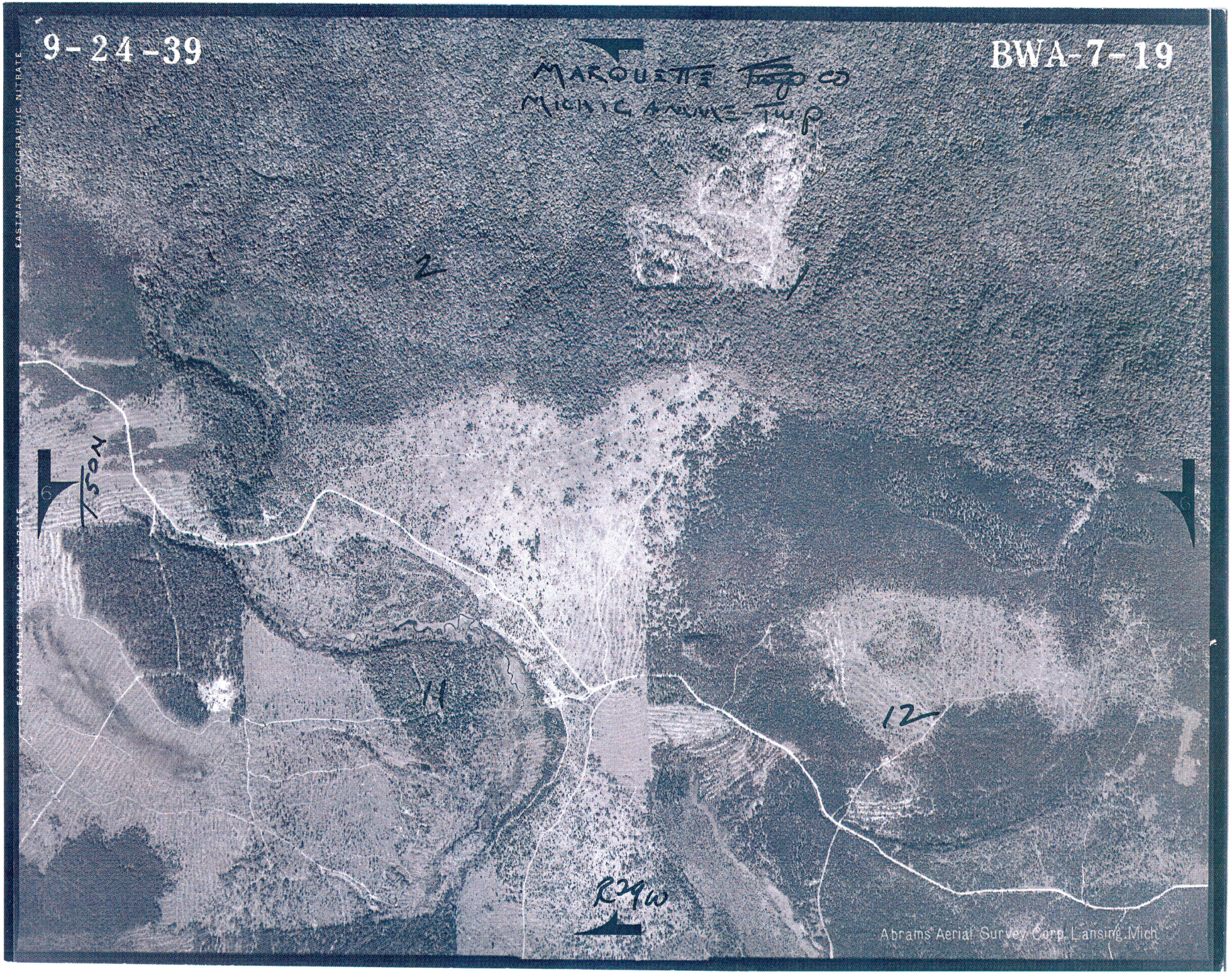
HISTORICAL AERIAL PHOTOGRAPHS

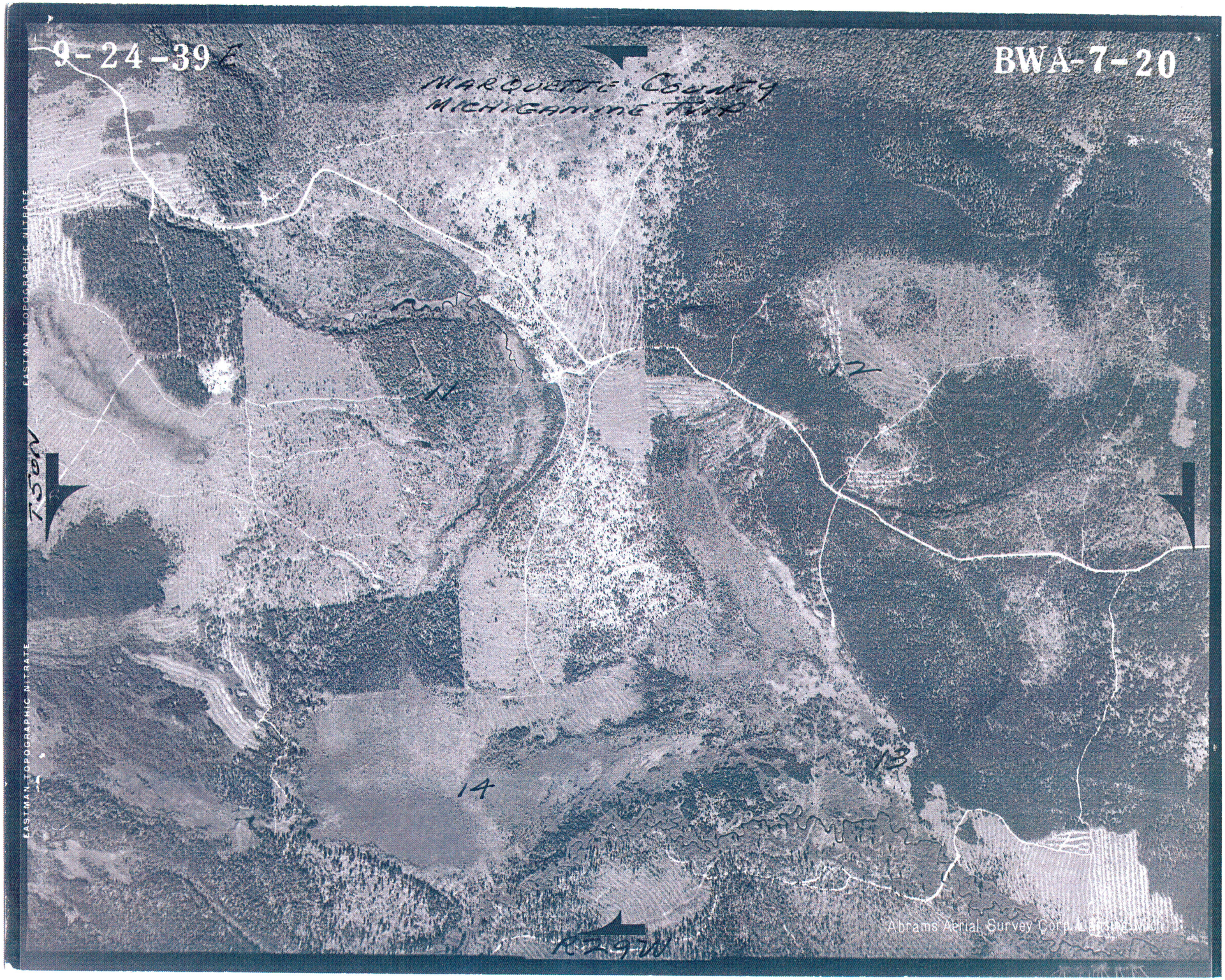

0-3 4
5-18-81
51-34
468601
HAP 81 F


Q-3 2
5-18-81
51-32
68601
HAP


7-21-'54 BWA- 2N-152


I-21-54
BWA-2N-153


9-24-39
BWA-7-19
MARQUETTE Twp CO
MICHIGAMME Twp
2
1
T 50 N
6
11
12
R 29 W
Abrams Aerial Survey Corp. Lansing, Mich.
EASTMAN TOPOGRAPHIC NITRATE


9-24-39 E
BWA-7-20
MARQUETTE COUNTY
MICHIGAMME TWP
11
12
13
14
T47N
R27W
R26W
EASTMAN TOPOGRAPHIC NITRATE
Abrams Aerial Survey Corp. Lansing, Mich.

APPENDIX C

GLACIAL OUTWASH
GRAIN SIZE DISTRIBUTION CURVES

Template For Sand Grain-size and Perm

Global Information:	PROJECT NAME:	Kex Eagle
	PROJECT NUMBER:	033-2156
	SAMPLE ID:	ABL - 010 061504
	SAMPLE TYPE:	Bag
	SAMPLE DEPTH:	-
	DESCRIPTION:	Red, SILTY SAND, trace gravel
	USCS:	SP-SM

AS-RECEIVED MOISTURE CONTENT:	
Weight of Wet Soil & Tare	62.77
Weight of Dry Soil & Tare	60.20
Weight of Tare	30.71
Weight of Water	2.57
Weight of Dry Soil	29.49
Water Content	8.71%

TITLE BLOCK:	
TECH	ARM/CC/NV
DATE	10/02/04
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136

PROJECT TITLE	Kex Eagle	**SAMPLE ID**	ABL - 010 061504
PROJECT NO.	033-2156	**SAMPLE TYPE**	Bag
REMARKS		**SAMPLE DEPTH**	-

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	62.77
Wt Dry Soil & Tare (gm)	(w2)	60.20
Weight of Tare (gm)	(w3)	30.71
Weight of Water (gm)	(w4=w1-w2)	2.57
Weight of Dry Soil (gm)	(w5=w2-w3)	29.49
Moisture Content (%)	(w4/w5)*100	8.71

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	62.77
Dry Soil & Tare (gm)	60.20
Tare Weight (gm)	30.71
Moisture Content (%)	8.71

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	716.74
	Tare Weight (gm)	158.69
(W6)	Total Dry Weight (gm)	513.32

SIEVE ANALYSIS

Tare Weight: 158.08

	Wt Ret + Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100	% PASS (100-%ret)	SIEVE	
3.0"	158.08	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	158.08	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	158.08	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	158.08	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	158.08	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	158.08	0.00	0.00	100.00	0.75"	fine gravel
0.50"	158.08	0.00	0.00	100.00	0.50"	fine gravel
0.375"	163.66	5.58	1.09	98.91	0.375"	fine gravel
#4	168.85	10.77	2.10	97.90	#4	coarse sand
#10	179.40	21.32	4.15	95.85	#10	medium sand
#20	204.72	46.64	9.09	90.91	#20	medium sand
#40	306.30	148.22	28.88	71.12	#40	fine sand
#60	527.91	369.83	72.05	27.95	#60	fine sand
#100	621.94	463.86	90.37	9.63	#100	fine sand
#200	642.91	484.83	94.45	5.55	#200	fines

% C GRAVEL	0.00
% F GRAVEL	2.10
% C SAND	2.06
% M SAND	24.72
% F SAND	65.58
% FINES	5.55
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

