Site Inspection
New York Mine Complex
Umatilla and Wallowa-Whitman National Forests

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Site Inspection
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Prepared For:	United States Department of Agriculture, Forest Service Region 6
Site Location:	New York Mine Complex Umatilla and Wallowa-Whitman National Forests Grant County, Oregon
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Cover Photos Independence Mill (upper left), and Lower (Bowes) New York Adit drainage (lower right).

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LIST OF ACRONYMS AND ABBREVIATIONS

90_{UCL}	90th percentile upper confidence limit on the arithmetic mean
ABA	Acid Based Accounting
ABP	Acid Base Potential
AGP	Acid Generating Potential
ANP	Acid Neutralization Potential
ARD	Acid Rock Drainage
bgs	below ground surface
CERCLA	Comprehensive Environmental Response and Liability Act
CES	Cascade Earth Sciences
COI	Contaminants of Interest
COPC	Contaminants of Potential Concern
COPEC	Contaminants of Potential Ecological Concern
CTE	Central Tendency Exposure
ECR	Excess Cancer Risk
EECA	Engineering Evaluation / Cost Analysis
ERA	Ecological Risk Assessment
HHRA	Human Health Risk Assessment

ODEQ	Oregon Department of Environmental Quality
QA/QC	Quality Assurance / Quality Control
RCRA	Resource Conservation Recovery Act
RME	Reasonable Maximum Exposure
RTE	Rare, Threatened, and Endangered
SI	Site Inspection
SPLP	Synthetic Precipitation Leaching Procedure
TCLP	Toxicity Characterization Leaching Procedure
USEPA	U.S. Environmental Protection Agency
Forest Service	U.S. Department of Agriculture, Forest Service

EXECUTIVE SUMMARY

- Cascade Earth Sciences (CES) was retained by the United States Department of Agriculture, Forest Service (Forest Service) under Contract # R6-27-06-113 to perform a Site Inspection (SI) for the New York Mine Complex (Site).
- The Site is located approximately four miles north of the town of Granite and is accessed by Grant County Road 73, and consists of:
  - The Independence Mill and New York Mine, located adjacent to Granite Creek; and
  - The East Eddy Group, located adjacent to Chipman Gulch.
- The SI has documented the following human health and environmental impacts:
  - New York Mine
    - Arsenic in wasterock and tailings was detected as high as 2,530 mg/kg (milligrams per kilogram), which exceeds U.S. Environmental Protection Agency (USEPA) Preliminary Remedial Goals (PRGs) for the carcinogenic end point of 1.6 mg/kg.
      - Arsenic is a concern because of the potential to cause cancer of the lungs, liver, bladder, kidneys, etc.
    - Arsenic in Granite Creek sediment below the New York Mine was detected at 186 mg/kg, which exceed USEPA Freshwater Threshold Effects Level (TEL) of 5.9 mg/kg.
      - The ecological risk assessment suggests mine related impacts in Granite Creek sediments.
  - Independence Mill
    - Wasterock and tailings analytical results for arsenic (16,180 mg/kg) and lead (16,100 mg/kg) exceed USEPA PRGs of 1.6 and 800 mg/kg, respectively.
    - Arsenic in Granite Creek sediment collected adjacent to the Independence Mill was detected as high as 142 mg/kg, which exceeds USEPA Freshwater TEL of 5.9 mg/kg.
  - East Eddy Group
    - Wasterock analytical results for arsenic (326 mg/kg) exceed USEPA PRG of 1.6 mg/kg.
    - Arsenic in Chipman Gulch sediment detected as high as 1,070 mg/kg, which exceeds USEPA Freshwater TEL of 5.9 mg/kg.
    - Arsenic concentration in Granite Creek sediment increases 300% from above the confluence with Chipman Gulch (24.2 mg/kg) to immediately below the confluence with Chipman Gulch (113 mg/kg) reflecting significant arsenic loading from Chipman Gulch.
    - Elevated metal concentrations in aquatic samples in the upper reaches in Chipman Gulch above the East Eddy Group indicate one or more additional sources of metals contamination.
- Risk-based cleanup concentrations for arsenic in wasterock, tailings, and soil was calculated to be 144 mg/kg, and for sediment to be 266 mg/kg.
- Based upon the SI, CES recommends that an Engineering Evaluation / Cost Analysis (EECA) be conducted at the Site. As part of the EECA, the following data gaps should be assessed:
  - Additional aquatic samples should be collected upstream from CG-01 in Chipman Gulch to determine the possibility of additional sources above East Eddy Group (~$6,000).
  - Samples should be collected at the unnamed mill site above the East Eddy Group to assess impacts to human health and the environment. Historic information should also be assessed to determine past ownership and practices (~$6,000).
  - Additional aquatic samples should be collected downstream from the New York Mine and GC-18, to assess downstream migration of metals in Granite Creek (~$6,000).
  - An updated risk assessment should be developed based on the new analytical data (~$5,000).
  - Further delineation of sediment in Chipman Gulch wetlands to determine lateral extent and volume of impacted sediment (~$3,000).
  - Detailed topographic surveys should be developed for the Site to refine the volume calculations and to develop drawings for the EECA (~$20,000).

SITE INSPECTION DATA SUMMARY SHEET

Project Name: New York Mine Complex Site Inspection
Project Location: Sections 22, 23 and 27, Township 8 South, Range 35.5 East
Latitude (New York Mine - Bowes Adit): 44° 50' 46.8" N **Longitude:** 118° 24' 03.3" W
Latitude (East Eddy Group-Adit 1): 44° 51' 21.3" N **Longitude:** 118° 23' 38.9" W
Latitude (Independence Millsite): 44° 50' 52.9" N **Longitude:** 118° 24' 08.7" W
Nearest Surface Water Body: Granite Creek and Chipman Gulch
Area of Disturbance: ~0.5 acres at East Eddy Group, 2 acres at Independence Mill, and 4 acres at New York Mine

SUMMARY OF ANALYTICAL/DOCUMENTED CONTAMINATION

Media	Number of Samples	Rate of Discharge/Volume (gpm or bcy)	Metal	Highest Concentration	Lowest Criteria Eco – Ecological HH – Human Health	Background Concentration
Wasterock, Tailings, and Soil						
New York Mine Lower Workings Tailings	6 Samples	2,100 bcy (projected under wasterock, may be less based on published production)	Arsenic Cadmium Manganese Mercury Zinc	2,330 mg/kg 18.30 mg/kg 4,990 mg/kg 3.83 mg/kg 1,220 mg/kg	1.6 mg/kg – HH 4 mg/kg – Eco 100 mg/kg – Eco 0.00051 mg/kg – Eco 8.5 mg/kg – Eco	20.0 mg/kg 1.5 mg/kg 803 mg/kg 0.05 mg/kg 102 mg/kg
New York Mine Lower Workings Wasterock	12 Samples	Bowes Adit = 2,400 bcy Crusher/Mill Area = 10,900 bcy	Arsenic	1,800 mg/kg	1.6 mg/kg – HH	20.0 mg/kg
New York Mine Upper Workings Wasterock	3 Samples	3,400 bcy	Arsenic Manganese Mercury	2,530 mg/kg 1,750 mg/kg 1.82 mg/kg	1.6 mg/kg – HH 100 mg/kg – Eco 0.00051 mg/kg – Eco	20.0 mg/kg 803 mg/kg 0.05 mg/kg
Independence Mill Tailings /Wasterock	3 Samples	250 bcy	Arsenic	2,090 mg/kg	1.6 mg/kg – HH	20.0 mg/kg
Independence Mill Ore Stockpiles	2 Samples	400 bcy	Arsenic	2,910 mg/kg	5 mg/kg – Eco	0.2 mg/kg
Independence Mill Soil	6 Samples	420 bcy (including flotation cell area)	Arsenic Lead Mercury	16,180 mg/kg 16,100 mg/kg 1.82 mg/kg	1.6 mg/kg – HH 16 mg/kg – Eco 0.00051 mg/kg – Eco	20.0 mg/kg 7.3 mg/kg 0.05 mg/kg
Wasterock East Eddy Group	10 Samples	5,010 bcy	Arsenic Manganese	326 mg/kg 3,060 mg/kg	1.6 mg/kg – HH 100 mg/kg – Eco	20.0 mg/kg 803 mg/kg
Surface Water						
Granite Creek	11 Samples	485 to 800 gpm	Arsenic	9.2 µg/L	0.018 µg/L – Eco	0.6 B µg/L
Chipman Gulch	5 Samples	22 to 56 gpm	Arsenic	57.7 µg/L	0.018 µg/L – Eco	43.2 µg/L
New York Mine Bowes Adit	1 Sample	5 gpm	Arsenic Iron	42.8 µg/L 3,530 µg/L	0.018 µg/L – Eco 300 µg/L – HH/Eco	0.6 B µg/L 230 µg/L
East Eddy Adit 1	2 Samples	1 or less gpm	Arsenic Iron	26.5 µg/L 12,100 µg/L	0.018 µg/L – Eco 300 µg/L – HH/Eco	43.2 µg/L 230 µg/L
Chipman Gulch Side Channel	2 Samples	2 gpm	Arsenic Iron Lead Manganese	313 µg/L 8,650 µg/L 12.8 µg/L 846 µg/L	0.018 µg/L – Eco 300 µg/L – HH/Eco 1.32 µg/L – Eco 50 µg/L – HH/Eco	43.2 µg/L 230 µg/L 0.5 µg/L 33 µg/L
Pore Water						
Granite Creek	11 Samples	NA	Arsenic Manganese	36.8 µg/L 745 µg/L	0.018 µg/L – Eco 50 µg/L – Eco	3.4 µg/L 259 µg/L
Chipman Gulch	5 Samples	NA	Manganese	1,890 µg/L	50 µg/L – Eco	173 µg/L
Sediment						
Granite Creek	11 Samples	NA	Arsenic Cadmium Lead Silver	186 mg/kg 3.55 mg/kg 91.8 mg/kg 5.89 mg/kg	5.9 mg/kg – Eco 0.596 mg/kg – Eco 35 mg/kg – Eco 1.8 mg/kg – Eco	36.5 mg/kg 0.22 B mg/kg 2.63 mg/kg 0.13 mg/kg
Chipman Gulch	5 Samples	NA	Arsenic Cadmium Mercury Manganese Zinc	1,070 mg/kg 18.90 mg/kg 21. mg/kg 7,170 mg/kg 909 mg/kg	5.9 mg/kg – Eco 0.596 mg/kg – Eco 0.17 mg/kg - Eco 1,100 mg/kg – Eco 123 mg/kg – Eco	475 mg/kg 11.10 mg/kg 0.18 mg/kg 3,820 mg/kg 663 mg/kg

NOTES: This table lists the highest sample concentrations in each media and group. These exceedances are considered the major metals of concern, and are not a complete list of all contaminants of concern. Highest background concentration in waters and sediments used since only three samples were collected; background soil concentrations listed are the 90_{UCL} of the mean.
gpm = gallons per minute; bcy = bank cubic yards; TR = total recoverable metals; Diss. = dissolved metals; µg/L = micrograms per liter; mg/kg = milligrams per kilogram; B = analyte detected between method detection limit and practical quantification limit.

1.0 INTRODUCTION AND OBJECTIVES

- The U. S. Department of Agriculture, Forest Service (Forest Service) retained Cascade Earth Sciences (CES) to perform a Site Inspection (SI) under Contract # R6-27-06-113 at the New York Mine, East Eddy Group, and Independence Mill, collectively referred to as the New York Mine Complex (Site).
- The purpose was to determine the potential threat to human health and the environment from issues identified during the Abbreviated Preliminary Assessments (APAs) conducted by the Forest Service in 2006 (Forest Service, 2006a, b, c).
- The objectives were to:
  - assess the immediate or potential threat that mining wastes pose to human health and/or the environment, and
  - collect sufficient information to support a decision regarding the need for further action.
- The SI was generally performed in accordance with:
  - Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) [42 USC 9604(a) and 7 CFR 2.60(m)] and Federal Executive Order 12580;
  - National Contingency Plan (NCP) as outlined in 40 CFR Parts 300.400;
  - Superfund Amendments and Reauthorization Act (SARA) of 1986;
  - U.S. Environmental Protection Agency (USEPA) "Risks Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual" (USEPA, 1991).
  - USEPA "Guidance for Site Inspections under CERCLA" (USEPA, 1992);
  - USEPA "Guidelines for Ecological Risk Assessment, Final" (USEPA, 1997);
  - Oregon Department of Environmental Quality (ODEQ) "Guidance for Conduct of Deterministic Human Health Risk Assessment, Final" (ODEQ, 1998);
  - ODEQ "Guidance for Ecological Risk Assessment" (ODEQ, 2001); and
  - CES "New York Mine Complex Site Inspection Work Plan" (CES, 2007).

2.0 SITE DESCRIPTION, OPERATIONAL HISTORY, AND WASTE CHARACTERISTICS

- The following sections give a description of the location and operational history of the Site.
- Photographs of the Site and sampling locations are included in Appendix A.
- No regulatory removal actions have been undertaken at the Site.
- No permits, violations, and/or regulatory inspections have been documented at the Site.

2.1 Location

- Latitude and longitude coordinates and elevations are listed below, the general layout and location of the Site is shown on Figures 1 and 2.
  - New York Mine – Bowes Adit portal
    - Latitude/Longitude: 50° 44.8"N/118° 24' 02.9"W
    - Elevation – 5,040 feet (ft) above mean sea level (amsl)
  - East Eddy Group –Adit 1 portal
    - Latitude/Longitude: 44° 51' 21.3"N/118° 23' 38.9"W
    - Elevation – 5,200 ft amsl
  - Independence Mill
    - Latitude/Longitude: 44° 50' 52.9"N/118° 24' 08.7"W
    - Elevation – 5,080 ft amsl
  - According to the U.S. Geological Survey (USGS) 7½ Minute Quadrangle Map – Granite (USGS, 1983), the Site location is described as Sections 22, 23, and 27, Township 8 south, Range 35.5 east of the Willamette Meridian.

2.2 Operational History

- The following information is a chronological summary of the operational history of the Site collected from the following references:
  - *Gold and Silver in Oregon (*Brooks *and Ramp, 1968)*;
  - *The New York Mine Granite, Oregon (Grove, 1940)*;
  - *Oregon Metal Mines Handbook (DOGAMI, 1941);*
  - *Some Mining Districts of Eastern Oregon (Gilluly et. al., 1933)*; *and*
  - *The Mineral Resources of Oregon, Handbook of the Mining Industry of Oregon (Park, 1916).*

New York Mine

- 1909 - W. H. Winston staked the New York claim.
  - Winston later partnered with Samuel Barker.
  - Winston and Barker drove three adits approximately 55 ft apart in elevation on the New York vein referred to herein as Adits 1, 2, and 3 as shown in Figures 3 and 4, and Appendix B.
  - They explored the vein on the surface for the length of the claim, opening it by trenching as deep as 12 ft at 200-ft intervals.
- 1932 - Barker took over the claim upon Winston's death.
- 1936 - Albert Anderson took an option on the New York claim for $5,000.
  - In the fall of 1936, Anderson shipped 30 tons of ore from a shaft on the ridge and netted $300.
- 1937 - Anderson brought in Frank Hancock, a mining engineer, and Charles Maxwell. They purchased five adjoining claims, known as the Alaska Group, from Charles Unick and Neal Stevens (see illustrations in Appendix B).
  - Of the Alaska Group, claims #4 and #5 were originally staked by a Mrs. Use in 1931.
  - These claims were jumped in 1936 by a Mrs. Roe, then jumped again by Unick and Stevens later in 1936. Subsequently, the claims were sold to Anderson, Hancock, and Maxwell.
- 1937 - Anderson, Hancock, and Maxwell bought the Barker (i.e., New York) claim for $5,000.
- 1937 - In the fall, Anderson, Hancock, and Maxwell built a small cyanide plant and treated 15 to 20 tons per day; the mill was probably located on the Alaska #2 claim as shown in Appendix B.
- 1937 - 105 tons of direct smelting ore was shipped to a Tacoma, Washington smelter; assay tests shows 0.07 ounce gold per ton.
- 1938 - The mill was expanded to a vat cyanidation mill as follows:
  - One-inch screen;
  - 5-ft by 7-inch crusher;
  - 6-ft by 8-ft cyanide supply tank;
  - 2½ horsepower motor for 2-ft by 16-ft Dorr classifier;
  - 3-ft by 3-ft, 15-ton, ball mill with 10 horsepower motor;
  - 8-ft by 8-ft Dorr agitator;
  - 8-ft by 16-ft thickeners;
  - 2-ft by 10-ft, 7-cell precipitator;
  - 8-ft by 12-ft sump tank;
  - Air vacuum and solutions pumps; and
  - A small melting furnace.
- 1939 - Mill ceased to function, approximately 1,000 tons of ore was treated.
- 1941 – Oregon Department of Geology and Mineral Industry (DOGAMI) reported that development consisted of five adits totaling about 900 ft.
  - A longitudinal section map of the New York No. 1 vein is included as Appendix B-2.
- 1976 - William A. Bowes, from Steamboat Springs, Colorado, operated the mine.
  - Developed an additional 1,000 ft of workings using a Wagner 2-yard ST-2B scoop tram.
  - Bowes constructed two settling basins for adit drainage as illustrated in Figure 4.
  - An extensive amount of the mining activity including the old mill and tailings were covered with waste from the drive of a new crosscut adit on the New York vein (Bowes Adit).

- Hauled ore to a 225-ft by 95-ft by 4-inch asphalt heap leach pad atop a ridge near the Cougar Mine. The exact location is not specified.
- Constructed a lined pond (150 ft by 30 ft) near the Cougar Mine to hold pregnant solution from leach process. The exact location is not specified.

- 1979 - The site was surveyed as illustrated in Appendix B.
- 1980 - New York Mines, Inc., through Registered Agent C.T. Corporation System of Portland, Oregon, applied for the mineral patent claims (No. OR 19725) on the New York Mine claim No.'s 1, 2, 3, and 4 and the New York Mill claim No.'s 1, 2, 3, and 4 (see Appendix B). The patent was not granted.
- 1982 - Brooks reported 2,300 ft of workings in six adits. Of this footage, 1,000 ft is attributed to the Bowes and 900 ft to Adits 1, 2, and 3. The remaining 400 ft is divided among the Unnamed Adit, three adits in the southwest corner of New York Claim No. 3, and a covered adit in the west-central portion on New York Claim No. 1. These latter adits were included in the SI (see Appendix B).
- The Upper New York Mine area (Figure 3) has been extensively logged (date unknown), and much of the initial mining activity has been covered or obliterated.

Independence Mill Site

- 1939 - Independence Mill, a non-selective sulfide flotation mill, built to process ore from the Cougar and Independence Mines; mill machinery was transported from the Highland Mine (Bourne District).
- Below is the flow sheet.
  - Mill ore trammed from mines and dumped into 150-ton coarse ore bin;
  - 1.5-inch screen;
  - 8-ft by 20-inch jaw crusher;
  - Crushed ore delivered to 70-ton fine ore bin by 18-inch conveyor;
  - 6-ft by 6-ft Colorado Iron Works grate discharge ball mill;
  - Minus 10 mesh ball mill discharge to #250 Denver Sub-A unit flotation cell;
  - 4.5-ft Dorr duplex classifier in closed circuit with ball mill;
  - Dorr thickener and Oliver filter;
  - Reagents used were soda ash, sodium metasilicate, pine oil, copper sulfate, thiocarbanilide, xanthate Z-6, and American cyanemid 301; and
  - Concentrates trucked to Baker City, Oregon for railroad shipment.
- 1940 - 46 cars of concentrate were shipped to United States Smelter at Salt Lake, Utah.
- 1942 - Mill operations halted; treated sulfide ore averaged $10 to $15 per ton to make $100 to $130 per ton concentrate.

East Eddy Group

- This group of mines is listed in Brooks et. al. (1982), geologic map of gold mines in the Granite District, as having five short adits.
- No other historical information was located on the East Eddy Group.
- The location of the East Eddy Group as defined in this SI consists of the main East Eddy Group workings (Figure 5) and a southern part noted on Figure 2 as EE-WRA2 and EE-WRA3.
- The Oregon Metal Mines Handbook (DOGAMI, 1941) description of the Central Mine indicates that at least the southern part of the East Eddy Group could be part of the Central Mine, also known as the Shipman Claims. Confusion may stem from the construction and fill of County Road 73, which may cover portions of what DOGAMI in 1941 called the Central Mine.

2.3 Site Description

- The Site is accessed from Grant County Road 73, four miles north of the town of Granite, and situated on the slopes adjacent to Granite Creek and Chipman Gulch (Plate 1).
- The following were identified as major features at the Site; photographs of pertinent features are included in Appendix A.

New York Mine

- Seven adits (totaling 2,300 ft in workings), remains of a mill/crusher, gloryhole, several surface pits and trenches, and structures are located at the Upper and Lower New York Mine (see Figures 3 and 4, and Appendix B).
- Upper New York Mine - Adits 1, 2, and 3 (APA - Adit 1 and Possible Shaft)
  - Latitude/Longitude: 44° 50’ 44.8”N/118° 24’ 03.3”W.
  - Hopper and ore chute present.
  - Adits 1 and 2 collapsed with no signs of water discharge and minimal wasterock.
  - Glory Hole, several surface pits and multiple trenches located on the hillside above Adit 1.
  - Logging operations have obliterated most of the workings.
  - Adit 3 appears to have been buried under approximately 20 ft of fill during logging operations and road construction.
  - Approximately 3,400 bank cubic yards (bcy) of wasterock/fill is associated with Adits 1 and 2;
  - Approximately 200 bcy is projected for Adit 3 wasterock (estimated based on underground workings), but is covered by ~2,000 bcy of road fill material.
- Lower New York Mine - Mill and Crusher Area
  - Latitude/Longitude: 44° 50’ 44.1”N/118° 24’ 08.7”W.
  - Located adjacent to Granite Creek.
  - Approximately 10,900 bcy of wasterock and 2,100 bcy of tailings.
- Lower New York Mine - Bowes Adit Area (APA - Adit 2)
  - Latitude/Longitude: 44° 50’ 45.3”N/118° 24’ 08.3”W.
  - Adit is collapsed.
  - Located adjacent to the former mill area, on the upgradient side of the FR 720.
  - Approximately 5 gallons per minute (gpm) of water discharging from Adit 2, which infiltrates into surrounding soils approximately 100 ft from the portal.
  - Approximately 2,400 bcy of wasterock.
- Lower New York Mine - Alaska Main Vein Exploration Adits (APA - Adits 3 and 4)
  - Latitude/Longitude: 44° 50’ 42.8”N/118° 24’ 08.8”W – Eastern Adit
  - Latitude/Longitude: 44° 50’ 43.2”N/118° 24’ 10.1”W – Western Adit
  - Eastern Adit collapsed with no water discharge; located on the hillside above a former settling pond south of Bowes Adit. Nominal amount of wasterock.
  - Western Adit partially collapsed and located 80 ft from Eastern Adit. No wasterock noted.
  - Standing water present in Western Adit, but no discharge or signs of discharge observed.
- Unnamed Adit Area (APA - Adit 5)
  - Latitude/Longitude: 44° 50’ 40”N/118° 24’ 14”W.
  - Adit is partially open, but no water observed.
  - Approximately 800 bcy of wasterock located 100 ft east of Granite Creek.
- Summary of New York Mine volumes:

Upper New York Mine (Adits 1, 2, and 3)	3,600 bcy
Lower New York Mine (Mill and Crusher)	13,000 bcy
Lower New York Mine (Bowes Adit)	2,400 bcy
Unnamed Adit Area	800 bcy
Total	**19,800 bcy**

East Eddy Group

- Five short adits reported (Brooks et. al., 1982), may be part of the workings called the Central Mine, see Figures 2 and 5.
- Adit 1 Area (APA - Adit 1)
  - Latitude/Longitude: 44° 51’ 21.3”N/118° 23’ 38.9”W.
  - A large metal culvert (~6-ft in diameter) and dilapidated wooden structure located at the portal; adit appears to be collapsed beyond the end of the culvert. The culvert may have been placed during highway construction fill placement to maintain access to the workings.

