Final Non-Time-Critical Removal Action Report - Oriole Mine
Colville National Forest
Pend Oreille County, Washington

October 2010

A valmont COMPANY
Conserving Resources. Improving Life

Cascade Earth Sciences
12720 East Nora Avenue
Spokane, Washington 99216
(509) 921-0290
www.cascade-earth.com

Final Non-Time-Critical Removal Action Report
Oriole Mine
Colville National Forest
Pend Oreille County, Washington

Prepared For:	Rodney T Lentz, On-Scene Coordinator USDA Forest Service, 1240 2nd Ave. South Okanogan, Washington 98840-9723
Site Location:	Oriole Mine Colville National Forest Pend Oreille County, Washington
Prepared By:	Cascade Earth Sciences 12720 East Nora Avenue, Suite A Spokane, Washington 99216 (509) 921-0290
Author:	Diana Washington, PE, Project Engineer
Reviewed By:	Dustin G. Wasley, PE, Principal Engineer
Revised Report Date:	October 7, 2010
Project Number:	2923007
Submitted By:	Diana Washington, PE, Project Engineer

Cover Photos: Top: View from the lower adit seep pipeline cleanouts above the old ore piles across the sloped, graded, and reclaimed Lower Adit waste rock pile to the reclaimed access road (CES, October 2009); Bottom: Upper Adit access culvert from toe of sloped, graded and reclaimed waste rock pile and access road (CES, October 2009).

Disclaimer: The contents of this document are confidential to the intended recipient at the location to which it has been addressed. The contents may not be changed, edited, and/or deleted. The information contained in this document is only valid on the date indicated on the original project file report retained by CES. By accepting this document, you understand that neither CES nor its parent company, Valmont Industries, Inc. (Valmont) accepts any responsibility for liability resulting from unauthorized changes, edits, and/or deletions to the information in this document.

CONTENTS

1.0 INTRODUCTION 1
1.1 Site Location 1
1.2 Background 1
1.3 Objectives 2
1.4 Roles and Responsibilities 2
1.5 Key Personnel 3
2.0 REMOVAL ACTION ACTIVITIES 3
2.1 Removal Action Timeline 3
2.2 Mobilization and Startup 5
2.3 Clearing and Grubbing 6
2.4 Waste Removal Areas 6
2.4.1 Upper Adit 6
2.4.2 Lower Adit 6
2.4.3 Ore Piles 7
2.4.4 Access Roads 7
2.4.5 Soil Borrow Area 7
2.4.6 Revegetation and Erosion Control 8
2.4.7 Final Inspection and Site Survey 8
3.0 CONFIRMATION SAMPLING AND ANALYSIS 9
4.0 DEVIATIONS FROM THE REMOVAL ACTION WORK PLAN 9
5.0 REMOVAL ACTION COSTS 10
6.0 POST REMOVAL ACTION MONITORING 10
REFERENCES 11

TABLE

Table 1. Confirmation Soil and Waste rock Sample Results

FIGURES

Sheet G-1. Site Location and Index of Drawings
Sheet C-1. Borrow Pit Pre-Excavation
Sheet C-2. Borrow Pit Post-Excavation
Sheet C-3. Oriole Mine Pre Removal Action
Sheet C-4. Oriole Mine Post Removal Action
Sheet C-5. Oriole Mine Sampling Locations
Sheet C-6. Oriole Mine Removal Action Sections –1
Sheet C-7. Oriole Mine Removal Action Sections – 2
Sheet C-8. Oriole Mine Removal Action Sections – 3
Sheet C-9. Oriole Mine Removal Action Sections – 4
Sheet C-10. Oriole Mine Soil Borrow Area Sections

APPENDIX

Appendix A. Pre and Post Removal Action Photographs

1.0 INTRODUCTION

The United States Department of Agriculture, Forest Service (Forest Service) retained Cascade Earth Sciences (CES) to perform Removal Action (RA) activities at the Oriole Mine (Site) under Contract No. AG-0046W-C-07-0005, Order No. AG-05K3-D-09-0005, and Requisition No. 257694. The Forest Service requested that all manpower, equipment, materials, and transportation necessary to implement and oversee the RA be provided under a Design-Build contracting mechanism.

The RA was documented in photographs (Appendix A). The photographs provide before and after documentation of each RA area and select activities (Appendix A).

1.1 Site Location

The Site is located in the Colville National Forest in Pend Oreille County, approximately 1.5 miles northeast of Metaline, Washington (Sheet G-1). According to the USGS 7 ½ Minute Quadrangle Map - Metaline (USGS, 1992), the Site location is described as:

- Section 19, Township 39 North, Range 43 East of the Willamette Principal Meridian
- Latitude – 48° 51' 37"
- Longitude – 117° 24' 50"
- Elevation – 2,760 to 3,000 feet above mean seal level

The Site is accessed from the City of Metaline and State Highway 20 by following Boundary Road to Oriole Road, then following Oriole Road west of Linton Creek across the power line clearing to Forest Road (FR) 2740. The remaining ¼ mile access to the Site on FR 2740 is extremely rough and requires a 4-wheel drive vehicle.

1.2 Background

The Site is an abandoned lead and zinc mine. The Site Inspection (SI; CES, 2005) identified two main adits (Upper and Lower Adits), two waste rock piles (WR 1 and WR 2), several small ore piles, and out buildings at the Site. The Engineering Evaluation/Cost Analysis (EECA; CES, 2007) indicated that elevated metals concentrations are associated with the Site. Elevated concentrations of antimony, cadmium, copper, iron, lead, selenium, silver, and zinc are present in nearly all soil/waste rock samples collected from the Site. Several multi-metal (antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, thallium, and zinc) ecological hot spots are present in waste rock, most noticeably the ore stockpile. However, there were no human health risks identified at the Site. Ecological hot spots are defined as areas where metal concentrations exceed risk-based criteria and background concentration by a factor of 10 or more, and were identified within the exposed waste rock and ore piles.

Approximately 130 bank cubic yards (bcy) of waste rock material and 120 bcy of ore pile material exceeded the toxicity characteristic leaching procedure (TCLP) criteria; however, synthetic precipitation leaching procedure (SPLP) results did not exceed the applicable dangerous waste concentrations. As outlined in the EECA, the TCLP analysis is not considered a valid test for analyzing metal leachability from mining waste, particularly for lead. As a result, this material is not considered a dangerous waste because the SPLP results did not exceed the standards; however, to mitigate any concerns associated with this material, it was proposed that the material be consolidated and covered with a liner. The remainder of the exposed waste rock and ore was graded in place and covered with a one foot clean cover soil to minimize the impact to individual plants and invertebrates within these localized areas.

Waste rock is also a likely source for contaminant transport to Linton Creek. Elevated cadmium, lead, and zinc attributable to the Site are present in sediment near the Site, and this impact is evident for approximately

1,200 feet downstream of the Site, based on stream sediment sample analyses. Elevated sediment concentration farther downstream may be attributable to other sources. Additional minor ecological hot spots are present in the adit seep for lead and Linton Creek sediment for zinc. Because 1) the waste rock metal concentrations exceed several state and federal soil criteria, 2) the minor exceedence of several of sediment and surface water criteria proximal to the Site, and 3) the identified ecological risks, a RA was completed to protect public health and the environment. The following documents the activities conducted during the RA.

1.3 Objectives

The objectives of the RA were to:

- Reduce ecological risk by controlling exposure to metals in waste rock and discharge at the Site.
  - To meet the objective, approximately 250 bcy of material was removed and isolated in a covered repository. In addition, the exposure waste rock and ore piles were graded to a more stable slope (minimum 2:1 horizontal: vertical [h:v]) and covered with clean cover soil. The areas were then mulched, fertilized and seeded to control erosion of the soil cover.
- Reduce ecological risk by controlling and reducing the migration of metals to Linton Creek from waste rock runoff and adit discharge at the Site that could reach Linton Creek during extreme events.
  - To meet the objective, the waste rock piles were graded to more stable slope (minimum 2:1 h:v) and covered with clean cover soil. The areas were then mulched, fertilized, and seeded to control erosion of the soil cover.
- Retain any significant historical evidence of mining activities to the extent practicable while meeting health and safety concerns.
  - Scrap metal and wood that could negatively impact the safety of the Site was removed from the mine area. The wood was crushed and buried in the borrow area and the metal was recycled offsite. Buildings and other wood structures that did not appear to be a threat to safety or were outside the RA boundaries were left intact.

1.4 Roles and Responsibilities

The following is a summary of the roles and responsibilities of the key parties for the RA.

Project Management, Engineering, and Oversight:	Cascade Earth Sciences 12720 East Nora Avenue, Suite A Spokane, Washington 99216
Onsite Construction Subcontractor:	SMAF Construction, LLC (SMAF) 2260 NW Industrial Park Way PO Box 672 Prineville, Oregon 97754
Survey Subcontractor:	Survey Solutions 15015 North Lynwood Drive Spokane, Washington 99208
Analytical Laboratory:	TestAmerica 11922 East 1st Avenue Spokane, Washington 99206
Forest Service - On-Scene Coordinator (OSC)/ Contracting Officers Representative (COR):	Rodney Lentz, LHG 1240 2nd Avenue South Okanogan, Washington 98840

1.5 Key Personnel

The field operations team included:

Diana Washington, PE – CES	Project Manager/Project Engineer
Dustin G. Wasley, PE – CES	Program Manager/Principal Engineer
Brian Porfily – SMAF	Onsite Construction Manager
SMAF Construction, LLC	Various Laborers
Dan Samson, Survey Solutions	Field Surveyor

2.0 REMOVAL ACTION ACTIVITIES

Removal Action activities were outlined in the RA Work Plan (CES, 2009), which was reviewed and approved by the Forest Service. An Innov-X Systems Alpha Series X-Ray Fluorescence (XRF) field sampling unit was used to guide RA activities. Upon completion of the RA, confirmation soil samples were collected to assess cleanup concentrations. A final walkthrough with the Forest Service was completed, in June 2009, following completion of the RA activities. The following sections summarize the RA activities.

2.1 Removal Action Timeline

The following is an outline of the general sequence of RA activities for the project by date. Details with respect to specific activities are provided in Sections 2.2 to 2.4.

- June 13-14, 2009 – Mobilization to the Site
- June 15-24, 2009 – RA activities
  - June 15, 2009
    - Equipment inspected
    - Safety meeting conducted
    - SMAF, CES, and Forest Service personnel walked the Site
    - Improvements made to the access road
    - Equipment moved to the equipment staging area near the soil borrow pit
    - Waste timbers hauled to soil borrow area
    - Lower Adit excavated to expose the existing seep pipe and began laying new seep pipeline
    - Soil borrow area topsoil removed and stockpiled
  - June 16, 2009
    - Safety meeting conducted
    - Tree removal and stockpile of slash during Site prep
    - Improvements to access road continued and rock trucks moved to waste rock piles
    - Continue installation of the new seep pipeline
    - Grizzly screen for borrow soil ordered
    - Woodstraw™ arrived onsite
    - Lower Adit seep pipeline trench finished
    - Perforated pipe connected to the seep pipeline
    - Lower Adit culvert in place and backfill began
    - Location for covered repository footprint identified

- June 17, 2009
  - Safety meeting conducted
  - Start screening and stockpiling cover soil
  - Excavator moved to Upper Adit to remove “hot” material to the repository area
  - Approximately 130 bcy of “hot” material at the Upper Adit was identified with the XRF and was moved to the repository
  - Confirmation samples collected from the boundary of excavated material
  - XRF used to identify “hot” material in the ore pile 1 and 2
  - Approximately 120 bcy of material moved from the ore pile to the repository.
  - Upper Adit excavated to prepare for corrugated metal pipe (CMP) placement
  - Repository shaped and prepared for cover
- June 18, 2009
  - Safety meeting conducted
  - Screen and stockpile of cover soil continued
  - HDPE cover placed on the repository
  - HDPE covered with clean soil from the soil borrow area
  - Begin to grade the ore pile area and move material to slope the Lower Adit and repository areas
  - Change in the amount of area to be sloped and graded requested by the Forest Service OSC
  - Install Upper Adit CMP
  - Begin sloping the Upper Adit waste rock pile
- June 19, 2009
  - Safety meeting conducted
  - Screen and stockpile of cover soil continued
  - Cobble screened from borrow soil used to reinforce the toe of repository
  - Cobble used to fill and slope the area east of the Lower Adit
  - Change in the amount of area to be sloped and graded requested by the Forest Service OSC
  - Change discussed and material from the Upper Adit waste rock pile was used to slope and grade the area northeast of the Lower Adit to a 2.5:1 (h:v) slope
  - Sloping and grading of the waste rock piles continued
  - Finished shaping Upper and Lower Adit waste rock piles
  - Access road improvements required due to precipitation event
- June 20, 2009
  - Safety meeting conducted
  - Screen and stockpile of cover soil continued
  - Cover soil hauled to the Upper and Lower Adits and placed
  - Stockpiled slash used to begin reclamation of the Upper Adit and waste rock pile
- June 21, 2009
  - Safety meeting conducted
  - Screen and stockpile of cover soil continued
  - Continue to haul cover soil and place at the Upper and Lower Adits