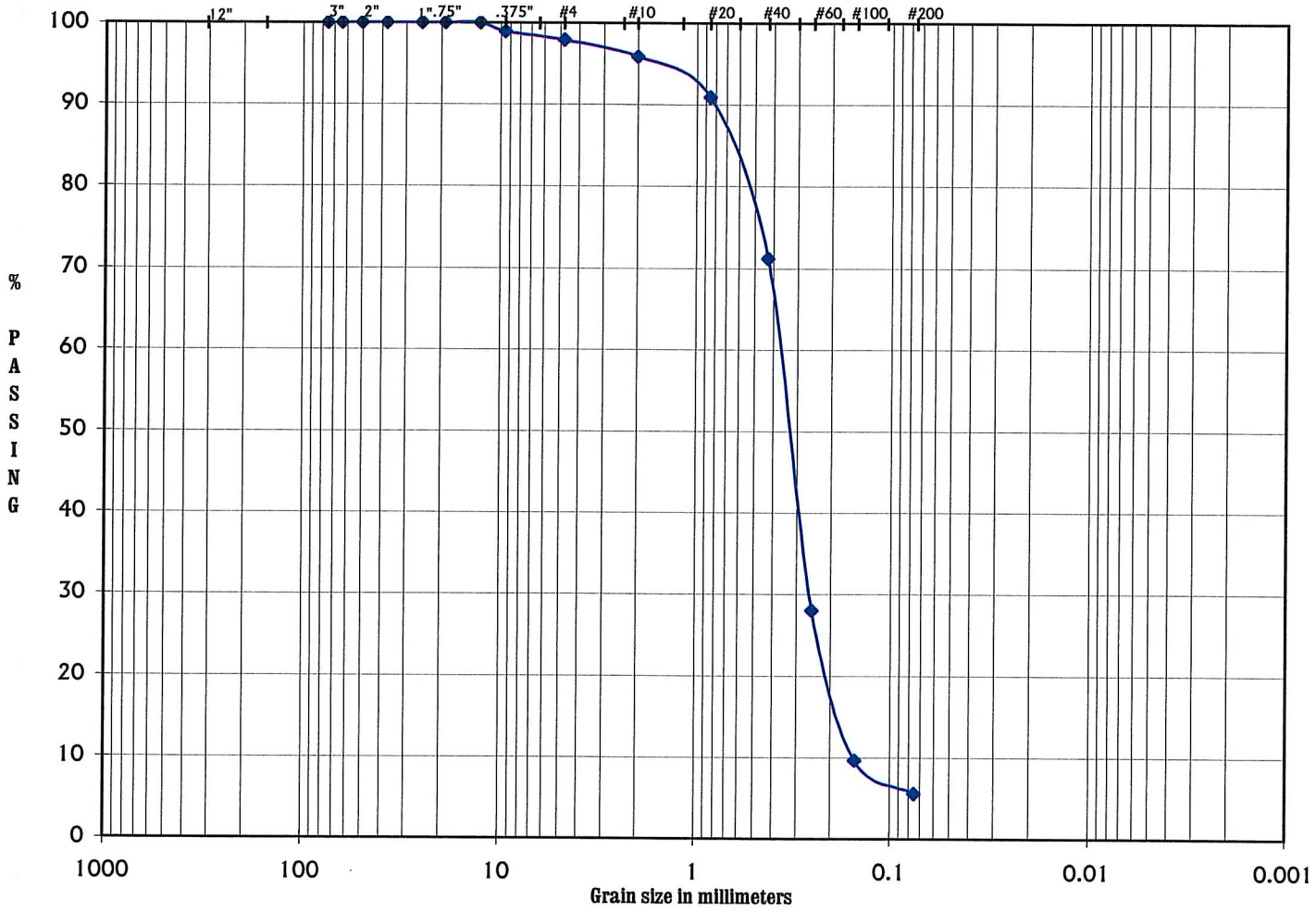
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION: Red, SILTY SAND, trace gravel

USCS: SP-SM

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	0.00	2.10	2.06	24.72	65.58	5.55

SAMPLE ID	ABL - 010 061504
SAMPLE TYPE	Bag
SAMPLE DEPTH	-

LL	-
PL	-
PI	-

DESCRIPTION	Red, SILTY SAND, trace gravel
USCS	SP-SM

Kex Eagle
033-2156

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

Template For Sand Grain-size and Perm

Global Information:	PROJECT NAME:	Kex Eagle
	PROJECT NUMBER:	033-2156
	SAMPLE ID:	ABL - 016 061504
	SAMPLE TYPE:	Bag
	SAMPLE DEPTH:	-
	DESCRIPTION:	Red, POORLY GRADED SAND, trace gravel, trace fines
	USCS:	SP

AS-RECEIVED MOISTURE CONTENT:	
Weight of Wet Soil & Tare	70.31
Weight of Dry Soil & Tare	67.84
Weight of Tare	30.82
Weight of Water	2.47
Weight of Dry Soil	37.02
Water Content	6.67%

TITLE BLOCK:	
TECH	ARM/CC/NV
DATE	10/02/04
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136

PROJECT TITLE	Kex Eagle	**SAMPLE ID**	ABL - 016 061504
PROJECT NO.	033-2156	**SAMPLE TYPE**	Bag
REMARKS		**SAMPLE DEPTH**	-

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	70.31
Wt Dry Soil & Tare (gm)	(w2)	67.84
Weight of Tare (gm)	(w3)	30.82
Weight of Water (gm)	(w4=w1-w2)	2.47
Weight of Dry Soil (gm)	(w5=w2-w3)	37.02
Moisture Content (%)	(w4/w5)*100	6.67

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	70.31
Dry Soil & Tare (gm)	67.84
Tare Weight (gm)	30.82
Moisture Content (%)	6.67

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	702.05
	Tare Weight (gm)	156.49
(W6)	Total Dry Weight (gm)	511.44

SIEVE ANALYSIS

Tare Weight: 156.28

	Wt Ret + Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100	% PASS (100-%ret)	SIEVE	
3.0"	156.28	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	156.28	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	156.28	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	156.28	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	156.28	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	156.28	0.00	0.00	100.00	0.75"	fine gravel
0.50"	156.38	0.10	0.02	99.98	0.50"	fine gravel
0.375"	161.59	5.31	1.04	98.96	0.375"	fine gravel
#4	165.21	8.93	1.75	98.25	#4	coarse sand
#10	169.69	13.41	2.62	97.38	#10	medium sand
#20	184.41	28.13	5.50	94.50	#20	medium sand
#40	340.14	183.86	35.95	64.05	#40	fine sand
#60	570.03	413.75	80.90	19.10	#60	fine sand
#100	641.01	484.73	94.78	5.22	#100	fine sand
#200	656.61	500.33	97.83	2.17	#200	fines

% C GRAVEL	0.00
% F GRAVEL	1.75
% C SAND	0.88
% M SAND	33.33
% F SAND	61.88
% FINES	2.17
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

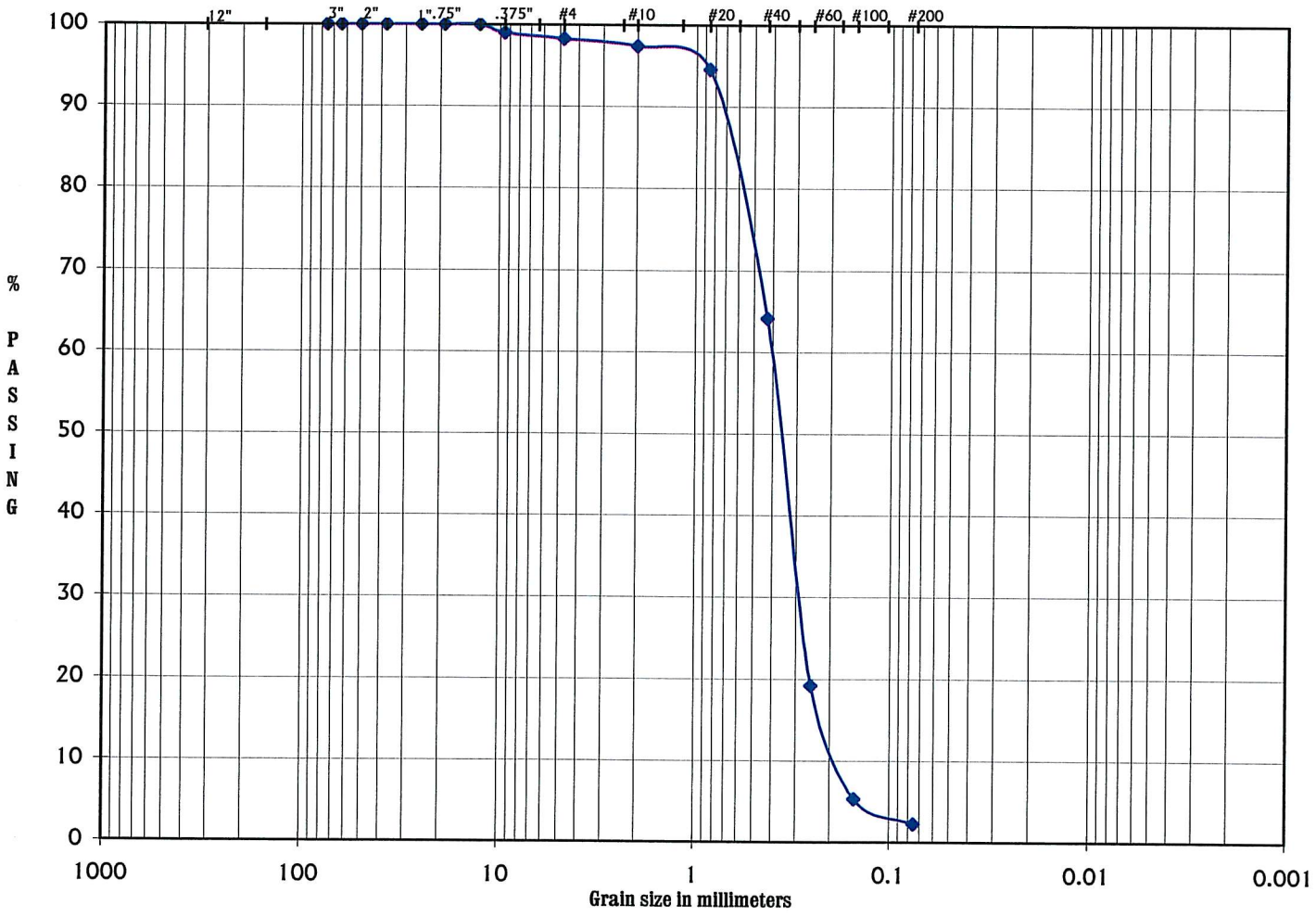
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION: Red, POORLY GRADED SAND, trace gravel, trace fines

USCS: SP

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	0.00	1.75	0.88	33.33	61.88	2.17

SAMPLE ID	ABL - 016 061504
SAMPLE TYPE	Bag
SAMPLE DEPTH	-

LL	-
PL	-
PI	-

DESCRIPTION	Red, POORLY GRADED SAND, trace gravel, trace fines
USCS	SP

Kex Eagle
033-2156

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

Template For Sand Grain-size and Perm

Global Information:	PROJECT NAME:	Kex Eagle
	PROJECT NUMBER:	033-2156
	SAMPLE ID:	ABL - 045 061504
	SAMPLE TYPE:	Bag
	SAMPLE DEPTH:	-
	DESCRIPTION:	Red, POORLY GRADED SAND, trace gravel, trace fines
	USCS:	SP

AS-RECEIVED MOISTURE CONTENT:	
Weight of Wet Soil & Tare	65.50
Weight of Dry Soil & Tare	62.89
Weight of Tare	30.73
Weight of Water	2.61
Weight of Dry Soil	32.16
Water Content	8.12%

TITLE BLOCK:	
TECH	ARM/CC/NV
DATE	10/02/04
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136

PROJECT TITLE	Kex Eagle	**SAMPLE ID**	ABL - 045 061504
PROJECT NO.	033-2156	**SAMPLE TYPE**	Bag
REMARKS		**SAMPLE DEPTH**	-