- Water discharges at 1 gpm from the adit and infiltrated into wasterock within 75 ft of the portal during the SI field investigation, but likely reaches Chipman Gulch during high storm events.
- Approximately 5,000 bcy of wasterock material present.
- No indications of a mill or tailings were identified. Fine-grained material adjacent to Chipman Gulch appears to be eroded soil/wasterock.
- A log cabin, timber structure of unknown use, and a collapsed cabin are also located in this area.
- The cabin is registered in Grant County as a private building on Forest Service property.

- EE-WRA2 Area (APA - Adit 2)
  - Latitude/Longitude: 44° 51’ 16.3”N/118° 23’ 37.1”W.
  - This area is a possible location for East Eddy Group Adit 2.
  - This is an area of former placer mining and limited surface exploration with exploration cuts in alluvium that could easily be mistaken for caved adits.
  - Two 15-ft long cuts in the alluvium across each other in Chipman Gulch are either placer exploration cuts or anchor notches for a temporary dam to store/divert water for placer mining.
    - Such temporary dams were common for small scale placer mining and placer exploration.
    - There are signs of a reducing environment in the marshy area adjacent to these notches.
    - This flat, marshy area may be a remnant of a placer pit.
  - Several other dozer cuts and exploration pits are present.
  - Hydraulic mining was also possibly performed on east hillsides in this area.
- EE-WRA3 Area (APA Adit 3)
  - Latitude/Longitude: 44° 51’ 17.0”N/118° 23’ 34.0”W.
  - This area is a possible location for East Eddy Group Adit 3.
  - This area is underlain entirely by iron-stained weathered bedrock.
  - A privately owned cabin and storage shed are in this location.
  - An excavation on the access road located below County Road 73 and behind the cabin initially appeared to be a caved adit portal, possibly Adit 3.
    - Additional inspection indicated no presence of support driving an adit in weathered bedrock, and the material did not exhibit the geometry typical of a mine portal dump.
    - Erosion characteristics or berms and limited revegetation indicate this road was constructed relatively recently, perhaps after 1970.
    - The termination of the road near the possible adit appears more like road excavation than adit wasterock.
    - There were no signs of water discharge from this excavation. It is most likely an excavation or borrow area rather than a caved adit.
  - Several dozer cuts and exploration pits are present as well as hillside placer as indicated by the presence of thin, riveted metal water pipe common to such placers.
- The location of East Eddy Group Adits 4 and 5 are unknown; they were possibly covered during the construction of County Road 73.
- Summary of Easy Eddy Group volumes:

Adit 1 Area	5,000 bcy
EE-WRA2 Area (Adit 2)	negligible
EE-WRA3 Area (Adit 3)	negligible
Total	**5,000 bcy**

Independence Mill

- Latitude/Longitude: 44° 50’ 52.9”N/118° 24’ 8.7”W.
- A dismantled and partially collapsed wooden mill building and a 30-ft by 30-ft concrete pad located on the west side of County Road 73 (Figure 6).
- Ruins of a cabin foundation adjacent to Historical Plaque on west side of County Road 73.
- A small wooden structure located on the east side of County Road 73.

- Wasterock, possible stockpiled ore and mixed tailings/wasterock located adjacent to Granite Creek.
  - Approximately 400 bcy of contaminated soil under and around the mill structure.
  - Two piles, 400 bcy total, of possible stockpiled ore for custom milling.
  - Tailings may have been removed or discharged to Granite Creek in the past; approximately 250 bcy of mixed tailings and wasterock are present just south of the mill.
  - Approximately 20 bcy of highly contaminated spilled material is present north of the mill around probable flotation cell pedestals.
- Water observed beneath the wooden structural members at the lower portion of the mill.
- Summary of Independence Mill volumes:

Impacted Soil Beneath Mill	400 bcy
Stockpiled Ore Piles	200 bcy
Tailings and wasterock mixture	250 bcy
Floatation cell spillage	20 bcy
Total	**870 bcy**

3.0 PATHWAYS AND ENVIRONMENTAL HAZARD ASSESSMENT

3.1 Groundwater Exposure Pathway

3.1.1 Targets

- Targets are defined as receptors that are located within the target distance for a particular pathway. The target distance for the groundwater pathway is four miles (USEPA, 1992). Example targets are drinking water wells, wellhead protection areas, etc.
- According to the Oregon Water Resource Department (OWRD, 2007), six drinking water wells are located within the 4-mile target distance and are shown on Plate 1. Details are discussed in Section 3.1.3.
  - Three wells are located approximately 2.5 miles downstream from the Site in the town of Granite; these are the only known wells that have potential to be impacted by Site activities.
  - Two wells are located in the Bull Run drainage and are not likely to be impacted by Site activities.
  - One well is located upgradient (at the Buffalo Mine) and at a higher elevation than the Site and is not likely to be impacted by the Site.

3.1.2 Geologic Setting

- For each of the mines, site-specific mining geology was compiled from DOGAMI (1941); Koch (1959); Brooks et. al. (1982); Brooks and Ramp (1968); and a Site-specific reconnaissance performed by a CES Oregon Registered Geologist.

New York Mine

- Country rock consists of Elkhorn Ridge Argillite, a very siliceous rock that may contain scattered carboniferous matter.
- Ore zone runs nearly due north, dipping 80° to 85° east.
- Ore vein varies from 3 to 7 ft in width consisting of silicified argillite breccia and gouge;
  - New York Vein #1 strikes from north 15° east to due north and dips 70° to 90° east; it is a strong fracture from 5 to 6 ft wide containing buff-colored gouge and breccia fragments of argillite rather than quartz or calcite vein filling.
- New York Vein #2 strikes 55° northwest and dips 90° southwest; and is 5 ft wide in sheared argillite that has been silicified and is iron stained;
- Ore changes from oxide to sulfide with depth; pyrite encountered in Adit 2 at a depth of 150 ft.
- Ore minerals at the Site consist of pyrite, arsenopyrite, chalcopyrite, and free gold occurring as disseminations, along fracture surfaces and within quartz veins.
- Fuchsite, a secondary mineral containing chromium, is also present.

East Eddy Group

- Situated adjacent to the Bald Mountain granodiorite batholith within a zone of ultra mafic rocks in a structurally chaotic juxtaposition with diorite, quartz, basalt, argillite, chert, volcanoclastic, and limestone, all metamorphosed to greenschist facies.
- Ore originated from two parallel shear zones with quartz lenses, pyrite stringers in argillite, metagabbro, and quartz diorite.

Independence Mill

- No site-specific mining geology was available.

3.1.3 Hydrogeology

- The hydrogeology around the Site is likely dominated by heterogeneous fracture flow within the bedrock (argillite and granodiorite) aquifer. Evidence of this is that water emanates from the New York Mine - Bowes and East Eddy Group adits indicating water bearing fractures were encountered.
- Of the six wells within four miles from the Site, only three wells (2.5 miles downstream from the Site in the town of Granite) have the potential to be impacted by Site activities.
  - The depth of these wells ranged from 100 to 340 ft below ground surface (bgs).
  - The depth at which water was first encountered in these wells at the time of installation ranged from 24 ft to 120 ft bgs corresponding to an elevation of 4,560 to 4,696 ft amsl.
  - Driller logs report gravel and clay, cemented clay, claystone, volcanic deposits, basalt, and black hard rock (argillite) at depths ranging from 15 to 350 ft bgs.
  - Static water levels at the time of well installation ranged from 14 to 50 ft bgs (4,586 to 4,698 ft amsl) indicating confined aquifer conditions in the area of the wells.
- According to Brooks et. al. (1982), two inactive reverse faults, perpendicular to Granite Creek, are located between the Site and the town of Granite.
  - The faults are concealed beneath the alluvial deposits in Granite Creek, and likely create impermeable aquifer boundaries thus eliminating any potential effects of Site activities to wells in the town of Granite by a bedrock transport mechanism.
  - Only wells screened in the alluvial deposits have potential to be impacted by Site activities; however, none of the target wells are screened in the alluvial aquifer.
- The connection between the unconsolidated alluvial aquifer with the bedrock aquifer is not known.
  - However, groundwater within the fractures likely discharges to the alluvial aquifer and ultimately to Granite Creek as discussed above.
  - This is further supported by the increase in flow rate between the upstream and downstream stations, without the addition of surface water inputs (refer to Section 3.2.2).

3.1.4 Groundwater Exposure Pathway Summary

- Six domestic (drinking water) wells are listed on the OWRD database within the 4-mile radius, three of which are located 2.5 miles downstream from the New York Mine in the town of Granite.
- Drainage from East Eddy Group Adit 1 and New York Mine Bowes Adit infiltrate into wasterock within 200 ft of the adits and may impact shallow groundwater quality.
- Shallow groundwater beneath the Site likely provides base flow to Granite Creek; therefore, it is addressed in the surface water pathway.
- The inactive faults located between the Site and the wells in the town of Granite likely create an impermeable boundary in the bedrock aquifer thus precluding any impact from the Site to the wells.
- The surface area of the Site is a small fraction of the total capture zone source area for the nearest downgradient wells and therefore any impact on these wells from the Site would likely be negligible.
- Groundwater sampling was not performed as part of the SI.
- Based on known information, the groundwater pathway does not appear complete and further assessment is not recommended.

3.2 Surface Water Exposure Pathway

3.2.1 Targets

- The target distance has been defined as 15 miles (USEPA, 1992), and example targets are surface water intakes supplying drinking water, sensitive environments (e.g., wetlands), and rare, threatened, and endangered species.

3.2.1.1 Local Surface Water Use

- The certificate of water right states the permit expires after 50 years, thus only surface water rights for domestic use permitted after 1958 are listed below and shown on Plate 1.
- A total of five active surface water rights for domestic purposes exist between the Site and 15 miles downstream along Granite Creek.
  - The first active surface water right is located 2.5 miles downstream in Granite Creek (Plate 1).
    - The water right is for 0.05 cubic feet per second (cfs) and was used for the town of Granite water supply before a well was installed. It is not in use, but the permit is still valid.
    - The town formerly used a water right in Boulder Creek and a spring above the town.
    - These are also shown on Plate 1 as there are no expiration dates on the permit.
  - Two active surface water rights are for springs for domestic water supply located above the town of Granite and are for 0.005 cfs.
  - The other active surface water right is in an unnamed tributary of Granite Creek, six miles downstream of the Site and is for 0.01 cfs.
- Surface water uses were not field verified as part of the SI.
- Since Granite Creek flows through Forest Service administered lands, public access is not restricted.
- Other surface water uses likely include swimming, and camping (washing dishes, cooking).

3.2.1.2 Wetlands

- The National Wetlands Inventory (NWI) utilizes maps as a preliminary tool for determining the location of potential wetlands, although the map alone is not sufficient for ascertaining the presence of jurisdictional wetlands.
- Figure 7 is a portion of the NWI map (USF&W, 1994) showing the wetlands that could potentially be affected by the Site.
- The NWI map does not clearly outline the boundaries of riverine wetland systems and wetlands located in riparian areas along streams. Therefore, the exact lateral boundaries adjacent to the streams cannot be determined without a jurisdictional wetland delineation conducted in accordance with the U.S. Army Corps of Engineers (USACE) Technical Report/Y-87-1 (Environmental Laboratory, 1987).
- According to the CERCLA (40 CFR 230.5) and USACE Technical Report/Y-87-1, "wetlands are those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."
- Based on field observations (i.e., plant types, etc.) and measurements made from the NWI map, potential wetlands that could be impacted by the Site are listed below:
  - Area adjacent to New York Adit 2 drainage ~0.02 acres.
  - Area adjacent to Granite Creek immediately below confluence with Chipman Gulch ~ 0.5 acres.
  - Area adjacent to Chipman Gulch below East Eddy Group Adit 1 ~ 0.25 acres.
  - Area below GC-18 ~ 0.5 acres.
  - Area of wetlands as outlined on the NWI map ~ 5.75 acres.
  - Total area of potential wetlands that could be affected by the Site is approximately 7 acres.

3.2.1.3 Aquatic Ecological Survey

- Aquatic surveys were conducted within eight Granite Creek reaches and five Chipman Gulch reaches (Figure 1) to assess the potential impacts of the Site on instream habitat, benthic macroinvertebrate community, and presence of fish species due to the potential for site-related physical impacts or chemical contamination (Appendix C).
- The Rare, Threatened, and Endangered (RTE) species known or expected to inhabit the area surrounding the Site are listed in Appendix C.
- The results of the aquatic ecological survey suggest:
  - Instream physical habitat conditions are suboptimal at the majority of Chipman Gulch and Granite Creek stations, but are optimal at stations CG-02, GC-11, and GC-13. Individual habitat parameters are rated as marginal or poor in various stations.
  - Habitat in the lower reaches of Chipman Gulch (CG-04 and CG-05) and Granite Creek (GC-12 to GC-18) show evidence of more human-induced alterations, where channel straightening has apparently impacted the creek and riparian corridor.
  - The relatively low Shannon-Weaver Index and high Metals Tolerance and Fine Sediment Indices indicate overall instream pool habitat (i.e., sediment) quality is low and mining-related contamination may be present in the pools.
  - The lowest number of invertebrates observed in the Granite Creek reference station GC-11, indicate potential mine-related impacts in the upper watershed of Granite Creek.
  - Decreasing Ephemeroptera, Plecoptera, and Trichoptera and clinger species diversity and percentages, intolerant taxa richness, Shannon-Weaver species diversity, and benthic index of biological integrity scoring downstream from the reference station in Chipman Gulch indicate worsening riffle conditions and the potential for notable impacts, especially at stations CG-04 and CG-05.
  - Fish were observed in a man-made pond along and hydraulically connected to Granite Creek (near GC-18).
    - These were potentially cutthroat trout or a cutthroat/rainbow trout hybrid, which have been documented in the North Fork John Day River (Gunckel, 2002).
    - Other fish that may inhabit Granite Creek include threatened middle Columbia River summer run steelhead, threatened bull trout, and spring run Chinook salmon (ORNHIC, 2007; Unterwagner, 2007).
    - Redband trout, brook trout, longnose and speckled dace, bridgelip and largescale suckers, sculpin, and brown bullhead are also known to inhabit the region.

3.2.2 Hydrologic Setting

- The Independence Mill and New York Mine are located adjacent to Granite Creek, and the East Eddy Group is located adjacent to Chipman Gulch (Figure 1).
- The Granite Creek watershed above the confluence with Chipman Gulch is 1,740 acres; the Chipman Gulch watershed above the East Eddy Group Adit 1 is 270 acres (Plate 1).
- Water emanates from East Eddy Group Adit 1 and appears to flow year round.
  - The seep from Adit 1 flowed across and infiltrated into the large wasterock pile below the adit during the field investigation; however, based on field observations, likely reaches Chipman Gulch during seasonal high flow periods.
  - Overland water flows down the slope and across the East Eddy Group wasterock piles and into Chipman Gulch or the adjacent marshy area.
- Water emanates from New York Mine - Bowes Adit and infiltrates into an adjacent marshy area; overland water flows down the slope and across the wasterock piles and into Granite Creek.
- Granite Creek discharges into the North Fork John Day River 13.5 miles downstream from the Site.

- Numerous creeks and unnamed drainages enter Granite Creek on its path to the North Fork John Day River. The following drainages are measured distance downstream from the confluence of Chipman Gulch with Granite Creek.
  - Lucas Gulch at 0.5 mile;
  - China Gulch at 0.75 mile;
  - Boulder Creek at 3.1 miles;
  - Gordon Gulch at 3.6 miles;
  - Bull Run at 4.0 miles;
  - Lost Boy Gulch at 4.5 miles;
  - Clear Creek at 5.9 miles;
  - Squaw Creek at 8.0 miles;
  - Buck Creek at 9.0 miles;
  - Lick Creek at 10.5 miles;
  - Indian Creek at 11.5 miles; and
  - Lake Creek at 13.0 miles.
- Flow rates were measured in Granite Creek and Chipman Gulch on June 19-21, 2007, and are summarized below and in Table 1.
  - Flow in Chipman Gulch ranged from 22 gpm at CG-01 to 56 gpm at CG-03.
  - Flow in Granite Creek ranged from 485 gpm at GC-12 to 800 gpm at GC-11 and GC-14.
    - A substantial amount of subsurface flow is occurring in the area near the confluence of Granite Creek and Chipman Gulch, and near the Independence Mill.
    - The fluctuation in stream flows between stations indicates subsurface flow in areas with loose unconsolidated substrate.
  - The flow rate of the New York Mine - Bowes Adit discharge was estimated a 5 gpm.
  - The flow rate of the East Eddy Group Adit 1 discharge was estimated at 1 gpm.

3.2.3 Previous Investigations

- In August 2006, the Forest Service performed APAs at each mine that comprises the Site; however, no surface water, pore water, or sediment samples were collected.

3.2.4 Site Inspection Analytical Results

- This section presents the surface water, pore water, and stream sediment analytical results for the SI conducted at the Site.
- Aquatic station locations are shown on Figure 1; analytical results are tabulated in Tables 1, 2, and 3.
- Due to the large difference in hardness between surface water samples collected from Chipman Gulch and Granite Creek, hardness based standards of comparison were calculated using the average hardness of Granite Creek samples as a conservative approach.
- Original laboratory reports and a complete report of the quality assurance - quality control (QA/QC) procedures and results are available in the Forest Service Project File.
- Photographs of selected sampling locations are included in Appendix A.
- Field activities were conducted from June 18 through June 24, 2007.
- The Field Operation Plan (CES, 2007) details sampling procedures, protocols, and analyses.
- A total of 37 water samples (16 surface water, 16 pore water, and 5 seeps/drainages) and 16 sediment samples were collected from pool substations in Granite Creek, Chipman Gulch, and adit drainages during the SI field activities. This includes three background aquatic stations established in Upper Granite Creek for comparison.
- Results of the metals analyses are summarized and discussed in the following table.

Summary of Surface Water, Pore Water, and Sediment Metals Results

Sample Type	Number of Samples	Highest Concentration of Major Metals of Concern	Trends Observed and Comments
Surface Water	**Table 1**	**Total Recoverable Metals (µg/L)**	
Upper Granite Creek – Background	3 Samples	Arsenic (0.6 B)	Background
Granite Creek (above Chipman Gulch to below the New York Mine)	8 Samples	Arsenic (9.2) – Below Independence Mill and above New York Mine	Arsenic concentration in Granite Creek increases 300% from above Chipman Gulch (2.4 µg/L @ GC-11) to immediately below Chipman Gulch (7.4 µg/L @ GC-12) reflecting arsenic loading from Chipman Gulch. Arsenic concentrations remain within the same magnitude in Granite Creek with only a slight increase to a high of 9.2 µg/L immediately below the Independence Mill.
Chipman Gulch	5 Samples	Arsenic (57.7) – Below East Eddy Group Adit 1	Arsenic is elevated in Chipman Gulch, both adjacent to the East Eddy and upstream/background, indicating additional sources upstream. Concentrations ranged from 9.9 µg/L to 57.7 µg/L, which are all higher than any sample in Granite Creek.
New York Mine - Bowes Adit	NY-AS-01	Arsenic (42.8), Iron (3,530), and Manganese (746)	No trends/comments.
East Eddy Group Adit 1 Discharge	EE-AS-01	Arsenic (2.0) and Iron (520)	Arsenic detected at the portal sample was an order of magnitude lower than downgradient sample, indicating that the adit discharge is entraining arsenic (and other metals) as it flows across the wasterock pile.
Where East Eddy Group Adit 1 Seep infiltrates into wasterock	EE-AS-02	Arsenic (26.5), Copper (12.3), Iron (12,100), Lead (8.6), and Manganese (228)	
Side drainage of Chipman Gulch, not an adit seep	EE-AS-03	Arsenic (313), Cadmium (0.9), Iron (8,650), Lead (12.8), and Manganese (846)	High arsenic, iron, and manganese concentrations in the side drainages indicates source may be from historic hillside placer mining.
Downstream of EE-AS-03	EE-AS-04	Arsenic (253), Iron (2,070), and Manganese (493)	
Pore Water	**Table 2**	**Dissolved Metals (µg/L)**	
Upper Granite Creek – Background	3 Samples	Arsenic (3.4), Iron (5,560), and Manganese (259)	Background
Granite Creek (above Chipman Gulch to below the New York Mine)	8 Samples	Arsenic (36.8), Manganese (745), and Cyanide (0.265 mg/L – 1 sample downstream from the New York Mine)	Arsenic concentration in Granite Creek increases 370% from above Chipman Gulch (2.9 µg/L @ GC-11) to immediately below Chipman Gulch (10.8 µg/L @ GC-12) reflecting arsenic loading from Chipman Gulch. Arsenic concentration increases downstream in Granite Creek to a high of 36.8 µg/L detected below Independence Mill (GC-16) which is over 2,000 times higher than the USEPA Human Health Level (0.018 µg/L), and 10 times higher than the background concentration. Total cyanide detected adjacent to New York Mine is over 50 times higher than Oregon and USEPA Aquatic Life level (0.0052 mg/L).
Chipman Gulch	5 Samples	Arsenic (62.9), Cadmium (0.6), Manganese (1890), and Mercury (0.0358)	Arsenic concentrations at all stations exceed the USEPA Human Health Level (0.018 µg/L) with the highest concentration detected above East Eddy Group, indicating upstream sources.
Sediment	**Table 3**	**Total Metals (mg/kg)**	
Upper Granite Creek – Background	3 Samples	Arsenic (36.5)	Background
Granite Creek (above Chipman Gulch to below the New York Mine)	8 Samples	Arsenic (186), Cadmium (3.55), Copper (37), Lead (98.5), Mercury (0.60), Silver (5.89), and Zinc (270)	Listed metals significantly elevated over background levels and all exceed the lowest screening levels. Highest concentrations in Granite Creek detected in lowest downstream sediment sample, below the New York Mine.
Chipman Gulch	5 Samples	Arsenic (1,070), Cadmium (18.90), Copper (90), Lead (168), Manganese (7,170), Mercury (2.1) Nickel (48), Silver (8.93), and Zinc (909)	Elevated concentrations of metals above East Eddy Group indicate upstream source(s). Sediment adjacent to East Eddy Group had arsenic detected at 1,070 mg/kg, three times higher than the highest arsenic concentration detected in wasterock from this area (326 mg/kg), indicating movement of sediment down the gulch from upstream sources.

Note: µg/L = micrograms per liter; mg/kg = milligrams per kilogram; mg/L = milligram per liter; B = analyte detected between method detection limit and practical quantification limit.

3.2.5 Surface Water Exposure Pathway Summary

- The surface water pathway is complete because metal concentrations in surface water, pore water, and sediment are elevated near the Site.
- Arsenic is the main metal of concern in surface water in both Granite Creek and Chipman Gulch.
  - The highest arsenic concentration detected was in Chipman Gulch, 57.7 µg/L, downstream of the East Eddy Group.
  - Arsenic concentration detected in surface water above East Eddy Group (43.2µg/L) is 2,400 times higher than EPA Human Health level (0.018µg/L) indicating additional upstream sources.
  - Arsenic in Granite Creek surface water immediately below Chipman Gulch (7.4 µg/L at GC-12) is 3 times higher than arsenic in surface water above Chipman Gulch (2.4 µg/L at GC-11) reflecting arsenic loading from Chipman Gulch.
- Arsenic, iron, and manganese are the metals of concern in both the New York Mine and East Eddy Group adit discharges, although both infiltrated and did not reach Granite Creek and Chipman Gulch at the time of the SI field activities.
  - The highest arsenic concentration was 42.8 µg/L at the New York Mine - Bowes Adit.
  - During high flow events, discharge may reach Chipman Gulch and Granite Creek.
  - Potential for subsurface transport following infiltration is unknown.
- Arsenic is the main metal of concern in pore water in both Granite Creek and Chipman Gulch.
  - The highest arsenic concentration detected was in Chipman Gulch (62.9 µg/L), upstream of the East Eddy Group.
  - Arsenic in Granite Creek pore water immediately below Chipman Gulch (10.8 µg/L at GC-12) is 3.7 times higher than arsenic in pore water above Chipman Gulch (2.9 µg/L at GC-11) reflecting arsenic loading from Chipman Gulch.
  - Cyanide was detected adjacent to New York Mine (GC-17 at 0.265 milligrams per liter [mg/L]) which is over 50 times higher than Oregon and USEPA Aquatic Life level (0.0052 mg/L).
- Arsenic, cadmium, lead, silver, and zinc are the metals of concern in Granite Creek and Chipman Gulch sediment. Copper, manganese, mercury, and nickel are also metals of concern in Chipman Gulch sediment.
  - Arsenic was detected at 475 mg/kg in Chipman Gulch sediment upstream from the East Eddy Group indicating an upstream source of the metal concentrations observed.
  - Sediment collected adjacent to the East Eddy Group, CG-SS-04, had the highest arsenic concentration detected at 1,070 mg/kg. However, the highest arsenic concentration detected in wasterock from this area was 326 mg/kg, suggesting a potential upstream source.
  - Sediment collected adjacent to the East Eddy Group, CG-SS-03, had the highest mercury concentration detected at 2.1 mg/kg.
  - The source of the mercury is unknown as the highest mercury concentration detected in wasterock from this area was 0.25 mg/kg. However, the area has been heavily placer and hydraulic mined in the past and amalgamation (using elemental mercury to recover gold) was a common practice.
- Elevated metals concentration in aquatic samples in the upper reaches in Chipman Gulch above the East Eddy Group indicate one or more additional sources of metals contamination.
  - The USGS quadrangle map shows an unnamed former mill and the Buffalo Mine upstream from the East Eddy Group in Chipman Gulch.
  - Neither was visited during the SI because they are located on private land.
- The aquatic survey results indicate overall instream pool habitat (i.e., sediment) quality is low and mining-related contamination is likely present in the pools in Granite Creek.
- Threatened middle Columbia River summer run steelhead and threatened bull trout may inhabit portions of Granite Creek and its tributaries. Spring run Chinook salmon have been documented by the Oregon Department of Fish and Wildlife in Granite Creek (Unterwagner, 2007); however, this run is not listed as rare, threatened, or endangered.