- June 22, 2009
  - Safety meeting conducted
  - Screen and stockpile of cover soil continued
  - Access road improvements required due to a significant precipitation event
  - Continue to haul cover soil and place at the Upper and Lower Adits
  - Cover soil completed at the Upper Adit
  - Begin placing Woodstraw™, fertilizing, and seeding at the Upper Adit
  - Cover soil placement completed at the Lower Adit
  - Continue to place slash as erosion control at the Upper and Lower Adits
- June 23, 2009
  - Safety meeting conducted
  - Close access road to the Upper Adit and reclaim
  - Continue Woodstraw™ placement
  - Begin seed spreading and continue slash placement
- June 24, 2009
  - Safety meeting conducted
  - Continue slash spreading
  - Additional Woodstraw™ placed at the Upper Adit
  - Began to place Woodstraw™, seed, and fertilize the Lower Adit and ore piles
  - Reclaim soil borrow area by spreading cover soil and working in wood debris pile
- June 25, 2009
  - Safety meeting conducted
  - Continue slash spreading
  - Close the Lower Adit access road
  - Finish placing Woodstraw™, fertilizing, and seeding the access road and soil borrow area

- June 25, 2009 – De-mobilization from the Site and final walk through with the Forest Service OSC/COR.
- July 29, 2009 – Final as-built topographic survey
- October 20, 2009 – First post-RA surface water and sediment sampling and monitoring event

2.2 Mobilization and Startup

Initial mobilization began on June 15, 2009, and equipment moved on and offsite throughout the RA. The following equipment was used during the RA:

- Two work trucks
- One 300-gallon water tank trailer with pump, dedicated for fire suppression
- Two 25-ton rock trucks (T-REX and Volvo)
- One Caterpillar D6 Track Dozer
- CAT 644 Wheeled Front End Loader
- Hitachi 200 Excavator
- Hitachi 120 Excavator
- 3-inch plus Grizzly Screen

All equipment was thoroughly pressure washed and cleaned to remove dirt/weeds and inspected in Metaline by the Forest Service OSC prior to mobilization to the Site.

2.3 Clearing and Grubbing

Clearing and grubbing was conducted throughout the RA, as needed. The materials were removed in stages as an erosion and sediment control measure. A Forest Service representative was onsite during the RA and consulted on tree removal. Slash collected during the process was stockpiled in various locations and later used during reclamation and revegetation activities.

2.4 Waste Removal Areas

The Site consists of: the Upper Adit, WR1, the Lower Adit, WR 2, ore piles 1, 2, and 3 (OR-1, OR-2, and OR-3), the access roads, and the soil borrow area (Sheets C-3 and C-4). To improve the slope stability at the Upper and Lower Adits and ore piles, approximate cut and fill volumes were 1,600 and 2,800 bcy, respectively. The RA activities in each area are described below.

2.4.1 Upper Adit

The Upper Adit is located approximately 0.5 miles from the intersection of Linton Creek and the Oriole Mine access road (Appendix A, Photograph 1.1). WR 1 is located adjacent to the Upper Adit and was 80 feet wide and 110 feet long, with an estimated volume of 4,400 bcy (Appendix A, Photograph 1.2). Approximately 130 bcy of material was removed from the Upper Adit waste rock pile and placed in a repository located at the Lower Adit (Appendix A, Photograph 1.3). This material was generally the material that exceeded TCLP leachate criteria (CES, 2007). The XRF was used along with visual inspection to identify the boundary of the material to be placed in the repository (Sheet C-5). The material was taken from the location sampled during the EECA (CES 2007). The XRF was used to identify the area with concentrations of lead greater than 7,500 parts per million (ppm). The waste rock pile had higher than background lead concentrations and the use of 7,500 ppm was based on evaluation of the results of the Site Inspection sampling results.

The Upper Adit opening was then excavated to remove material to adequately fit a 5 foot diameter, 30 foot CMP into the adit opening to provide access for bat habitat (Appendix A, Photograph 1.4). The waste rock pile and surrounding area was sloped and graded to 2.5:1 (h:v). Approximately 700 bcy of material was removed from WR1 to WR2 to achieve the desired slope. The area was then covered with soil from the soil borrow area and reclaimed (Sheets C-6, C-7, and C-8 and Appendix A, Photograph 1.5). The soil cover consisted of a six inch equipment compacted layer and a six inch loose layer.

The area was then seeded, fertilized, mulched with WoodStraw™, and stockpiled with slash to control erosion. The Upper Adit access road was ripped and sloped into the existing natural contour to the extent practicable. Stockpiled slash was used to recover the access road (Appendix A, Photograph 1.6). The access road was then seeded, fertilized, and mulched.

2.4.2 Lower Adit

The Lower Adit is located approximately 200 feet east of the Upper Adit (Sheet C-3; Appendix A, Photograph 1.7). WR 2 is adjacent to the Lower Adit (Appendix A, Photograph 1.8). The adit had a five foot diameter CMP extending from it prior to the RA (Appendix A, Photographs 1.9 and 1.10).

The Lower Adit opening was excavated (Appendix A, Photograph 1.11) and the adit seep discharge was exposed (Appendix A, Photograph 1.12). Approximately 154 feet of 4-inch PVC pipe was connected to the existing seep discharge pipe (Appendix A, Photograph 1.13) and the adit seep was routed along the old ore haul road to the north east of the adit opening. A cleanout was placed at the end of the PVC pipe and an approximately 134 feet of 4-inch perforated pipe was connected to the cleanout. The perforated pipe was laid

using a laser level in the soil to provide an infiltration zone for the seep away from the waste rock area (Sheet C-4 and Appendix A, Photograph 1.14). Following installation of the discharge pipe, a 5-foot diameter, 40 foot, CMP was added to the existing CMP to provide bat habitat access (Appendix A, Photograph 1.15).

A repository approximately 70 feet by 50 feet was constructed just south of the Lower Adit opening. Approximately 130 bcy of material from WR1 (from the Upper Adit) and approximately 120 bcy of material from OP1 and OP2 was added to the repository (Sheets C-6 and C-9). The repository was covered with a 60-mil HDPE liner. The liner was keyed into the existing material (Appendix A, Photograph 1.16). Approximately 250 bcy of material from OP3 and 300 bcy of clean cover soil was placed over the repository cover. Cobble screened from cover soil borrow area was placed around the edges and the toe of the repository and the area was covered with one foot of clean soil. The remainder of OP3 was graded in place and additional material from WR1 was used to grade the Lower Adit and adjacent area to a slope of 2.5:1 (h:v) (Sheet C-8 and Appendix A, Photograph 1.17).

Three to 18-inch cobbles were separated from the cover soil using a grizzly screen and were used to secure and control erosion of the toe of the repository. The area was covered with six inches of equipment compacted soil and six inches of loose soil. The area was then seeded, fertilized, mulched with WoodStraw™, and stockpiled slash. (Appendix A, Photograph 1.18)

2.4.3 Ore Piles

The ore bin was located approximately 70 feet southeast of the Lower Adit (Appendix A, Photograph 1.19). The ore bin was dismantled and the wood was taken to the soil borrow area under the direction of the Forest Service OSC. The wood was later crushed into the soil borrow area during grading of the area and partially covered with topsoil saved during soil borrow activities.

Scrap metal from the ore pile area was stock piled and then hauled to a metal scrap yard in Spokane, Washington. As outlined above, approximately 250 bcy was deposited into the Lower Adit repository. The additional material was moved and graded as required to get the minimum desired slope of 2.5:1 (h:v) (Sheet C-8 and Appendix A, Photograph 1.20). The area was covered with approximately one foot of clean soil from the borrow area, seeded, fertilized, mulched with WoodStraw™, and available slash (Appendix A, Photograph 1.21).

2.4.4 Access Roads

The access road to the Site was ripped and graded. Large cobble, tree stumps, and trees removed during clearing and grubbing activities were used to reclaim the access road (Appendix A, Photographs 1.22, 1.23, and 1.24). Water bars were placed strategically to direct runoff and limit erosion of the area during stormwater and spring runoff events. Several large boulders were places at the end of the access road to limit motor vehicle access. The access road was seeded, fertilized, mulched with WoodStraw™, and covered with slash.

2.4.5 Soil Borrow Area

The soil borrow area was located approximately 0.5 miles from the Site adjacent to Linton Creek, under the power lines (Sheet G-1 and C-11) (Appendix A, Photograph 1.25). Approximately 2,370 bcy of soil containing cobble, from 3 to 24 inches, was removed from the area (Sheet C-2 and Appendix A, Photograph 1.26). The soil was screened and used as cover and grading material for the Upper and Lower Adits. The cobble was used to protect the toe of the repository and provide drainage areas to control erosion of the waste rock pile below the Lower Adit.

Reclamation of the area was concurrent with excavation activities. The area was sloped to drain to the southeast. (Sheets C-2 and C-10 and Appendix A, Photographs 1.27 and 1.28). The Woodstraw™ was used

as a filter strip on the edges of the area to control erosion and the area was seeded and fertilized on June 24, 2009. Re-growth of the vegetation in the soil borrow area was documented during the fall 2009 and spring 2010 sampling event (Appendix A, Photographs 1.29 and 1.30). Areas where growth is thin will be reseeded and fertilized during the fall 2010 sampling event.

2.4.6 Revegetation and Erosion Control

Two blends of seed were used to revegetate the area based on the difference in moisture.

- High moisture seed blend was used to reseed the mine area.

Common Name	Scientific Name	% Live Seed (LS)
Fescue	Hard Nordic	22
Wheatgrass	Intermediate Oahe	38
Wheatgrass	Streambank Sodar	22

- Low moisture seed mix was used to reseed the soil borrow area.

Common Name	Scientific Name	% Live Seed (LS)
Wheatgrass	Pubescent Luna	42
Fescue	Sheen Rack	28
Wheatgrass	Streambank Sodar	28

The fertilizer was 16% total nitrogen, 16% available phosphoric acid, 16% total water soluble potash and 20% sulfur (16-16-16-20) and was applied at the rate of 400 pounds per acre. Woodstraw™ was applied as an erosion and sediment control measure using the following approximate applied coverages based on manufacturer's recommendations and in consultation with the Forest Service:

- Slope >33% -- 70% coverage
- Slope between 5% and 33% -- 50% coverage
- Slope less than 5% -- 40% coverage

In addition to the Woodstraw™, slash gathered and stockpiled during clearing and grubbing was used to provide additional soil erosion protection, micro climate growing environments, and organic material.

2.4.7 Final Inspection and Site Survey

CES contracted with Daniel Samson of Survey Solutions to provide a third party survey of the pre- and post-RA conditions. The final survey for all Site areas was completed in July 29, 2009. On June 25, 2009, CES conducted a final walkthrough with the Forest Service OSC and no issues were identified.

CES conducted an additional site visit and inspection to identify issues during the first post RA sampling event in October 2009. Seed germination appeared to be adequate in the mine area and thin in the soil borrow area. CES evaluated the site with the OSC and a weed control specialist from the Forest Service District office. Weed control activities were completed in July 2010 and spot seeding and fertilizing will be completed fall 2010.

The area was also evaluated for weed spreading that may have occurred as a result of the use of the soil from the soil borrow area. No weeds were present during the fall sampling event. The Site will be evaluated for weeds during the spring sampling event and spot treated as needed.

3.0 CONFIRMATION SAMPLING AND ANALYSIS

During the RA, an Innov-X XRF was used to guide the removal of the contaminated material. As outlined in the EECA, no human risk was identified and the RA was implemented to reduce erosion of waste rock and ore material into Linton Creek and to provide a barrier for ecological receptors. Therefore, there was not an established cleanup goal and the XRF was used to generally guide the RA and to identify material that was consolidated in the onsite repository.

Surface and subsurface confirmation samples (C1, C2, C3, C4, and C-5) were collected from in and around the excavation at WR1 to document the removal of the material that exceeded TCLP criteria (Table 1 and Sheet C-5). As outlined above, an XRF concentration of 7,500 ppm lead was used as the general screening level to delineate the extents of the excavation. The XRF readings ranged from 2,078 to 6,477 ppm in the pit following excavation; however, laboratory results ranged from 589 to 24,400 mg/kg. The 24,400 mg/kg result is above the general target level; however, given the heterogeneous nature of the material in the waste rock pile, this is considered an anomaly and not indicative of the overall concentration of the waste rock pile.