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	65.50
Wt Dry Soil & Tare (gm)	(w2)	62.89
Weight of Tare (gm)	(w3)	30.73
Weight of Water (gm)	(w4=w1-w2)	2.61
Weight of Dry Soil (gm)	(w5=w2-w3)	32.16
Moisture Content (%)	(w4/w5)*100	8.12

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	65.50
Dry Soil & Tare (gm)	62.89
Tare Weight (gm)	30.73
Moisture Content (%)	8.12

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	700.87
	Tare Weight (gm)	157.46
(W6)	Total Dry Weight (gm)	502.62

SIEVE ANALYSIS

Tare Weight: 157.36

	Wt Ret + Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100	% PASS (100-%ret)	SIEVE	
3.0"	157.36	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	157.36	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	157.36	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	157.36	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	157.36	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	157.36	0.00	0.00	100.00	0.75"	fine gravel
0.50"	161.25	3.89	0.77	99.23	0.50"	fine gravel
0.375"	162.71	5.35	1.06	98.94	0.375"	fine gravel
#4	167.45	10.09	2.01	97.99	#4	coarse sand
#10	173.68	16.32	3.25	96.75	#10	medium sand
#20	185.97	28.61	5.69	94.31	#20	medium sand
#40	267.57	110.21	21.93	78.07	#40	fine sand
#60	524.57	367.21	73.06	26.94	#60	fine sand
#100	625.76	468.40	93.19	6.81	#100	fine sand
#200	641.26	483.90	96.28	3.72	#200	fines

% C GRAVEL	0.00
% F GRAVEL	2.01
% C SAND	1.24
% M SAND	18.68
% F SAND	74.35
% FINES	3.72
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

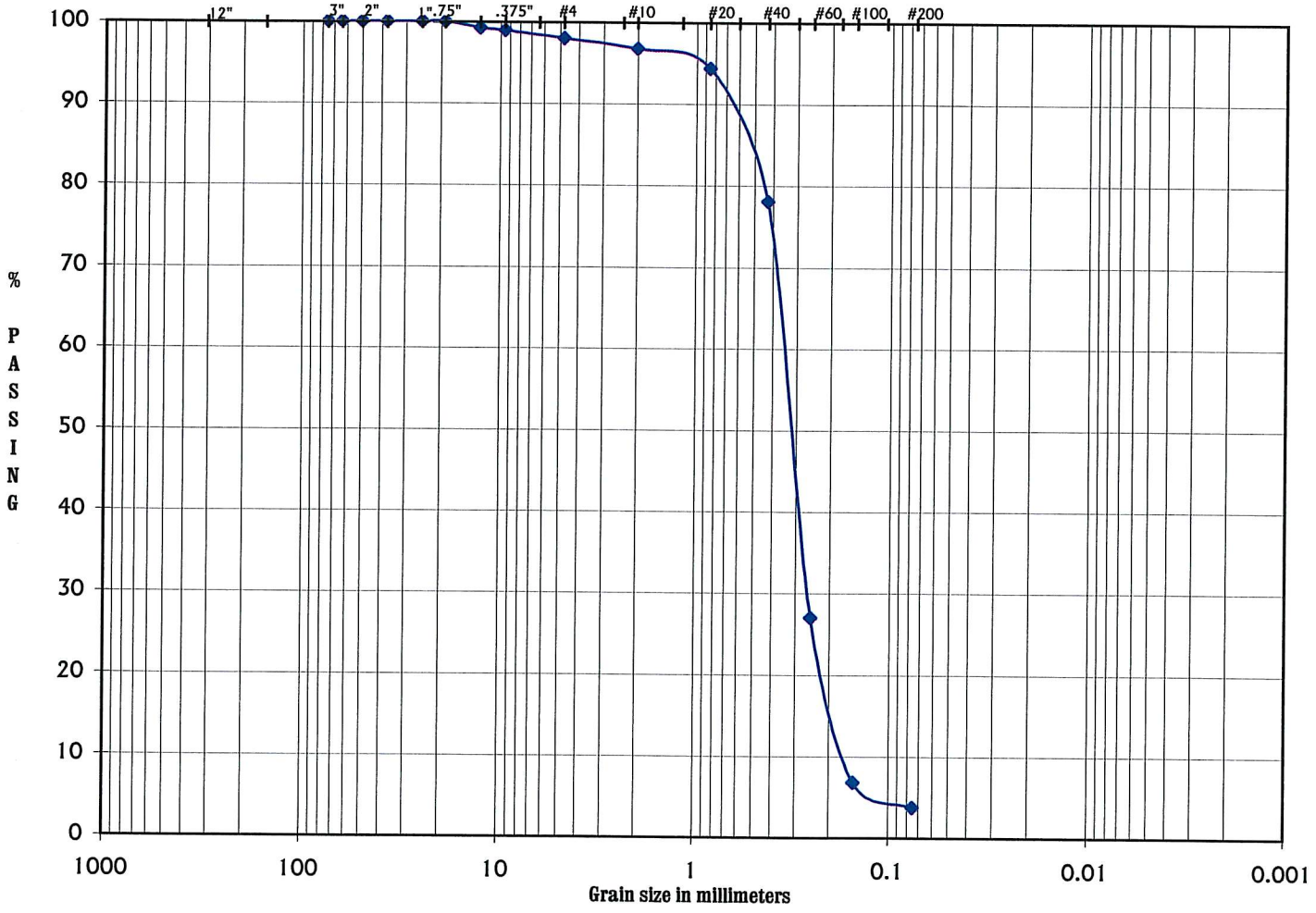
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION: Red, POORLY GRADED SAND, trace gravel, trace fines

USCS: SP

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	0.00	2.01	1.24	18.68	74.35	3.72

SAMPLE ID	ABL - 045 061504
SAMPLE TYPE	Bag
SAMPLE DEPTH	-

LL	-
PL	-
PI	-

DESCRIPTION	Red, POORLY GRADED SAND, trace gravel, trace fines
USCS	SP

Kex Eagle
033-2156

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

Template For Sand Grain-size and Perm

Global Information:	PROJECT NAME:	Kex Eagle
	PROJECT NUMBER:	033-2156
	SAMPLE ID:	ABL - 051 061604
	SAMPLE TYPE:	Bag
	SAMPLE DEPTH:	-
	DESCRIPTION:	Red, POORLY GRADED SAND, trace gravel, trace fines
	USCS:	SP

AS-RECEIVED MOISTURE CONTENT:	
Weight of Wet Soil & Tare	70.29
Weight of Dry Soil & Tare	68.26
Weight of Tare	30.65
Weight of Water	2.03
Weight of Dry Soil	37.61
Water Content	5.40%

TITLE BLOCK:	
TECH	ARM/CC/NV
DATE	10/02/04
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136

PROJECT TITLE	Kex Eagle	**SAMPLE ID**	ABL - 051 061604
PROJECT NO.	033-2156	**SAMPLE TYPE**	Bag
REMARKS		**SAMPLE DEPTH**	-

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	70.29
Wt Dry Soil & Tare (gm)	(w2)	68.26
Weight of Tare (gm)	(w3)	30.65
Weight of Water (gm)	(w4=w1-w2)	2.03
Weight of Dry Soil (gm)	(w5=w2-w3)	37.61
Moisture Content (%)	(w4/w5)*100	5.40

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	70.29
Dry Soil & Tare (gm)	68.26
Tare Weight (gm)	30.65
Moisture Content (%)	5.40

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	703.09
	Tare Weight (gm)	156.84
(W6)	Total Dry Weight (gm)	518.28

SIEVE ANALYSIS

Tare Weight: 156.64

	Wt Ret + Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100	% PASS (100-%ret)	SIEVE	
3.0"	156.64	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	156.64	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	156.64	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	156.64	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	156.64	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	156.64	0.00	0.00	100.00	0.75"	fine gravel
0.50"	156.73	0.09	0.02	99.98	0.50"	fine gravel
0.375"	156.73	0.09	0.02	99.98	0.375"	fine gravel
#4	157.48	0.84	0.16	99.84	#4	coarse sand
#10	160.35	3.71	0.72	99.28	#10	medium sand
#20	170.17	13.53	2.61	97.39	#20	medium sand
#40	290.05	133.41	25.74	74.26	#40	fine sand
#60	595.09	438.45	84.60	15.40	#60	fine sand
#100	661.83	505.19	97.48	2.52	#100	fine sand
#200	666.68	510.04	98.41	1.59	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.16
% C SAND	0.55
% M SAND	25.03
% F SAND	72.67
% FINES	1.59
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

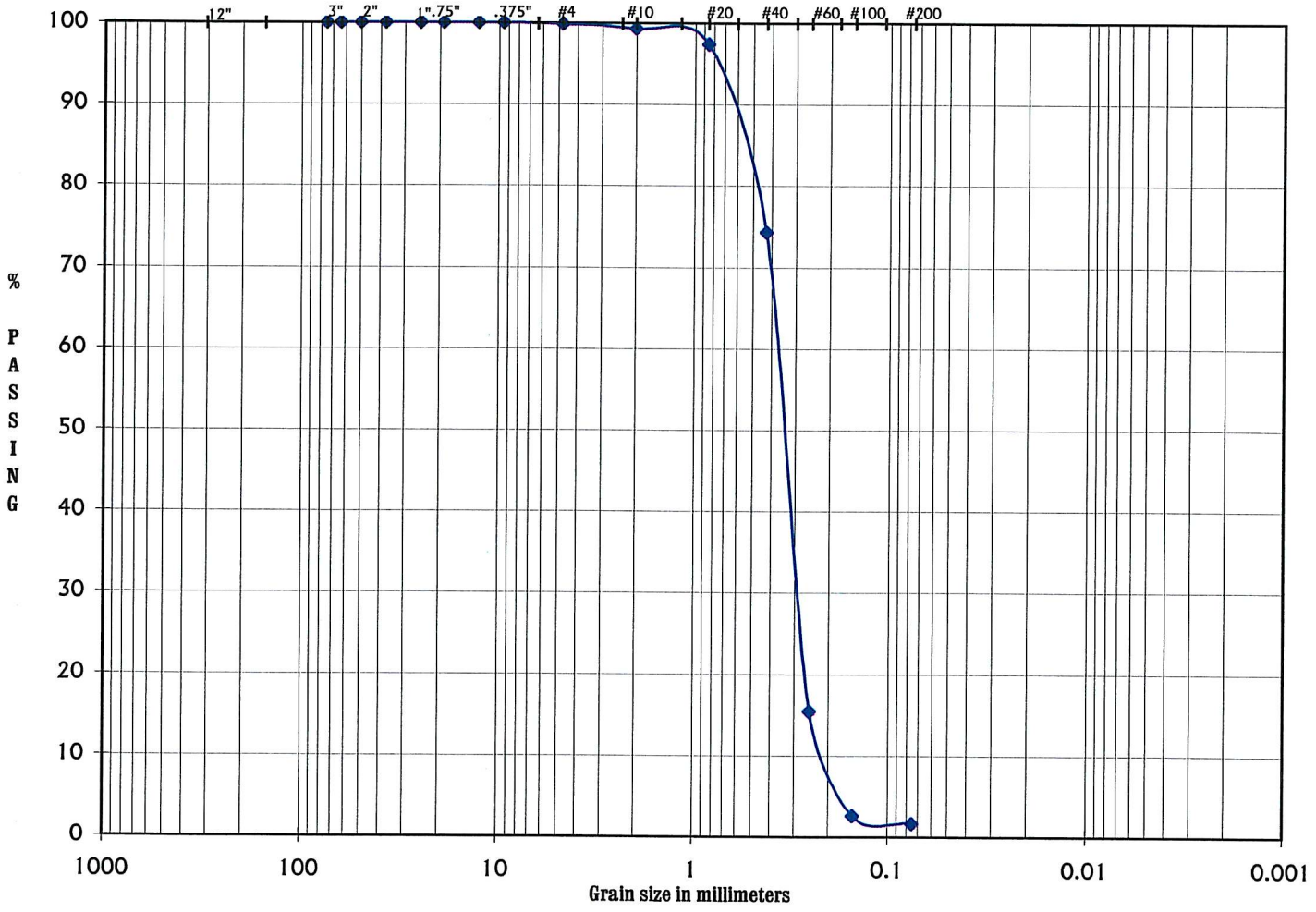
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION: Red, POORLY GRADED SAND, trace gravel, trace fines