3.3 Soil Exposure Pathway

3.3.1 Targets

3.3.1.1 Local Use

- The target distances for the soil pathway is 200-ft for residential receptors and 1-mile for nearby population threats (USEPA, 1992); there are no persons living within 1-mile of the Site (Plate 1).
- Public use of the Site appears to be moderate, although public access records are not maintained**.**
- Access is not restricted by fencing, nor were any "No Trespassing" signs noted during the SI.
- Land uses in this area are limited to timber harvesting, firewood cutting, recreation (e.g., hiking, camping, hunting), and some minerals prospecting.

3.3.1.2 Terrestrial Ecological Survey

- Terrestrial habitats and animals that are present or likely at and surrounding the Site were documented during the ecological survey and via examination of previous ecological study results for the Site vicinity (Appendix C).
  - Qualitative surveys were conducted at and surrounding the Site for mammal and terrestrial invertebrate presence and use.
  - A majority of plants were identified across each identified major vegetative community; three were identified (disturbed mine areas, open conifer forest, and riparian areas).
  - Lists of RTE plants and animals likely or known to be present in the vicinity of the Site were obtained from the Forest Service (Ziegler, 2007) and the Oregon Natural Heritage Information Center (ORNHIC).
- Results of the terrestrial ecological surveys showed:
  - The disturbed mine areas were primarily wasterock or excavated/disturbed gravelly soil with numerous colonizing and weedy species, no canopy layer, and a patchy herbaceous layer. The vegetation within the disturbed plant communities is clearly different from the two other communities surrounding the Site (open conifer forest and riparian areas).
  - Mine-related impacts were noted immediately adjacent to and within Chipman Gulch, particularly in the vicinity of CG-04 and CG-05.
  - Terrestrial invertebrates noted on and near the Site included ants, butterflies, moths, mosquitoes, beetles, and black flies. None of these or any other invertebrates around the Site are known RTE species.
  - Game trails were present at the Site providing evidence of mule deer and elk. Several RTE mammal species are possible, but none were observed or expected near the Site.
  - The birds identified at the Site represent an assemblage common among the Blue Mountains portion of the Middle Rocky Mountain Steppe ecoregion.
    - Of these, the three-toed woodpecker was the only RTE species documented by the ONHP within 2 miles of the Site.
    - No RTE bird species were observed, but several other RTE bird species may be expected or possible at the Site.
  - No RTE herpetile species were identified as inhabiting the Site. The Columbia spotted frog was the only herpetile species listed by the ONHP within 2 miles of the site
  - Of the terrestrial invertebrates and wildlife documented or likely to inhabit the Site, plants and ground-dwelling, sessile invertebrate species, such as ants, are most likely to be exposed to mine-related contamination.

3.3.2 Previous Investigations

- In August 2006, the Forest Service performed APAs (Forest Service, 2006a, b, c) at each mine that comprises the Site, which consisted of field screening of wasterock and tailings piles with a Niton XL-722S x-ray fluorescent (XRF) unit.
  - Arsenic, chromium, copper, iron, lead, manganese, nickel, selenium, and zinc were detected at elevated concentrations at the Independence Mill, East Eddy Group, and New York Mine.
  - Mercury was detected at elevated concentrations at the East Eddy Group and New York Mine.
  - All samples exceeded the USEPA Region IX Preliminary Remediation Goals for arsenic.
  - Based on these results, the Forest Service recommended that an SI be performed at the Site.

3.3.3 Site Inspection Analytical Results

- The following sections present the background soil, wasterock, on-site soil, and tailings results.
  - A total of 8 background soil, 28 wasterock, 13 soil, and 13 tailings samples were collected around the Site.
  - Background soil sampling locations are shown on Figure 2.
  - The wasterock, on-site soil, and tailings sample locations for the New York Mine, East Eddy Group, and Independence Mill are shown on Figures 3, 4, 5, and 6.
  - Analytical results for background soils are tabulated in Table 4; soil, wasterock, and tailings in Table 5; and toxicity characteristic leaching procedure (TCLP) and synthetic precipitation leaching procedure (SPLP) results for wasterock and tailings in Table 6.
  - Site soil, wasterock, and tailings samples were screened with the use of a Niton XRF and 22 wasterock, 9 soil, and 11 tailings samples were submitted for laboratory analysis.
    - The Niton XRF analytical results are tabulated in Table 7, along with the corresponding laboratory analytical results and the relative percent differences (RPDs).
    - The RPD between the laboratory and Niton arsenic results varied greatly between 5% and 182%; the wide range of RPDs can be attributed to non-homogenization of samples caused by simple field procedures (rather than using laboratory equipment).
  - The Field Operation Plan (CES, 2007) details sampling procedures, protocols, and analyses.
  - The complete laboratory analytical results and a discussion of QA/QC procedures and results are available in the Forest Service Project File.

3.3.3.1 Background Soil, Wasterock, and Tailings Metals/pH Results

- Laboratory pHs:
  - Background soil pH ranged from 5.1 to 6.5 standard units (su);
  - East Eddy Group wasterock pH ranged from 5.8 to 7.9 su;
  - New York Mine wasterock pH ranged from 3.7 to 7.9 su;
  - New York Mine tailings pH ranged from 5.5 to 8.0 su; and
  - Independence Mill wasterock pH ranged from 3.0 to 6.8.
- The following table summarizes the metals results for background soil and waste sample at the Site.
  - The background arsenic concentration in BGS-08 (43.5 mg/kg) was 3 times higher than the next highest background concentration (15.3 mg/kg).
  - CES believes this sample does represent actual background soil concentrations because the area around the Site is highly mineralized and this sample was collected from outside visually impacted mining areas.
- The table presents metals that exceeded at least one comparison criteria and the 90th percentile upper confidence limit on the arithmetic mean (90_{UCL}) of the eight background samples.

Summary of Background Soil, Site Soil, and Waste Source Metals Results

SAMPLE TYPE	NUMBER OF SAMPLES	METALS EXCEEDING AT LEAST ONE CRITERIA	METALS EXCEEDING ONE CRITERIA AND THE 90_{UCL} MEAN BACKGROUND	TRENDS OBSERVED AND COMMENTS
Background Soil	**Table 4**	**Total metals (units in mg/kg)**		
Background Soil	8 Samples	Arsenic, chromium, copper, manganese, selenium, and zinc	Not Applicable (NA)	NA
New York Mine	**Table 5**	**Total metals (units in mg/kg) / Criteria: Eco = Ecological, HH = Human Health**		
Upper Area Wasterock	3 Samples	Antimony, arsenic, chromium, copper, lead, manganese, mercury, nickel, selenium, and zinc	Antimony (53), arsenic (2,530), chromium (49), copper (91), lead (18), manganese (1,750), mercury (1.82), nickel (42), selenium (3.43), and zinc (131)	The Upper New York wasterock shows elevated concentrations of listed metals, especially arsenic. Wasterock and tailings in the Lower New York Mill area also exhibit high concentrations of metals, primarily arsenic. However, the concentration of arsenic and other metals in wasterock from Adit 5 are similar to or below background concentrations.
Lower Area Wasterock	12 Samples	Antimony, arsenic, chromium, copper, lead, manganese, mercury, nickel, selenium, silver, and zinc	Antimony (14), arsenic (1,800) chromium (74), copper (118), lead (29.0), manganese (1,670), mercury (2.31), nickel (66), selenium (26.0), silver (2.41), and zinc (315)	
Tailings	5 Samples	Antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc	Antimony (20B), arsenic (2,330), cadmium (18.30), chromium (64), copper (302), iron (102,000), lead (105), manganese (4,990), mercury (3.83), nickel (140), selenium (6.79), silver (3.36), and zinc (1,220)	
East Eddy Group	**Table 5**	**Total metals (units in mg/kg) / Criteria: Eco = Ecological, HH = Human Health**		
Wasterock	10 Samples	Arsenic, chromium, copper, lead, manganese, mercury, selenium, and zinc	Arsenic (326), chromium (43), copper (58), lead (16.20), manganese (3,060), mercury (0.31), selenium (0.65) and zinc (225)	Arsenic, manganese, and zinc are the metals of concern when compared to the lowest regulatory screening criteria and the 90_{UCL} mean background concentrations. Wasterock pile WR-1 has the highest arsenic concentration, but areas EE-WR2 and EE-WR3 appear to be placers and the arsenic concentrations are similar to background.
Independence Mill	**Table 5**	**Total metals (units in mg/kg) / Criteria: Eco = Ecological, HH = Human Health**		
Mill Soil / Tailings	7 Samples	Antimony, arsenic, chromium, copper, lead, manganese, mercury, selenium, silver, and zinc	Antimony (30B), arsenic (16,180), chromium (49), copper (210), lead (16,100), mercury (1.82), selenium (4.03) silver (10.6), and zinc (475)	All wasterock, tailings and miscellaneous soil samples in this area have metal concentrations that exceed regulatory screening levels and the 90_{UCL} mean background concentrations.
Wasterock	4 Samples	Antimony, arsenic, chromium, copper, lead, manganese, mercury, selenium, silver, and zinc	Antimony (40), arsenic (2,910), copper (176), lead (284), mercury (0.99), selenium (4.74), silver (9.86), and zinc (187)	

Notes: Table only includes main metals of concern (arsenic, lead, etc.).
µg/L = micrograms per liter; mg/kg = milligrams per kilogram; mg/L = milligram per liter; B = analyte detected between method detection limit and practical quantification limit.

3.3.3.2 Acid Based Accounting / Sulfur Results

- Acid Based Accounting (ABA) was analyzed on three wasterock samples and one tailings sample from the Independent Mill, two wasterock samples from the East Eddy Group, five wasterock samples from New York Mine, and one tailings sample from New York Mine (Table 5).
  - The acid base potential (ABP) of wasterock and tailings at the Independence Mill ranged from -5 to +2 t $CaCO_3$/Kt (ABP units are presented as tons of calcium carbonate needed to neutralize a kiloton of waste [$CaCO_3$/Kt]).
  - The ABP of wasterock at the East Eddy Group ranged from -7 to +7 t CaCO3/Kt.
  - The ABP of soil, wasterock, and tailings at the New York Mine ranged from -15 to +311 t $CaCO_3$/Kt.
  - ABP is the acid neutralizing potential (ANP) minus the acid generating potential (AGP).
  - A negative ABP indicates that the AGP is greater than the ANP, and thus the material has the potential to produce acid rock drainage (ARD).
  - Based on this, wasterock and tailings at the Site have a very slight potential to produce ARD.

- Total sulfur in the ten wasterock samples analyzed ranged from <0.01% to 1.54%; total sulfur ranged from 0.05% to 0.16% in the two tailings samples.

3.3.3.3 Wasterock and Tailings SPLP / TCLP Results

- Four wasterock samples and two tailings samples from New York Mine, two wasterock samples from East Eddy Group, and three wasterock samples and one tailings sample from the Independence Mill workings were submitted for TCLP and SPLP analyses for the eight Resource Conservation Recovery Act (RCRA) metals (Table 6).
- One sample, collected at the Independence Mill (IM-S-7), exceeded the RCRA TCLP disposal limit for lead with 43.9 mg/L. This sample, collected beneath a former flotation cell, was likely spillage, and represents a very small volume (less than 20 bcy).

3.3.4 Soil Exposure Pathway Summary

- The soil exposure pathway is complete for both human and ecological receptors, and a release of hazardous substances has been documented in this SI.
- Arsenic, the primary metal of concern, was detected at up to 16,180 mg/kg in wasterock and tailings at the Site, which exceeds the USEPA PRGs for the carcinogenic end point of 1.6 mg/kg and other regulatory screening concentrations.
- Other metals of concern in wasterock, tailings, and on-site soils at the Site are chromium, manganese, mercury, selenium, and zinc.
- Copper, lead, and silver were also metals of concern at the New York Mine and Independence Mill.
- Soil, wasterock, and tailings from the Site are likely contributing to the elevated metals concentrations observed in aquatic samples in Granite Creek.
- Metals concentrations detected in wasterock from the East Eddy Group are lower than metals concentrations detected in Chipman Gulch sediment indicating another upstream source.

3.4 Air Exposure Pathway

3.4.1 Targets

- The target distance has been defined as 1 and 4 miles from the Site (USEPA, 1992).
- There is no dominant wind direction in the area.
- The town of Granite is located within 4 miles of the Site (Plate 1).
- There are up to 25 full time residents in Granite; and 11 people in Porterville and along Clear Creek.

3.4.2 Previous Investigations

- In August 2006, the Forest Service performed APAs at the Site; however, no air samples were collected.

3.4.3 Site Inspection Analytical Results

- Air samples were not collected as part of the field activities.

3.4.4 Air Exposure Pathway Summary

- Arsenic and other metals were likely released to the air during the mining and milling processes as dust and particulate matter.
- The air pathway is complete because metal impacted soil and waste material is concentrated at the surface where human and terrestrial ecological receptors could be exposed to particulate matter by inhalation.
- Further assessment of the air pathway is not recommended because addressing and/or eliminating the soil exposure pathway will render the air exposure pathway incomplete.

4.0 STREAMLINED HUMAN AND ECOLOGICAL RISK ASSESSMENTS

4.1 Streamlined Human Health Risk Assessment

- A human health risk assessment (HHRA) is an analysis of the potential adverse health effects that could result from current or future exposures to contaminates released from a facility, in the absence of any action to control or mitigate these releases.
- The HHRA (Appendix D) evaluated potential impacts to human health resulting from exposure to Site-related contaminants of potential concern (COPCs) in surface and subsurface soils, sediment, and surface water at the Site.
- Determining the COPCs is the first step in the HHRA.
  - COPCs are determined by screening the analytical data against applicable preliminary remediation goals and background concentrations.
  - COPCs are listed in Appendix D, Table 2-10.
- The Conceptual Human Exposure Model is presented in Appendix D, Figure 3-1.
- For the purposes of this HHRA, both reasonable maximum exposure (RME) and central tendency exposure (CTE) scenarios were evaluated.
  - The RME scenario is a conservative estimate of potential exposure.
  - The CTE scenario is typically more realistic.
- The following sections summarize the estimated human health risks and hazards; a more detailed discussion of the HHRA is provided in Appendix D.

4.1.1 Risk and Hazard Estimates

- The Site is not currently occupied, nor is it expected to be occupied or developed in the near future. Therefore, the only likely current and future receptors identified for the Site are recreational users (e.g., hikers, campers, and hunters).
- Calculations, assumptions, and exposure inputs are available in the Forest Service Project File.
- The Hazard Quotient (HQ) is defined as a comparison of the estimated intake dose of a metal with the reference dose or concentration, expressed as a ratio. An HQ of less than 1.0 indicates that the exposure is unlikely to cause adverse non-carcinogenic risks.
- The sum of all individual chemical-specific HQs is termed the Hazard Index (HI) and is calculated under each exposure pathway.
- The excess cancer risk (ECR) is defined as the incidence of cancer over and above known background (one case for every three people). The standard of one in one million (1×10^{-6}) sets the allowable "excess" cancer cases at one case in a population of one million people.
- The following sections providing a summary of the non-carcinogenic, carcinogenic, and lead risks.

4.1.1.1 Non-Carcinogenic Risks Results

- Soils, Wasterock, Tailings: Arsenic and lead were identified as the COPCs for this media. The 90_{UCL} concentrations were used as the Exposure Point Concentrations (EPCs). None of the constituents exceeded the regulatory standard of 1.0 under CTE and RME exposure conditions; therefore, a non-carcinogenic risk is not expected.
- Sediments: Arsenic was quantitatively evaluated in sediments. The HQs are below the regulatory standard of 1.0 for all constituents under both the RME and CTE exposure scenarios; therefore, a non-carcinogenic risk is not expected.
- Surface water: Arsenic was quantitatively evaluated in surface water. The HQs are below the regulatory standard of 1.0 for all constituents under both the RME and CTE exposure scenarios; therefore, a non-carcinogenic risk is not expected.
- The HI did not exceed the regulatory standard of 1.0 for non-carcinogens under CTE or RME conditions. Therefore, no unacceptable non-carcinogenic health effects were identified.

4.1.1.2 Carcinogenic Risks Results

- Soil, Wasterock, and Tailings:
  - The only carcinogenic constituent identified was arsenic.
  - The average concentration and the 90_{UCL} concentrations were used as the EPCs for the CTE and RME exposures, respectively.
  - The ECR did not exceed the regulatory standard of 1×10^{-6} under CTE exposure conditions.
  - Under the RME exposure condition, ECRs for ingestion (5×10^{-5}) and dermal contact (4×10^{-6}) of arsenic exceeded the regulatory standard of 1×10^{-6}.
  - Therefore, a carcinogenic risk is possible for exposure to arsenic impacted soil, wasterock, and tailings under the RME exposure scenario.
- Sediments:
  - The only carcinogenic constituent identified in sediment is arsenic.
  - The ECRs for arsenic in sediment ranged from 2×10^{-6} (RME) to 4×10^{-7} (CTE), because 2×10^{-6} exceeds the acceptable threshold, sediment samples from Chipman Gulch and Granite Creek were segregated and quantitatively evaluated.
  - The ECRs for the Granite Creek samples did not exceed the regulatory standard of 1×10^{-6} under CTE and RME exposure conditions. Therefore, no carcinogenic risk is expected from exposure to sediments in Granite Creek.
  - No unacceptable risks are expected from exposure to sediments in Chipman Gulch under CTE exposure conditions. However, a carcinogenic risk is possible for exposure to arsenic impacted sediments in Chipman Gulch only for ingestion of sediment under the RME exposure scenario.
- Surface Water and Air:
  - No unacceptable human health risk is anticipated from arsenic in surface water or air.

4.1.1.3 Lead Risk Results

- Meaningful ingestion and inhalation critical toxicity values have not been developed for lead.
- Many of the non-carcinogenic effects associated with lead may not exhibit a threshold, especially in young children.
- In lieu of a reference dose or slope factor, the USEPA has developed two models which correlate dose with blood lead levels.
- The results of the lead screening are summarized in the following bullets:
- Soil, Sediment, Wasterock, and Tailings:
  - Using an EPC of 428 mg/kg (CTE – arithmetic mean) and 1,210 mg/kg (RME = 90_{UCL}) the predicted intake was calculated to be 0.0043 µg/day (CTE) and 0.054 µg/day (RME).
  - The USEPA provisional ingestion intake value for men (most likely receptor) is 75 µg/day and children under six (least likely receptor) is 6 µg/day.
  - Assuming the total intake from dermal exposure and inhalation is equal to the intake from ingestion; no risk is expected for exposure to lead in soil, wasterock, and tailings.
- Surface Water:
  - The USEPA maximum containment level (MCL) for lead is 15 µg/L.
  - The maximum concentration of lead was 12.8 µg/L in East Eddy Adit Seep.
  - The highest concentration detected in surface water was 0.7 µg/L in Chipman Gulch.
  - Therefore, exposure to lead in drinking water is not expected to be a risk.

4.1.2 Determination of Risk-Based Cleanup Concentrations

- Site-specific cleanup concentrations protective of the RME recreational users were calculated for soil/wasterock and sediment based on the regulatory standard of 1×10^{-6} ECR.
- The Site-specific risk-based cleanup concentration was calculated to be 144 mg/kg total arsenic for soil/wasterock.

- The Site-specific risk-based cleanup concentration for sediment was calculated to be 266 mg/kg total arsenic.
- These risk-based cleanup concentrations are used to calculate hotspot concentrations in soil/wasterock (see Section 4.1.3).

4.1.3 Determination of Hotspots

- The assessment of hotspots is performed by comparing the concentration of each constituent that exceeded the risk criteria (HQ = 1.0 and ECR = 1×10^{-6}); arsenic in surface soil, wasterock, and tailings was the only metal that exceeded risk criteria.
- The hotspot levels correspond to a lifetime ECR of 1×10^{-4} for carcinogens and a HQ of 10.0 for non-carcinogens.
- Using an ECR of 1×10^{-4}, a hotspot concentration for arsenic in soil, wasterock, and tailings was calculated to be 14,394 mg/kg. This concentration was compared with the sampling results at the Site; one soil sample (IM-S-5; 16,180 mg/kg) exceeded the hotspot concentration.
- A hotspot concentration for arsenic in sediment was calculated to be 26,643 mg/kg; no hotspots were identified in sediment.

4.1.4 Human Health Risk Assessment Summary

- The following were identified as COPCs:
  - Wasterock, tailings, and soil: arsenic and lead
  - Sediment: arsenic
  - Surface water: arsenic
- Based on current and future land use, individuals who might come in contact with Site-related contaminants through recreational activities such as hunting, hiking, and camping were the only potential receptors identified.
- The risk assessment determined no unacceptable non-carcinogenic health risks associated with the COPCs.
- Arsenic was the only carcinogenic COPC identified at the Site.
  - Concentrations of arsenic in surface water did not result in unacceptable carcinogenic risks.
  - Concentrations of arsenic in sediment in Granite Creek did not result in unacceptable carcinogenic risks under the CTE or RME scenarios.
  - Concentrations of arsenic in sediment in Chipman Gulch did not result in unacceptable carcinogenic risks under the CTE exposure conditions. A carcinogenic risk is possible for exposure to arsenic impacted sediments in Chipman Gulch under the RME scenario.
  - Concentrations of arsenic in soil, wasterock, and tailings did not result in unacceptable carcinogenic risks under the CTE exposure conditions.
  - A carcinogenic health risk was predicted for human exposure to arsenic in soil, wasterock, and tailings at the Site under the RME exposure scenario.
- Calculating the risk associated with lead was done using two USEPA models because ingestion and inhalation toxicity values have not been developed.
  - Lead exposure from soil, wasterock, tailings, and sediment is not expected to be a risk because the predicted intake values were lower then the USEPA provisional intake values.
  - Lead exposure from surface water was determined not to be a risk because detected concentrations did not exceed the USEPA MCL of 15 µg/L.
- A risk-based cleanup concentration for soil, wasterock, and tailings was calculated to be 144 mg/kg total arsenic.
- A risk-based cleanup concentration for sediment was calculated to be 266 mg/kg total arsenic.
  - Arsenic concentrations in Granite Creek sediment did not exceed this value.
  - Arsenic concentrations in Chipman Gulch sediment exceeded this value with the highest concentration detected at 1,070 mg/kg at station CG-SS-04.

- Hotspots are only calculated for constituents that exceed risk criteria (HQ = 1.0 and ECR = 1 x 10^{-6}).
  - For this Site, arsenic is the only metal that exceeded the risk criteria.
  - The arsenic hotspot concentration was calculated to be 14,394 mg/kg for soil, wasterock, and tailings. Soil sample IM-S-5 exceeded the hotspot concentration (16,180 mg/kg).
  - The arsenic hotspot concentration was calculated to be 26,643 mg/kg for sediment. No sediment samples exceeded the hotspot concentration.