Ten additional surficial confirmation samples were also collected from random locations around the Site (Table 1 and Sheet C-5). Samples were collected from the regraded waste rock and ore before the placement of the 1 foot of clean cover soil. The XRF readings of these confirmation samples ranged from 3,400 to 7,866 ppm, and laboratory results ranged from 273 to 6,270 mg/kg.

The average concentrations from the post-RA confirmation samples, along with the average pre-RA sampling concentrations, are shown on Table 1. With the exception of aluminum, the post-RA results are all lower than the pre-RA results. However, pre-RA samples were collected from waste rock and ore (surficial and subsurface) that represented the worst-case concentrations to quantify the nature and extent during the SI and EECA; and post-RA samples were mainly collected from random surficial locations of the regraded piles. Therefore, these data should not be directly compared, and are included for illustration purposes only.

4.0 DEVIATIONS FROM THE REMOVAL ACTION WORK PLAN

The Work Plan (CES, 2009) called for approximately 750 bcy of material from OP3 (located upgradient from the ore bin) to be placed as fill over the liner for the repository. During removal activities, it became clear that removal of this material would cause over steepening and instability of the hill above the ore bin. After discussions with the Forest Service OSC, the decision was made to leave approximately 500 bcy of the material from OP3 in place and to move excess material fromWR1 to grade the hill above OP1 and adjacent to the repository. Additionally, cobble from the soil borrow area and extra soil was used to provide fill to improve the slope stability and drainage around the toe of the repository.

The Work Plan (CES, 2009) called for the woody mine debris collected and removed from the mine, mill, and ore bin to be piled on Site for later disposal by the Forest Service. After evaluation of the material and discussing the advanced deterioration with the Forest Service OSC, the decision was made to crush and track the material into the disturbed soil borrow area. The material will provide a source of carbon and other nutrients as it degrades over time.

The Work Plan (CES 2009) called for WoodStraw™ mulch, seed, and fertilizer for all disturbed areas. The materials were ordered for the Site per the original Work Plan. Due to the need for additional clean soil to cover the additional 0.75 acres of sloped and grade hillside above OP1, the soil borrow area size was expanded. After discussions with the Forest Service OSC, the decision was made to adjust the coverage of mulch, seed, and fertilizer on the soil borrow area. The area has slopes of less than one percent and excessive erosion is not expected. The available Woodstraw™ was placed around the edges and used as a filter strip for sediment and erosion control.

Post RA inspections were conducted in spring 2010. It was noted that minor amounts of weeds from the soil borrow were introduced to the mine area. A weed control expert from the Forest Service recommended that weed control be implemented. In July 2010, CES contracted with Timberline Silvics Inc. out of Snoqualmie, Washington to treated the mine area, and CES will be reseeding the mine and borrow area in late October 2010.

5.0 REMOVAL ACTION COSTS

The following table outlines the actual cost incurred. The project will not be closed until the semi-annual water sampling tasks (Task 4-6) are completed.

Task Name	Budgeted Amount	Actual Amount (To Date)
Task 1 – Project Management	$ 12,640.00	$ 12,780.00
Task 2 – Removal Action	$ 150,975.00	$ 142,950.04*
Task 3 – Post Removal Action Report	$ 17,481.00	$ 15,724.68*
Task 4 – First Year Post RA Sampling	$ 13,467.00	$ 11,295.10*
Task 5 – Second Year Post RA Sampling	$ 13,683.00	$ 67.00*
Task 6 – Third Year Post RA Sampling	$ 13,925.00	$ 0.00*
Task 7 – Contract Close Out	$ 1,308.00	$ 0.00*
Total	**$ 223,616.00**	**$ 182,816.82**

* Additional tasks to be incurred as part of the fixed fee project.

** Tasks remaining include, reseeding a portions of the Site, revised RA report, Task 5 and 6, post RA monitoring report, and contract closeout.

6.0 POST REMOVAL ACTION MONITORING

As part of the RA contract, CES will perform three years of semi-annual sampling and monitoring. Two events have already been completed. Sampling and monitoring will be performed at three of the aquatic sample stations along Linton Creek, one background location (LC-1a), one immediately downstream of the Site (LC-2), and one in Linton Creek slightly upstream of the water supply reservoir (upstream of LC-4) following the RA. The events will be timed for collection during one high flow and one low flow event each year. One sediment sample will be collected at each station annually. In addition, CES will collect one adit discharge sample semi-annually. CES will submit a letter report after the each sampling event that summarizes the results of the sampling and monitoring and provides a comparison to the previous sampling results.

Prepared By:

CASCADE EARTH SCIENCES

Diana Washington, PE
Project Engineer

Reviewed By:

CASCADE EARTH SCIENCES

Dustin G. Wasley, PE
Principal Engineer

REFERENCES

CES, 2005. Site Inspection of the Oriole Mine, Colville National Forest, Pend Oreille County, Washington. Cascade Earth Sciences. Spokane, Washington.

CES, 2007. Engineering Evaluation / Cost Analysis, Oriole Mine, Colville National Forest, Pend Oreille County, Washington. Cascade Earth Sciences. Spokane, Washington.

CES, 2009. Revised Removal Action Work Plan and Preliminary Drawings Oriole Mine, Colville National Forest, Pend Oreille County, Washington. Cascade Earth Sciences. Spokane, Washington.

USGS, 1992. 7.5 Minute Topographic Map, Metaline Falls, Washington. U.S. Geological Survey.

TABLE

Table 1. Confirmation Soil and Waste Rock Sample Results

Table 1. Confirmation Soil and Waste Rock Sample Results
Oriole Mine Removal Action Colville National Forest, Washington

Sample ID	Sample Date	Aluminum, Total	Antimony, Total	Arsenic - Total	Cadmium, Total	Chromium, Total	Copper, Total	Iron, Total	Lead, Total	Manganese, Total	Zinc, Total
		mg/kg									
WR-1 TCLP Material Excavation Confirmation Samples											
OM-WR1-C1-3'	6/17/2009	1,560	**314.0**	**58**	**231**	**5.26**	**2,610**	9,240	**24,400**	**2,030**	**37,100**
OM-WR1-C2-2'	6/17/2009	2,280	**79.2**	**38.8**	**61**	**13.3**	**470**	11,800	**4,370**	**2,080**	**7,440**
OM-WR1-C3-6'	6/17/2009	686	**93.2**	**39.9**	**145**	**3.3**	**1,000**	4,700	**4,540**	**1,140**	**22,600**
OM-WR1-C4-1'	6/17/2009	406	**44.4**	**16.6**	**15.4**	**0.994**	**132**	6,020	**589**	**2,160**	**2,310**
OM-WR1-C5-7'	6/17/2009	1,470	**15.2**	**13.1**	**7.7**	**3.15**	19	8,220	**1,160**	**4,240**	**3,250**
Remaining Confirmation Samples											
OM-WR2-Road-C6-1'	6/17/2009	3,010	**8.4**	**10.5**	**8.22**	**11.4**	46	8,720	**1,960**	**2,690**	**892**
OM-WR2-Road-C7-1'	6/17/2009	3,010	**15.7**	**18.1**	**30.5**	**16.1**	**271**	16,500	**1,110**	**2,130**	**5,340**
OM OP3-C8-1'	6/17/2009	3,290	**36.9**	**25.4**	**46.7**	**7.65**	**410**	11,300	**2,560**	**1,620**	**5,900**
OM OP3-C10-1'	6/17/2009	16,300	**2.9**	**5.25**	**10.6**	**11.4**	23	19,000	**273**	814	**1,740**
OM-WR2-Rep-C9-1'	6/17/2009	11,400	**4.38**	**8.6**	**1.59**	**9.7**	15	14,900	**389**	715	**505**
OM-OP2-C12-1'	6/17/2009	12,000	**20.0**	**23.8**	**12.1**	**9.13**	**67**	14,100	**798**	689	**2,170**
OM-OP2-C11-1'	6/17/2009	14,900	**16.1**	**12.6**	**107**	**17.5**	**151**	23,300	**1,480**	**5,640**	**12,900**
OM-OP1-C13-1'	6/17/2009	8,530	**137.0**	**52.3**	**95.6**	**13.7**	**632**	18,200	**6,270**	**3,140**	**12,800**
OM-QA-C14-1'	6/17/2009	7,440	**84.7**	**32.8**	**122**	**9.87**	**730**	17,600	**5,500**	**2,150**	**13,000**
Average Post-Removal Action		6,163	**62.3**	**25.4**	**63.9**	**9.46**	**470**	13,114	**3,957**	**2,231**	**9,139**
Average Pre-Removal Action*		5,917	**178.0**	**58.1**	**114.6**	**15.1**	**841**	19,866	**15,392**	**2,493**	**22,121**
Standards											
WA - Method A Indust. Soil Cleanup Levels - Human Receptors[1]		NS	**0.6**	**20**	**2**	NS	NS	NS	**1,000**	NS	NS
WA - Ecological Receptors (p = plant, b = soil biota, w = wildlife)[2]		NS	**5** p	NS	**4** p	**42** bp	**50** b	NS	**50** p	**1,100** p	**86** p
EPA Indust. PRGs - Human Receptors[3]		NS	410	**1.6**	810	1400	41,000	720,000	**800**	NS	310,000
EPA - Ecological Receptors (m = mammal, b = bird, i = invertebrate, p = plant)[4]		NS	**21** m	**37** p	**29** p	**5** p	**61** i	NS	NS	NS	**120** i
ORNL - Ecological Receptors[5]		NS	**5**	**9.9**	**4**	**0.4**	**60**	NS	**40.5**	NS	**8.5**

NOTES:

mg/kg = milligrams per kilogram

Bolded values indicate that the value exceeds one or more standard

* Average pre-RA waste rock, ore, and soil concentrations are presented for illustration purposes and shouldn't be directly compared because pre-RA samples were specifically collected from worst-case locations, and post-RA samples were collected from surficial random locations.

STANDARD NOTES:

1 - Washington Department of Ecology MTCA (WAC 173-340) Industrial criteria, Table 745-1 (Ecology, 2007).

2 - Washington Department of Ecology MTCA (WAC 173-340) Industrial criteria, Table 749-3 (Ecology, 2007).

3 - EPA Region 9 Industrial Preliminary Remediation Goals - (EPA, 2008).

4 - EPA Ecological Soil Screening Levels - Lowest Criteria Listed (EPA, 2000).

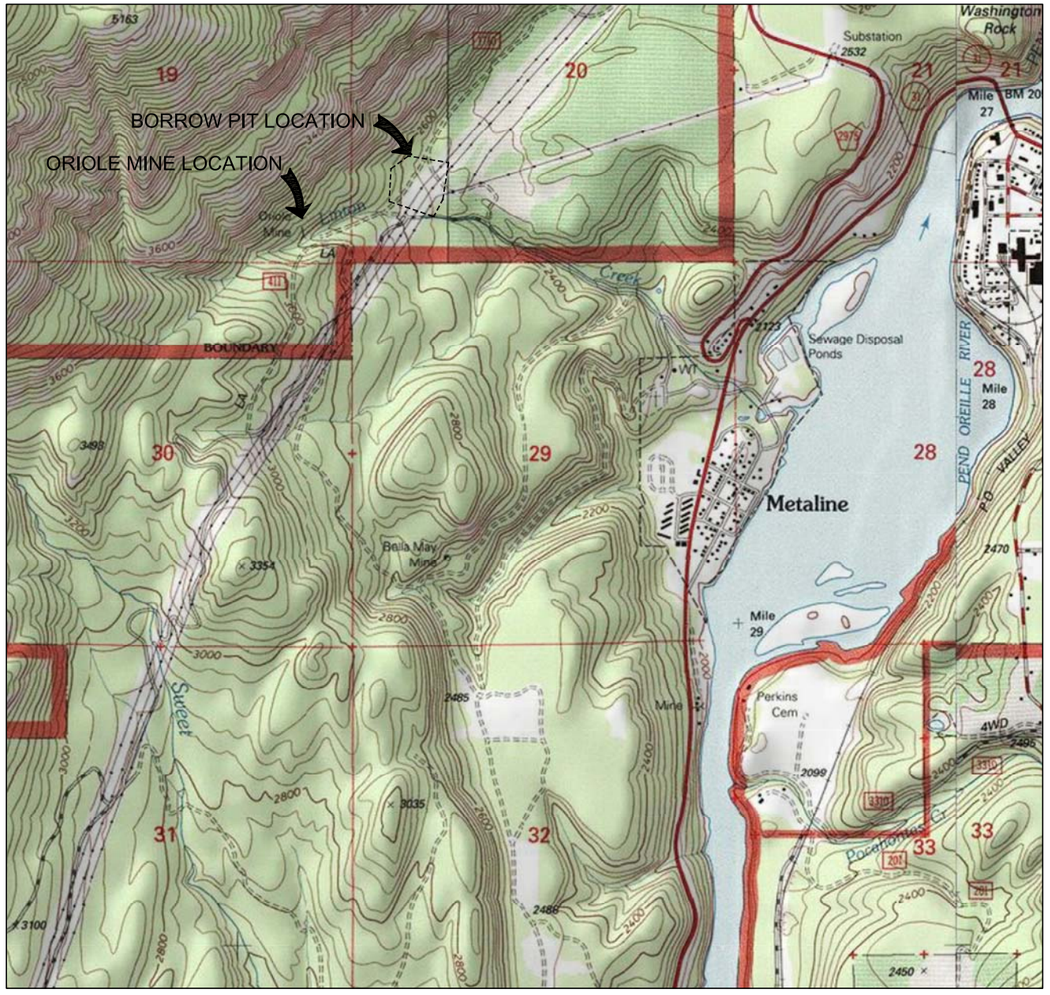
5 - ORNL = Oak Ridge National Laboratory Preliminary Remediation Goals for Ecological Endpoints August 1997.