USCS: SP

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse Gravel	Fine Gravel	Cor SAND	Med SAND	Fine SAND	SILT OR CLAY FINES
	0.00	0.00	0.16	0.55	25.03	72.67	1.59

SAMPLE ID	ABL - 051 061604
SAMPLE TYPE	Bag
SAMPLE DEPTH	-

LL	-
PL	-
PI	-

DESCRIPTION	Red, POORLY GRADED SAND, trace gravel, trace fines
USCS	SP

Kex Eagle
033-2156

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

Template For Sand Grain-size and Perm

Global Information:	PROJECT NAME:	Kex Eagle
	PROJECT NUMBER:	033-2156
	SAMPLE ID:	ABL - 073 061704
	SAMPLE TYPE:	Bag
	SAMPLE DEPTH:	-
	DESCRIPTION:	Red, POORLY GRADED SAND, trace gravel, trace fines
	USCS:	SP

AS-RECEIVED MOISTURE CONTENT:	
Weight of Wet Soil & Tare	50.95
Weight of Dry Soil & Tare	48.22
Weight of Tare	15.73
Weight of Water	2.73
Weight of Dry Soil	32.49
Water Content	8.40%

TITLE BLOCK:	
TECH	ARM/CC/NV
DATE	10/02/04
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136

PROJECT TITLE	Kex Eagle	**SAMPLE ID**	ABL - 073 061704
PROJECT NO.	033-2156	**SAMPLE TYPE**	Bag
REMARKS		**SAMPLE DEPTH**	-

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	50.95
Wt Dry Soil & Tare (gm)	(w2)	48.22
Weight of Tare (gm)	(w3)	15.73
Weight of Water (gm)	(w4=w1-w2)	2.73
Weight of Dry Soil (gm)	(w5=w2-w3)	32.49
Moisture Content (%)	(w4/w5)*100	8.40

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	50.95
Dry Soil & Tare (gm)	48.22
Tare Weight (gm)	15.73
Moisture Content (%)	8.40

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	700.53
	Tare Weight (gm)	152.06
(W6)	Total Dry Weight (gm)	505.96

SIEVE ANALYSIS

Tare Weight: 152.01

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100	% PASS (100-%ret)	SIEVE	
3.0"	152.01	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	152.01	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	152.01	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	152.01	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	152.01	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	152.01	0.00	0.00	100.00	0.75"	fine gravel
0.50"	152.01	0.00	0.00	100.00	0.50"	fine gravel
0.375"	157.77	5.76	1.14	98.86	0.375"	fine gravel
#4	174.50	22.49	4.45	95.55	#4	coarse sand
#10	188.91	36.90	7.29	92.71	#10	medium sand
#20	226.45	74.44	14.71	85.29	#20	medium sand
#40	366.55	214.54	42.40	57.60	#40	fine sand
#60	584.90	432.89	85.56	14.44	#60	fine sand
#100	636.07	484.06	95.67	4.33	#100	fine sand
#200	636.13	484.12	95.68	4.32	#200	fines

% C GRAVEL	0.00
% F GRAVEL	4.45
% C SAND	2.85
% M SAND	35.11
% F SAND	53.28
% FINES	4.32
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

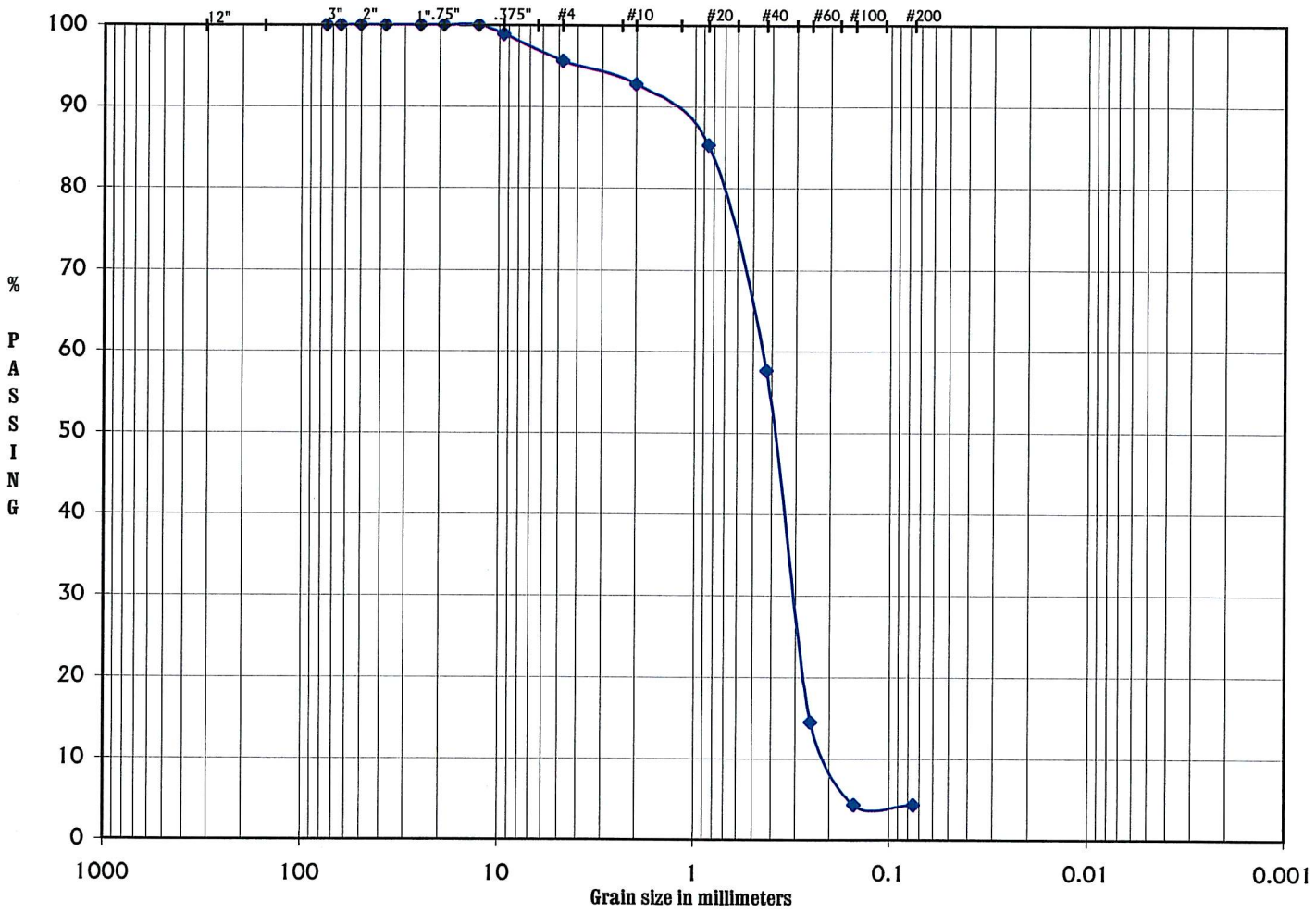
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION: Red, POORLY GRADED SAND, trace gravel, trace fines

USCS: SP

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	0.00	4.45	2.85	35.11	53.28	4.32

SAMPLE ID	ABL - 073 061704
SAMPLE TYPE	Bag
SAMPLE DEPTH	-

LL	-
PL	-
PI	-

DESCRIPTION	Red, POORLY GRADED SAND, trace gravel, trace fines
USCS	SP

Kex Eagle
033-2156

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

Template For Sand Grain-size and Perm

Global Information:	PROJECT NAME:	Kex Eagle
	PROJECT NUMBER:	033-2156
	SAMPLE ID:	ABL - 082 061704
	SAMPLE TYPE:	Bag
	SAMPLE DEPTH:	-
	DESCRIPTION:	Red, POORLY GRADED SAND, trace gravel, trace fines
	USCS:	SP

AS-RECEIVED MOISTURE CONTENT:	
Weight of Wet Soil & Tare	37.57
Weight of Dry Soil & Tare	36.48
Weight of Tare	15.95
Weight of Water	1.09
Weight of Dry Soil	20.53
Water Content	5.31%

TITLE BLOCK:	
TECH	ARM/CC/NV
DATE	10/02/04
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136

PROJECT TITLE	Kex Eagle	**SAMPLE ID**	ABL - 082 061704
PROJECT NO.	033-2156	**SAMPLE TYPE**	Bag
REMARKS		**SAMPLE DEPTH**	-

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	37.57
Wt Dry Soil & Tare (gm)	(w2)	36.48
Weight of Tare (gm)	(w3)	15.95
Weight of Water (gm)	(w4=w1-w2)	1.09
Weight of Dry Soil (gm)	(w5=w2-w3)	20.53
Moisture Content (%)	(w4/w5)*100	5.31

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	37.57
Dry Soil & Tare (gm)	36.48
Tare Weight (gm)	15.95
Moisture Content (%)	5.31

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	675.51
	Tare Weight (gm)	156.23
(W6)	Total Dry Weight (gm)	493.10

SIEVE ANALYSIS

Tare Weight: 156.17

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100	% PASS (100-%ret)	SIEVE	
3.0"	156.17	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	156.17	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	156.17	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	156.17	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	156.17	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	156.17	0.00	0.00	100.00	0.75"	fine gravel
0.50"	156.17	0.00	0.00	100.00	0.50"	fine gravel
0.375"	158.23	2.06	0.42	99.58	0.375"	fine gravel
#4	161.66	5.49	1.11	98.89	#4	coarse sand
#10	168.64	12.47	2.53	97.47	#10	medium sand
#20	186.00	29.83	6.05	93.95	#20	medium sand
#40	373.10	216.93	43.99	56.01	#40	fine sand
#60	557.48	401.31	81.39	18.61	#60	fine sand
#100	622.56	466.39	94.58	5.42	#100	fine sand
#200	638.50	482.33	97.82	2.18	#200	fines

% C GRAVEL	0.00
% F GRAVEL	1.11
% C SAND	1.42
% M SAND	41.46
% F SAND	53.82
% FINES	2.18
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