4.2 Streamlined Ecological Risk Assessment

- In accordance with ODEQ guidance (ODEQ, 2001), a Screening Level Ecological Risk Assessment (ERA) was completed for the Site (located in the Forest Service Project File).
- The ERA is also consistent with national guidance (USEPA, 1992, 1997, 1998).
- The goal of the ERA is to provide an understanding of the potential for ecological risks due to Site-related contamination and to determine whether there is a need for more detailed ERA.
- The ERA includes the following:
  - A description of the uses of the contaminants of interest (COI)-based Site and data gathered during the SI;
  - A description of the ecology of the Site and potential ecological receptors (including RTE species);
  - Presentation of the conceptual ecological exposure model (CEEM), which provides a summary of potential and likely exposure media and pathways;
  - Assessment and measurement endpoints;
  - An assessment of the analytical data used in the ERA;
  - An ecological risk-based screening; and
  - A risk characterization to assess the potential for significant ecological effects due to Site COIs.
- The problem formulation, risk assessment data, ecological risk-based screening, risk characterization, uncertainty analysis, conclusions, and recommendations are located in Appendix D.

4.2.1 Conceptual Ecological Exposure Model

- The CEEM (Appendix D, Figure 4-1) graphically depicts the sources of contamination, contaminant release and transport mechanisms, impacted exposure media, and exposure routes for ecological receptor types at the Site.
- Based on previous investigations and current understanding of Site conditions, the potentially contaminated exposure media for ecological receptors include:
  - Surface soil, wasterock, and tailings in the vicinity of the Site;
  - Surface water (including adit drainages) at East Eddy Group and New York Mines;
  - Pore water within Granite Creek and Chipman Gulch; and
  - Sediment in Granite Creek and Chipman Gulch.

4.2.2 Ecological Risk Assessment Summary

A summary of the contaminants of potential ecological concern (COPECs) are summarized in Table 8. The following sections briefly outline the findings.

4.2.2.1 Soil, Wasterock, and Tailings

- Every sample had at least one exceedance of an ecological risk based screening concentration (ERBSC) and maximum background concentrations.
- Many COPECs had multiple exceedances at multiple sample locations. This suggests that elevated concentrations of COPECs are present in all the waste piles.
- Given the magnitude of the risk ratios and the number of sample locations where concentrations exceeded ERBSCs, the COPECs of most concern are total arsenic, arsenic V, and lead.

- Given the multiple exceedances of ERBSCs by multiple chemicals at multiple stations, ecological risks are expected by COPECs in soil, wasterock, and tailings.
  - The most significant risk would be posed to plants and invertebrates that inhabit the soil, wasterock, and tailings in the immediate vicinity of the Site.
  - Mobile and wide-ranging wildlife species are unlikely to spend large amounts of time on or around the Site, and thus, are less likely to be impacted by the COPECs.

4.2.2.2 Surface Water

- Iron and manganese were the only COPECs with EPCs that exceeded an ERBSC. These two COPECs also contributed an inordinate amount to the overall risks for aquatic life.
- Beryllium and silver were selected as COPECs solely because there were no ERBSCs for birds and mammals for these metals.
- The remaining COPECs for surface water (arsenic III, arsenic V, total arsenic, cadmium, lead, mercury, and selenium) were selected solely due to the potential to bioaccumulate.
- All ERBSC exceedances occurred in the adit drainage samples and only for aquatic life. The lack of any exceedances of ERBSCs in Granite Creek and Chipman Gulch suggests that any elevated concentrations of iron and manganese are not reaching and are not likely to impact aquatic life in these streams.
- Given that beryllium and silver were only detected in adit seep samples at very low concentrations and were not detected within Granite Creek or Chipman Gulch, no significant ecological effects are predicted.
- Iron and manganese at East Eddy Group seeps EE-AS-02, EE-AS-02-03, and EE-AS-02-04; and arsenic V at CG-SW-5, are the only locations where COPEC concentrations are slightly elevated. These locations represent a very small area of potential exposure.
- Given this information, ecological impacts are deemed unlikely due to COPECs in surface water.

4.2.2.3 Pore Water

- Manganese was the only COPEC with an unacceptable risk ratio.
- Methyl mercury was selected as a COPEC due to a lack of an ERBSC for aquatic life.
- The remaining COPECs (arsenic III, manganese, mercury, and selenium) were selected due to the potential to bioaccumulate.
- Overall, the ERA suggests there is a slight potential for pore water related ecological impacts posed to aquatic species exposed to a few COPECs, primarily arsenic III, manganese, mercury, and/or selenium at GC-PW-16, GC-PW-17, GC-PW-18 (vicinity of the Independence Mill and New York Mine), CG-PW-04, and CG-PW-05, downstream of the East Eddy Group.

4.2.2.4 Sediment

- The COPECs for sediment were total arsenic, cadmium, iron, lead manganese, mercury, and zinc.
- Iron was selected as a COPEC solely because of a lack of an ERBSC.
- Unacceptable risk ratios were calculated for the remainder of the COIs.
- All COPECs except iron had exceedances of ERBSCs, with total arsenic and zinc exhibiting the highest risk ratios.
- All of the exceedances of ERBSCs were at CG-SS-03, CG-SS-04, and GC-SS-18.
- All of the COPEC concentrations that exceeded ERBSCs were 2 times or less than background concentrations, except mercury at CG-SS-03, which was approximately 12 times the background sediment mercury concentration.
- Potential risks were predicted at only three stations, but mercury at CG-SS-04 was the only COPEC that significantly exceeded background concentrations.
- Benthic macroinvertebrate enumeration and analysis suggests notable impacts may exist at CG-04 and CG-05, but some level of impact may be occurring at GC-SS-11, GC-SS-14, GC-SS-16, and GC-SS-18.

- When combined, the sediment risk assessment and invertebrate analysis results suggest mine-related chemical impacts may be occurring at CG-SS-03, CG-SS-04, CG-SS-05, and GC-SS-18.

4.2.3 Determination of Risk-Based Cleanup Concentrations

- Ecological risk-based cleanup concentrations cannot be calculated unless a more detailed species specific ERA is performed.
- However, removal or containment of soil, wasterock, and tailings to the human risk-based cleanup concentration is expected to be protective of ecological receptors.

4.2.4 Determination of Ecological Hotspots

- Numerous ecological hotspots were identified in all media at the Site because the areas that indicated ecological risk were deemed to be highly concentrated (i.e., >10 times the ecological risk-based screening concentration) and/or highly mobile.
- The locations of ecological hotspots listed in Appendix B, Table 4.6 are summarized below:
  - Antimony – New York Mine wasterock (1 sample)
  - Arsenic V – New York Mine and Independence Mill wasterock/tailings (9 samples)
  - Arsenic – Wasterock/tailings from all sites (24 samples); Chipman Gulch sediment (2 samples)
  - Cadmium – Chipman Gulch sediment (2 samples)
  - Iron – Wasterock/tailings from all sites (23 samples); Chipman Gulch surface water (1 sample)
  - Lead – Independence Mill floatation cell spillage (1 sample)
  - Manganese – Wasterock/tailings from the New York Mine and East Eddy Group (14 samples); Chipman Gulch pore water (1 sample)
  - Mercury – Wasterock/tailings from the New York Mine and Independence Mill (10 samples); Chipman Gulch sediment (1 sample)
  - Selenium – New York Mine wasterock (1 sample)
  - Silver – Independence Mill wasterock (1 sample)
  - Zinc – New York Mine tailings (2 samples); Chipman Gulch sediment (2 samples)

4.3 Streamlined Risk Assessment Summary

- Table 9 summarizes the human and ecological COPCs and COPECs for the Site.
- No carcinogenic risk is expected from exposure to sediments in Granite Creek.
- No unacceptable risks are expected from exposure to sediments in Chipman Gulch under CTE exposure conditions.
- A carcinogenic risk is possible for exposure to arsenic impacted sediments in Chipman Gulch only for ingestion of sediment under the RME exposure scenario.
- The risk assessment determined that there are no unacceptable human health risks from exposure to surface water, pore water, and air under the CTE exposure scenario.
- There is a potential for unacceptable risk for the RME exposure condition from ingestion and dermal contact with arsenic in soil, wasterock, and tailings.
- A risk-based cleanup concentration for soil, wasterock, and tailings was calculated to be 144 mg/kg (total arsenic). A sediment clean-up concentration was calculated to be 266 mg/kg.
- One human health hotspot was identified at the Independence Mill (sample IM-S-5) with an arsenic concentration of 16,180 mg/kg, which exceeded the hotspot concentration of 14,394 mg/kg.
- Ecological impacts were predicted for terrestrial plants and terrestrial invertebrates due to COPECs in soil, wasterock, and tailings.
- A slight potential for ecological impacts was predicted for aquatic life in the lower portions of Granite Creek and Chipman Gulch. Immobile or resident species inhabiting terrestrial and sediment habitats are the most likely species to be impacted.
- Numerous ecological hotspots were identified in wasterock, sediment, surface water, and pore water.

- Remediation, removal, or reduced receptor exposure to COPECs in soil, wasterock, tailings, and sediment would be necessary to adequately reduce the predicted impacts to ecological receptors.
- Ecological risk-based cleanup concentrations cannot be calculated unless a more detailed species specific ERA is performed.
- Further species-specific ecological assessment would be required to more accurately assess the potential for the predicted bird and mammal bioaccumulation risks to be realized.
- The decision whether to complete more detailed ecological assessment should be made in coordination with any removal action planning to select the most cost-effective approach.
- Removal or containment of soil, wasterock, and tailings to the human risk-based cleanup concentration is expected to be protective of ecological receptors.

5.0 REMOVAL ACTION JUSTIFICATION

- The NCP states that an appropriate Removal Action may be conducted at a site when a threat to human health or welfare or the environment is identified (40 CFR 300.415(b)(2)).
- A Removal Action is undertaken to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or the threat of a release at a site.
- The NCP outlines the following eight factors to be considered when determining the appropriateness of a Removal Action:
  1. **"Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants"**
     - Complete human and ecological exposure pathways (ingestion and inhalation) were documented during the SI from exposure to metal-impacted mining waste at the Site.
     - Arsenic was detected up to 16,180 mg/kg in wasterock, which exceeds the USEPA Region IX PRG of 1.6 mg/kg for carcinogenic endpoint exposure.
       - Human exposure to high concentrations of arsenic through ingestion and inhalation is associated with cancer (skin, lung, liver, bladder, kidney, etc.).
     - Lead was detected up to 16,100 mg/kg, which exceeds the USEPA Region IX PRG of 800 mg/kg.
       - Lead is of particular concern to small children because they absorb lead more easily than adults and are more susceptible to the effects.
       - Women are also more susceptible from exposure to elevated concentrations of lead, which can increase the rate of miscarriages and stillbirths.
     - Human exposure is currently limited to recreational visitors with the potential for miners/workers in the future.
       - Recreational visitors and miners/workers traversing the area would be exposed to the contaminants.
       - Nearby residents are not likely to be impacted by the elevated concentrations because there is no dominant wind direction or direct wind pathway from the Site to the nearest residences.
     - Arsenic concentrations are elevated in Chipman Gulch and Granite Creek, with concentrations detected up to 1,070 mg/kg, which exceeds the USEPA Freshwater Threshold Effects Level (TEL) of 5.9 mg/kg.
       - As identified in the ERA, notable mine-related impacts to benthic macroinvertebrates are occurring in various reaches within Chipman Gulch and Granite Creek.
       - Ecological hotspots (for arsenic, cadmium, mercury, and zinc) were identified in two Chipman Gulch sediment stations.
  2. **"Actual or potential contamination of drinking water supplies or sensitive ecosystems"**
     - There are several domestic water right intakes (town of Granite) within Granite Creek downstream of the Site.
       - These intakes are no longer used because of the town of Granite now obtains their drinking water from groundwater wells.

        - There is a potential for the town to use the surface water rights for drinking water in the future if they have supply problems with their current groundwater wells.
        - There appears to be no current contamination of drinking water supplies; however, there is a slight potential that surface water intakes could be used in the future.
        - Arsenic in Granite Creek surface water near the New York Mine (7.6 µg/L) is significantly above the Oregon human health criteria of 0.018 µg/L.
3. **"Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers that may pose a threat of release"**
    - No drums, tanks, or barrels were observed onsite.
4. **"High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate"**
    - Surface wasterock and tailings exhibited arsenic as high as 16,180 mg/kg and lead up to 16,100 mg/kg, exceeding all regulatory screening levels.
    - Erosion of these materials has been documented in Granite Creek, Chipman Gulch, and adjacent wetlands.
        - Arsenic in sediment below New York Mine was detected at 186 mg/kg and arsenic in Chipman Gulch sediment was detected as high as 1,070 mg/kg, both exceed the USEPA Freshwater TEL of 5.9 mg/kg.
    - Ecological hotspots for arsenic are present in wasterock at all locations.
    - Ecological hotspots for arsenic, cadmium, mercury, and zinc have also been identified in two stations immediately above the East Eddy Group in Chipman Gulch.
5. **"Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released"**
    - Wasterock and tailings that are adjacent to and within (i.e., banks and sediment) Granite Creek and Chipman Gulch floodplains will continue to migrate during high flow events; this will continue to increase the metal load in the aquatic environment and continue to impact aquatic receptors (i.e., fish, benthic macroinvertebrates, etc.).
    - Wasterock and tailings from the Site will continue to be released into surface water bodies during heavy precipitation events (i.e., rain on snow events, thunderstorms, etc.).
6. **"Threat of fire or explosion"**
    - No known fire or explosion threat is present at the Site.
7. **"The availability of other appropriate federal or state mechanisms to respond to the release"**
    - None.
8. **"Other situations or factors that may pose threats to public health or welfare of the United States or the environment."**
    - The Site is located on Forest Service administered land, along a maintained county road where access via vehicle and on foot is readily available to the public.
    - The Site (primarily the Independence Mill and New York Mine) is an attractive nuisance that poses a physical and chemical threat to the public.

6.0 CONCLUSIONS

- The SI has documented the following human health and environmental impacts:
    - New York Mine
        - Arsenic in wasterock and tailings was detected as high as 2,530 mg/kg (milligrams per kilogram), which exceeds the USEPA PRGs for the carcinogenic end point of 1.6 mg/kg.
        - Total volume of metal-impacted wasterock, tailings and soil is 19,800 bcy.
        - Arsenic in Granite Creek sediment below New York Mine detected at 186 mg/kg, which exceeds the USEPA Freshwater TEL of 5.9 mg/kg.
            - The ecological risk assessment suggests mine related impacts in Granite Creek sediments.

- Independence Mill
  - Wasterock and tailings analytical results for arsenic (16,180 mg/kg) and lead (16,100 mg/kg) exceed the USEPA PRGs of 1.6 and 800 mg/kg, respectively.
  - Total volume of metal-impacted wasterock, tailings and soil is 870 bcy.
  - Arsenic in Granite Creek sediment collected adjacent to Independence Mill was detected as high as 142 mg/kg, which exceeds the USEPA Freshwater TEL of 5.9 mg/kg.
- East Eddy Group
  - Wasterock analytical results for arsenic (326 mg/kg) exceed USEPA PRG of 1.6 mg/kg.
  - Volume of metal-impacted wasterock is 5,000 bcy.
  - Arsenic in Chipman Gulch sediment detected as high as 1,070 mg/kg, which exceeds the USEPA Freshwater TEL of 5.9 mg/kg.
    - Ecological hotspots for arsenic, cadmium, mercury, and zinc have been identified in two stations immediately above the East Eddy Group, indicating an upstream source.
  - Arsenic concentration in Granite Creek sediment increases 300% from above the confluence with Chipman Gulch (24.2 mg/kg) to immediately below the confluence with Chipman Gulch (113 mg/kg) reflecting significant arsenic loading from Chipman Gulch.
  - Elevated metals concentration in aquatic samples in the upper reaches in Chipman Gulch above the East Eddy Group indicate one or more additional sources of metals contamination.

- Risk-based cleanup concentrations for arsenic in wasterock, tailings, and soil was calculated to be 144 mg/kg, and for sediment to be 266 mg/kg.
- There appears to be sufficient area at the New York Mine or in the East Eddy Group for the construction of a centralized repository for wasterock, tailings, and impacted-soil. In addition, sufficient area appears to be available at the Site for the construction of on-site treatment ponds for the adit discharges.
- Based upon the SI, CES recommends that an Engineering Evaluation / Cost Analysis (EECA) be conducted at the Site. As part of the EECA, the following data gaps should be assessed:
  - Additional aquatic samples should be collected upstream from CG-01 in Chipman Gulch to determine the possibility of additional sources above East Eddy Group (~$6,000).
  - Samples should be collected at the unnamed mill site above the East Eddy Group to assess impacts to human health and the environment. Historic information should also be assessed to determine past ownership and practices (~$6,000).
  - Additional aquatic samples should be collected downstream from the New York Mine and GC-18, to assess downstream migration of metals in Granite Creek (~$6,000).
  - An updated risk assessment should be developed based on the new analytical data (~$5,000).
  - Further delineation of sediment in Chipman Gulch wetlands to determine lateral extent and volume of impacted sediment (~$3,000).
  - Detailed topographic surveys should be developed for the Site to refine the volume calculations and to develop drawings for the EECA (~$20,000).

7.0 FOREST SERVICE DISCLAIMER

This abandoned mine/mill site was created under the General Mining Law of 1872 and is located solely on National Forest System (NFS) lands administered by the USDA Forest Service. The United States has taken the position and courts have held that the United States is not liable as an "owner" under CERCLA Section 107 for mine contamination left behind on NFS lands by miners operating under the 1872 Mining Law. Therefore, USDA Forest Service believes that this site should not be considered a "federal facility" within the meaning of CERCLA Section 120 and should not be listed on the Federal Agency Hazardous Waste Compliance Docket. Instead, this site should be included on the USEPA's CERCLIS database. Consistent with the June 24, 2003 OECA/FFEO "Policy on Listing Mixed Ownership Mine or Mill Sites Created as a Result of the General Mining Law of 1872 on the Federal Agency Hazardous Waste Compliance Docket," we respectfully request that the USEPA Regional Docket Coordinator consult with the Forest Service and USEPA Headquarters before making a determination to include this site on the Federal Agency Hazardous Waste Compliance Docket.

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Table 1. Surface Water Analytical Results
New York Mine Complex Site Inspection, Umatilla and Wallowa-Whitman National Forest, Oregon

Sample I.D.	Sample Date	Antimony, TR	Arsenic III, Inorganic	Arsenic V, Inorganic	Arsenic, TR	Beryllium, TR	Cadmium, TR	Calcium, TR	Chromium, TR	Copper, TR	Iron, TR	Lead, TR	Magnesium, TR	Manganese, TR	Mercury, TR	Nickel, TR	Selenium, TR	Silver, TR	Zinc, TR
		Results in µg/L																	
Granite Creek Background																			
GC-SW-01	6/25/2007	< 0.4	NA	NA	0.6 B	< 0.10 U	< 0.10 U	4,500	< 10 U	< 0.5 U	30 B	0.1 B	700 B	< 5.0 U	< 0.0001	< 10 U	< 0.1 U	< 0.05 U	< 10.0 U
GC-SW-02	6/25/2007	< 0.4	NA	NA	< 0.5	< 0.10 U	< 0.10 U	4,500	< 10 U	< 0.5 U	40 B	< 0.1	800 B	< 5.0 U	0.00048	< 10 U	< 0.1 U	< 0.05 U	10.0 B
GC-SW-03	6/5/2007	< 0.4	NA	NA	0.6 B	< 0.10 U	< 0.10 U	4,700	< 10 U	< 0.5 U	100	0.1 B	900 B	< 5.0 U	0.00048	< 10 U	< 0.1 U	< 0.05 U	10.0 B
Granite Creek																			
GC-SW-11	6/21/2007	< 0.4	0.07	2.33	2.4	< 0.1	< 0.1	10,300	< 10	< 0.5	40 B	< 0.1	2,200	< 5	0.0125	< 10	< 0.1	< 0.05	< 10
GC-SW-12	6/20/2007	< 0.4	NA	NC	7.4	< 0.1	< 0.1	16,000	< 10	< 0.5	60	< 0.1 B	3,900	11 B	0.00505	< 10	< 0.1	< 0.05	< 10
GC-SW-13	6/20/2007	< 0.4	NA	NC	8.3	< 0.1	< 0.1	16,100	< 10	< 0.5	60	0.2 B	4,200	8 B	0.0048	< 10	< 0.1	< 0.05	< 10
GC-SW-14	6/20/2007	< 0.4	NA	NC	9.0	< 0.1	< 0.1	17,600	< 10	< 0.5	70	0.2 B	5,000	9 B	0.0047	< 10	< 0.1	< 0.05	< 10
GC-SW-15	6/20/2007	< 0.4	NA	NC	7.8	< 0.1	< 0.1	15,800	< 10	< 0.5	60	0.2 B	4,500	7 B	0.00461	< 10	< 0.1	< 0.05	< 10
GC-SW-16	6/20/2007	< 0.4	NA	NC	9.2	< 0.1	< 0.1	17,100	< 10	0.6 B	50 B	0.2 B	4,900	6 B	0.00385	< 10	0.1 B	< 0.05	< 10
GC-SW-17	6/19/2007	< 0.4	0.19 H	7.61	7.8	< 0.1	< 0.1	13,700	< 10	0.6 B	50	0.2 B	3,700	5 B	0.00455	< 10	< 0.1	< 0.05	< 10
GC-SW-18	6/19/2007	< 0.4	NA	NC	7.6	< 0.1	< 0.1	16,300	< 10	< 0.5	50 B	0.2 B	4,500	< 5	0.00423	< 10	< 0.1	< 0.05	< 10
Chipman Gulch																			
CG-SW-1	6/21/2007	3.5	0.44	9.46	9.9	< 0.1	0.2 B	86,900	< 10	1.4 B	130	0.2 B	24,300	30 B	0.0142	< 10	0.3 B	< 0.05	20 B
CG-SW-2	6/21/2007	2.4	NA	NC	43.2	< 0.1	0.1 B	79,000	< 10	1.2 B	230	0.5	22,300	33	0.00302	< 10	0.2 B	< 0.05	10 B
CG-SW-3	6/21/2007	2.1	NA	NC	43.1	< 0.1	0.1 B	73,400	< 10	1.1 B	90	0.3 B	20,800	8 B	0.00262	< 10	0.2 B	< 0.05	10 B
CG-SW-4	6/21/2007	1.8	NA	NC	57.7	< 0.1	0.2 B	72,800	< 10	1.3 B	270	0.7	21,100	49	0.00372	< 10	0.2 B	< 0.05	20 B
CG-SW-5	6/21/2007	1.6 B	0.73 H	49.2	49.9	< 0.1	0.1 B	74,400	< 10	1.1 B	120	0.4 B	21,800	21 B	0.00250	< 10	0.2 B	< 0.05	20 B
New York Mine - Bowes Adit																			
NY-AS-01	6/22/2007	< 0.4	NA	NC	42.8	< 0.1	< 0.1	64,800	< 10	0.6 B	3530	< 0.1	27,100	746	0.0006	< 10	< 0.1	< 0.05	10
East Eddy Adit Seeps																			
EE-AS-01	6/22/2007	< 0.4	NA	NC	2	< 0.1	< 0.1	84,400	< 10	1.0 B	520	0.4 B	37,000	11 B	0.0065	< 10	0.3 B	< 0.05	50
EE-AS-02	6/22/2007	1.1 B	NA	NC	26.5	0.1 B	0.4 B	89,600	< 10	12.3	12,100	8.6	38,900	228	0.0711	< 10	0.5 B	0.42	290
EE-AS-03	6/22/2007	0.1 B	NA	NC	313	< 0.1	0.9	63,200	< 10	5.8	8,650	12.8	21,400	846	0.0599	< 10	0.2 B	0.52	70
EE-AS-04	6/22/2007	1.1 B	95	158	253	< 0.1	0.3 B	75,400	< 10	1.5 B	2,070	1.5	21,800	493	0.0092	< 10	0.1 B	< 0.05	30
Standards, corrected for hardness where applicable (use 55 mg/L background for surface water samples																			
Oregon - Aquatic Life [1]		NS	NS	NS	150	NS	0.17	NS	NS	5.6	1,000	1.50	NS	NS	0.012	32	5	0.12	73
Oregon - Ecological Screening Level Values[2]		1,600	150	150	NS	5.3	2.2	116,000	NS	9	1,000	2.5	82,000	120	0.77	52	5	0.12	120
Oregon - Human Health [3]		5.6	NS	NS	0.018	NS	NS	NS	NS	1,300	300	NS	NS	50	NS	610	170	NS	7,400
EPA - Aquatic Life (CCC)[4]		NS	NS	NS	150	NS	0.163	NS	100	5.4	1,000	1.32	NS	NS	0.77	31.5	5	NS	73
EPA - Human Health (Water+Organism)[5]		5.6	NS	NS	0.018	NS	NS	NS	NS	1,300	300	NS	NS	50	NS	610	170	NS	7,400
ORNL - Surface Water PRGs[6]		30	190	3.1	NS	0.66	1.10	NS	NS	12	1,000	3.20	NS	120	1.3	160	0.39	0.36	73