NS = No standard

FIGURES

Sheet G-1.	**Site Location and Index of Drawings**
Sheet C-1.	**Borrow Pit Pre-Excavation**
Sheet C-2.	**Borrow Pit Post-Excavation**
Sheet C-3.	**Oriole Mine Pre Removal Action**
Sheet C-4.	**Oriole Mine Post Removal Action**
Sheet C-5.	**Oriole Mine Sampling Locations**
Sheet C-6.	**Oriole Mine Removal Action Sections –1**
Sheet C-7.	**Oriole Mine Removal Action Sections – 2**
Sheet C-8.	**Oriole Mine Removal Action Sections – 3**
Sheet C-9.	**Oriole Mine Removal Action Sections – 4**
Sheet C-10.	**Oriole Mine Soil Borrow Area Sections**

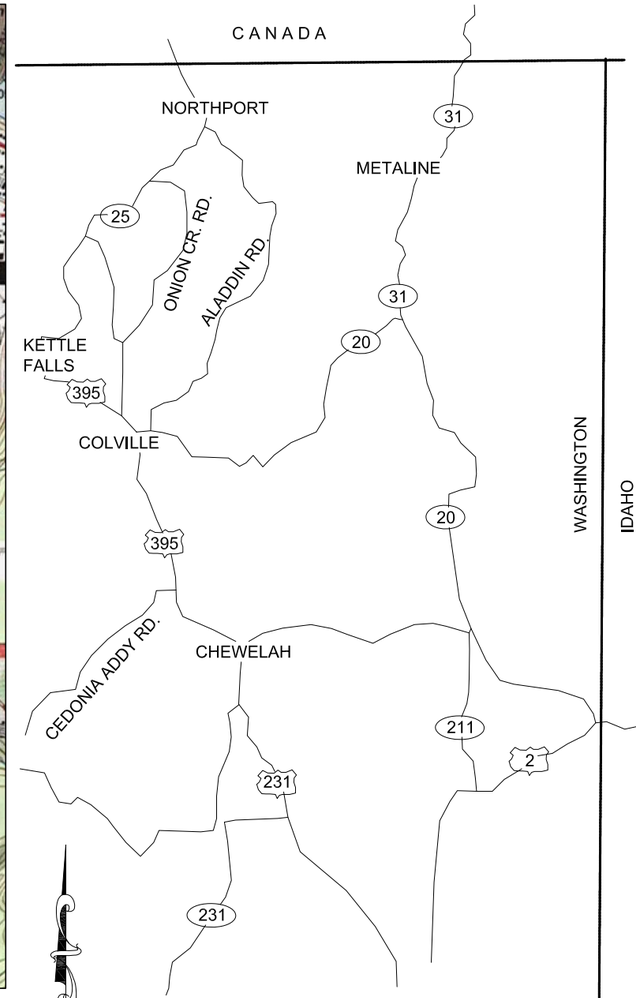
COLVILLE NATIONAL FOREST
ORIOLE MINE - REMOVAL ACTION



SITE LOCATION

0 1000 2000 FEET

SCALE



VICINITY MAP

NOT TO SCALE

INDEX OF DRAWINGS

SHEET	GENERAL
G-1	SITE LOCATION & INDEX OF DRAWINGS

CIVIL	
C-1	BORROW PIT PRE-EXCAVATION
C-2	BORROW PIT POST-EXCAVATION
C-3	PRE REMOVAL ACTION
C-4	POST REMOVAL ACTION
C-5	SAMPLING LOCATIONS
C-6	REMOVAL ACTION SECTIONS
C-7	SECTIONS
C-8	SECTIONS
C-9	SECTIONS
C-10	SOIL BORROW AREA SECTIONS

SOURCE: USGS 7.5' TOPOGRAPHIC MAP FROM TOPO! SOFTWARE

REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\AABDrafting Files\2923007 – USFS Oriole Mine – Oriole Mine Removal Action\Drawings\2923007 G1.dwg Renning, John K. 9/21/2010

COLVILLE NATIONAL FOREST
METALINE, WASHINGTON

REV #	DESCRIPTION	BY	DATE
1	Editorial Changes	3KAC	4-29-2010
2	REVISED PER U.S.F.S. COMMENT LETTER	6DLW	9-17-2010

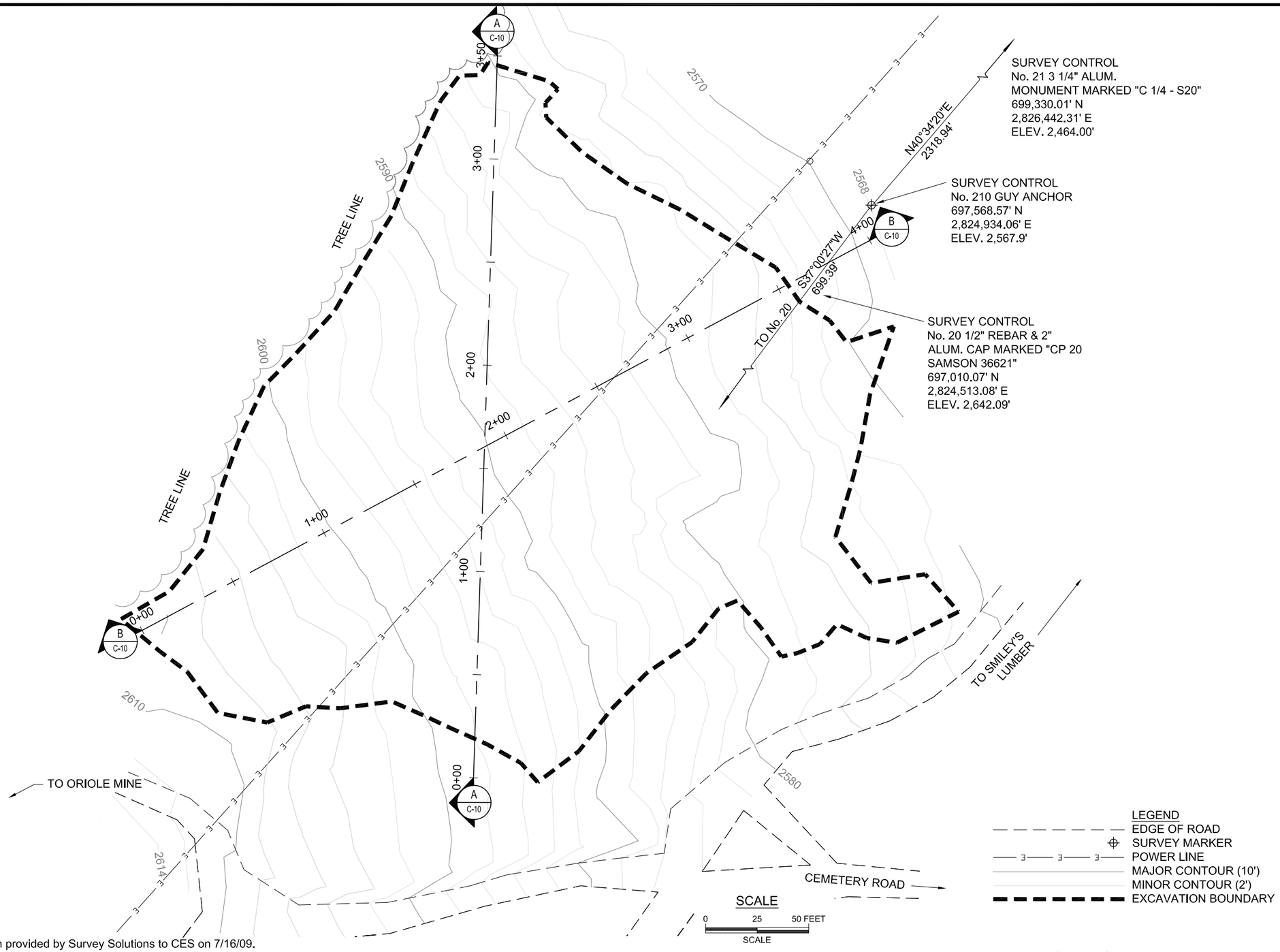
DES. BY TCE
DRG. BY TCE
CHK. BY DW
DATE CREATED 2-19-2010
JOB No. 2923007

CASCADE EARTH SCIENCES
A Valmont Industries Company
CALL 1-800-728-8322
FOR NATIONAL OFFICE LOCATIONS

SITE LOCATION & INDEX OF DRAWINGS

ORIOLE MINE – REMOVAL ACTION

SHEET G-1



SOURCE: Topographic information provided by Survey Solutions to CES on 7/16/09.

REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\AABDrafting Files\2923007 – USFS Oriole Mine – Oriole Mine Removal Action\Drawings\2923007 C1,2,10.dwg Renning, John K. 9/21/2010

COLVILLE NATIONAL FOREST
METALINE, WASHINGTON

REV #	DESCRIPTION	BY	DATE
1	Editorial changes	3KAC	4–29–2010
2	REVISED PER U.S.F.S. COMMENT LETTER	6DLW	9–17–2010

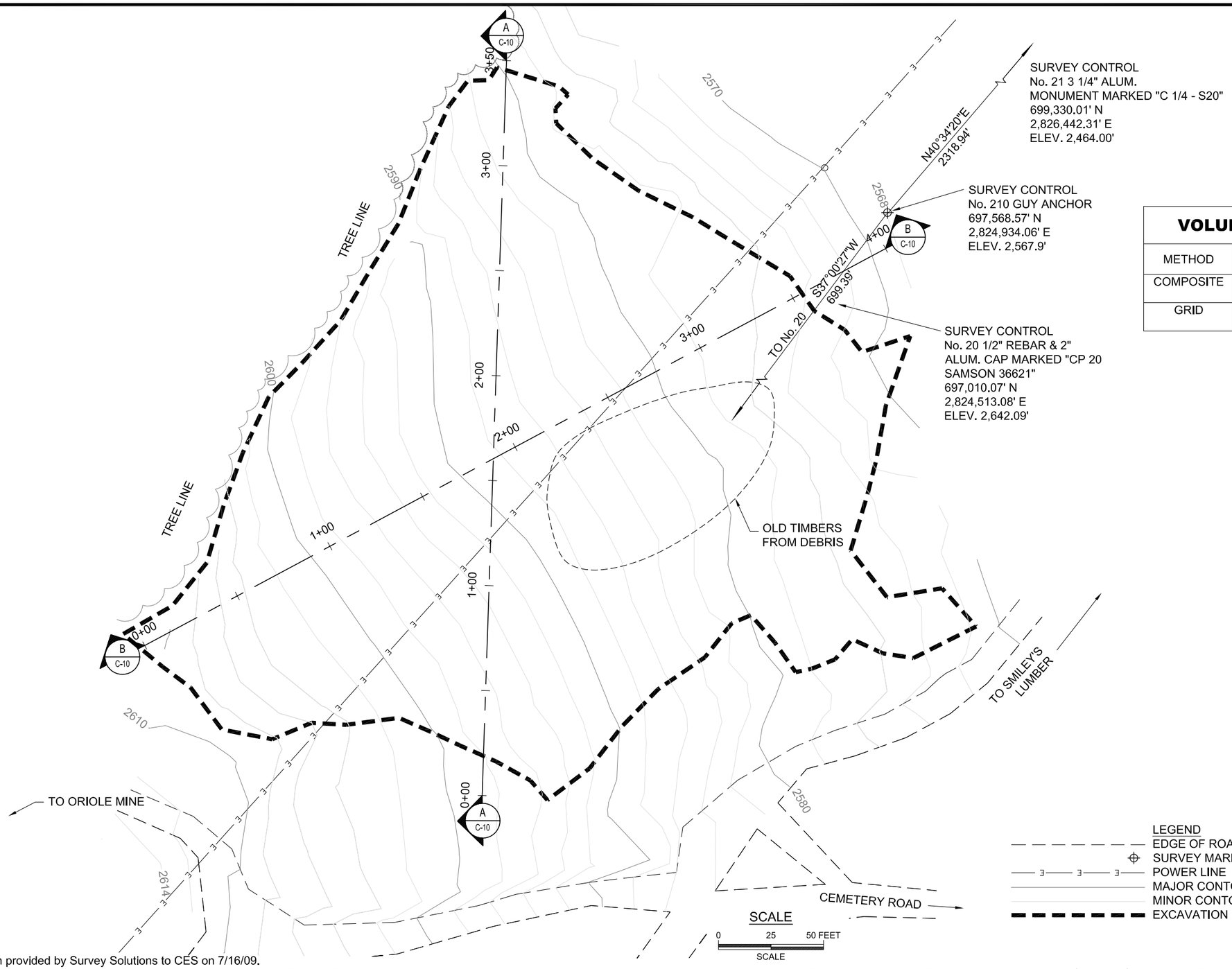
DES. BY 8TCE
DRG. BY 8TCE
CHK. BY -
DATE CREATED 7-28-2009
JOB No. 2923007

CASCADE EARTH SCIENCES
A Valmont Industries Company
CALL 1-800-728-8322
FOR NATIONAL OFFICE LOCATIONS

BORROW PIT PRE-EXCAVATION

ORIOLE MINE – REMOVAL ACTION

SHEET
C-1



VOLUME CALCULATIONS

METHOD	CUT (BCY)	FILL (BCY)	NET (BCY)
COMPOSITE	2487	117	2370 CUT
GRID	2483	115	2368 CUT

SOURCE: Topographic information provided by Survey Solutions to CES on 7/16/09.

REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\AABDrafting Files\2923007 – USFS Oriole Mine – Oriole Mine Removal Action\Drawings\2923007 C1,2,10.dwg Renning, John K. 9/21/2010

COLVILLE NATIONAL FOREST
METALINE, WASHINGTON

REV #	DESCRIPTION	BY	DATE
1	Editorial Changes	3KAC	4–29–2010
2	REVISED PER U.S.F.S. COMMENT LETTER	6DLW	9–17–2010

DES. BY 8TCE
DRG. BY 8TCE
CHK. BY -
DATE CREATED 7-28-2009
JOB No. 2923007

CASCADE EARTH SCIENCES
A Valmont Industries Company
CALL 1-800-728-8322
FOR NATIONAL OFFICE LOCATIONS

BORROW PIT POST-EXCAVATION

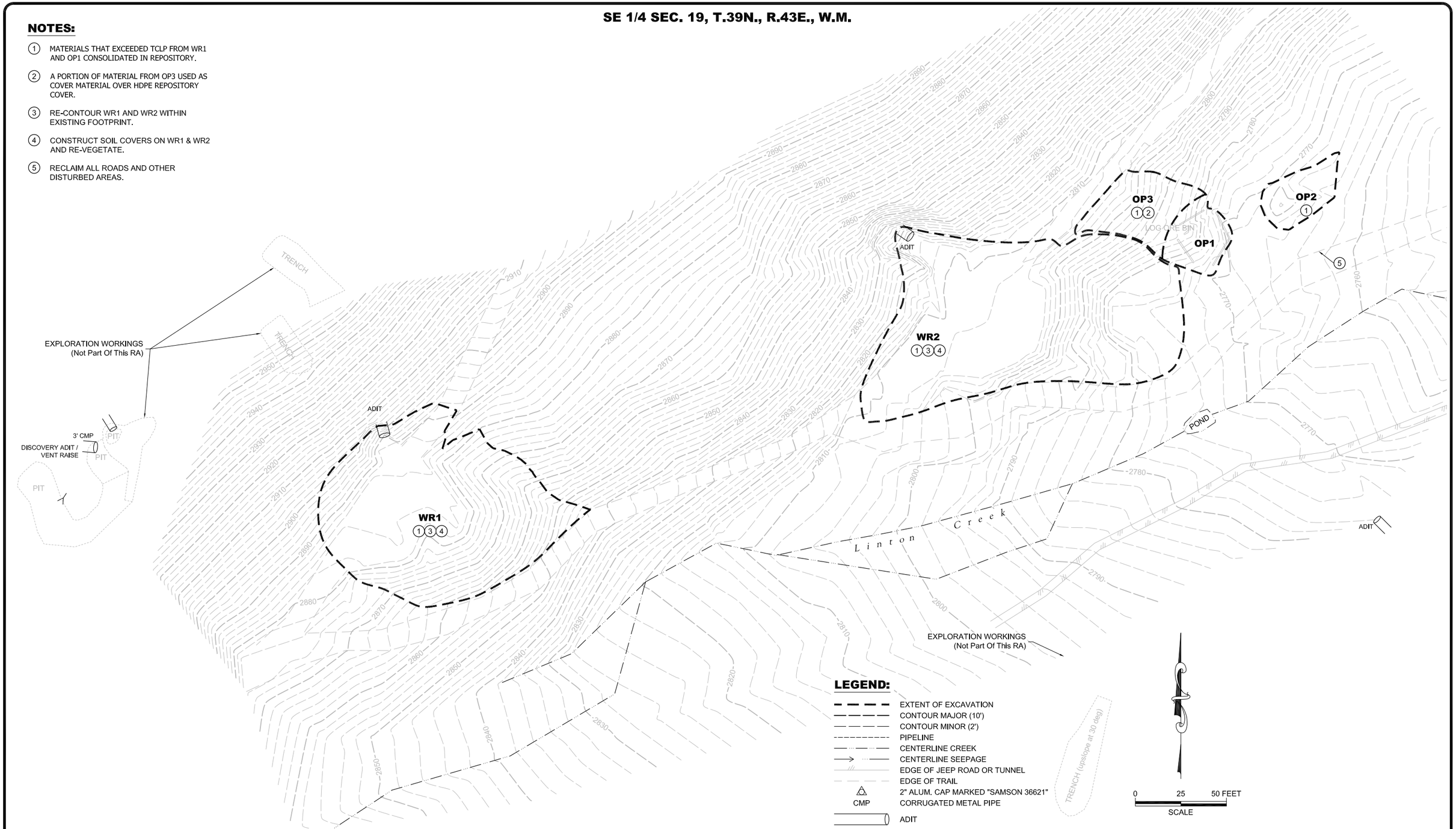
ORIOLE MINE – REMOVAL ACTION

SHEET
C-2

SE 1/4 SEC. 19, T.39N., R.43E., W.M.

NOTES:

1. MATERIALS THAT EXCEEDED TCLP FROM WR1 AND OP1 CONSOLIDATED IN REPOSITORY.
2. A PORTION OF MATERIAL FROM OP3 USED AS COVER MATERIAL OVER HDPE REPOSITORY COVER.
3. RE-CONTOUR WR1 AND WR2 WITHIN EXISTING FOOTPRINT.
4. CONSTRUCT SOIL COVERS ON WR1 & WR2 AND RE-VEGETATE.
5. RECLAIM ALL ROADS AND OTHER DISTURBED AREAS.



LEGEND:

- EXTENT OF EXCAVATION
- CONTOUR MAJOR (10')
- CONTOUR MINOR (2')
- PIPELINE
- CENTERLINE CREEK
- CENTERLINE SEEPAGE
- EDGE OF JEEP ROAD OR TUNNEL
- EDGE OF TRAIL
- 2" ALUM. CAP MARKED "SAMSON 36621"
- CMP — CORRUGATED METAL PIPE
- ADIT

REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\AABDRAFTING FILES\2923007 – USFS ORIOLE MINE – ORIOLE MINE REMOVAL ACTION\DRAWINGS\2923007 C3-9.DWG RENNING, JOHN K. 9/21/2010

COLVILLE NATIONAL FOREST
METALINE, WASHINGTON

REV #	DESCRIPTION	BY	DATE
1	REVISED PER U.S.F.S. COMMENT LETTER	6DLW	9-17-2010

DES. BY 8TCE
DRG. BY 6JKR
CHK. BY 6DLW
DATE CREATED 9-17-2010
JOB No. 2923007

CASCADE EARTH SCIENCES
A Valmont Industries Company
CALL 1-800-728-8322
FOR NATIONAL OFFICE LOCATIONS

ORIOLE MINE
PRE REMOVAL ACTION

ORIOLE MINE – REMOVAL ACTION

SHEET
C-3

SE 1/4 SEC. 19, T.39N., R.43E., W.M.

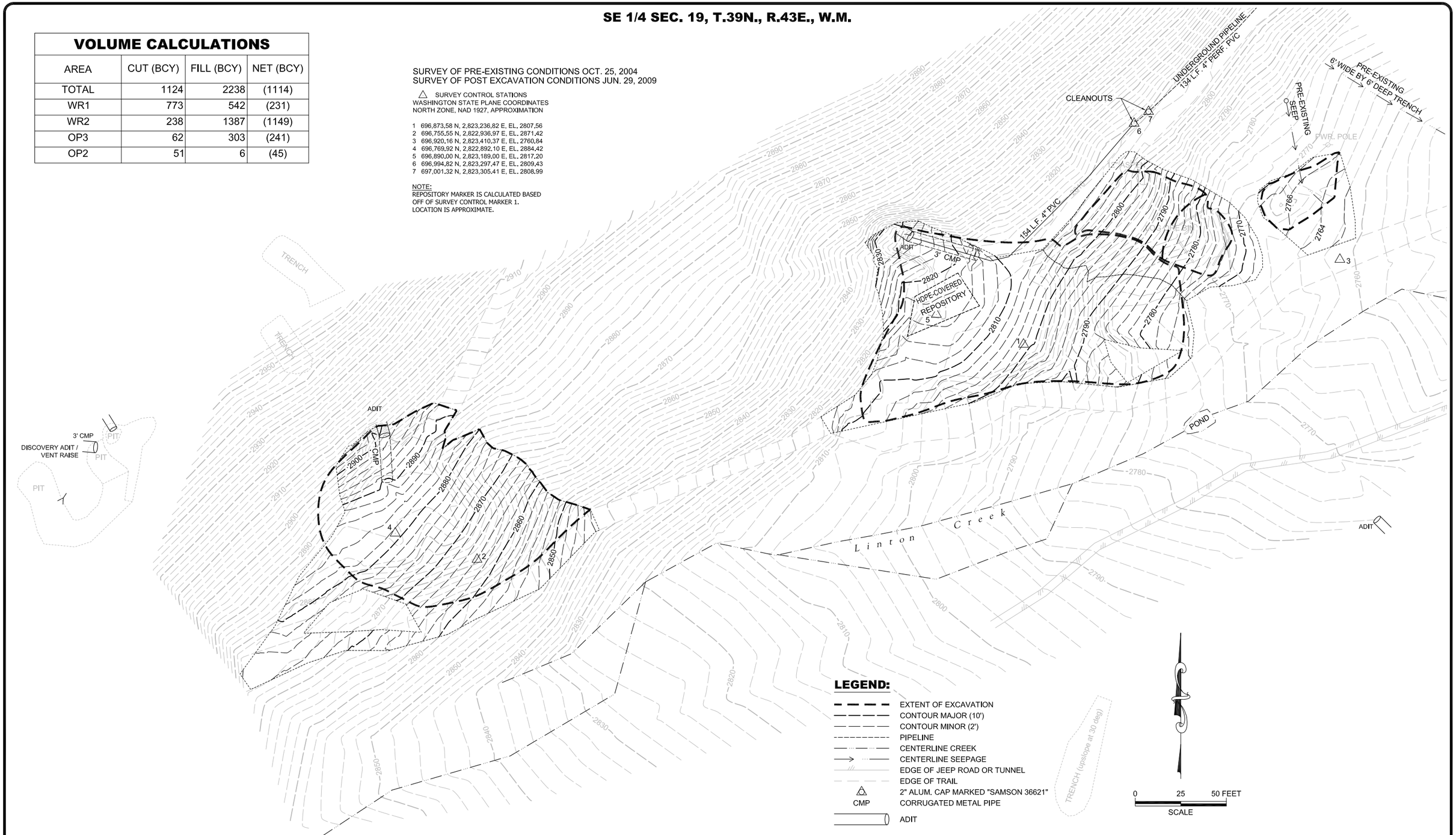
VOLUME CALCULATIONS			
AREA	CUT (BCY)	FILL (BCY)	NET (BCY)
TOTAL	1124	2238	(1114)
WR1	773	542	(231)
WR2	238	1387	(1149)
OP3	62	303	(241)
OP2	51	6	(45)

SURVEY OF PRE-EXISTING CONDITIONS OCT. 25, 2004
SURVEY OF POST EXCAVATION CONDITIONS JUN. 29, 2009

△ SURVEY CONTROL STATIONS
WASHINGTON STATE PLANE COORDINATES
NORTH ZONE, NAD 1927, APPROXIMATION

1 696,873.58 N, 2,823,236.82 E, EL. 2807.56
2 696,755.55 N, 2,822,936.97 E, EL. 2871.42
3 696,920.16 N, 2,823,410.37 E, EL. 2760.84
4 696,769.92 N, 2,822,892.10 E, EL. 2884.42
5 696,890.00 N, 2,823,189.00 E, EL. 2817.20
6 696,994.82 N, 2,823,297.47 E, EL. 2809.43
7 697,001.32 N, 2,823,305.41 E, EL. 2808.99

NOTE:
REPOSITORY MARKER IS CALCULATED BASED OFF OF SURVEY CONTROL MARKER 1. LOCATION IS APPROXIMATE.



REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\AABDRAFTING FILES\2923007 – USFS ORIOLE MINE – ORIOLE MINE REMOVAL ACTION\DRAWINGS\2923007 C3-9.DWG RENNING, JOHN K. 9/21/2010

COLVILLE NATIONAL FOREST
METALINE, WASHINGTON

REV #	DESCRIPTION	BY	DATE
1	REVISED PER U.S.F.S. COMMENT LETTER	6DLW	9-17-2010

DES. BY 8TCE
DRG. BY 6JKR
CHK. BY 6DLW
DATE CREATED 9-17-2010
JOB No. 2923007

CASCADE EARTH SCIENCES
A Valmont Industries Company
CALL 1-800-728-8322
FOR NATIONAL OFFICE LOCATIONS

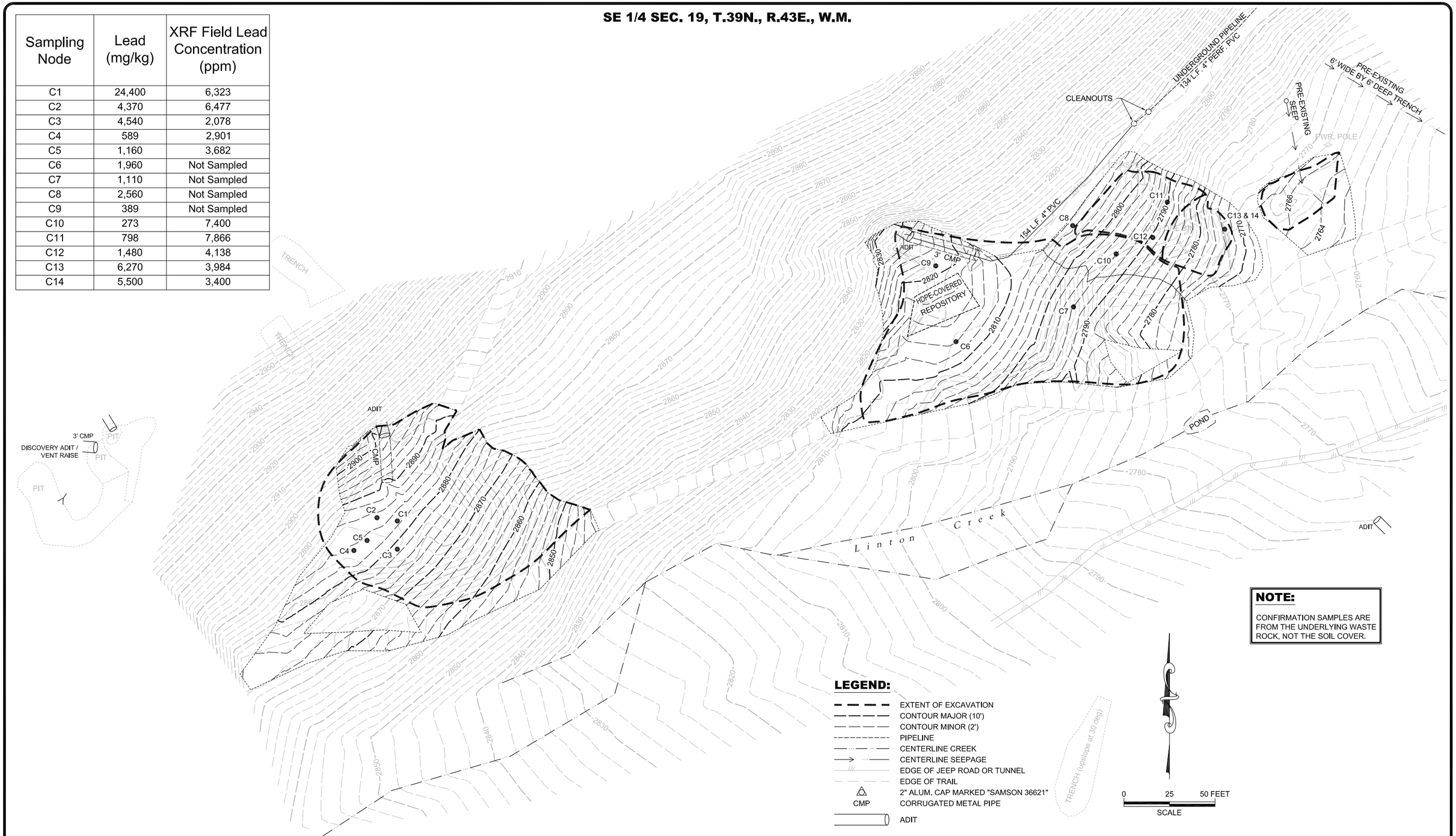
ORIOLE MINE
POST REMOVAL ACTION

ORIOLE MINE – REMOVAL ACTION

SHEET
C-4

Sampling Node	Lead (mg/kg)	XRF Field Lead Concentration (ppm)
C1	24,400	6,323
C2	4,370	6,477
C3	4,540	2,078
C4	589	2,901
C5	1,160	3,682
C6	1,960	Not Sampled
C7	1,110	Not Sampled
C8	2,560	Not Sampled
C9	389	Not Sampled
C10	273	7,400
C11	798	7,866
C12	1,480	4,138
C13	6,270	3,984
C14	5,500	3,400

SE 1/4 SEC. 19, T.39N., R.43E., W.M.



NOTE:

CONFIRMATION SAMPLES ARE FROM THE UNDERLYING WASTE ROCK, NOT THE SOIL COVER.

LEGEND:

- EXTENT OF EXCAVATION
- CONTOUR MAJOR (10')
- CONTOUR MINOR (2')
- PIPELINE
- CENTERLINE CREEK
- CENTERLINE SEEPAGE
- EDGE OF JEEP ROAD OR TUNNEL
- EDGE OF TRAIL
- 2" ALUM. CAP MARKED "SAMSON 36621"
- CMP — CORRUGATED METAL PIPE
- ADIT

0 25 50 FEET
SCALE

REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\AABDRAFTING FILES\2923007 – USFS ORIOLE MINE – ORIOLE MINE REMOVAL ACTION\DRAWINGS\2923007 C3–9.DWG RENNING, JOHN K. 9/21/2010

COLVILLE NATIONAL FOREST
METALINE, WASHINGTON

REV #	DESCRIPTION	BY	DATE
1	REVISED PER U.S.F.S. COMMENT LETTER	6DLW	9–17–2010

DES. BY 8TCE
DRG. BY 6JKR
CHK. BY 6DLW
DATE CREATED 9-17-2010
JOB No. 2923007

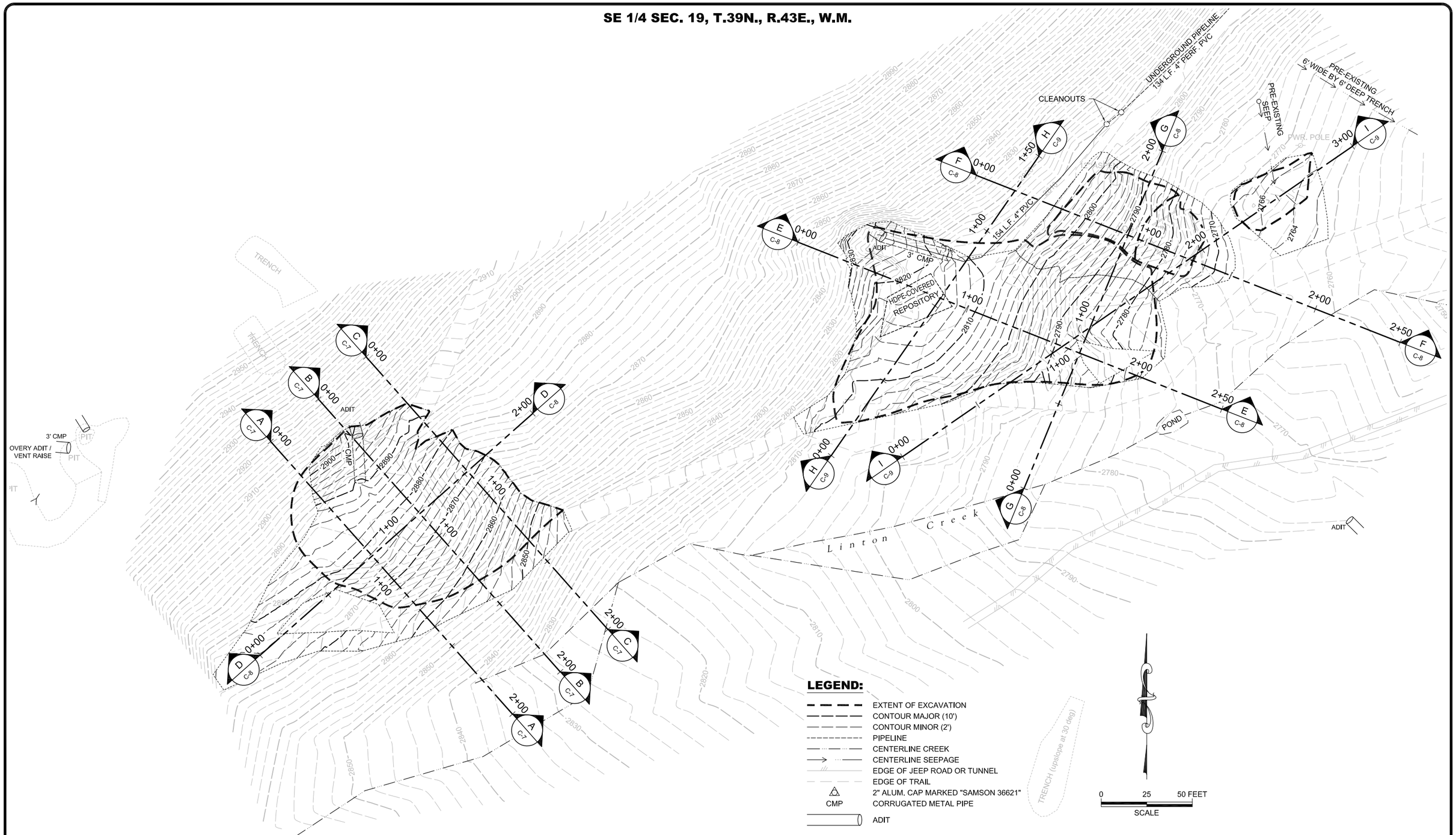
CASCADE EARTH SCIENCES
A Valmont Industries Company
CALL 1-800-728-8322
FOR NATIONAL OFFICE LOCATIONS

ORIOLE MINE
SAMPLING LOCATIONS

ORIOLE MINE – REMOVAL ACTION

SHEET
C-5

SE 1/4 SEC. 19, T.39N., R.43E., W.M.



REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\AABDRAFTING FILES\2923007 – USFS ORIOLE MINE – ORIOLE MINE REMOVAL ACTION\DRAWINGS\2923007 C3-9.DWG RENNING, JOHN K. 9/21/2010

COLVILLE NATIONAL FOREST
METALINE, WASHINGTON

REV #	DESCRIPTION	BY	DATE
1	REVISED PER U.S.F.S. COMMENT LETTER	6DLW	9-17-2010

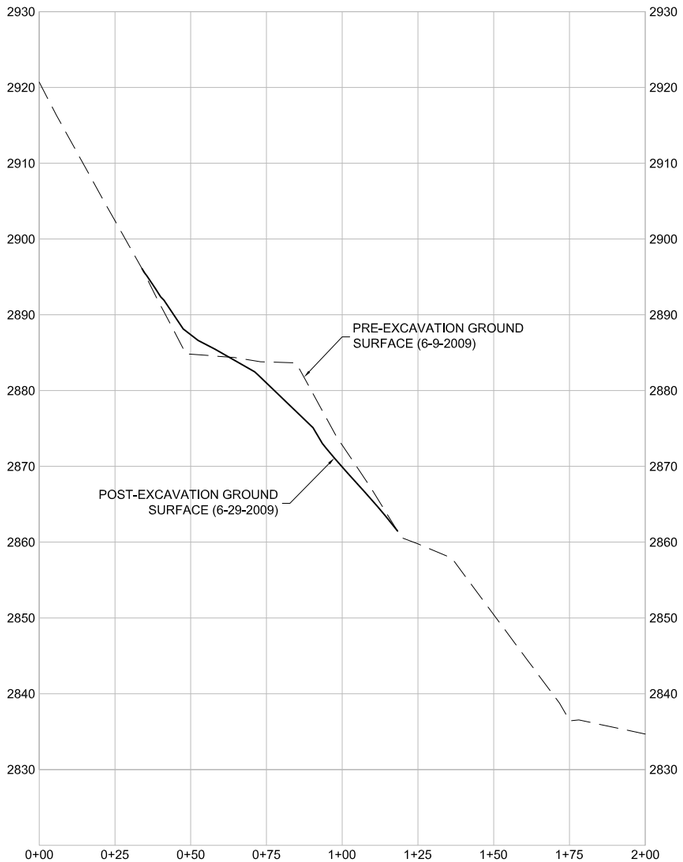
DES. BY 8TCE
DRG. BY 6JKR
CHK. BY 6DLW
DATE CREATED 9-17-2010
JOB No. 2923007

CASCADE EARTH SCIENCES
A Valmont Industries Company
CALL 1-800-728-8322
FOR NATIONAL OFFICE LOCATIONS

ORIOLE MINE
REMOVAL ACTION SECTIONS

ORIOLE MINE – REMOVAL ACTION

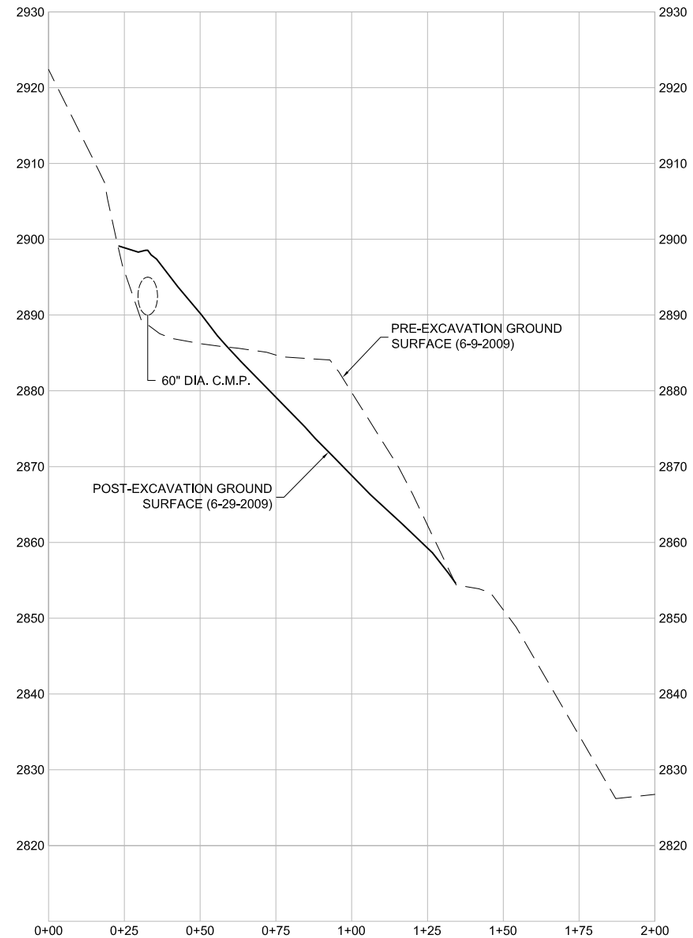
SHEET
C-6



A C-6 SECTION A

0 25 50 FEET

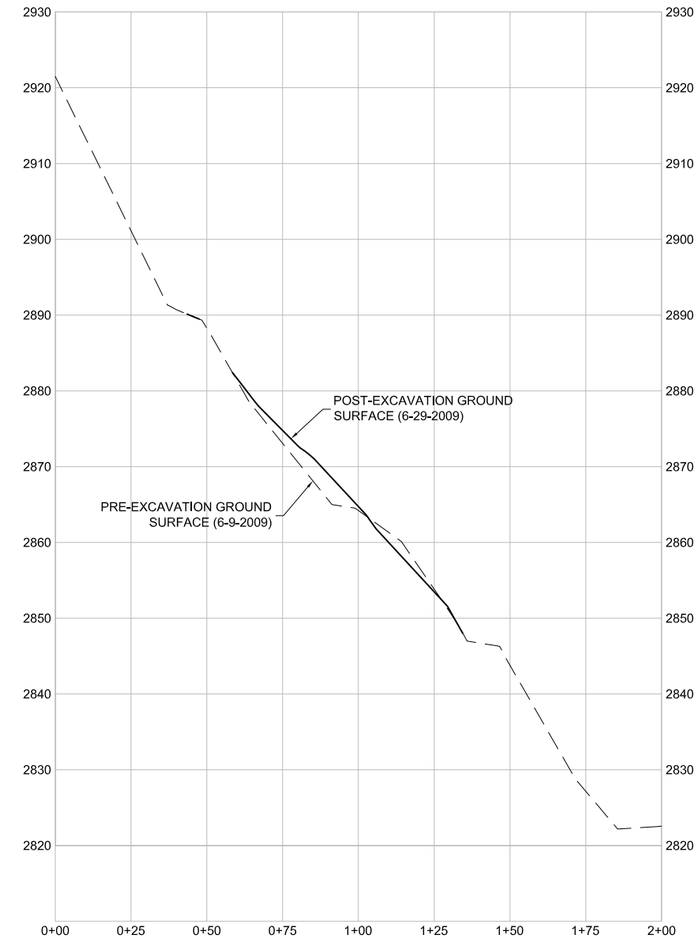
SCALE
2.5X EXAGGERATION



B C-6 SECTION B

0 25 50 FEET

SCALE
2.5X EXAGGERATION



C C-6 SECTION C

0 25 50 FEET

SCALE
2.5X EXAGGERATION

REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\AABDRAFTING FILES\2923007 – USFS ORIOLE MINE – ORIOLE MINE REMOVAL ACTION\DRAWINGS\2923007 C3-9.DWG RENNING, JOHN K. 9/21/2010

COLVILLE NATIONAL FOREST
METALINE, WASHINGTON

REV #	DESCRIPTION	BY	DATE
1	REVISED PER U.S.F.S. COMMENT LETTER	6DLW	9-17-2010

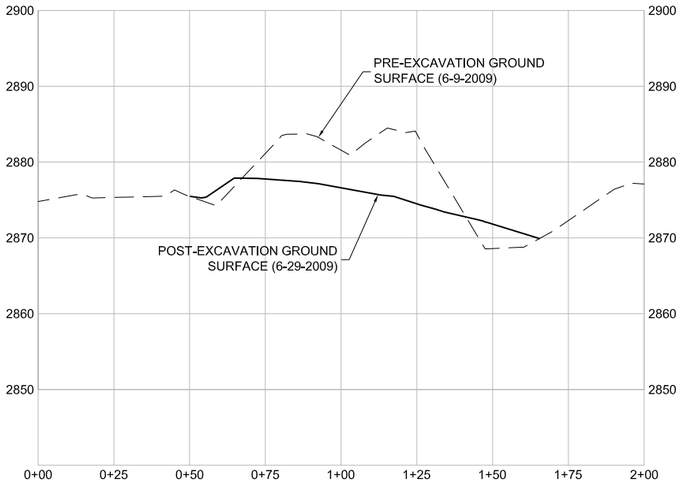
DES. BY 8TCE
DRG. BY 6JKR
CHK. BY 6DLW
DATE CREATED 9-17-2010
JOB No. 2923007

CASCADE EARTH SCIENCES
A Valmont Industries Company
CALL 1-800-728-8322
FOR NATIONAL OFFICE LOCATIONS

ORIOLE MINE REMOVAL ACTION
SECTIONS

ORIOLE MINE – REMOVAL ACTION

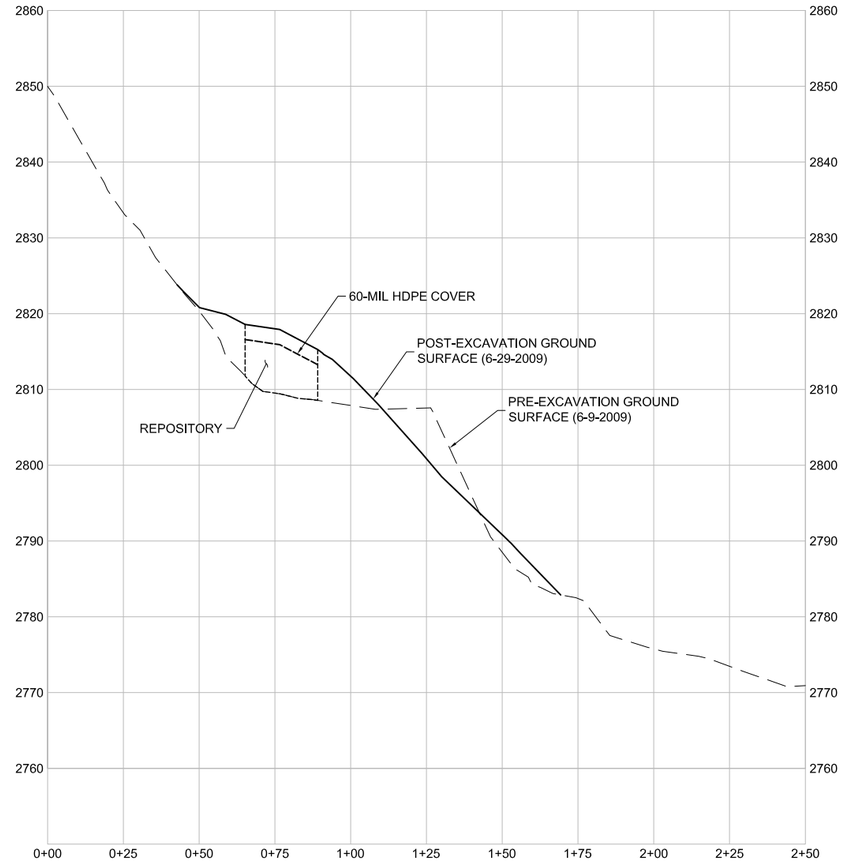
SHEET
C-7



D C-6 SECTION D

0 25 50 FEET

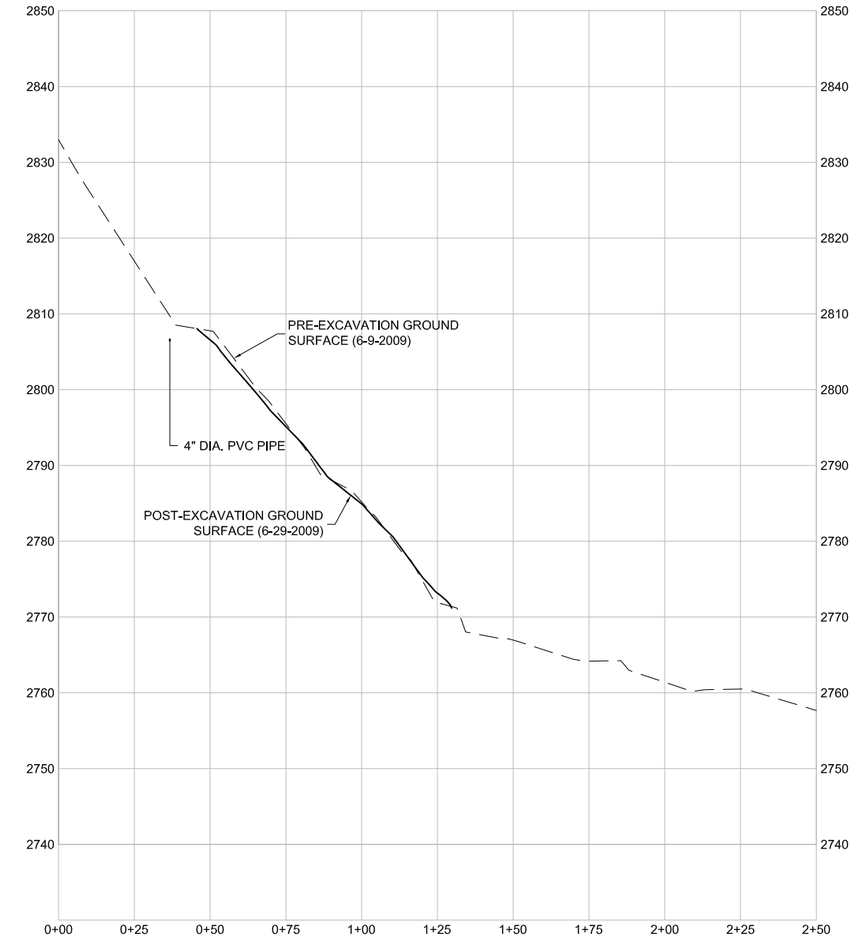
SCALE
2.5X EXAGGERATION



E C-6 SECTION E

0 25 50 FEET

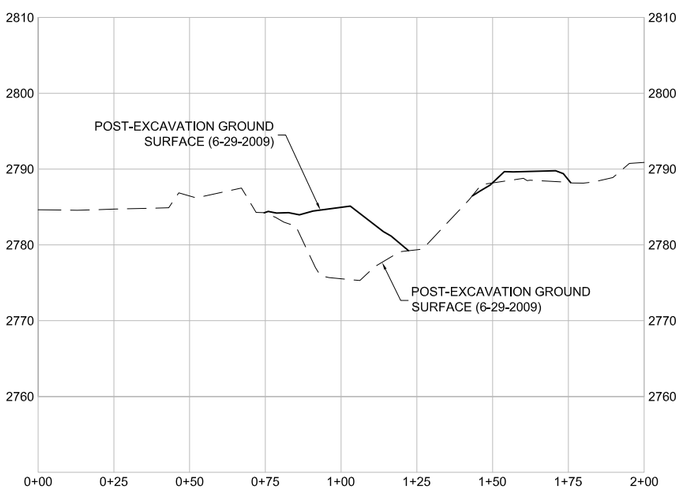
SCALE
2.5X EXAGGERATION



F C-6 SECTION F

0 25 50 FEET

SCALE
2.5X EXAGGERATION



G C-6 SECTION G

0 25 50 FEET

SCALE
2.5X EXAGGERATION

REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\AABDRAFTING FILES\2923007 – USFS ORIOLE MINE – ORIOLE MINE REMOVAL ACTION\DRAWINGS\2923007 C3–9.DWG RENNING, JOHN K. 9/21/2010