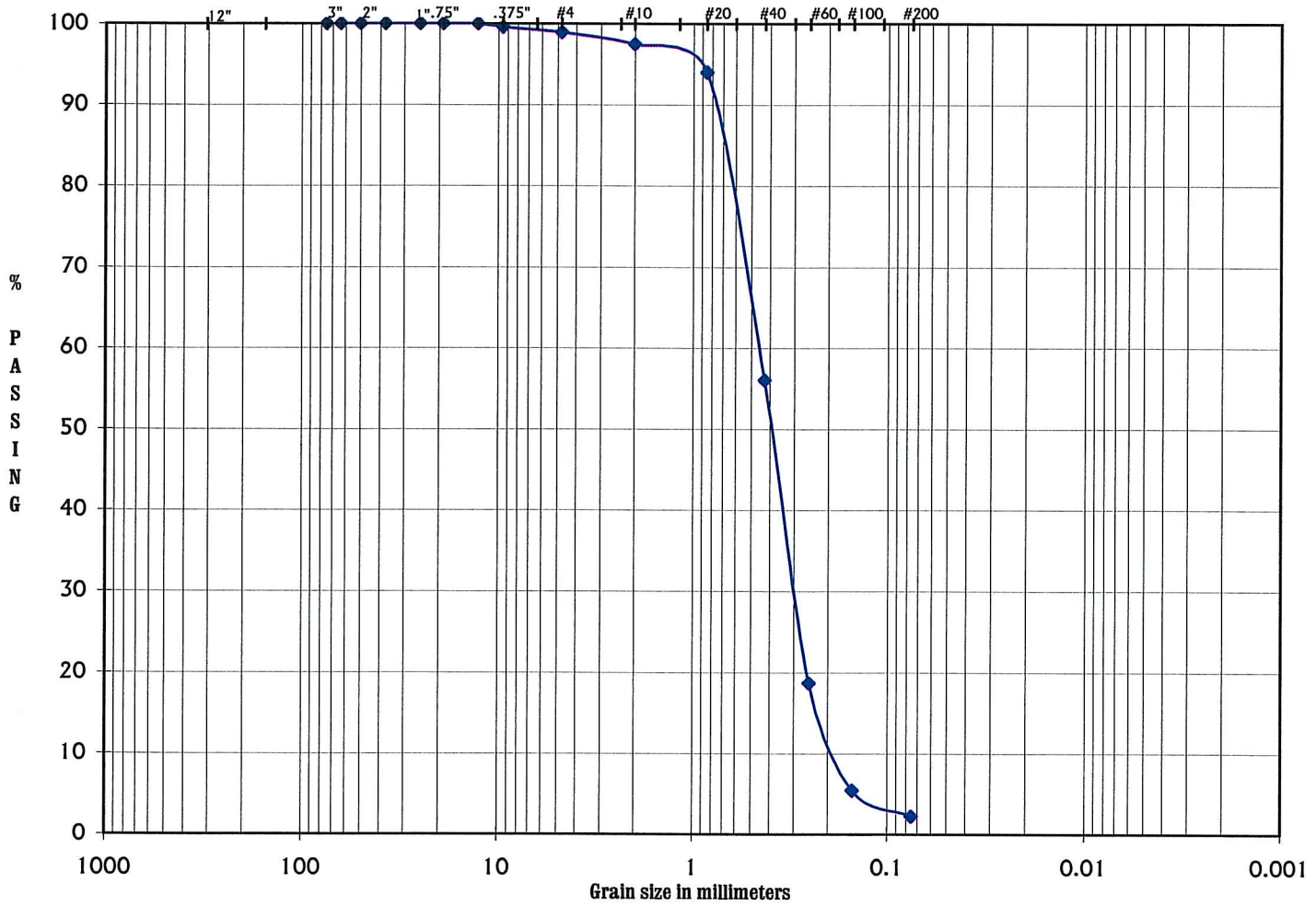
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION: Red, POORLY GRADED SAND, trace gravel, trace fines

USCS: SP

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel			SAND		FINES
	0.00	0.00	1.11	1.42	41.46	53.82	2.18

SAMPLE ID	ABL - 082 061704
SAMPLE TYPE	Bag
SAMPLE DEPTH	-

LL	-
PL	-
PI	-

DESCRIPTION	Red, POORLY GRADED SAND, trace gravel, trace fines
USCS	SP

Kex Eagle
033-2156

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

Template For Sand Grain-size and Perm

Global Information:	PROJECT NAME:	Kex Eagle
	PROJECT NUMBER:	033-2156
	SAMPLE ID:	DPR - 014 061504
	SAMPLE TYPE:	Bag
	SAMPLE DEPTH:	-
	DESCRIPTION:	Red, POORLY GRADED SAND, trace gravel, trace fines
	USCS:	SP

AS-RECEIVED MOISTURE CONTENT:	
Weight of Wet Soil & Tare	34.97
Weight of Dry Soil & Tare	33.99
Weight of Tare	15.98
Weight of Water	0.98
Weight of Dry Soil	18.01
Water Content	5.44%

TITLE BLOCK:	
TECH	ARM/CC/NV
DATE	10/02/04
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136

PROJECT TITLE	Kex Eagle	**SAMPLE ID**	DPR - 014 061504
PROJECT NO.	033-2156	**SAMPLE TYPE**	Bag
REMARKS		**SAMPLE DEPTH**	-

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	34.97
Wt Dry Soil & Tare (gm)	(w2)	33.99
Weight of Tare (gm)	(w3)	15.98
Weight of Water (gm)	(w4=w1-w2)	0.98
Weight of Dry Soil (gm)	(w5=w2-w3)	18.01
Moisture Content (%)	(w4/w5)*100	5.44

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	34.97
Dry Soil & Tare (gm)	33.99
Tare Weight (gm)	15.98
Moisture Content (%)	5.44

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	678.44
	Tare Weight (gm)	157.02
(W6)	Total Dry Weight (gm)	494.51

SIEVE ANALYSIS

Tare Weight: 156.90

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100	% PASS (100-%ret)	SIEVE	
3.0"	156.90	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	156.90	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	156.90	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	156.90	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	156.90	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	156.90	0.00	0.00	100.00	0.75"	fine gravel
0.50"	156.90	0.00	0.00	100.00	0.50"	fine gravel
0.375"	156.90	0.00	0.00	100.00	0.375"	fine gravel
#4	164.63	7.73	1.56	98.44	#4	coarse sand
#10	211.86	54.96	11.11	88.89	#10	medium sand
#20	310.38	153.48	31.04	68.96	#20	medium sand
#40	482.66	325.76	65.88	34.12	#40	fine sand
#60	600.56	443.66	89.72	10.28	#60	fine sand
#100	632.96	476.06	96.27	3.73	#100	fine sand
#200	640.44	483.54	97.78	2.22	#200	fines

% C GRAVEL	0.00
% F GRAVEL	1.56
% C SAND	9.55
% M SAND	54.76
% F SAND	31.91
% FINES	2.22
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

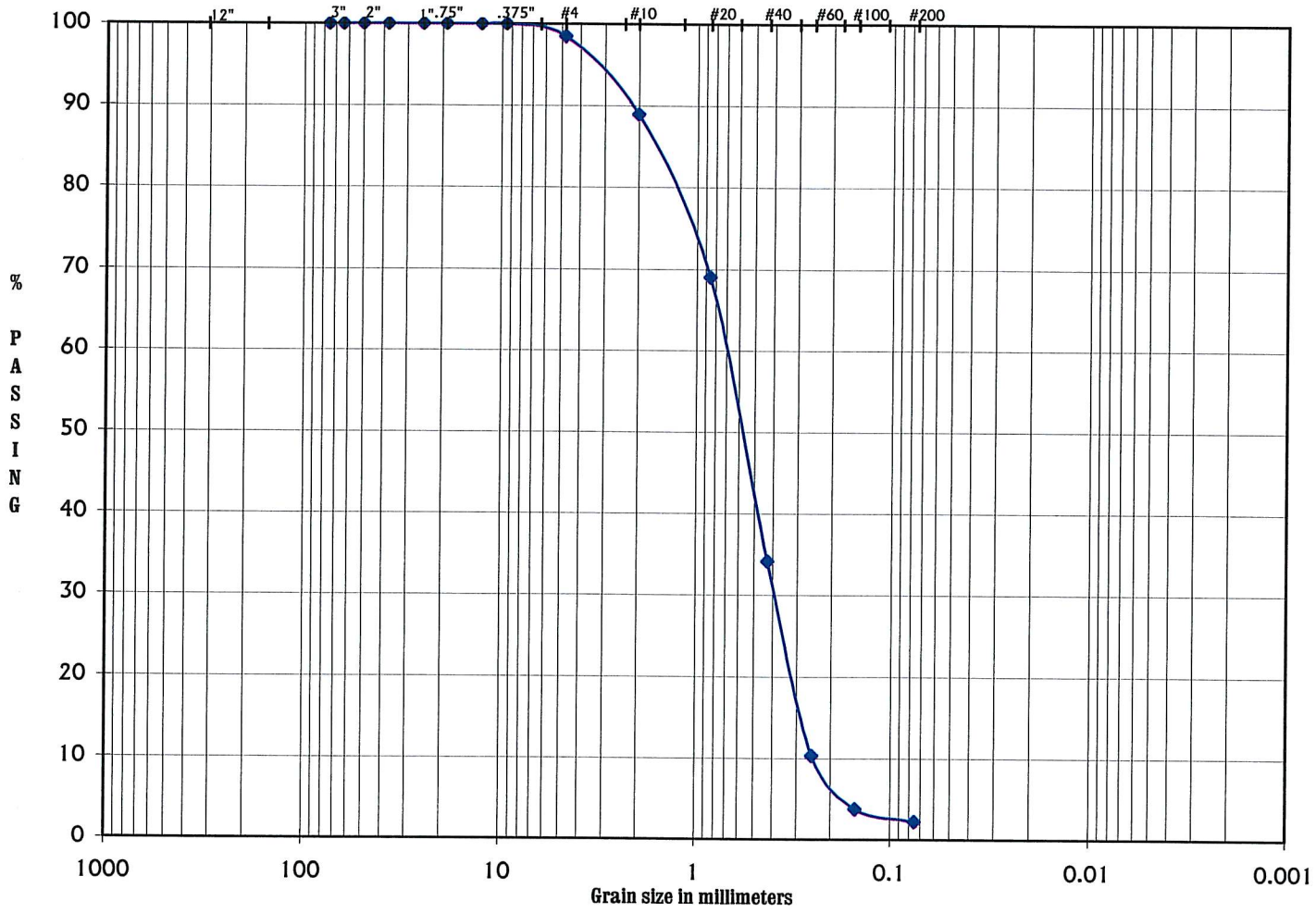
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION: Red, POORLY GRADED SAND, trace gravel, trace fines

USCS: SP

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	0.00	1.56	9.55	54.76	31.91	2.22

SAMPLE ID	DPR - 014 061504
SAMPLE TYPE	Bag
SAMPLE DEPTH	-

LL	-
PL	-
PI	-

DESCRIPTION	Red, POORLY GRADED SAND, trace gravel, trace fines
USCS	SP

Kex Eagle
033-2156

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

Template For Sand Grain-size and Perm

Global Information:	PROJECT NAME:	Kex Eagle
	PROJECT NUMBER:	033-2156
	SAMPLE ID:	DPR - 020 061604
	SAMPLE TYPE:	Bag
	SAMPLE DEPTH:	-
	DESCRIPTION:	Red, POORLY GRADED SAND, trace gravel, trace fines
	USCS:	SP

AS-RECEIVED MOISTURE CONTENT:	
Weight of Wet Soil & Tare	55.67
Weight of Dry Soil & Tare	53.84
Weight of Tare	15.77
Weight of Water	1.83
Weight of Dry Soil	38.07
Water Content	4.81%

TITLE BLOCK:	
TECH	ARM/CC/NV
DATE	10/02/04
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136

PROJECT TITLE	Kex Eagle	**SAMPLE ID**	DPR - 020 061604
PROJECT NO.	033-2156	**SAMPLE TYPE**	Bag
REMARKS		**SAMPLE DEPTH**	-

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	55.67
Wt Dry Soil & Tare (gm)	(w2)	53.84
Weight of Tare (gm)	(w3)	15.77
Weight of Water (gm)	(w4=w1-w2)	1.83
Weight of Dry Soil (gm)	(w5=w2-w3)	38.07
Moisture Content (%)	(w4/w5)*100	4.81

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	55.67
Dry Soil & Tare (gm)	53.84
Tare Weight (gm)	15.77
Moisture Content (%)	4.81

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	714.43
	Tare Weight (gm)	153.56
(W6)	Total Dry Weight (gm)	535.15