Table 1. Surface Water Analytical Results (Continued) - Field and Wet Parameters
New York Mine Complex Site Inspection, Umatilla and Wallowa-Whitman National Forest, Oregon

Sample I.D.	Sample Date	Flow Rate	Temperature (Field)	pH (Field)*	pH (Lab)*	Conductivity (Field)	Conductivity @ 25C (Lab)	Dissolved Oxygen (Field)*	Oxygen Reduction Potential (Field)	Hardness as $CaCO_3$, TR*	Residue, Filterable (TDS) @180*	Residue, Non- Filterable (TSS) @105° C*	Sulfate+
		gpm	°C	su	su	µS/cm		mg/L	mV	mg/L			
Granite Creek Background													
GC-SW-01	6/25/2007	2	6.1	6.47	7.6 H	38	45	10.8	225	14	40	< 5 U	< 10 U
GC-SW-02	6/25/2007	145	4.9	6.24	7.8 H	38	47	12.55	343	15	50	< 5 U	< 10 U
GC-SW-03	6/5/2007	161	4.47	5.45	7.8 H	50	52	13.19	375	15	50	< 5 U	< 10 U
Granite Creek													
GC-SW-11	6/21/2007	800	7.5	7.62	7.4 H	84	88	11.21	206	35	60	< 5	< 10
GC-SW-12	6/20/2007	485	11.0	8.52	7.3 H	120	124	10.4	89	56	80 H	< 5 H	< 10
GC-SW-13	6/20/2007	775	12.6	8.09	7.5 H	133	129	10.22	156	58	90 H	< 5 H	20 B
GC-SW-14	6/20/2007	800	11.4	8.1	7.5 H	145	149	10.3	101	65	90 H	< 5 H	20 B
GC-SW-15	6/20/2007	640	9.9	8.63	7.5 H	144	149	10.7	117	58	100 H	< 5 H	20 B
GC-SW-16	6/20/2007	790	8.2	7.76	7.6 H	145	152	10.9	177	63	110 H	< 5 H	10 B
GC-SW-17	6/19/2007	625	12.7	8.2	7.7 H	142	147	9.6	103	49	90 H	8 BH	20 B
GC-SW-18	6/19/2007	775	13	8.21	7.3 H	145.0	159	9.70	210	59	90 H	6 BH	30 B
Chipman Gulch													
CG-SW-1	6/21/2007	22	17.6	8.18	7.6 H	621	637	8.25	164	317	450	< 5	230
CG-SW-2	6/21/2007	32	14.6	8.75	7.6 H	585	604	9.24	106	289	420	< 5	210
CG-SW-3	6/21/2007	46	13.9	8.68	7.7 H	579	571	10.2	111	269	400	< 5	190
CG-SW-4	6/21/2007	43	12.5	8.04	7.6 H	552	577	10.1	118	269	390	< 5	190
CG-SW-5	6/21/2007	56	10.2	8.23	7.6 H	551	575	10.2	188	276	390	< 5	190
New York Mine - Bowes Adit													
NY-AS-01	6/22/2007	5	7.96	8.5	7.8 H	640	635	1.35	-25	273	390	6 B	70
East Eddie Adit Seeps													
EE-AS-01	6/22/2007	1	8.31	7.14	7.7 H	708	734	10.07	226	363	490	< 5	220
EE-AS-02	6/22/2007	0.25	11.7	8.11	7.9 H	681	744	10.3	170	384	500	160	220
EE-AS-03	6/22/2007	2	14.9	7.17	7.4 H	515	520	3.92	-2	246	360	70	150
EE-AS-04	6/22/2007	2	11.5	7.61	7.6 H	558	577	8.17	60	278	380	< 5	180
Standards													
Oregon - Aquatic Life [1]		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Oregon - Ecological Screening Level Values[2]		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Oregon - Human Health [3]		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
EPA - Aquatic Life [4]		NS	9-19	6.5-9	6.5-9	NS	NS	9.5	NS	NS	NS	NS	NS
EPA - Human Health [5]		NS	NS	5-9	5-9	NS	NS	NS	NS	NS	NS	NS	NS
ORNL - Surface Water PRGs[6]		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NOTES:

All analyses except Arsenic III & Low-Level Mercury were conducted by ACZ Laboratories, Inc., Steamboat Springs, CO per EPA Method 200 series
Arsenic III and Low-Level Mercury analyses were conducted by Brooks Rand, Seattle, WA per EPA Methods 1631 & 1632, respectively
TR = Total recoverable metals
Arsenic V was calculated from difference between Arsenic, TR and Arsenic III
mg/L = milligrams per liter
µg/L = micrograms per liter
su = standard units
µS/cm = microsiemens per centimeter
mV = millivolts
B = Analyte was detected above the method detection limit (MDL) but below the practical quantitation limit (PQL)
H = Storage and preservation times were not met
NA = Not analyzed
Italic values indicate that the MDL exceeds the lowest standard
NC = Not Calculated
Shaded values indicate that the value exceeds one or more standard; exceeded criteria also shaded
C = Calculated
gpm = gallons per minute

STANDARDS NOTES:

1 - State of Oregon proposed Aquatic Life criteria (Toxic Compounds Criteria, May 2004), underline - corrected for hardness, italics - expressed as dissolved
2 - State of Oregon Level II Ecological Screening criteria (ODEQ, December 2001), *italics* - expressed as dissolved
3 - State of Oregon proposed Human Health criteria, water+organism (Toxic Compounds Criteria, May 2004), underline - corrected for hardness, italics - expressed as dissolved
4 - EPA recommended chronic ambient water quality criteria for freshwater aquatic life used (EPA, 2002), underline - corrected for hardness, italics - expressed as dissolved
5 - EPA recommended ambient water quality criteria for protection of human consumption of water and fish (EPA, 2002 NTR), italics - expressed as dissolved
6 - ORNL Preliminary Remediation Goals for Ecological Endpoints (ORNL, 1997)
NS = No Standard

Table 2. Pore Water Analytical Results
New York Mine Complex Site Inspection, Umatilla and Wallowa-Whitman National Forest, Oregon

Sample I.D.	Sample Date	Pool (P) or Riffle (R)	Antimony, Diss.	Arsenic III, Inorganic	Arsenic V, Inorganic	Arsenic, Diss.	Beryllium, Diss.	Cadmium, Diss.	Calcium, Diss.	Chromium, Diss.	Copper, Diss.	Iron, Diss.	Lead, Diss.	Magnesium, Diss.	Manganese, Diss.	Mercury, Diss.	Methyl Mercury	Nickel, Diss.	Selenium, Diss.	Silver, Diss.	Zinc, Diss.
			Results in ug/L																		
Granite Creek Background																					
GC-PW-01	6/25/2007		< 0.4 U	NA	NC	0.8 B	< 2 U	< 0.1 U	5,800	10 B	< 10 U	< 20 U	0.3 B	900 B	< 5	< 0.0001	NA	< 10 U	< 0.1 U	< 0.05 U	< 10 U
GC-PW-02	6/25/2007		< 0.4 U	NA	NC	3.4	< 2 U	< 0.1 U	4,200	10 B	< 10 U	5,560	0.2 B	800 B	259	0.00024	NA	< 10 U	< 0.1 U	< 0.05 U	< 10 U
GC-PW-03	6/25/2007		< 0.4 U	NA	NC	1.6	< 2 U	< 0.1 U	5,900	10 B	< 10 U	< 20 U	0.2 B	1,100	< 5	0.00066	NA	< 10 U	< 0.1 U	< 0.05 U	< 10 U
Granite Creek																					
GC-PW-11	6/21/2007	P	< 0.4	0.015 H	2.885	2.9	< 2	< 0.1	10,600	< 10	< 10	< 20	0.5	2,300	< 5	0.00389	2.6E-05 HB	< 10	< 0.1	< 0.05	< 10
GC-PW-12	6/20/2007	P	< 0.4	NA	NC	10.8	< 2	0.1 B	16,100	< 10	< 10	< 20	0.2 B	4,000	161	0.00332	NA	< 10	< 0.1	< 0.05	< 10
GC-PW-13	6/20/2007	P	< 0.4	NA	NC	17.7	< 2	< 0.1	18,900	< 10	< 10	< 20	0.2 B	6,600	< 5	0.00339	NA	< 10	< 0.1	< 0.05	< 10
GC-PW-14	6/20/2007	P	0.5 B	NA	NC	13.6	< 2	0.2 B	16,700	< 10	< 10	< 20	0.2 B	5,800	7 B	0.0019	NA	< 10	< 0.1	< 0.05	< 10
GC-PW-15	6/20/2007	P	< 0.4	NA	NC	9.3	< 2	< 0.1	17,600	< 10	< 10	< 20	< 0.1	5,000	< 5	0.00335	< 0.00002 H	< 10	< 0.1	< 0.05	< 10
GC-PW-16	6/20/2007	P	< 0.4	NA	NC	36.8	< 2	< 0.1	18,400	< 10	< 10	750	< 0.1	5,300	298	0.00273	NA	< 10	1.1	< 0.05	10 B
GC-PW-17	6/17/2007	P	< 0.4	1.18 H	3.320	4.5	< 2	< 0.1	12,700	< 10	< 10	< 20	0.1 B	3,600	9 B	0.0117	4.8E-05 HB	< 10	< 0.1	< 0.05	< 10
GC-PW-18	6/17/2007	P	< 0.4	NA	NC	29.2	< 2	< 0.1	17,200	< 10	< 10	40 B	0.3 B	4,800	745	0.0053	NA	< 10	< 0.1	< 0.05	10 B
Chipman Gulch																					
CG-PW-01	6/21/2007	P	3.7	0.28	10.42	10.7	< 2	0.2 B	93,000	< 10	< 10	60	0.1 B	26,200	35	8E-04	< 0.00002	< 10	0.2 B	< 0.05	20 B
CG-PW-02	6/21/2007	P	< 0.4	NA	NC	62.9	< 2	0.6	45,300	< 10	< 10	40 B	0.4 B	12,600	173	0.00209	NA	< 10	< 0.1	< 0.05	50 B
CG-PW-03	6/21/2007	P	1.0 B	NA	NC	27.6	< 2	< 0.1	67,100	< 10	< 10	< 20	< 0.1	19,600	< 5	0.0018	NA	< 10	0.1 B	< 0.05	10 B
CG-PW-04	6/21/2007	P	0.7 B	NA	NC	25.4	< 2	< 0.1	54,600	< 10	< 10	< 20	< 0.1	15,900	18 B	0.0358	NA	< 10	< 0.1	< 0.05	< 10
CG-PW-05	6/21/2007	P	0.8 B	49.4 H	7.800	57.2	< 2	0.6	72,400	< 10	< 10	60	< 0.1	20,700	1890	0.00193	4.3E-05 B	10 B	0.1 B	< 0.05	20 B
Standards, corrected for hardness where applicabl			**60 mg/L as average in pore-water samples)**																		
Oregon - Aquatic Life [1]			NS	NS	NS	150	NS	0.18	NS	NS	6.0	1,000	1.64	NS	NS	0.012	NS	33.6	5	0.12	77
Oregon - Ecological Screening Level Values [2]			1,600	150	150	NS	5.3	2.2	######	NS	9	1,000	2.5	82,000	120	0.77	NS	52	5	0.12	120
Oregon - Human Health [3]			5.6	NS	NS	0.018	NS	NS	NS	NS	1,300	300	NS	NS	50	NS	NS	610	170	NS	7,400
EPA - Aquatic Life (CCC)[4]			NS	NS	NS	150	NS	0.171	NS	NS	5.7	1,000	1.42	NS	NS	0.77	NS	33.5	5	NS	77
EPA - Human Health (Water+Organism)[5]			5.6	NS	NS	0.018	NS	NS	NS	NS	1,300	300	NS	NS	50	NS	NS	610	170	NS	7,400
ORNL - Pore Water PRGs[6]			30	190	3.1	NS	0.66	1.10	NS	NS	12	1,000	3.20	NS	120	1.3	2.8E-03	160	5	0.36	77

Sample I.D.	Sample Date	Pool (P) or Riffle (R)	°Temperature (Field)	pH (Field)*	pH (Lab)*	Conductivity (Field)	Conductivity @ 25C (Lab)	Dissolved Oxygen (Field)*	Oxygen Reduction Potential (Field)	Hardness as $CaCO_3$, TR*	Residue, Filterable (TDS) @180*	Residue, Non- Filterable (TSS) @105° C*	Cyanide, Total	Cyanide, WAD	Sulfate+
			°C	su		µS/cm		mg/L	mV	mg/L					
Granite Creek Background															
GC-PW-01	6/25/07	P	6.04	7.35	7.5 H	43	50	9.4	201	18	30	NA	NA	NA	< 10 U
GC-PW-02	6/25/07	P	6.11	5.82	7.2 H	53	50	1.77	38.1	14	60	NA	NA	NA	< 10 U
GC-PW-03	6/25/07	P	5.42	5.6	7.7 H	50	52	9.14	350	19	50	NA	NA	NA	< 10 U
Granite Creek															
GC-PW-11	6/21/07	P	8.38	7.58	7.6 H	85	114	8.25	125.3	36	50	< 5	< 0.005	< 0.005	< 10
GC-PW-12	6/20/07	P	11.6	7.64	7.3 H	132	132	10.27	79	57	80	< 5 H	NA	NA	10 B
GC-PW-13	6/20/07	P	13.2	8.52	7.6 H	166	169	7.46	50.8	74	110	< 5 H	NA	NA	20 B
GC-PW-14	6/20/07	P	12.9	7.5	7.7 H	147	153	5.2	44.5	66	110 H	< 5 H	NA	NA	20 B
GC-PW-15	6/20/07	P	12.1	7.68	7.5 H	145	150	8.7	48	65	100 H	< 5 H	< 0.005	< 0.005	20 B
GC-PW-16	6/20/07	P	11.7	7.6	7.6 H	152	158	1.6	-75	68	110 H	< 5 H	NA	NA	20 B
GC-PW-17	6/17/07	P	12.9	7.56	7.7 H	151	161	4.5	120	47	90 H	< 5 H	0.265	< 0.005	20 B
GC-PW-18	6/17/07	P	17.4	7.24	7.7 H	151	146	5.75	135	63	110 H	< 5 H	NA	NA	20 B
Chipman Gulch															
CG-PW-01	6/21/07	P	17.7	8.14	7.6 H	623	640	7.6	110	340	410	< 5	< 0.005	< 0.005	230
CG-PW-02	6/21/07	P	16.6	7.58	7.6 H	472	501	1.27	109	165	290	< 5	NA	NA	140
CG-PW-03	6/21/07	P	12.6	8.15	7.8 H	552	522	6.31	182	248	340	8 B	NA	NA	170
CG-PW-04	6/21/07	P	14.9	8.1	7.1 H	554	602	9.54	131.4	202	380	14 B	NA	NA	180
CG-PW-05	6/21/07	P	13.2	7.53	7.5 H	555	574	3.3	106	266	390	< 5	< 0.005	< 0.005	180
Standards															
Oregon - Aquatic Life [1]			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.0052	NS	NS
Oregon - Ecological Screening Level Values [2]			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.0052	NS	NS
Oregon - Human Health [3]			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.14	NS	NS
EPA - Aquatic Life [4]			9-19	6.5-9	6.5-9	NS	NS	9.5	NS	NS	NS	NS	0.0052	NS	NS
EPA - Human Health [5]			NS	5-9	5-9	NS	NS	NS	NS	NS	NS	NS	0.7	NS	NS
ORNL - Pore-water PRGs[6]			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.0052	NS	NS

NOTES:
All analyses except Arsenic III & Low-Level Mercury were conducted by ACZ Laboratories, Inc., Steamboat Springs, CO per EPA Method 200 series
Arsenic III and Low-Level Mercury analyses were conducted by Brooks Rand, Seattle, WA per EPA Methods 1631 & 1632, respectively
Arsenic V was calculated from difference between Arsenic, TR and Arsenic III
All analyses except Arsenic III & Low-Level Mercury were conducted by ACZ Laboratories, Inc., Steamboat Springs, CO per EPA Method 200 series
Arsenic III and Low-Level Mercury analyses were conducted by Brooks Rand, Seattle, WA per EPA Methods 1631 & 1632, respectively
Arsenic V was calculated from difference between Arsenic, TR and Arsenic III
mg/L = milligrams per liter
< value U = analyte not detected above method detection limit (MDL)
su = standard units
µS/cm = microsiemens per centimeter
mV = millivolts
NM = Not measured
Italic values indicate that the MDL exceeds the lowest standard
NM - Not Measured
NA = Not analyzed or sample not obtained
Italic values indicate that the MDL exceeds the lowest standard
H = Holding time exceeded
B = Analyte was detected above the method detection limit (MDL) but below the practical quantitation limit (PQL)
NC = Not Calculated
Shaded values indicate that the value exceeds one or more standard; exceeded criteria also shaded
NA = Not analyzed or sample not obtained

STANDARDS NOTES:
1 - State of Oregon proposed Aquatic Life criteria (Toxic Compounds Criteria, May 2004)underline - corrected for hardness, *italics* - expressed as dissolved
2 - State of Oregon Level II Ecological Screening criteria (ODEQ, December 2001)*italics* - expressed as dissolved
3 - State of Oregon proposed Human Health criteria, water+organism (Toxic Compounds Criteria, May 2004)underline - corrected for hardness, *italics* - expressed as dissolved
4 - EPA recommended chronic ambient water quality criteria for freshwater aquatic life used (EPA, 2002)underline - corrected for hardness, *italics* - expressed as dissolved
5 - EPA recommended ambient water quality criteria for protection of human consumption of water and fish (EPA, 2002 NTR)*italics* - expressed as dissolved
6 - ORNL Preliminary Remediation Goals for Ecological Endpoints (ORNL, 1997)
NS = No Standard

Table 3. Sediment Analytical Results
New York Mine Complex Site Inspection, Umatilla and Wallowa-Whitman National Forest, Oregon

Sample ID	Sample Date	Antimony, Total	Arsenic - Total	Beryllium, Total	Cadmium, Total	Chromium, Total	Copper, Total	Iron, Total	Lead, Total	Manganese, Total	Mercury, Total	Mercury-Methyl Total	Nickel, Total	Selenium, Total	Silver, Total	Zinc, Total
		mg/kg														
Granite Creek Background																
GC-SS-01	6/25/2007	< 0.2	7.5	0.3 B	0.22 B	9	3 B	9,320	1.89	165	0.07 B	NA	1 B	0.31	0.12	25
GC-SS-02	6/25/2007	0.3 B	6.3	0.6 B	0.12 B	9	2 B	13,700	2.04	213	< 0.04	NA	< 1	0.09 B	0.05 B	36
GC-SS-03	6/25/2007	0.3 B	36.5	0.8 B	0.17 B	10	3 B	16,600	2.63	298	0.10 BH	NA	< 1	0.15 B	0.13	36
Granite Creek																
GC-SS-11	6/21/2007	0.5 B	24.2	1.2	0.56	11	7	20,900	17.6	293	0.1 B	NA	2 B	0.32	0.68	101
GC-SS-12	6/20/2007	0.7 B	113	0.7 B	0.75	7	8	15,500	16.3	495	< 0.04	NA	2 B	0.37	0.62	76
GC-SS-13	6/20/2007	2.0 B	166	0.8 B	1.78	10	18	16,200	98.5	613	< 0.04	3E-04	5	0.85	5.78	164
GC-SS-14	6/20/2007	1.4	131	0.6 B	1.60	8	17	14,400	46.1	603	< 0.05	NA	6	0.71	3.29	149
GC-SS-15	6/20/2007	1.7	142	0.8 B	1.91	11	19	16,800	53.0	631	< 0.04	2E-04	6	2.58	4.31	179
GC-SS-16	6/20/2007	0.4 B	47	0.5 B	0.61	10	9	12,400	17.2	304	< 0.04	NA	3 B	0.31	0.56	100
GC-SS-17	6/19/2007	1.2	82.5	0.7 B	0.90	8	12	15,700	24.5	319	< 0.04	8E-05	5	0.49	2.83	115
GC-SS-18	6/19/2007	3.0 B	186	1.2	3.55	16	37	20,500	91.8	751	0.60	NA	14	2.02	5.89	270
Chipman Gulch																
CG-SS-01	6/21/2007	5 B	410	1.9	11.10	29	90	27,500	133	3,820	< 0.07	7E-04	48	7.98	5.61	663
CG-SS-02	6/21/2007	4 B	475	1.5	7.25	21	48	22,400	115	2,350	0.18	NA	29	2.41	7.37	588
CG-SS-03	6/21/2007	4 B	590	1.7	12.10	24	70	25,400	168	2,220	2.1	NA	33	4.01	8.93	718
CG-SS-04	6/21/2007	< 10	1070	1.8	18.90	20	66	29,300	135	7,170	0.11 B	NA	38	3.07	7.99	909
CG-SS-05	6/21/2007	2.0 B	299	1.0 B	6.03	13	32	18,000	108	1,820	0.06 B	6E-04	16	1.33	4.39	385
Standards																
OR - Freshwater [1]		3	NS	NS	0.6	37	36	NS	35	1,100	0.2	NS	18	NS	4.5	123
EPA - Freshwater TEL [2]		NS	5.9	NS	0.596	NS	36	NS	35	NS	0.17	NS	18	NS	NS	123.1
EPA - Freshwater PEL [3]		NS	17	NS	3.53	NS	197	NS	91.3	NS	0.486	NS	35.9	NS	NS	315
ORNL - Freshwater [4]		NS	42	NS	4.2	159	77.7	NS	110	NS	0.7	NS	38.5	NS	1.8	270

Sample ID	Sample Date	Total Organic Carbon	Size Fraction by Hydrometer			Total Cyanide	WAD Cyanide
			Clay	Sand	Silt		
		%				mg/kg	
Granite Creek							
GC-SS-11	6/21/2007	1.6	< 0.1	90.0	10.0	NA	NA
GC-SS-12	6/20/2007	0.9	< 0.1	96.3	3.8	NA	NA
GC-SS-13	6/20/2007	1.0	1.3	93.8	5.0	< 0.2	< 0.2
GC-SS-14	6/20/2007	1.1	1.3	87.5	11.3	NA	NA
GC-SS-15	6/20/2007	1.1	3.8	88.8	7.5	< 0.2	< 0.2
GC-SS-16	6/20/2007	1.9	1.3	96.3	2.5	NA	NA
GC-SS-17	6/19/2007	0.7	2.5	90.0	7.5	< 0.2	< 0.2
GC-SS-18	6/19/2007	3.8	3.8	73.8	22.5	NA	NA
Chipman Gulch							
CG-SS-01	6/21/2007	2.0	10.0	62.5	27.5	< 0.3	< 0.3
CG-SS-02	6/21/2007	2.4	10.0	56.3	33.8	NA	NA
CG-SS-03	6/21/2007	3.4	10.0	67.5	22.5	NA	NA
CG-SS-04	6/21/2007	2.3	8.8	62.5	28.8	NA	NA
CG-SS-05	6/21/2007	1.6	5.0	81.3	13.8	< 0.2	< 0.2

STANDARDS NOTES:
1 - State of Oregon, Level II Screening Level Values for Freshwater Sediment (ODEQ, 2001)
2 - EPA Threshold Effects Level (NOAA, 1999)
3 - EPA Probable Effects Level (NOAA, 1999)
4 - ORNL ecological screening level values for freshwater, lowest chronic value used (ORNL, 1997)
NS = No Standard