COLVILLE NATIONAL FOREST

METALINE, WASHINGTON

REV #	DESCRIPTION	BY	DATE
1	REVISED PER U.S.F.S. COMMENT LETTER	6DLW	9–17–2010

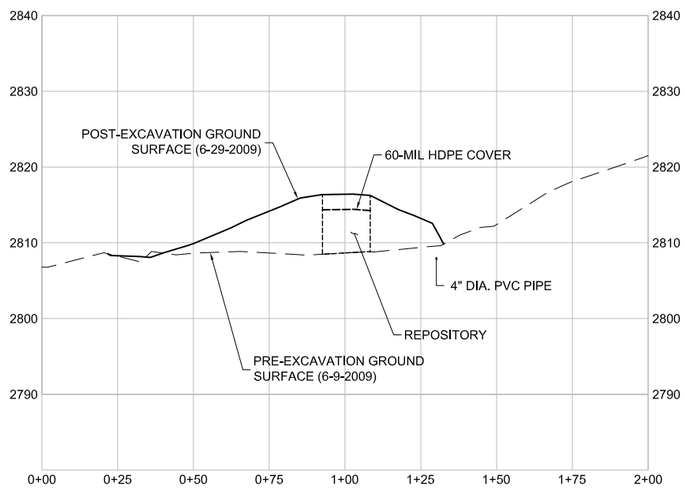
DES. BY 8TCE
DRG. BY 6JKR
CHK. BY 6DLW
DATE CREATED 9-17-2010
JOB No. 2923007

CASCADE EARTH SCIENCES
A Valmont Industries Company
CALL 1-800-728-8322
FOR NATIONAL OFFICE LOCATIONS

ORIOLE MINE REMOVAL ACTION
SECTIONS

ORIOLE MINE – REMOVAL ACTION

SHEET
C-8



H C-6 SECTION H

0 25 50 FEET

SCALE
2.5X EXAGGERATION

I C-6 SECTION I

0 25 50 FEET

SCALE
2.5X EXAGGERATION

REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\AABDRAFTING FILES\2923007 – USFS ORIOLE MINE – ORIOLE MINE REMOVAL ACTION\DRAWINGS\2923007 C3-9.DWG RENNING, JOHN K. 9/21/2010

COLVILLE NATIONAL FOREST
METALINE, WASHINGTON

REV #	DESCRIPTION	BY	DATE
1	REVISED PER U.S.F.S. COMMENT LETTER	6DLW	9-17-2010

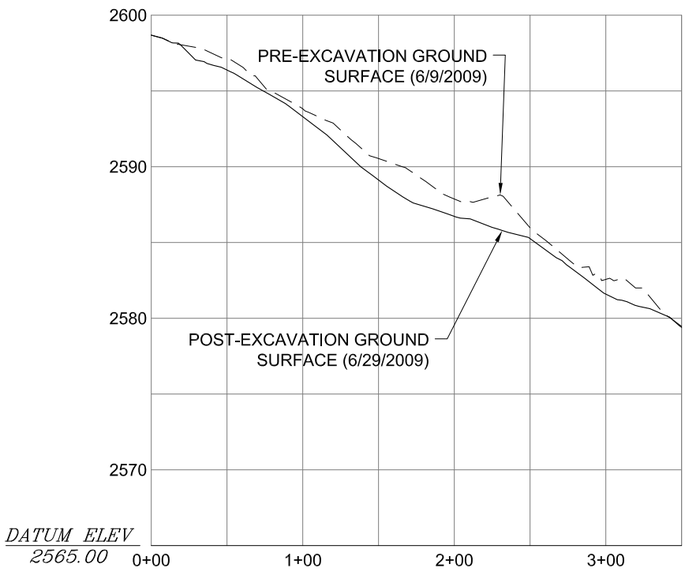
DES. BY 8TCE
DRG. BY 6JKR
CHK. BY 6DLW
DATE CREATED 9-17-2010
JOB No. 2923007

CASCADE EARTH SCIENCES
A Valmont Industries Company
CALL 1-800-728-8322
FOR NATIONAL OFFICE LOCATIONS

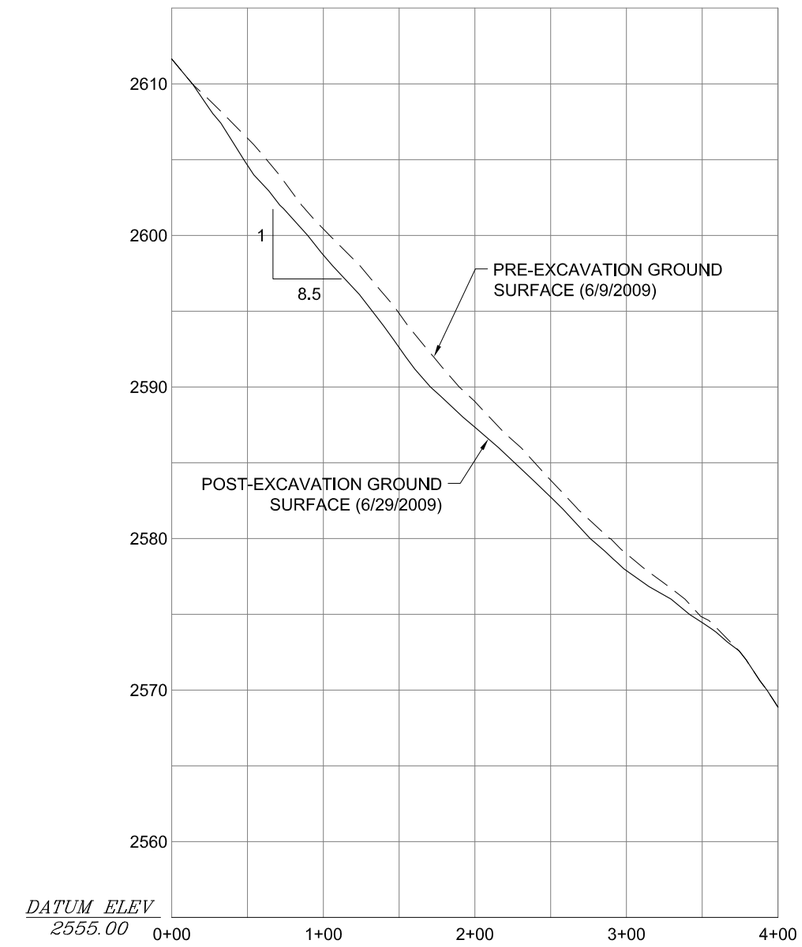
ORIOLE MINE REMOVAL ACTION
SECTIONS

ORIOLE MINE – REMOVAL ACTION

SHEET
C-9



A C-2 SECTION A
0 50 100 FEET
SCALE
10 X VERTICAL EXAGGERATION



B C-2 SECTION B
0 50 100 FEET
SCALE
10 X VERTICAL EXAGGERATION

SOURCE: Topographic information provided by Survey Solutions to CES on 7/16/09.

REUSE OF DOCUMENTS: THIS DOCUMENT AND THE IDEAS AND DESIGN INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE IS THE PROPERTY OF CASCADE EARTH SCIENCES AND IS NOT TO BE USED, WHOLE OR IN PART WITHOUT THE WRITTEN AUTHORIZATION OF CASCADE EARTH SCIENCES

S:\AABDrafting Files\2923007 – USFS Oriole Mine – Oriole Mine Removal Action\Drawings\2923007 C1,2,10.dwg Renning, John K. 9/21/2010

COLVILLE NATIONAL FOREST
METALINE, WASHINGTON

REV #	DESCRIPTION	BY	DATE
1	Editorial Changes	3KAC	4-29-2010
2	REVISED PER U.S.F.S. COMMENT LETTER	6DLW	9-17-2010

DES. BY 8TCE
DRG. BY 8TCE
CHK. BY -
DATE CREATED 7-28-2009
JOB No. 2923007

CASCADE EARTH SCIENCES
A Valmont Industries Company
CALL 1-800-728-8322
FOR NATIONAL OFFICE LOCATIONS

ORIOLE MINE
SOIL BORROW AREA SECTIONS

ORIOLE MINE – REMOVAL ACTION

SHEET
C-10

APPENDIX

Appendix A. Pre and Post Removal Action Photographs

Photograph 1.1

Upper Adit prior to Removal Action (CES, July 2004).

Photograph 1.2

Upper Adit looking upslope from the toe prior to Removal Action (CES, July 2004).

Photograph 1.3

Approximate location of "hot" spot prior to Removal Action (CES, July 2004).

Photograph 1.4

Upper Adit opened and culvert in place (CES, June 2009).

Photograph 1.5

Upper Adit waste rock pile sloped and graded during Removal Action activities (CES, June 2009).

Photograph 1.6

Reclaimed Upper Adit access road following Removal Action activities (CES, June 2009).

Photograph 1.7

Lower Adit from waste rock pile prior to Removal Action activities (CES, July 2004).

Photograph 1.8

Oriole Mine Lower Adit waste rock pile from toe prior to Removal Action activities (CES, June 2009).

Photograph 1.9

Lower Adit culvert prior to Removal Action activities (CES June 2009).

Photograph 1.10

Lower Adit culvert bat gate prior to Removal Action activities (CES, July 2004).

Photograph 1.11

Lower Adit culvert excavated during Removal Action activities (CES, June 2009).

Photograph 1.12

Lower Adit Seep, approximately 12 gpm, during Removal Action activities (CES, June 2009).

Photograph 1.13

Lower Adit Seep pipeline during Removal Action activities (CES, June 2009).

Photograph 1.14

Perforated pipe added to PVC, at the cleanout, to infiltrate adit seep away from waste rock piles (CES June, 2009).

Photograph 1.15

Corrugated metal pipe added to existing pipe (CES, June 2009).

Photograph 1.16

Covering repository with HDPE liner (CES, June 2009).

Photograph 1.17

HDPE was covered with approximately 250 bank cubic yards of material from OP3 (CES, June 2009).

Photograph 1.18

Lower Adit repository during fall sampling event (CES, October 2009).

Photograph 1.19

OP1 Ore bin before Removal Action activities (CES, July 2004).

Photograph 1.20

OP3 and Ore bin area sloped and graded (CES, June 2009).

Photograph 1.21

Reclaimed ore bin area (CES, October 2009).

Photograph 1.22

Upper Adit access road reclaimed (CES, June 2009).

Photograph 1.23

Lower Adit access road reclaimed (CES, June 2009).

Photograph 1.24

Reclaimed mine access road during fall 2009 sampling event (CES, October 2009).

Photograph 1.25

Soil borrow area during soil pit evaluation (CES, May 2009).

Photograph 1.26

Borrow soil test pit with cobble from 3 to 24 inches. Cobble separated from soil and used as fill around repository (CES, May2009).

Photograph 1.27

Soil borrow area sloped and graded (CES, June 2009).

Photograph 1.28

Soil borrow area sloped and graded (CES, June 2009).

Photograph 1.29

Re-growth of vegetation of soil borrow area during fall 2009 sampling event (CES, October 2009).

Photograph 1.30

Re-growth of vegetation of soil borrow area during fall 2009 sampling event (CES, October 2009).