SIEVE ANALYSIS

Tare Weight: 153.63

	Wt Ret + Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	153.63	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	153.63	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	153.63	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	153.63	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	153.63	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	153.63	0.00	0.00	100.00	0.75"	fine gravel
0.50"	153.63	0.00	0.00	100.00	0.50"	fine gravel
0.375"	153.63	0.00	0.00	100.00	0.375"	fine gravel
#4	155.53	1.90	0.36	99.64	#4	coarse sand
#10	160.77	7.14	1.33	98.67	#10	medium sand
#20	179.21	25.58	4.78	95.22	#20	medium sand
#40	342.40	188.77	35.27	64.73	#40	fine sand
#60	600.95	447.32	83.59	16.41	#60	fine sand
#100	673.77	520.14	97.20	2.80	#100	fine sand
#200	681.57	527.94	98.65	1.35	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.36
% C SAND	0.98
% M SAND	33.94
% F SAND	63.38
% FINES	1.35
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

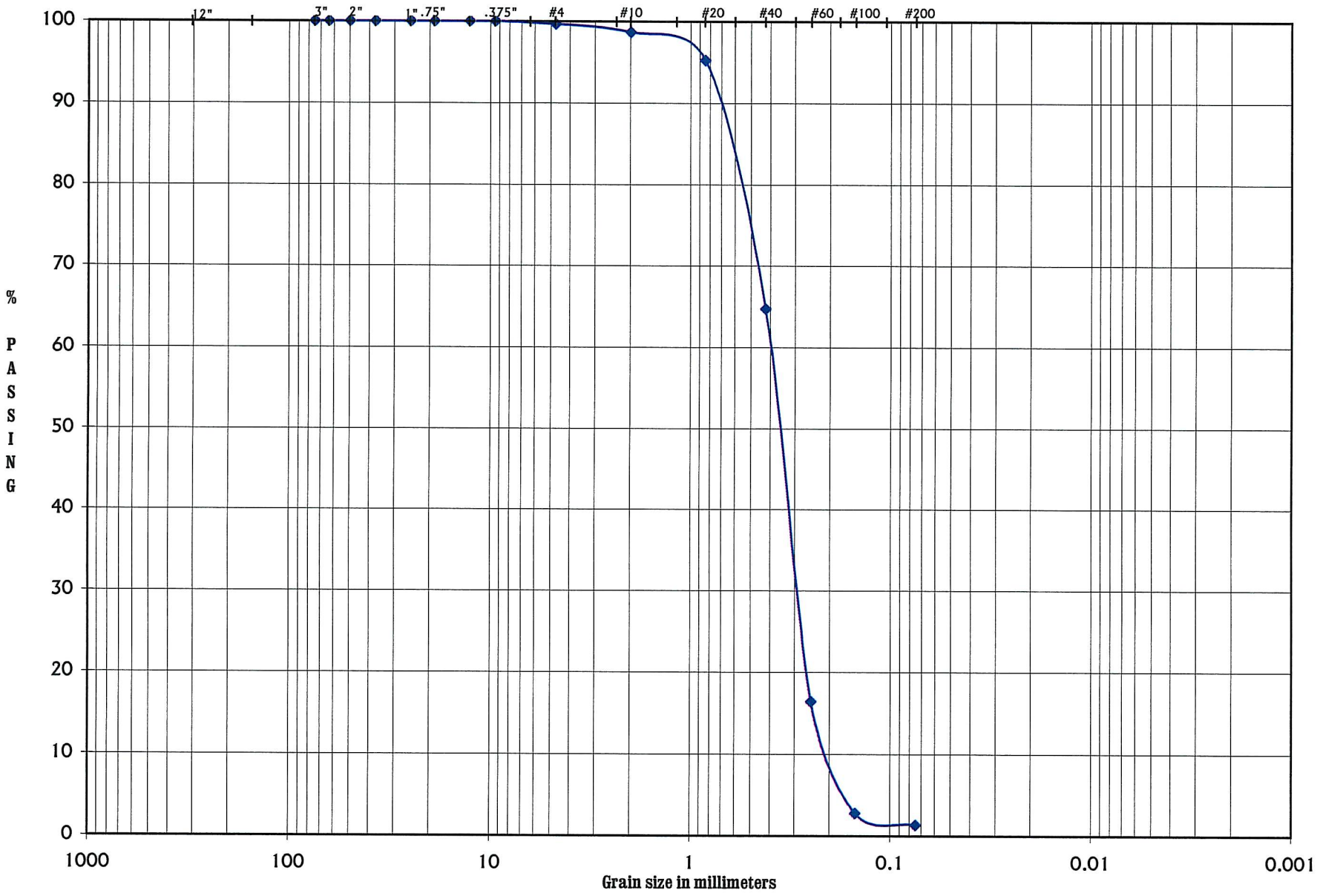
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION: Red, POORLY GRADED SAND, trace gravel, trace fines

USCS: SP

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

SIEVE GRAPH Chart 1



Template For Sand Grain-size and Perm

Global Information:	PROJECT NAME:	Kex Eagle
	PROJECT NUMBER:	033-2156
	SAMPLE ID:	DPR - 050 061704
	SAMPLE TYPE:	Bag
	SAMPLE DEPTH:	-
	DESCRIPTION:	Red, POORLY GRADED SAND , trace gravel, trace fines
	USCS:	SP

AS-RECEIVED MOISTURE CONTENT:	
Weight of Wet Soil & Tare	36.65
Weight of Dry Soil & Tare	35.35
Weight of Tare	15.60
Weight of Water	1.30
Weight of Dry Soil	19.75
Water Content	6.58%

TITLE BLOCK:	
TECH	ARM/CC/NV
DATE	10/02/04
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136

PROJECT TITLE	Kex Eagle	**SAMPLE ID**	DPR - 050 061704
PROJECT NO.	033-2156	**SAMPLE TYPE**	Bag
REMARKS		**SAMPLE DEPTH**	-

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	36.65
Wt Dry Soil & Tare (gm)	(w2)	35.35
Weight of Tare (gm)	(w3)	15.60
Weight of Water (gm)	(w4=w1-w2)	1.30
Weight of Dry Soil (gm)	(w5=w2-w3)	19.75
Moisture Content (%)	(w4/w5)*100	6.58

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	36.65
Dry Soil & Tare (gm)	35.35
Tare Weight (gm)	15.60
Moisture Content (%)	6.58

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	651.61
	Tare Weight (gm)	151.14
(W6)	Total Dry Weight (gm)	469.56

SIEVE ANALYSIS

Tare Weight: 151.09

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100	% PASS (100-%ret)	SIEVE	
3.0"	151.09	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	151.09	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	151.09	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	151.09	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	151.09	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	151.09	0.00	0.00	100.00	0.75"	fine gravel
0.50"	151.09	0.00	0.00	100.00	0.50"	fine gravel
0.375"	151.09	0.00	0.00	100.00	0.375"	fine gravel
#4	154.09	3.00	0.64	99.36	#4	coarse sand
#10	159.08	7.99	1.70	98.30	#10	medium sand
#20	168.96	17.87	3.81	96.19	#20	medium sand
#40	219.80	68.71	14.63	85.37	#40	fine sand
#60	437.50	286.41	61.00	39.00	#60	fine sand
#100	585.97	434.88	92.61	7.39	#100	fine sand
#200	609.41	458.32	97.61	2.39	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.64
% C SAND	1.06
% M SAND	12.93
% F SAND	82.97
% FINES	2.39
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

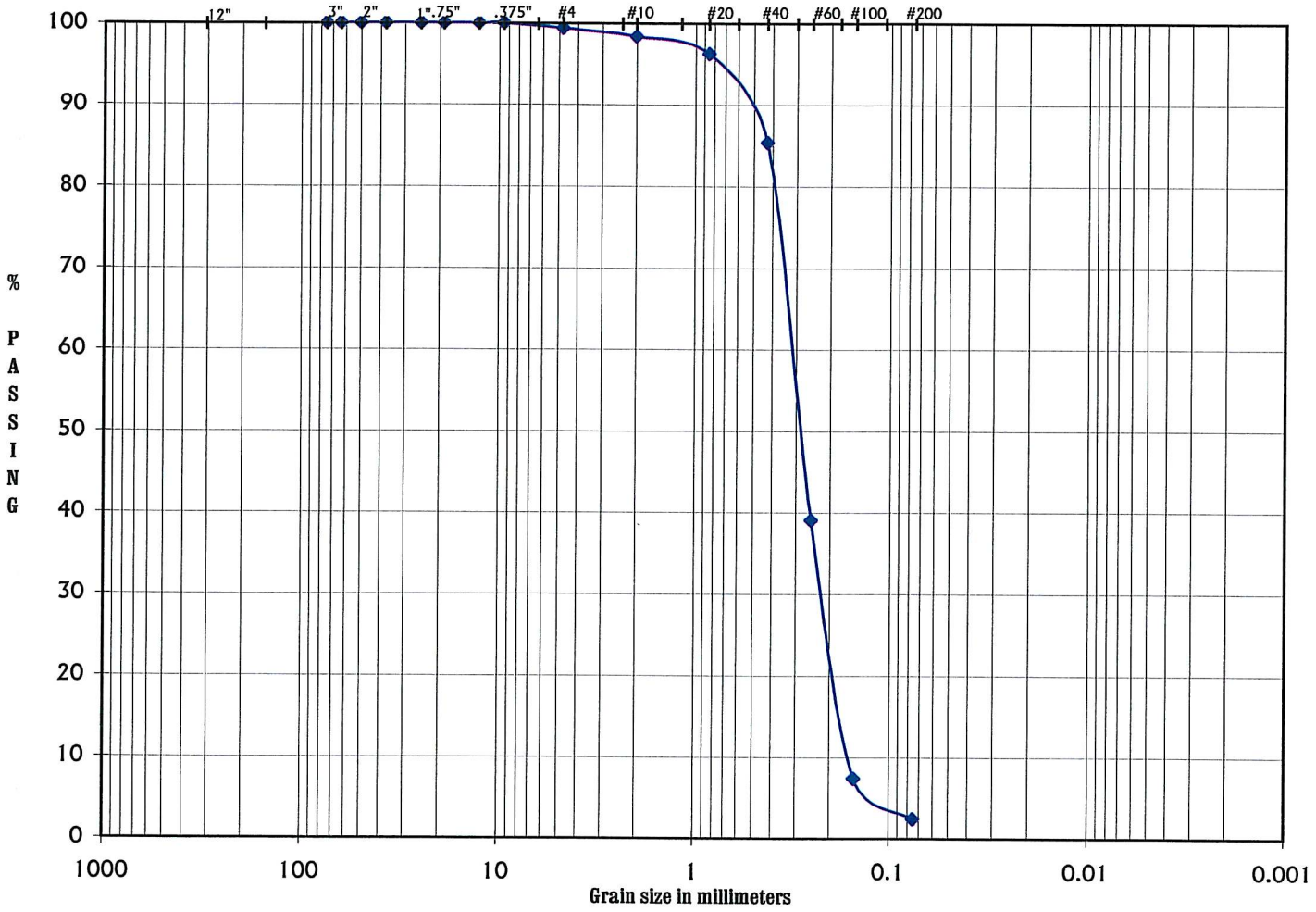
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION: Red, POORLY GRADED SAND , trace gravel, trace fines

USCS: SP

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse Gravel	Fine Gravel	Cor SAND	Med SAND	Fine SAND	SILT OR CLAY FINES
	0.00	0.00	0.64	1.06	12.93	82.97	2.39