GENERAL NOTES:
All analyses except Arsenic III & Methyl Mercury were conducted by ACZ Laboratories, Inc., Steamboat Springs, CO per EPA Method 200 series
B = analyte detected between MDL and practical quantification limit (PQL)
Shaded values indicate that the value exceeds one or more standard; exceeded criteria also shaded
NA = Not Analyzed
mg/kg = Milligrams per kilogram
< value = Analyte not detected above Method Detection Limit (MDL, shown)
B = Analyte detected between MDL and Practical Quantification Limit (PQL, not shown)
H = Storage and preservation times were not met
Shaded values indicate that the value exceeds one or more standard; exceeded criteria also shaded

Table 4. Background Soil Analytical Results
New York Mine Complex Site Inspection, Umatilla and Wallowa-Whitman National Forest, Oregon

Sample ID	Sample Date	Sample Depth (feet)	Paste pH	Antimony, Total	Arsenic, Total	Beryllium, Total	Cadmium, Total	Chromium, Total	Copper, Total	Iron, Total	Lead, Total	Manganese, Total	Mercury, Total	Nickel, Total	Selenium, Total	Silver, Total	Zinc, Total
			su	mg/kg													
Background																	
BGS-01	6/26/2007	0.5 - 1.0	6.5	< 0.2	6.2	0.6 B	1.1	12	8	22,900	8.04	716	0.06 B	7	0.37	0.29	71
BGS-02	6/26/2007	0.5 - 1.0	6.5	< 0.2	7.8	0.6 B	1.45	7	10	13,600	5.98	668	< 0.04	6	0.28 B	0.51	61
BGS-03	6/26/2007	0.5 - 1.0	5.1	0.2 B	5.4	0.4 B	0.39	11	8	20,300	4.58	644	< 0.05 B	8	0.15 B	0.20	71
BGS-04	6/26/2007	0.5 - 1.0	5.8	< 0.2	9.0	0.8 B	2.03	15	24	16,800	7.63	848	0.06 B	23	0.36	0.63	126
BGS-05	6/26/2007	0.5 - 1.0	6.0	0.3	11.8	0.9 B	1.85	7	31	13,400	7.92	319	0.06 B	10	0.77	0.58	44
BGS-06	6/27/2007	0.5 - 1.0	6.3	0.2 B	15.3	0.4 B	0.51	15	5	29,800	4.86	644	< 0.04	7	0.24 B	0.32	88
BGS-07	6/27/2007	0.5 - 1.0	5.8	< 0.2	5.0	0.6 B	1.01	12	30	13,600	5.93	606	0.07 B	13	0.39	0.23	60
BGS-08	6/27/2007	0.5 - 1.0	6.2	0.3 B	43.5	0.4 B	1.11	70	67	35,300	7.30	1,060	0.08 B	70	0.38	0.53	145
Mean			**6.0**	**0.1**	**13.0**	**0.59**	**1.2**	**18.6**	**22.9**	**20,713**	**6.5**	**688**	**0.0425**	**18.0**	**0.27**	**0.4**	**83**
90% UCL(Mean)			**6.3**	**0.2**	**20.0**	**0.69**	**1.5**	**30.0**	**34.1**	**25,172**	**7.3**	**803**	**0.0501**	**29.8**	**0.37**	**0.5**	**102**
Standards																	
OR - Ecological Receptors (p=plant, i=invertebrate, b =birds, m = mammals) [1]				5 p	NS	10 p	4 p	NS	50 i	NS	16 b	100 i	0.1 i	30 p	1 p	2 p	50 p
EPA Indust. PRGs - Human Receptors[2]				410	1.6	1,900	7.4	64	41,000	100,000	800	19,000	310	20,000	5,100	5,100	100,000
EPA - Ecological Receptors (m=mammal, b=bird, i = invertebrate, p=plant)[3]				21 m	37 p	NS	29 p	5 p	61 i	NS	NS	NS	NS	NS	NS	NS	120 i
ORNL - Ecological Receptors[4]				5	9.9	10	4	0.4	60	NS	40.5	NS	0.00051	30	0.21	2	8.5

NOTES:
All analyses except Arsenic III & Methyl Mercury were conducted by ACZ Laboratories, Inc., Steamboat Springs, CO per EPA Method 200 series
Arsenic III and Low-Level Mercury analyses were conducted by Brooks Rand, Seattle, WA per EPA Methods 1631 & 1632, respectively
Arsenic V was calculated from difference between Arsenic, TR and Arsenic III
B = analyte detected between MDL and practical quantification limit (PQL)
Shaded values indicate that the value exceeds one or more standard; exceeded criteria also shaded
NA = Not analyzed
mg/kg = Milligrams per kilogram
< value = Analyte not detected above Method Detection Limit (MDL, shown)
su = Standard units
NC = Not Calculated

STANDARDS NOTES:
1 - State of Oregon, Level II Ecological Screening Level Values for Soil (ODEQ, 2001); dominantly based on soluble salts
2 - EPA Region 9 Industrial Preliminary Remediation Goals - (EPA, 2004).
3 - EPA Ecological Soil Screening Levels - Lowest Criteria Listed (EPA, 2000)
4 - ORNL = Oak Ridge National Laboratory Preliminary Remediation Goals for Ecological Endpoints August 1997
NS = Not standard

Table 5. Soil and Waste Material Analytical Results
New York Mine Complex Site Inspection, Umatilla and Wallowa-Whitman National Forest, Oregon

Sample ID	Sample Date	Sample Depth (feet)	Solids	Paste pH	Antimony, Total	Arsenic III, Inorganic	Arsenic V, Inorganic	Arsenic, Total	Beryllium, Total	Cadmium, Total	Chromium, Total	Copper, Total	Iron, Total	Lead, Total	Manganese, Total	Mercury, Total	Nickel, Total	Selenium, Total	Silver, Total	Zinc, Total	Sulfur Forms: Total Sulfur	Sulfur Forms: Pyritic Sulfur	Sulfur Forms: Sulfate Sulfur	Acid Base Accounting: Acid Generation Potential	Acid Base Accounting: Acid Neutralization Potential	Acid Base Accounting: Acid-Base Potential
			%	su	mg/kg																%			t $CaCO_3$/Kt		
Independence Mill - Soil, Wasterock, Ore, and Tailings																										
IM-S-1	6/21/2007	0.5	83.8	5.5	4 B	NA	NC	284	0.5 B	0.40	26	81	35,800	12.90	503	0.33	15	1.27	0.92	65	NA	NA	NA	NA	NA	NA
IM-S-2	6/21/2007	0.5	85.6	3.0	30 B	NA	NC	3,720	0.2 B	0.26 B	10	34	32,400	28.90	84.8	0.59	5	4.03	6.67	31	NA	NA	NA	NA	NA	NA
IM-S-3	6/21/2007	0.5	85.4	4.0	10 B	NA	NC	980	0.3 B	0.18 B	11	33	28,100	68.30	79.2	0.89	6	3.94	10.60	33	NA	NA	NA	NA	NA	NA
IM-S-4	6/21/2007	0.5	85.2	4.5	20 B	NA	NC	640	0.4 B	0.72	23	210	37,300	108	409	0.34	18	2.75	2.70	475	NA	NA	NA	NA	NA	NA
IM-S-5	6/19/2007	0.5	83.1	4.9	30 B	NA	NC	16,180	0.4 B	0.78	49	28	38,900	18	542	1.82	18	3.43	1.93	80	NA	NA	NA	NA	NA	NA
IM-S-7-0.5'	6/21/2007	0.5	68.1	6.8	< 40	0.07 B	34.2	34.3	0.2 B	0.95	10	19	15,500	16100	398	0.28	6	0.66	0.50	70	< 0.01	< 0.01	< 0.01	0	2	2
IM-WP1-2-0.5'	6/22/2007	0.5	64.3	6.5	18	NA	NC	242	< 0.2	0.36	18	34	26,500	9.22	685	0.21 B	4 B	4.74	0.89	50	NA	NA	NA	NA	NA	NA
IM-WR1-1-0.5'	6/20/2007	0.5	88	4.2	< 10	16.00 J	2,894.0	2910	0.3 B	0.52	15	45	29,400	27.80	329	0.45	6	3.48	2.25	44	0.16	0.01 B	0.13	5	0	-5
IM-WR3-1-0.5'	6/20/2007	0.5	90.7	5.1	7	3.55 J	381.5	385	0.3 B	2.38	12	55	20,700	158	460	0.56	8	1.80	9.86	90	0.03 B	< 0.01	0.01 B	0	0	0
IM-WR3-2-0.5'	6/22/2007	0.5	78.2	4.5	30 B	NA	NC	2,030	0.2 B	0.74	12	176	35,500	284	183	0.99	13	1.80	27	100	NA	NA	NA	NA	NA	NA
IM-TP1-1-0.5'	6/20/2007	0.5	96.7	4.4	11	70.8 J	2,019.2	2,090	0.4 B	1.48	26	106	64,100	151	273	0.78	23	3.52	6.99	187	0.05 B	0.01 B	0.02 B	2	0	-2
		Mean	**83**	**5**	**19**	**22.6**	**1,332**	**2,681**	**0**	**1**	**111**	**75**	**33,109**	**1,542**	**359**	**1**	**11**	**3**	**6**	**111**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**
East Eddy Group - Soil and Wasterock																										
EE-S-1-0.5	6/22/2007	0.5	81.3	6.4	0.4 B	NA	NC	59.4	< 0.2	0.69	10	20	27,700	14.60	694	< 0.04	10	0.27 B	0.35	69	NA	NA	NA	NA	NA	NA
EE-WRA1-1-0.5	6/22/2007	0.5	78.5	6.6	< 0.2 B	NA	NC	17.3	0.5 B	0.42	43	58	37,700	2.93	1,520	< 0.03	90	0.21 B	0.24	55	NA	NA	NA	NA	NA	NA
EE-WRA1-2-0.5	6/22/2007	0.5	88.3	6.1	0.7 B	NA	NC	101.0	0.3 B	3.29	18	54	32,700	16.20	3,060	0.05 B	14	0.31	1.44	137	NA	NA	NA	NA	NA	NA
EE-WRA1-3-0.5	6/22/2007	0.5	87.5	7.5	0.3 B	NA	NC	326.0	0.3 B	2.21	14	28	43,700	5.39	1,910	0.25	3 B	0.65	0.77	225	1.54	1.37	< 0.01	48	41	-7
EE-WRA1-4-0.5	6/22/2007	0.5	88.1	7.8	0.3 B	NA	NC	24.3	< 0.2	0.26 B	4 B	17	18,900	7.68	760	< 0.03	2 B	0.54	0.41	52	NA	NA	NA	NA	NA	NA
EE-WRA1-5-0.5	6/22/2007	0.5	88.3	7.9	< 0.2	NA	NC	51.2	0.6 B	0.20 B	7	12	36,300	1.58	1,630	0.31	2 B	0.49	0.23	159	NA	NA	NA	NA	NA	NA
EE-WRA2-1-0.5	6/22/2007	0.5	77.2	6.4	< 0.2	NA	NC	2.3	0.3 B	0.55	3 B	15	6,520	2.45	71.5	< 0.05	4 B	0.27 B	0.14	17	NA	NA	NA	NA	NA	NA
EE-WRA3-1-0.5	6/22/2007	0.5	86	5.8	2.3	NA	NC	88.4	0.3 B	0.71	7	17	22,000	13.90	693	0.07 B	4 B	0.32	1.21	75	< 0.01	< 0.01	< 0.01	0	7	7
EE-WRA3-2-0.5	6/22/2007	0.5	89.8	6.2	2.2	NA	NC	35.8	0.3 B	0.69	14	13	30,100	12.90	829	0.05 B	6	0.23 B	1.29	98	NA	NA	NA	NA	NA	NA
EE-WRA3-3-0.5	6/22/2007	0.5	93	7.0	1.3	NA	NC	34.6	< 0.2	0.55	9	9	23,100	7.62	623	0.14 B	5	0.24 B	0.59	82	NA	NA	NA	NA	NA	NA
		Mean	**85.8**	**6.8**	**0.8**	**NC**	**NC**	**74.0**	**0.3**	**1.0**	**13**	**24**	**27,872**	**8.53**	**1,179**	**0.09**	**14**	**0.35**	**0.67**	**97**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**
New York Mine - Upper Area - Soil and Wasterock																										
NY-S-1-0.5'	6/19/2007	0.5	83.1	4.9	30 B	NA	NC	1,680	0.4 B	0.78	49	28	38,900	18.00	542	1.82 B	18	3.43	1.93	80	NA	NA	NA	NA	NA	NA
NY-S-4-0.5'	6/19/2007	0.5	76.0	6.0	53	NA	NC	2,530	0.7 B	1.35	21	91	35,900	14.70	1,750	0.13 B	42	1.47	1.09	131	NA	NA	NA	NA	NA	NA
NY-S-6-0.5'	6/20/2007	0.5	81.2	7.7	5.0	1.81 N	496.2	498	0.5 B	0.79	32	57	39,000	9.11	1,540	1.06	32	1.07	0.65	100	0.17	0.11	0.02 B	5	108	103
		Mean	**80.1**	**6.2**	**29.3**	**NC**	**NC**	**1569.3**	**0.5**	**1.0**	**34.0**	**58.7**	**37,933**	**13.9**	**1277**	**1.0**	**30.7**	**2.0**	**1.2**	**103.7**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**
New York Mine - Lower Area - Wasterock																										
NY-WRA2-1-0.5'	6/20/2007	0.5	87.7	6.7	0.4 B	NA	NC	8.9	0.6 B	0.72	6	99	58,600	4.95	1,190	0.09 B	15	2.07	0.15	103	NA	NA	NA	NA	NA	NA
NY-WRA2-2-0.5'	6/19/2007	0.5	90.6	7.6	3 B	0.52 J	261.5	262	0.7 B	2.26	45	69	34,000	29.00	1,090	0.97	42	2.69	0.73	315	0.88	0.64	0.15	28	88	61
NY-WRA3-1-0.5'	6/20/2007	0.5	79.9	4.0	11	2.04 J	834.0	836	< 0.2	0.10	46	27	48,200	10.40	120	2.31	12	2.14	0.87	41	0.78	0.07 B	0.64	24	9	-15
NY-WRA3-2-0.5'	6/20/2007	0.5	91.5	7.6	1.3	NA	NC	94.4	0.7 B	0.54 B	74	86	50,000	10.50	1,280	0.22	42	1.74	0.39	111	NA	NA	NA	NA	NA	NA
NY-WRA5-2-0.5'	6/20/2007	0.5	91.2	3.8	< 0.2	NA	NC	< 0.3	< 0.2	0.09 B	34	8	12,300	8.88	4.5	1.13	7	8.30	0.80	12	NA	NA	NA	NA	NA	NA
NY-WRM-WR1-1-0.5'	6/20/2007	0.5	86.0	7.1	11	1.77 J	747.2	749	0.5 B	0.56	44	63	47,900	10.20	974	3.10	32	2.50	1.19	92	1.09	0.79	0.21	34	87	53
NY-WRM-WR1-3-0.5'	6/20/2007	0.5	89.4	7.4	8.9	NA	NC	590	0.6 B	0.85	54	72	63,800	15.10	1,190	1.06	40	2.50	1.20	150	NA	NA	NA	NA	NA	NA
NY-WRM-WR2-1-0.5'	6/20/2007	0.5	86.4	7.9	14	2.52 J	1,797.5	1,800	0.5 B	0.59	41	44	38,800	16.60	1,670	0.90	33	2.59	2.41	112	1.23	1.16	< 0.01	38	349	311
NY-WRM-WR2-3-0.5'	6/20/2007	0.5	88.4	7.9	5 B	NA	NC	586	0.6 B	0.47	67	38	36,800	13.80	1,120	0.92	66	4.15	1.49	92	NA	NA	NA	NA	NA	NA
NY-WRM-WR2-5-0.5'	6/20/2007	0.5	88.2	3.7	4.1	NA	NC	16.0	< 0.2	0.19 B	33	23	28,900	22.40	72.9	0.94	8	26.00	2.31	50	NA	NA	NA	NA	NA	NA
NY-MILL-WR3-1-0.5'	6/20/2007	0.5	86.3	3.8	0.5 B	NA	NC	9.2	0.7 B	0.70	29	118	44,500	11.90	855	0.04 B	29	5.47	0.32	130	NA	NA	NA	NA	NA	NA
NY-MILL-WR4-1-0.5'	6/20/2007	0.5	86.3	6.2	1.7	NA	NC	95.0	0.7 B	0.53	22	65	47,700	15.50	975	0.10	19	3.08	0.80	92	NA	NA	NA	NA	NA	NA
		Mean	**87.7**	**6.1**	**5.1**	**1.71**	**910**	**420.6**	**0.5**	**0.6**	**41.3**	**59.3**	**42,625**	**14.1**	**878.5**	**1.0**	**28.8**	**5.3**	**1.1**	**108.3**	**1.00**	**0.67**	**0.25**	**NC**	**NC**	**NC**
New York Mine - Lower Area - Tailings																										
NY-MILL-TP1-1-0.5'	6/20/2007	0.5	72.5	7.6	10 B	NA	NC	700	0.6 B	3.08	43	99	53,800	97.90	2,470	1.54	47	1.68	1.07	779	NA	NA	NA	NA	NA	NA
NY-MILL-TP1-1-2.5'	6/20/2007	2.5	79.5	7.8	10 B	NA	NC	850	0.5 B	2.48	35	71	51,300	53.70	2,930	1.64	46	2.20	2.22	516	NA	NA	NA	NA	NA	NA
NY-MILL-TP1-2-0.5'	6/20/2007	0.5	85.5	8.0	20 B	3.0	2,327	2,330	0.7 B	3.20	42	102	90,600	105	4,990	3.83	59	6.79	3.36	1,220	0.16	0.06 B	0.03 B	5	91	86
NY-MILL-TP1-2-4.5'	6/20/2007	4.5	80.4	7.9	10 B	NA	NC	1,210	0.5 B	2.86	37	81	67,300	76.60	4,090	2.00	41	2.27	1.70	567	NA	NA	NA	NA	NA	NA
NY-MILL-TP2-1-0.5'	6/20/2007	0.5	74.5	5.5	10	NA	NC	637	1.0 B	18.30	64	302	102,000	21.60	1,730	2.07	140	3.82	1.46	560	NA	NA	NA	NA	NA	NA
NY-MILL-TP2-1-1.5'	6/20/2007	1.5	87.4	7.1	2.5	NA	NC	166	0.3 B	1.83	16	27	27,100	6.95	702	0.25	31	0.60	0.55	252	NA	NA	NA	NA	NA	NA
		Mean	**80.0**	**7.3**	**10.4**	**3.0**	**2327.0**	**982.2**	**0.6**	**5.3**	**39.5**	**113.7**	**65,350**	**60.3**	**2818.7**	**1.9**	**60.7**	**2.9**	**1.7**	**649.0**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**
Standards																										
OR - Ecological Receptors (p=plant, i=invertebrate, b =birds, m = mammals)[1]					5 p	10 p	NS	NS	10 p	4 p	NS	50 i	NS	16 b	100 i	0.1 i	30 p	1 p	2 p	50 p	NS	NS	NS	NS	NS	NS
EPA Indust. PRGs - Human Receptors2					410	NS	NS	1.6	1,900	7.4	64	41,000	100,000	800	19,000	310	20,000	5,100	5,100	100,000	NS	NS	NS	NS	NS	NS
EPA - Ecological Receptors (m=mammal, b=bird, i = invertebrate,					21 m	NS	NS	37 p	NS	29 p	5 p	61 i	NS	NS	NS	NS	NS	NS	NS	120 i	NS	NS	NS	NS	NS	NS
ORNL - Ecological Receptors[4]					5	NS	NS	9.9	10	4	0.4	60	NS	40.5	NS	0.00051	30	0.21	2	8.5	NS	NS	NS	NS	NS	NS

NOTES:
All analyses except Arsenic III & Methyl Mercury were conducted by ACZ Laboratories, Inc., Steamboat Springs, CO per EPA Method 200 series
Arsenic III and Low-Level Mercury analyses were conducted by Brooks Rand, Seattle, WA per EPA Methods 1631 & 1632, respectively
C = Arsenic V was calculated from difference between Arsenic, TR and Arsenic III
B = analyte detected between MDL and practical quantification limit (PQL)
Shaded values indicate that the value exceeds one or more standard; exceeded criteria also shaded
mg/kg = milligrams per kilogram; NC= not collected; NA = not analyzed
su = standard units

STANDARDS NOTES:
1 - State of Oregon, Level II Ecological Screening Level Values for Soil (ODEQ, 2001); dominantly based on soluble salts
2 - EPA Region 9 Industrial Preliminary Remediation Goals - (EPA, 2004).
3 - EPA Ecological Soil Screening Levels - Lowest Criteria Listed (EPA, 2000)
4 - ORNL = Oak Ridge National Laboratory Preliminary Remediation Goals for Ecological Endpoints August 1997
NS = Not standard

Table 6. Synthetic Precipitation Leaching Procedure and Toxicity Characterization Leaching Procedure Results for Soil and Waste Material Samples
New York Mine Complex Site Inspection, Umatilla and Wallowa-Whitman National Forest, Oregon

Sample ID	Sample Date	Sample Depth (feet)	SPLP Arsenic	TCLP Arsenic	SPLP Barium	TCLP Barium	SPLP Cadmium	TCLP Cadmium	SPLP Chromium	TCLP Chromium	SPLP Lead	TCLP Lead	SPLP Mercury	TCLP Mercury	SPLP Selenium	TCLP Selenium	SPLP Silver	TCLP Silver
			mg/L															
Independence Mill - Soil, Wasterock, Ore, and Tailings																		
IM-TP1-1-0.5'	6/20/2007	0.5	< 0.04	< 0.04	0.332	0.564	< 0.005	< 0.006 B	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.01	< 0.01
IM-WR1-1-0.5'	6/20/2007	0.5	< 0.04	0.06 B	0.226	0.454	< 0.005	< 0.005	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.01	< 0.01
IM-WR3-1-0.5'	6/20/2007	0.5	< 0.04	< 0.04	0.266	1.320	< 0.005	0.010 B	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.01	< 0.01
IM-S-7-0.5'	6/21/2007	0.5	< 0.04	< 0.04	0.139	1.530	< 0.005	0.007 B	< 0.01	< 0.01	3.32	43.9	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.01	< 0.01
East Eddie Group - Soil and Wasterock																		
EE-WRA1-3-0.5	6/22/2007	0.5	< 0.04	< 0.04	0.004 B	0.173	< 0.005	0.014 B	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.01	< 0.01
EE-WRA3-1-0.5	6/22/2007	0.5	< 0.04	< 0.04	0.556	0.920	< 0.005	< 0.005	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.01	< 0.01
New York Mine - Wasterock and Tailings																		
NY-S-6-0.5'	6/20/2007	0.5	0.05 B	< 0.04	0.177	0.736	< 0.005	< 0.005	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.01	< 0.01
NY-WRAZ-1-0.5'	6/20/2007	0.5	< 0.04	< 0.04	0.036	0.136	< 0.005	< 0.005	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.01	< 0.01
NY-WRAZ-2-0.5'	6/19/2007	0.5	< 0.04	< 0.04	0.020	0.690	< 0.005	0.014 B	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.01	< 0.01
NY-WRM-WR1-1-0.5'	6/20/2007	0.5	< 0.04	< 0.04	0.016	0.216	< 0.005	< 0.005	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.01	< 0.01
NY-WRM-WR2-1-0.5'	6/20/2007	0.5	< 0.04	< 0.04	0.008	0.234	< 0.005	< 0.005	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.01	< 0.01
NY-MILL-TP1-2-0.5'	6/20/2007	0.5	0.050 B	< 0.04	< 0.003	0.026	< 0.005	< 0.005	< 0.01	< 0.01	< 0.04	< 0.04	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.01	< 0.01
Applicable Standards																		
RCRA TCLP Disposal Limits			5	5	100	100	1	1	5	5	5	5	0.2	0.2	1	1	5	5

NOTES: All analyses were performed by ACZ Laboratories, Inc., Steamboat Springs, CO per EPA Method 6000 series
Shaded values indicate that the value exceeds one or more standard; exceeded criteria also shaded
NA = Not analyzed
mg/L = Milligrams per liter
< value = Analyte not detected above Method Detection Limit (MDL, shown)
B = Analyte detected between MDL and Practical Quantification Limit (PQL, not shown)
RCRA = Resource Conservation and Recovery Act

Table 7. Soil and Waste Material Laboratory and Niton XRF Analytical Results for Arsenic, Lead, and Zinc
New York Mine Complex Site Inspection, Wallowa-Whitman and Umatilla National Forest, Oregon

Sample ID	Sample Date	Sample Depth (feet)	Arsenic, Total - Lab	Arsenic, Total - XRF	RPD - Arsenic (Lab/XRF)	Lead, Total - Lab	Lead, Total - XRF	RPD - Lead (Lab/XRF)	Zinc, Total - Lab	Zinc, Total - XRF	RPD - Zinc (Lab/XRF)
			mg/kg	ppm	%	mg/kg	ppm	%	mg/kg	ppm	%
Independence Mill											
IM-S-1	6/21/2007	0.5	284	161	55%	12.90	< 12.5	3%	65	32.9	66%
IM-S-2	6/21/2007	0.5	3,720	2,480	40%	28.90	14.7	65%	31	27.7	11%
IM-S-3	6/21/2007	0.5	980	2,253	79%	68.30	44.1	43%	33	< 22.0	40%
IM-S-4	6/21/2007	0.5	640	323	66%	108	22.2	132%	475	< 12.3	190%
IM-S-5	6/21/2007	0.5	16,180	951	178%	18	64.4	113%	80	272.7	109%
IM-S-6	6/21/2007	0.5	NA	162.7	NC	NA	40.4	NC	NA	1,055	NC
IM-S-7	6/21/2007	0.5	34.3	131.5	117%	16,100	4485	113%	70	128.9	59%
IM-WR1-1	6/20/2007	0.5	2,910	2349	21%	27.80	22.6	21%	44	59.1	29%
IM-WR2-1	6/20/2007	0.5	NA	16.9	NC	NA	< 6.8	NC	NA	82.1	NC
IM-WR3-1	6/20/2007	0.5	385	427	10%	158	104.7	41%	90	94.7	5%
IM-TP1-1	6/20/2007	0.5	2,090	1,284	48%	151	103.7	37%	187	148.5	23%
New York Mine Wasterock											
NY-S-1	6/19/2007	0.5	1,680	389	125%	18.00	9.2	65%	80	33.2	83%
NY-S-2	6/19/2007	0.5	NA	197.1	NC	NA	9.9	NC	NA	87.7	NC
NY-S-3	6/19/2007	0.5	NA	220.8	NC	NA	11.1	NC	NA	62.4	NC
NY-S-4	6/19/2007	0.5	2,530	134	180%	14.70	< 7.9	60%	131	109.5	18%
NY-S-5	6/19/2007	0.5	NA	222.8	NC	NA	< 7.5	NC	NA	60.5	60.5
NY-S-6	6/20/2007	0.5	498	418	17%	9.11	8.2	11%	100	105.6	5%
NY-S-7	6/20/2007	0.5	NA	206	NC	NA	13.4	NC	NA	40.7	NC
NY-WRA2-1	6/20/2007	0.5	8.9	< 5.6	46%	4.95	8.0	47%	103	49.6	70%
NY-WRA2-2	6/19/2007	0.5	262	207	23%	29.0	7.7	116%	315	357	13%
NY-WRA3-1	6/20/2007	0.5	836	636.4	27%	10.4	< 7.5	32%	41	< 16	88%
NY-WRA3-2	6/20/2007	0.5	94.4	63.5	39%	10.5	< 6.7	44%	111	92.5	18%
NY-WRA3-3	6/20/2007	0.5	NA	16.0	NC	NA	< 7.0	NC	NA	78	NC
NY-WRA5-1	6/20/2007	0.5	NA	10.5	NC	NA	7.0	NC	NA	19.7	NC
NY-WRA5-2	6/20/2007	0.5	< 0.3	6.5	182%	8.88	< 6.5	31%	12	< 11.1	8%
NY-WRA5-3	6/20/2007	0.5	NA	11.5	NC	NA	< 6.5	NC	NA	< 10.3	NC
NY-WRM-WR1-1	6/20/2007	0.5	749	478	44%	10.20	10.5	3%	92	53.2	53%
NY-WRM-WR1-2	6/20/2007	0.5	NA	465.4	NC	NA	< 7.4	NC	NA	77.7	NC
NY-WRM-WR1-3	6/20/2007	0.5	590	287.1	69%	15.10	15.2	1%	150	99.1	41%
NY-WRM-WR2-1	6/20/2007	0.5	1,800	948	62%	16.60	8.8	61%	112	85.6	27%
NY-WRM-WR2-2	6/20/2007	0.5	NA	864	NC	NA	9.6	NC	NA	99.8	NC
NY-WRM-WR2-3	6/20/2007	0.5	586	471	22%	13.80	11.2	21%	92	73.2	23%
NY-WRM-WR2-4	6/20/2007	0.5	NA	93	NC	NA	8.9	NC	NA	25.8	NC
NY-WRM-WR2-5	6/20/2007	0.5	16.0	15.2	5%	22.40	7.8	97%	50	22.7	75%
NY-MILL-WR3-1	6/20/2007	0.5	9.2	12.1	27%	11.90	< 7.1	51%	130	98.4	28%
NY-MILL-WR4-1	6/20/2007	0.5	95.0	115.2	19%	15.50	9.6	47%	92	57.6	46%
New York Mine Tailings											
NY-MILL-TP1-1	6/20/2007	0.5	700	477	38%	97.90	58.7	50%	779	453	53%
NY-MILL-TP1-1	6/20/2007	2.5	850	431	65%	53.70	20.1	91%	516	356	37%
NY-MILL-TP1-2	6/20/2007	0.5	2,330	1,747	29%	105	61.7	52%	1,220	764	46%
NY-MILL-TP1-2	6/20/2007	4.5	1,210	916	28%	76.60	44.8	52%	567	410	32%
NY-MILL-TP1-3	6/20/2007	0.5	NA	1,180	NC	NA	61.5	NC	NA	793	NC
NY-MILL-TP2-1	6/20/2007	0.5	637	359	56%	21.60	10.5	69%	560	166	109%
NY-MILL-TP2-1	6/20/2007	1.5	166	77.5	73%	6.95	8.8	23%	252	277.4	10%
NY-MILL-TP2-2	6/20/2007	0.5	NA	657.3	NC	NA	23.0	NC	NA	473.5	NC
Standards											
OR - Ecological Receptors (p=plant, i=invertebrate, b =birds, m =			NS	NS	NA	16 b	16 b	NA	50 p	50 p	NA
EPA Indust. PRGs - Human Receptors[2]			1.6	1.6	NA	800	800	NA	100,000	100,000	NA
EPA - Ecological Receptors (m=mammal, b=bird, i =			37 p	37 p	NA	NS	NS	NA	120 i	120 i	NA
ORNL - Ecological Receptors[4]			9.9	9.9	NA	40.5	40.5	NA	8.5	8.5	NA

NOTES:
All analyses conducted by ACZ Laboratories, Inc., Steamboat Springs, CO per EPA Method 200 series.
XRF analyses conducted by CES in Granite.
RPD - Relative Percent Difference
mg/kg - milligrams per kilogram
ppm - parts per million

STANDARDS NOTES:
1 - State of Oregon, Level II Ecological Screening Level Values for Soil (ODEQ, 2001); dominantly based on soluble salts.
2 - EPA Region 9 Industrial Preliminary Remediation Goals - (EPA, 2004).
3 - EPA Ecological Soil Screening Levels - Lowest Criteria Listed (EPA, 2000).
4 - ORNL = Oak Ridge National Laboratory Preliminary Remediation Goals for Ecological Endpoints August 1997.
NS = Not standard

Table 8. Summary of Contaminants of Potential Ecological Concern
New York Mine Complex Site Inspection, Umatilla and Wallowa-Whitman National Forest, Oregon

Analyte	Soil/Waste Material	Surface Water	Sediment	Pore Water
Antimony	P, B	B	-	-
Arsenic III	P, B, M	B, M	-	B, M
Arsenic, V	P, I, B, M	B, M	-	-
Arsenic	P, I, B, M	A, B, M	I, B, M	-
Cadmium	B, M	B, M	I, B, M	-
Iron	P, I	A	I, B, M	-
Lead	P, I, B, M	B, M	B, M	-
Manganese	P, I	A	I, B, M	A
Mercury	P, I, B, M	B, M	I, B, M	B, M
Methyl Mercury	-	-	-	A
Selenium	P, B, M	B, M	-	B, M
Silver	P	-	-	-
Zinc	P, B	-	I, B, M	-

NOTES:

A = Aquatic Life

B = Birds

I = invertebrates

M = Mammals

P = plants

Table 9. Summary of Human and Ecological Contaminants of Potential Concern
New York Mine Complex Site Inspection, Umatilla and Wallowa-Whitman National Forest, Oregon

Analyte	Soil/Waste Material		Surface Water		Sediment		Groundwater (Human)/ Pore Water (Ecological)	
	Human	Ecological	Human	Ecological	Human	Ecological	Human	Ecological
Antimony	-	X	-	-	-	-	-	-
Arsenic III	-	X	-	X[1]	-	-	-	X[1]
Arsenic, V	-	X	-	X[1]	-	-	-	-
Arsenic	X	X	X	X[1]	X	X	-	-
Cadmium	-	-	-	X[2]	-	X	-	-
Iron	-	X	-	X	-	X[1]	-	-
Lead	X	X	-	X[1]	-	X	-	-
Manganese	-	X	-	X	-	X[1]	-	X
Mercury	-	X	-	X[1]	-	X	-	X[1]
Methyl mercury	-	-	-	-	-	X[1,2]	-	X[1, 2]
Selenium	-	X	-	X[1]	-	-	-	X[1]
Silver	-	X	-	-	-	-	-	-
Zinc	-	X	-	-	-	X	-	-

NOTES:
1 - Identified as a Contaminant of Potential Concern/Contaminant of Potential Ecological Concern due solely to a lack of risk-based screening concentrations.
2 - Identified as a Contaminant of Potential Ecological Concern based on its bioaccumulative potential only.

FIGURES

Plate 1. **New York and East Eddy Group Watershed Boundary with 1- and 4-mile radius**
Figure 1. **Aquatic Sampling Stations**
Figure 2. **Background Soil and East Eddy Group Sampling Locations**
Figure 3. **Site Layout and Sampling Locations, New York Mine – Upper Workings**
Figure 4. **Site Layout and Sampling Locations, New York Mine – Lower Workings**
Figure 5. **Site Layout and Sampling Locations, East Eddy Group**
Figure 6. **Site Layout and Sampling Locations, Independence Mill**
Figure 7. **Wetlands Map New York Mine Complex**

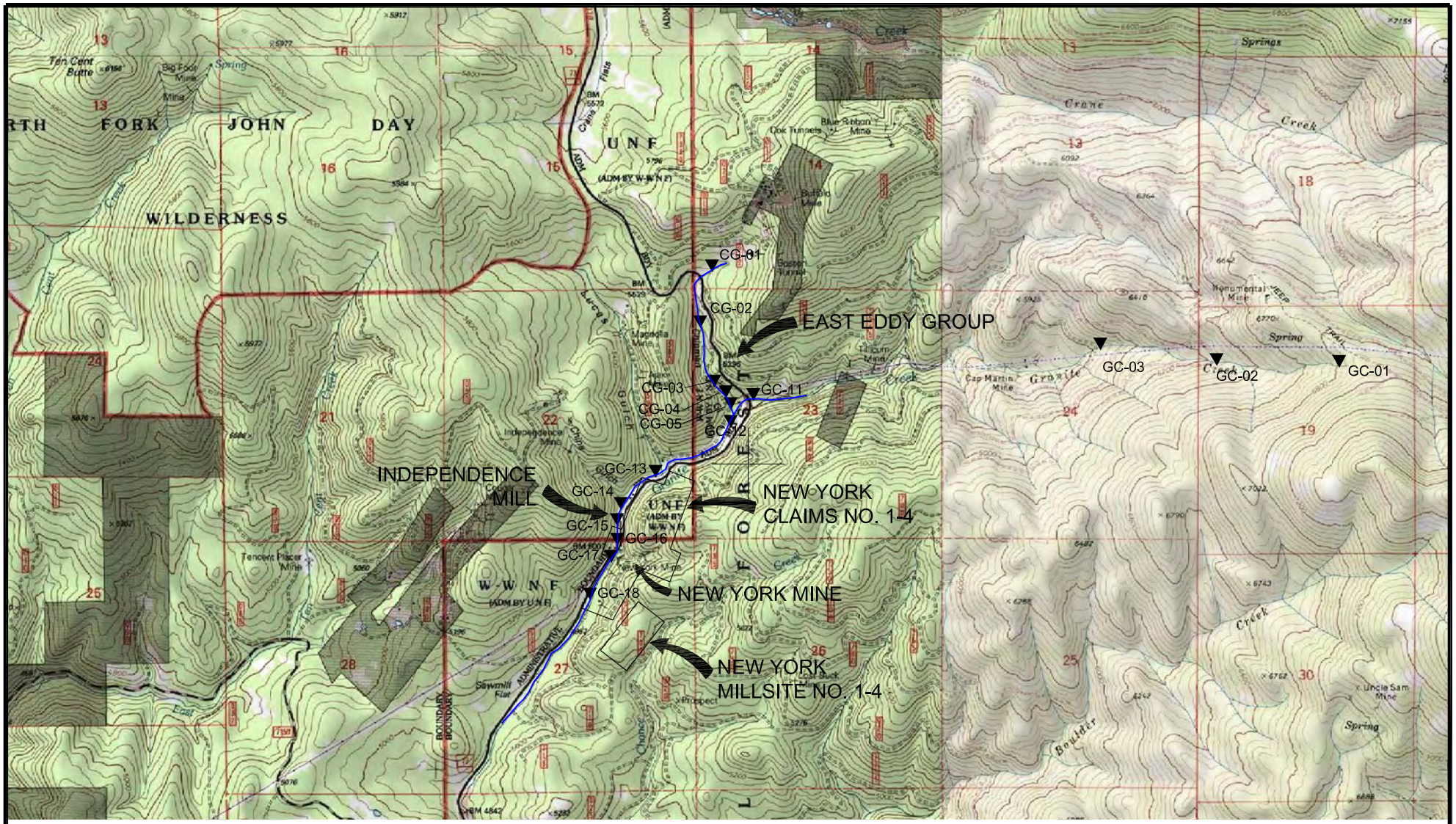


Figure 1. Aquatic Sampling Stations

LEGEND

▼ **Aquatic Sampling Station**

N

NOT TO SCALE
(LOCATIONS ARE APPROXIMATE)

CONTOUR INTERVAL = 40 FEET

PROJECT NUMBER: 2723014-003	New York Mine Complex Site Inspection
DATE: 12/13/07	
DWG BY: 3kac / DWG NO: 2723014-003F1.dwg	Wallowa-Whitman National Forest Oregon
PROJECT MANAGER: 6DGW	
REVISED:	CASCADE EARTH SCIENCES A Valmont Industries Company

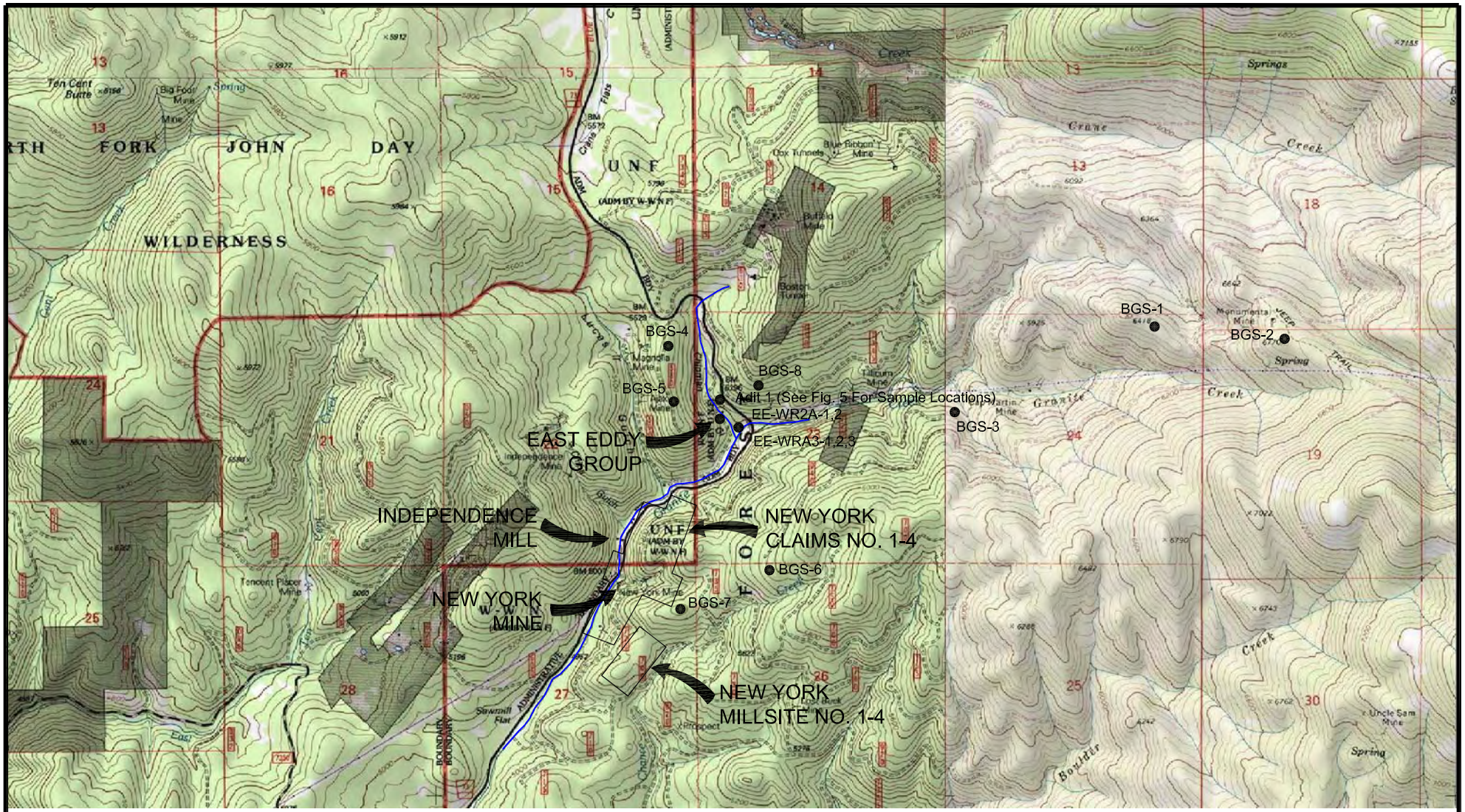


Figure 2. Background and East Eddy Group Soil Sampling Locations

LEGEND

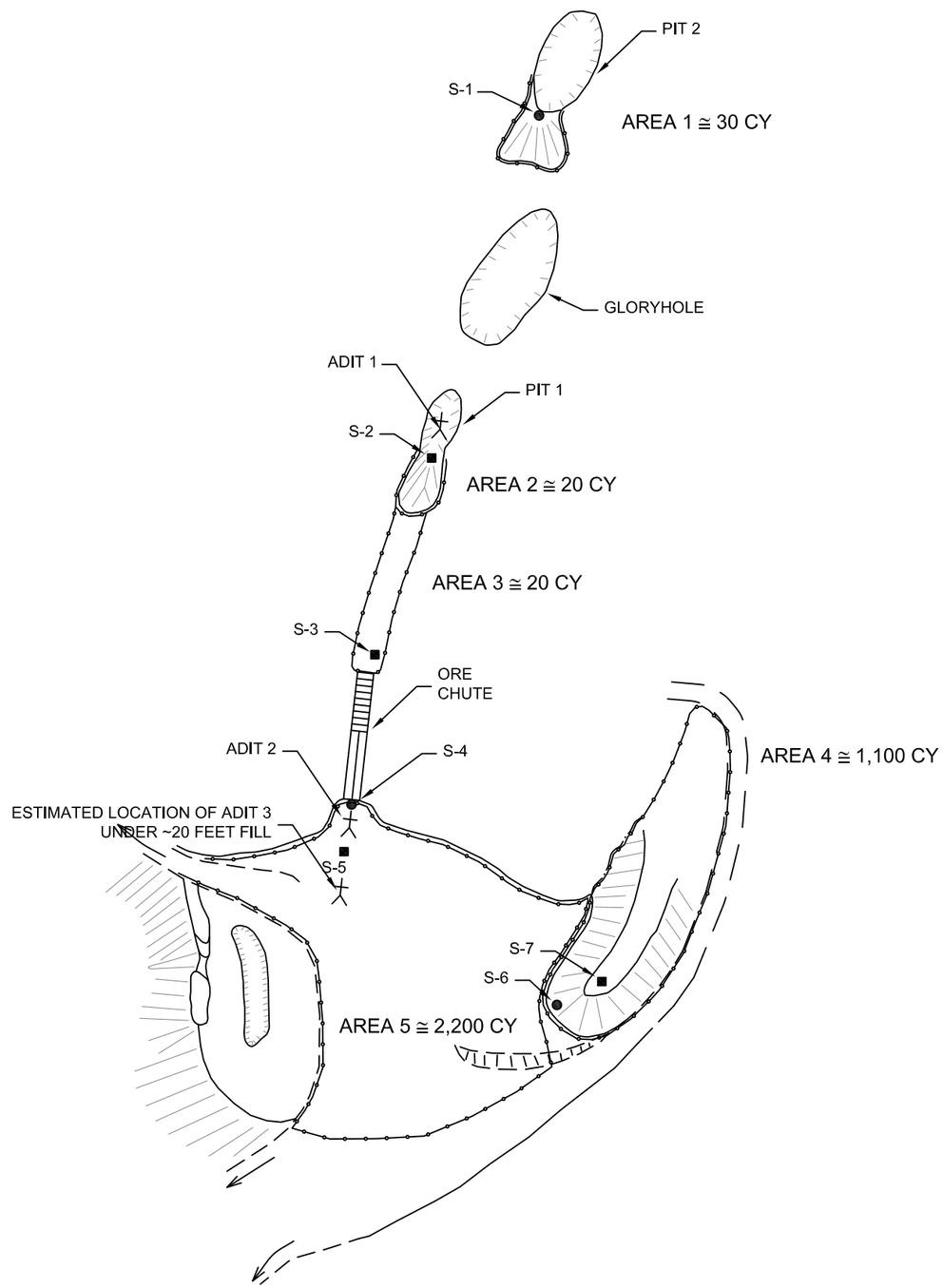
● **Soil Samples**

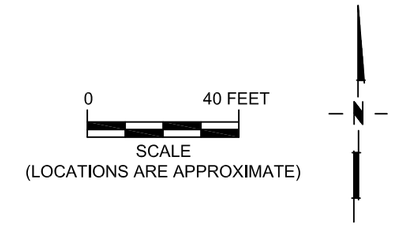
N

NOT TO SCALE
(LOCATIONS ARE APPROXIMATE)

CONTOUR INTERVAL = 40 FEET

PROJECT NUMBER: 2723014-003	New York Mine Complex Site Inspection
DATE: 12/13/07	
DWG BY: 3kac / DWG NO: 2723014-003F2.dwg	Wallowa-Whitman National Forest Oregon
PROJECT MANAGER: 6DGW	
REVISED:	CASCADE EARTH SCIENCES A Valmont Industries Company





LEGEND

- Road
- Stream
- Caved Adit
- S-1 Sample Location and ID
  S = Soil
- S-5 Niton Sample Location and ID
- Removal Area
- Depression
- Slope Lines

NOTE: NY prefix removed from sample ID on figure.