SAMPLE ID	DPR - 050 061704
SAMPLE TYPE	Bag
SAMPLE DEPTH	-

LL	-
PL	-
PI	-

DESCRIPTION	Red, POORLY GRADED SAND , trace gravel, trace fines
USCS	SP

Kex Eagle
033-2156

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

Template For Sand Grain-size and Perm

Global Information:	PROJECT NAME:	Kex Eagle
	PROJECT NUMBER:	033-2156
	SAMPLE ID:	DPR - 056 061704
	SAMPLE TYPE:	Bag
	SAMPLE DEPTH:	-
	DESCRIPTION:	Red, SILTY SAND, trace gravel, trace fines
	USCS:	SP

AS-RECEIVED MOISTURE CONTENT:	
Weight of Wet Soil & Tare	35.54
Weight of Dry Soil & Tare	32.66
Weight of Tare	15.56
Weight of Water	2.88
Weight of Dry Soil	17.10
Water Content	16.84%

TITLE BLOCK:	
TECH	ARM/CC/NV
DATE	10/02/04
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136

PROJECT TITLE	Kex Eagle	**SAMPLE ID**	DPR - 056 061704
PROJECT NO.	033-2156	**SAMPLE TYPE**	Bag
REMARKS		**SAMPLE DEPTH**	-

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	35.54
Wt Dry Soil & Tare (gm)	(w2)	32.66
Weight of Tare (gm)	(w3)	15.56
Weight of Water (gm)	(w4=w1-w2)	2.88
Weight of Dry Soil (gm)	(w5=w2-w3)	17.10
Moisture Content (%)	(w4/w5)*100	16.84

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	35.54
Dry Soil & Tare (gm)	32.66
Tare Weight (gm)	15.56
Moisture Content (%)	16.84

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	588.48
	Tare Weight (gm)	156.05
(W6)	Total Dry Weight (gm)	370.10

SIEVE ANALYSIS

Tare Weight: 156.10

	Wt Ret + Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	156.10	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	156.10	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	156.10	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	156.10	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	156.10	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	156.10	0.00	0.00	100.00	0.75"	fine gravel
0.50"	156.10	0.00	0.00	100.00	0.50"	fine gravel
0.375"	156.10	0.00	0.00	100.00	0.375"	fine gravel
#4	158.65	2.55	0.69	99.31	#4	coarse sand
#10	168.89	12.79	3.46	96.54	#10	medium sand
#20	179.39	23.29	6.29	93.71	#20	medium sand
#40	283.92	127.82	34.54	65.46	#40	fine sand
#60	491.25	335.15	90.56	9.44	#60	fine sand
#100	506.54	350.44	94.69	5.31	#100	fine sand
#200	508.11	352.01	95.11	4.89	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.69
% C SAND	2.77
% M SAND	31.08
% F SAND	60.58
% FINES	4.89
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

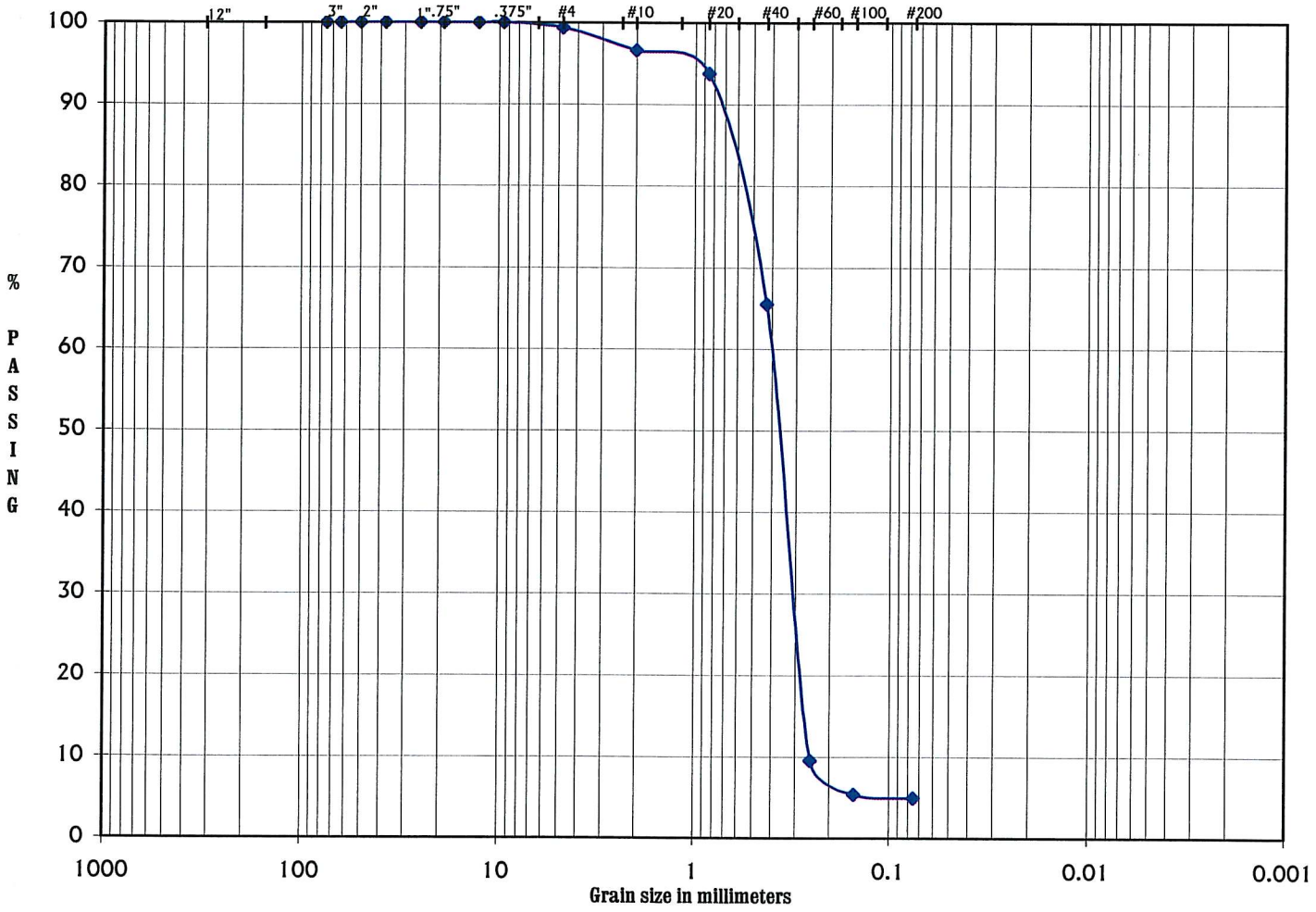
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION: Red, SILTY SAND, trace gravel, trace fines

USCS: SP

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	0.00	0.69	2.77	31.08	60.58	4.89

SAMPLE ID	DPR - 056 061704
SAMPLE TYPE	Bag
SAMPLE DEPTH	-

LL	-
PL	-
PI	-

DESCRIPTION	Red, SILTY SAND, trace gravel, trace fines
USCS	SP

Kex Eagle
033-2156

TECH	ARM/CC/NV
DATE	10/2/2004
CHECK	
REVIEW	

APPENDIX D

LABORATORY REPORT FOR SOIL METAL ANALYSES

ALS Chemex
EXCELLENCE IN ANALYTICAL CHEMISTRY
ALS Canada Ltd.
212 Brooksbank Avenue
North Vancouver BC V7J 2C1 Canada
Phone: 604 984 0221 Fax: 604 984 0218

To: **KENNECOTT MINERALS COMPANY**
200 ECHELON DRIVE
SUITE A & B
NEGAUNEE MICHIGAN 49866 USA

Finalized Date: 27-NOV-2004
This copy reported on 29-NOV-2004
Account: KMC

CERTIFICATE TB04081351

Project: EAGLE

P.O. No.:

This report is for 17 Soil samples submitted to our lab in Thunder Bay, ON, Canada on 19-NOV-2004.

The following have access to data associated with this certificate:

STEVE COOMBES	JAY HAMMITT	ANDREW WARE

SAMPLE PREPARATION

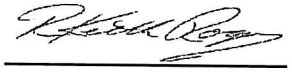
ALS CODE	DESCRIPTION
WEI-21	Received Sample Weight
DRY-22	Drying - Maximum Temp 60C
LOG-22	Sample login - Rcd w/o BarCode
SCR-41	Screen to -180um and save both

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	
ME-MS61	47 element four acid ICP-MS	
Hg-CV41	Trace Hg - cold vapor/AAS	FIMS

To: **KENNECOTT MINERALS COMPANY**
ATTN: ANDREW WARE
200 ECHELON DRIVE
SUITE A & B
NEGAUNEE MICHIGAN 49866 USA

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

Signature: 

ALS Chemex
EXCELLENCE IN ANALYTICAL CHEMISTRY
ALS Canada Ltd.
212 Brooksbank Avenue
North Vancouver BC V7J 2C1 Canada
Phone: 604 984 0221 Fax: 604 984 0218

To: **KENNECOTT MINERALS COMPANY**
200 ECHELON DRIVE
SUITE A & B
NEGAUNEE MICHIGAN 49866 USA

Finalized Date: 27-NOV-2004
Account: KMC

Project: EAGLE

CERTIFICATE OF ANALYSIS TB04081351

Sample Description	Method Analyte Units LOR	WEI-21 Recvd Wt. kg 0.02	ME-MS61 Ag ppm 0.01	ME-MS61 Al % 0.01	ME-MS61 As ppm 0.2	ME-MS61 Ba ppm 10	ME-MS61 Be ppm 0.05	ME-MS61 Bi ppm 0.01	ME-MS61 Ca % 0.01	ME-MS61 Cd ppm 0.02	ME-MS61 Ce ppm 0.01	ME-MS61 Co ppm 0.1	ME-MS61 Cr ppm 1	ME-MS61 Cs ppm 0.05	ME-MS61 Cu ppm 0.2	ME-MS61 Fe % 0.01
ABL-026		0.27	0.05	4.95	4.9	570	0.56	0.13	0.34	0.07	30.6	4.1	44	1.22	9	3.84
ABL-027		0.19	0.06	4.07	4.2	520	0.56	0.14	0.35	0.08	37.9	5.2	57	0.91	8.6	6.76
ABL-028		0.33	0.08	4.51	9	510	0.62	0.18	0.26	0.09	34.5	4.1	35	1.44	9.5	3.69
ABL-029		0.33	0.1	4.73	4.1	570	0.68	0.12	0.34	0.09	44.6	5.1	30	1.23	10.7	3.27
ABL-036		0.32	0.07	4.12	3.9	570	0.53	0.12	0.33	0.06	28.3	4.2	32	0.94	6.8	3.44
ABL-037		0.30	0.08	4.86	4.4	560	0.85	0.13	0.44	0.1	42.3	6.3	45	1.38	13.5	4.01
ABL-038		0.36	0.04	4.02	3.1	500	0.63	0.08	0.45	0.07	33.4	4.3	39	0.93	6	3.81
ABL-039		0.33	0.14	4.8	4.9	510	0.88	0.18	0.52	0.12	55	8.3	55	1.57	12.9	4.99
ABL-040		0.35	0.29	5.19	8.6	440	0.87	0.19	0.46	0.27	40	9.6	46	1.5	18	4.79
DPR-021		0.31	0.05	3.88	3.1	580	0.54	0.09	0.27	0.07	30.2	4.1	24	1.16	7.1	2.35
DPR-022		0.25	0.06	3.63	3.3	550	0.59	0.09	0.27	0.06	34.8	4.4	22	1.08	7.9	2.54
DPR-023		0.27	0.09	3.15	3.5	560	0.55	0.11	0.36	0.08	42.4	3.7	24	0.8	7.1	2.58
DPR-024		0.23	0.06	3.7	3.2	550	0.66	0.11	0.36	0.07	43.6	5.3	30	0.89	8.6	3.46
DPR-025		0.34	0.05	4.05	2.9	540	0.7	0.1	0.44	0.06	32.4	5.1	27	0.96	7.6	2.98
DPR-026		0.29	0.05	3.75	2.7	590	0.56	0.06	0.27	0.05	35	4	18	0.98	7.1	1.78
DPR-027		0.22	0.06	4.68	3.8	510	0.77	0.11	0.51	0.07	44	5.6	33	0.99	11.9	3.46
DPR-028		0.22	0.05	3.85	3	540	0.62	0.11	0.39	0.07	34.5	5.7	33	0.97	6.5	3.27

Comments: REE's may not be totally soluble in MS61 method.

ALS Chemex
EXCELLENCE IN ANALYTICAL CHEMISTRY
ALS Canada Ltd.
212 Brooksbank Avenue
North Vancouver BC V7J 2C1 Canada
Phone: 604 984 0221 Fax: 604 984 0218

To: **KENNECOTT MINERALS COMPANY**
200 ECHELON DRIVE
SUITE A & B
NEGAUNEE MICHIGAN 49866 USA

Finalized Date: 27-NOV-2004
Account: KMC

Project: EAGLE

CERTIFICATE OF ANALYSIS TB04081351

Sample Description	Method Analyte Units LOR	ME-MS61 Ga ppm 0.05	ME-MS61 Ge ppm 0.05	ME-MS61 Hf ppm 0.1	Hg-CV41 Hg ppm 0.01	ME-MS61 In ppm 0.005	ME-MS61 K % 0.01	ME-MS61 La ppm 0.5	ME-MS61 Li ppm 0.2	ME-MS61 Mg % 0.01	ME-MS61 Mn ppm 5	ME-MS61 Mo ppm 0.05	ME-MS61 Na % 0.01	ME-MS61 Nb ppm 0.1	ME-MS61 Ni ppm 0.2	ME-MS61 P ppm 10
ABL-026		10.7	0.11	4.2	0.07	0.022	2.39	19.8	7.6	0.24	357	0.76	0.54	8.1	10	500
ABL-027		7.71	0.13	3.8	0.03	0.021	2.38	18.8	5.7	0.26	676	0.63	0.46	8.5	8.6	460
ABL-028		12.65	0.14	5.1	0.08	0.029	2.42	19.9	9.5	0.21	447	0.99	0.39	8.6	7.8	740
ABL-029		10.9	0.14	5	0.06	0.022	2.59	24.5	9.6	0.26	341	0.72	0.49	8.4	10.8	550
ABL-036		7.61	0.1	2.9	0.04	0.019	2.51	18	6.2	0.23	367	0.63	0.52	7.7	7.7	370
ABL-037		11.45	0.13	5.2	0.05	0.025	2.54	23	11.8	0.29	387	0.77	0.62	8.7	12.2	460
ABL-038		7.59	0.1	3.3	0.03	0.014	2.25	15.8	5.5	0.26	431	0.4	0.6	5.8	7.8	420
ABL-039		13.1	0.16	4.7	0.05	0.032	2.18	32.9	13.4	0.34	476	0.83	0.67	11.7	14.7	490
ABL-040		12.8	0.14	4.5	0.15	0.038	1.79	23.8	14.5	0.32	772	1.16	0.55	9.9	16.5	960
DPR-021		8.68	0.1	3.3	0.03	0.015	2.65	16	7.3	0.19	334	0.45	0.41	6.5	7.2	360
DPR-022		8.16	0.11	5.1	0.03	0.016	2.53	19.6	7.3	0.2	318	0.52	0.41	6.8	8.4	240
DPR-023		6.8	0.12	3.6	0.01	0.016	2.61	19	4.9	0.21	383	0.36	0.39	7.4	6.1	360
DPR-024		7.77	0.13	4.6	0.01	0.016	2.56	21.4	6	0.24	407	0.5	0.47	7.7	8.9	210
DPR-025		8.79	0.11	3.3	0.03	0.015	2.37	17	7.1	0.24	317	0.41	0.66	6.2	9	280
DPR-026		7.33	0.1	2.9	0.03	0.012	2.72	15	6.5	0.19	253	0.34	0.41	5.4	7	210
DPR-027		9.53	0.15	5.2	0.03	0.019	2.2	21.9	8.4	0.28	385	0.57	0.68	7.4	10.2	420
DPR-028		8.69	0.12	3.5	0.01	0.016	2.41	18.6	6.8	0.24	374	0.43	0.53	7	16	430

Comments: REE's may not be totally soluble in MS61 method.

ALS Chemex
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212 Brooksbank Avenue
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To: **KENNECOTT MINERALS COMPANY**
200 ECHELON DRIVE
SUITE A & B
NEGAUNEE MICHIGAN 49866 USA

Finalized Date: 27-NOV-2004
Account: KMC

Project: EAGLE

CERTIFICATE OF ANALYSIS TB04081351

Sample Description	Method Analyte Units LOR	ME-MS61 Pb ppm 0.5	ME-MS61 Rb ppm 0.1	ME-MS61 Re ppm 0.002	ME-MS61 S % 0.01	ME-MS61 Sb ppm 0.05	ME-MS61 Se ppm 1	ME-MS61 Sn ppm 0.2	ME-MS61 Sr ppm 0.2	ME-MS61 Ta ppm 0.05	ME-MS61 Te ppm 0.05	ME-MS61 Th ppm 0.2	ME-MS61 Ti % 0.005	ME-MS61 Tl ppm 0.02	ME-MS61 U ppm 0.1	ME-MS61 V ppm 1
ABL-026		14	65.7	<0.002	0.02	0.82	2	1.3	83.2	0.49	<0.05	5.8	0.466	0.35	1.6	97
ABL-027		13.4	59.3	<0.002	0.01	0.89	2	1.6	71.4	0.57	<0.05	6.2	0.794	0.31	1.7	181
ABL-028		18.3	75.6	<0.002	0.02	0.86	2	1.6	72.5	0.6	0.05	7.8	0.456	0.44	2.1	86
ABL-029		13.8	70.6	<0.002	0.03	0.62	2	1.3	86.5	0.55	<0.05	8.6	0.465	0.38	1.8	80
ABL-036		11.8	56.6	<0.002	0.01	0.74	1	1.4	79.75	0.48	<0.05	5	0.447	0.3	1.4	84
ABL-037		15.3	79.1	<0.002	0.01	0.73	2	1.4	110.5	0.54	<0.05	8.6	0.443	0.46	2	99
ABL-038		11.3	58.1	<0.002	0.01	0.55	1	1.1	89.4	0.47	<0.05	13.5	0.426	0.27	1.3	88
ABL-039		17.3	74.8	<0.002	0.01	0.86	2	1.7	120.5	2.72	<0.05	10.5	0.528	0.45	2.1	126
ABL-040		20.8	59.8	<0.002	0.03	0.92	3	1.8	100.5	0.61	0.05	9.2	0.518	0.4	2	118
DPR-021		12.7	80.3	<0.002	0.01	0.57	1	1.1	74.7	0.44	<0.05	5.1	0.354	0.46	1.4	56
DPR-022		12.4	76.8	<0.002	0.01	0.61	1	1.1	76.6	0.41	<0.05	6.1	0.412	0.43	1.6	63
DPR-023		12.2	77	<0.002	0.01	0.89	1	1.1	79	0.47	<0.05	5.4	0.455	0.4	1.4	62
DPR-024		13.1	73.3	<0.002	0.01	0.69	1	1.3	82	0.54	<0.05	6.5	0.495	0.37	1.8	84
DPR-025		12.9	70.3	<0.002	0.01	0.57	1	1.1	113	0.44	<0.05	4.8	0.361	0.37	1.3	69
DPR-026		11.8	80.8	<0.002	0.01	0.51	1	0.9	74.2	0.35	<0.05	4.3	0.277	0.44	1.3	40
DPR-027		14.7	62.4	<0.002	0.01	0.57	2	1.2	114.5	0.51	<0.05	9.2	0.417	0.34	1.9	80
DPR-028		12.7	70.7	<0.002	0.01	0.61	1	1.2	92.2	0.47	<0.05	5.5	0.391	0.37	1.4	76

Comments: REE's may not be totally soluble in MS61 method.

ALS Chemex
EXCELLENCE IN ANALYTICAL CHEMISTRY
ALS Canada Ltd.
212 Brooksbank Avenue
North Vancouver BC V7J 2C1 Canada
Phone: 604 984 0221 Fax: 604 984 0218

To: **KENNECOTT MINERALS COMPANY**
200 ECHELON DRIVE
SUITE A & B
NEGAUNEE MICHIGAN 49866 USA

Finalized Date: 27-NOV-2004
Account: KMC

Project: EAGLE

CERTIFICATE OF ANALYSIS TB04081351

Sample Description	Method / Analyte / Units / LOR	ME-MS61 W ppm 0.1	ME-MS61 Y ppm 0.1	ME-MS61 Zn ppm 2	ME-MS61 Zr ppm 0.5
ABL-026		0.6	15.1	36	166.5
ABL-027		0.7	18.7	45	215
ABL-028		0.8	14.1	36	156.5
ABL-029		0.6	13.6	32	178
ABL-036		0.7	14.1	29	115.5
ABL-037		0.7	13.1	36	211
ABL-038		0.4	11.5	44	159
ABL-039		0.9	14.8	47	168
ABL-040		0.9	13.4	68	181.5
DPR-021		0.6	10.5	32	132
DPR-022		0.5	10.9	23	190.5
DPR-023		0.7	13	16	143
DPR-024		0.6	14.4	23	177.5
DPR-025		0.5	9.5	21	126
DPR-026		0.5	13.1	18	113
DPR-027		0.5	13.2	29	184.5
DPR-028		0.6	11.7	25	130.5

Comments: REE's may not be totally soluble in MS61 method.

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To: **KENNECOTT MINERALS COMPANY**
200 ECHELON DRIVE
SUITE A & B
NEGAUNEE MI 49866
USA

Finalized Date: 3-FEB-2005
Account: KMC

CERTIFICATE TB05006894

Project: EAGLE

P.O. No.:

This report is for 17 Pulp samples submitted to our lab in Thunder Bay, ON, Canada on 31-JAN-2005.

The following have access to data associated with this certificate:

STEVE COOMBES	JAY HAMMITT	ANDREW WARE

SAMPLE PREPARATION

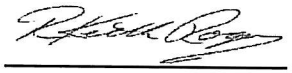
ALS CODE	DESCRIPTION
FND-02	Find Sample for Addn Analysis

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION
OA-ELE05	Soil pH (1:1 ratio)

To: **KENNECOTT MINERALS COMPANY**
ATTN: ANDREW WARE
200 ECHELON DRIVE
SUITE A & B
NEGAUNEE MI 49866
USA

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

Signature: 

ALS Chemex
EXCELLENCE IN ANALYTICAL CHEMISTRY
ALS Canada Ltd.
212 Brooksbank Avenue
North Vancouver BC V7J 2C1
Phone: 604 984 0221 Fax: 604 984 0218

To: **KENNECOTT MINERALS COMPANY**
200 ECHELON DRIVE
SUITE A & B
NEGAUNEE MI 49866
USA

Project: EAGLE

Finalized Date: 3-FEB-2005
Account: KMC

CERTIFICATE OF ANALYSIS TB05006894

Sample Description	Method Analyte Units LOR	OA-ELE05 pH Unity 0.1
ABL-026		6.6
ABL-027		5.2
ABL-028		5.4
ABL-029		5.4
ABL-036		5.1
ABL-037		5.0
ABL-038		4.6
ABL-039		4.9
ABL-040		4.2
DPR-021		4.9
DPR-022		5.3
DPR-023		5.2
DPR-024		5.2
DPR-025		5.3
DPR-026		5.4
DPR-027		5.1
DPR-028		5.3