Figure 3. Site Layout and Sampling Locations
New York Mine - Upper Workings

PROJECT NUMBER: 2723014	New York Mine Complex Site Inspection
DATE: 03-19-08	
DWG BY 3KAC / DWG NO: 2723014-003F3-4.dwg	Wallowa-Whitman National Forest Oregon
PROJECT MANAGER: 6DGW	
REVISED:	CASCADE EARTH SCIENCES A Valmont Industries Company

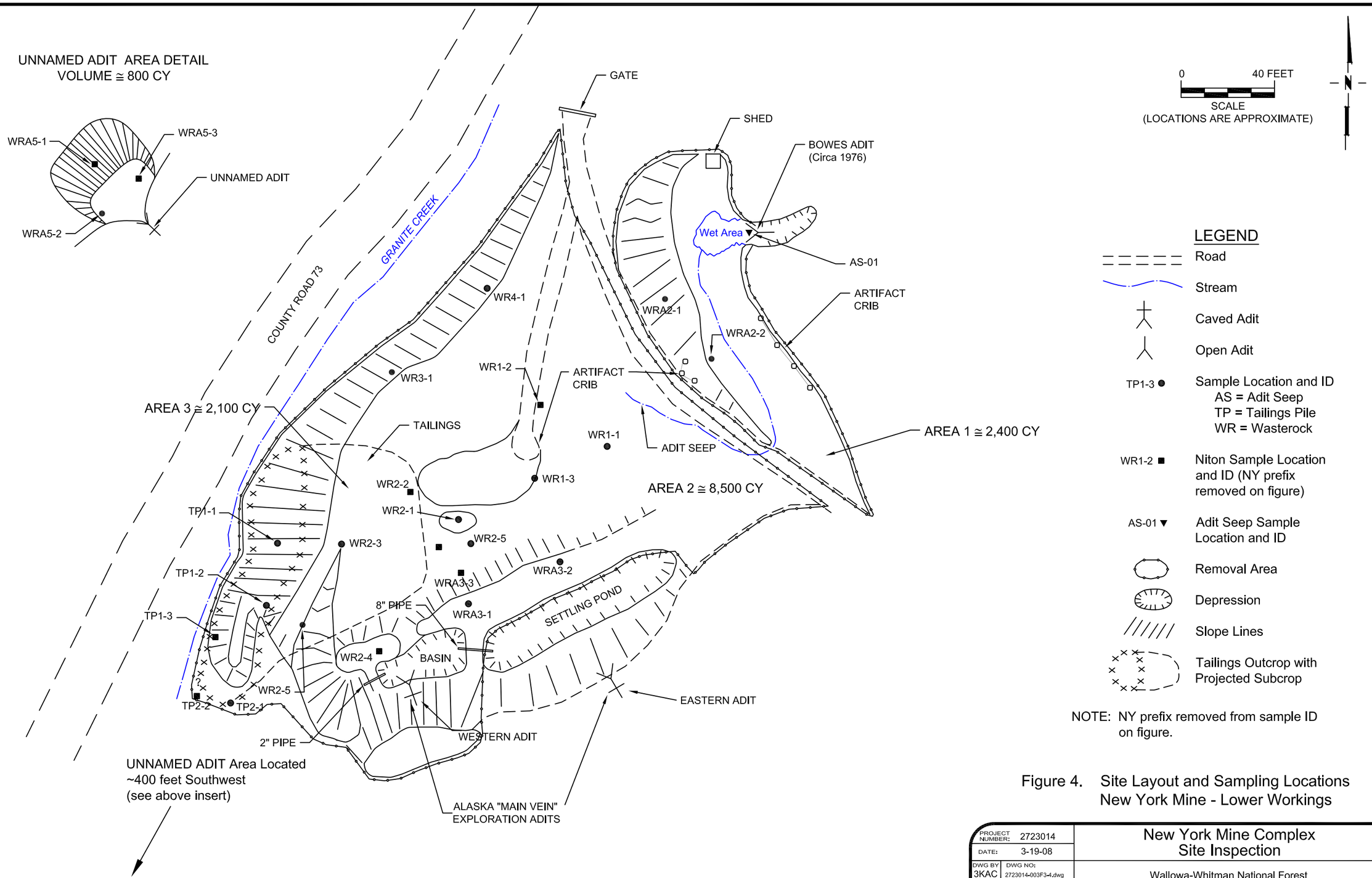


Figure 4. Site Layout and Sampling Locations
New York Mine - Lower Workings

PROJECT NUMBER: 2723014	New York Mine Complex Site Inspection
DATE: 3-19-08	
DWG BY 3KAC / DWG NO: 2723014-003F3-4.dwg	Wallowa-Whitman National Forest Oregon
PROJECT MANAGER: 6DGW	
REVISED:	CASCADE EARTH SCIENCES A Valmont Industries Company

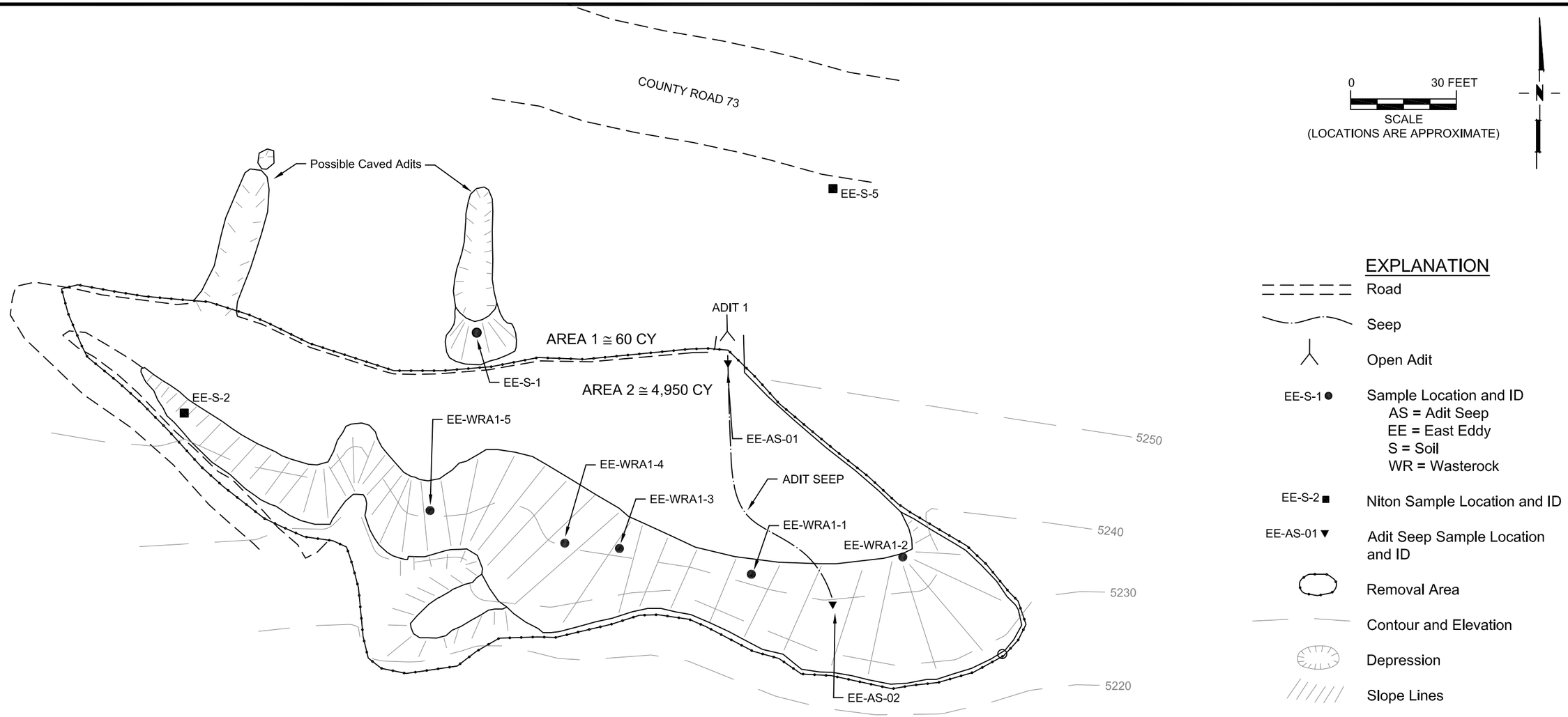


Figure 5. Site Layout and Sampling Locations
East Eddy Group Mine

PROJECT NUMBER: 2723014-003	New York Mine Complex Site Inspection
DATE: 3-19-08	
DWG BY 3KAC / DWG NO: 2723014-003F5-6.dwg	Wallowa-Whitman National Forest Oregon
PROJECT MANAGER: 6DGW	
REVISED:	CASCADE EARTH SCIENCES A Valmont Industries Company

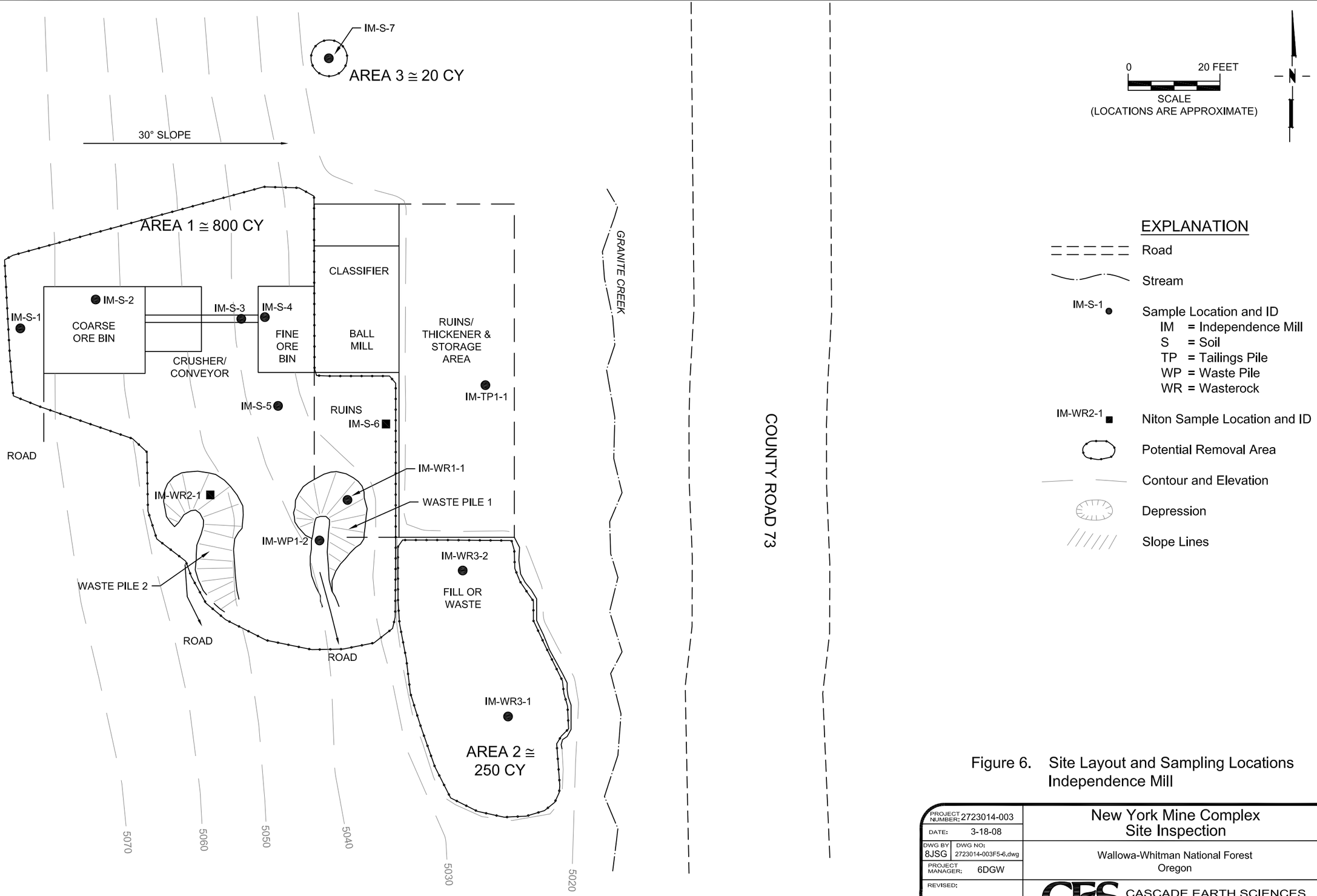
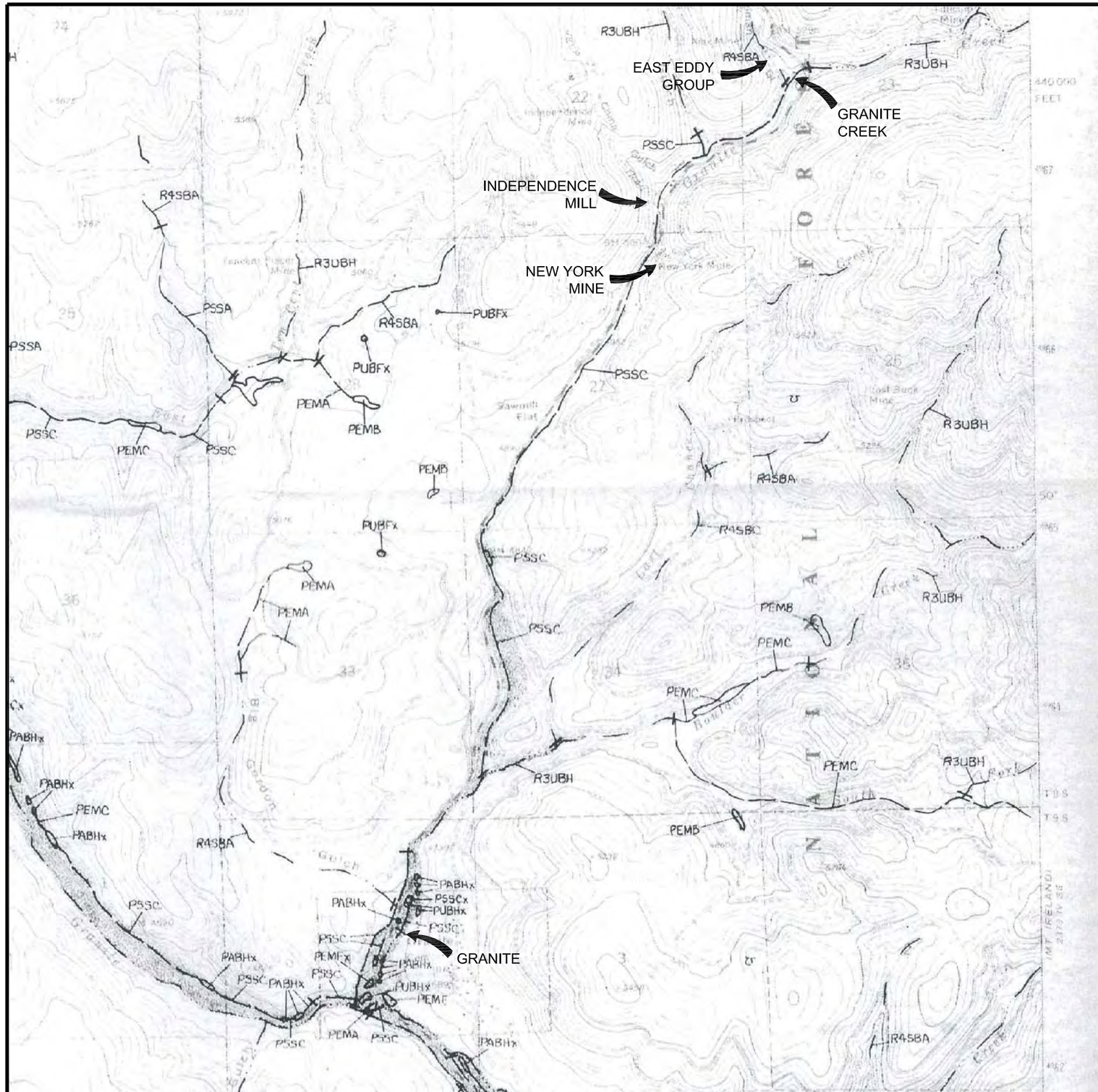


Figure 6. Site Layout and Sampling Locations
Independence Mill

PROJECT NUMBER: 2723014-003	New York Mine Complex Site Inspection
DATE: 3-18-08	
DWG BY 8JSG / DWG NO: 2723014-003F5-6.dwg	Wallowa-Whitman National Forest Oregon
PROJECT MANAGER: 6DGW	
REVISED:	CASCADE EARTH SCIENCES A Valmont Industries Company



0 2000 FEET
SCALE
(LOCATIONS ARE APPROXIMATE)

N

LEGEND

Stream

PABHx	Palustrine, Aquatic Bed, Permanently Flooded, Excavated
PEMB	Palustrine, Emergent, Saturated Wetland
PEMF	Palustrine, Emergent, Semi-permanently Flooded
PSSC	Palustrine, Scrub-Shrub, Seasonally Flooded Wetland
PUBHx	Palustrine, Unconsolidated Bottom, Permanently Flooded, Excavated
R3UBH	Riverine, Upper Perennial, Unconsolidated Bottom, Permanently Flooded Wetland
R4SBA	Riverine, Intermittent, Streambed, Temporarily Flooded Wetland

NOTE: Legend includes only those wetlands within 4 miles downstream of Site.

(Source: National Wetlands Inventory, U.S. Department of the Interior, U.S. Fish and Wildlife Service, 1994)

Figure 7. Wetlands Map New York Mine

PROJECT NUMBER: 2723014-003	New York Mine Complex Site Inspection
DATE: 9/12/07	
DWG BY: 3kac; DWG NO: 2723014-003F7.dwg	Wallowa-Whitman National Forest Oregon
PROJECT MANAGER: 6DGW	
REVISED:	CASCADE EARTH SCIENCES A Valmont Industries Company

APPENDICES

Appendix A **Photographs**
Appendix B. **New York Mine Map**
Appendix C. **Ecological Survey**
Appendix D. **Human and Ecological Risk Assessment**

Appendix A.

Photographs

Photograph 1.
New York Mine Bowes Adit (CES, June 2007).

Photograph 2.
New York Mine – Alaska Main Vein Exploration Western Adit (CES, June 2007).

Photograph 3.
Hopper and ore chute at Upper New York Mine Area (CES, June 2007).

Photograph 4.
Waste Pile in Upper New York Mine Area (CES, June 2007).

Photograph 5.
Tailings Pile at New York Mine adjacent to Granite Creek (CES, June 2007).

Photograph 6.
Settling Pond below New York Mine – Alaska Main Vein Exploration Eastern Adit (CES, June 2007).

Photograph 7.
Trenching along hillside above Upper New York Mine area (CES, June 2007).

Photograph 8.
Seep and wetland area in front of New York Mine Bowes Adit (CES, June 2007).

Photograph 9.
View north at Adit 1 (collapsed) and wasterock Upper New York Mine (CES, June 2007).

Photograph 10.
Tailing at New York Mine adjacent to Granite Creek (CES, June 2007).

Photograph 11.
View south at gloryhole in Upper New York Mine workings (CES, June 2007).

Photograph 12.
View east at East Eddy Adit 1 (CES, June 2007).

Photograph 13.
Seep from East Eddy Adit 1 (CES, June 2007).

Photograph 14.
View northeast at wasterock below East Eddy Adit 1 (CES, June 2007).

Photograph 15.
Seepage in Chipman Gulch below East Eddy Group (CES, June 2007).

Photograph 16.
View southeast at the wetland in Chipman Gulch below East Eddy Group (CES, June 2007).

Photograph 17.
Independence Mill ball mill foundations and fine ore bin (CES, June 2007).

Photograph 18.
Independence Mill base and probable clarifier foundations w/ boiler in background (CES, June 2007).

Photograph 19.
Independence Mill ruins, coarse ore bin, and probable tram deadman cables (CES, June 2007).

Photograph 20.
Independence Mill lower stockpile, ruins, and tram deadman cables (CES, June 2007).

Photograph 21.
View upstream at GC-11 (CES, June 2007).

Photograph 22.
View downstream of the culvert at GC-11 (CES, June 2007).

Photograph 23.
View northeast at station GC-12 (CES, June 2007).

Photograph 24.
View downstream, southwest, at GC-13 (CES, June 2007).

Photograph 25.
Lucas Gulch (CES, June 2007).

Photograph 26.
View upstream at GC-14 (CES, June 2007).

Photograph 27.
View downstream at GC-15 (CES, June 2007).

Photograph 28.
GC-16 (CES, June 2007).

Photograph 29.
View downstream at Station GC-17 (CES, June 2007).

Photograph 30.
View upstream at Station GC-18 (CES, June 2007).

Photograph 31.
Pond below GC-18 (CES, June 2007).

Photograph 32.
View Upstream at CG-1 (CES, June 2007).

Photograph 33.
View upstream at Station CG-2 (CES, June 2007).

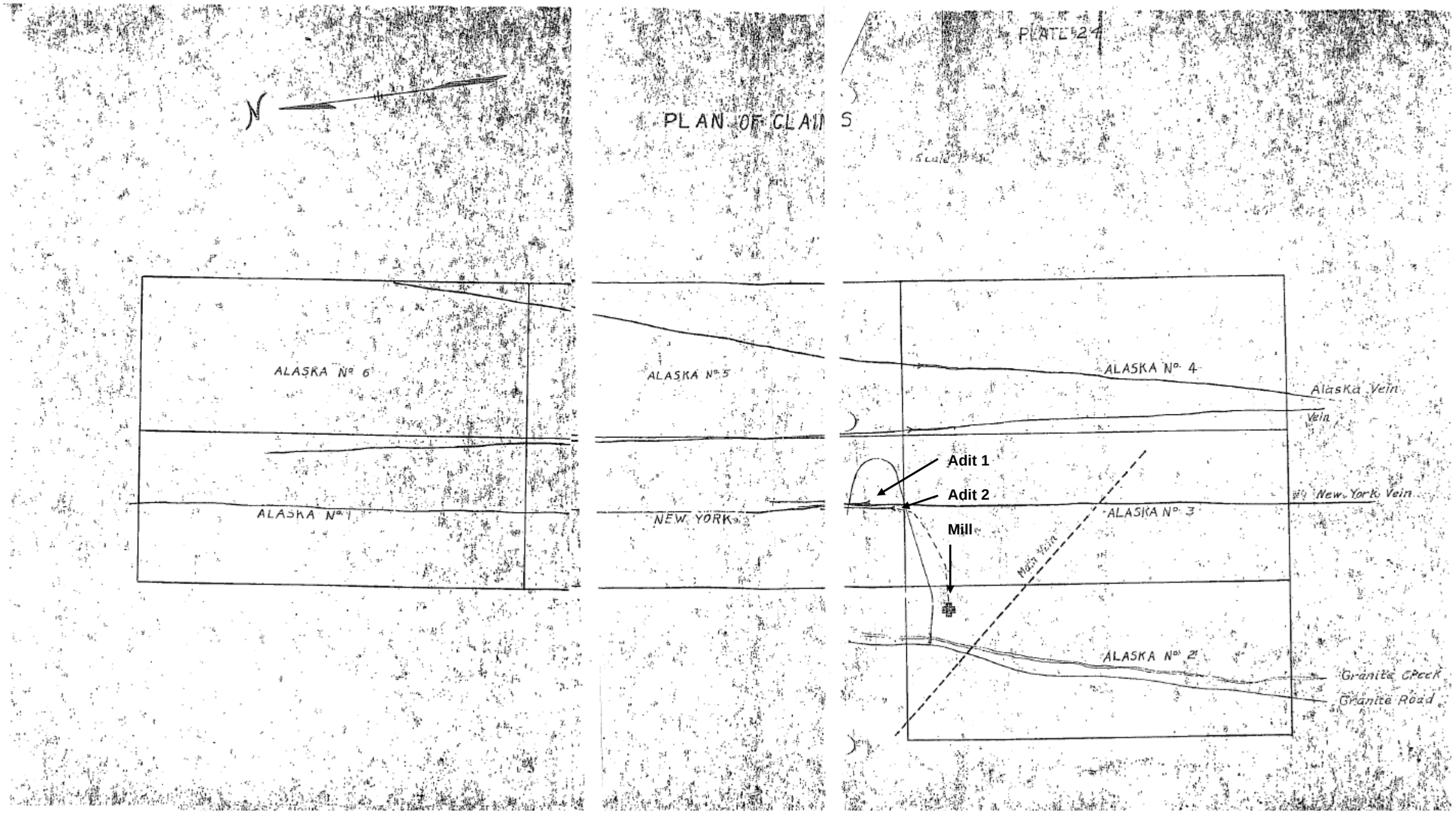
Photograph 34.
View downstream at Station CG-3 (CES, June 2007).

Photograph 35.
View upstream of Station CG-4 (CES, June 2007).

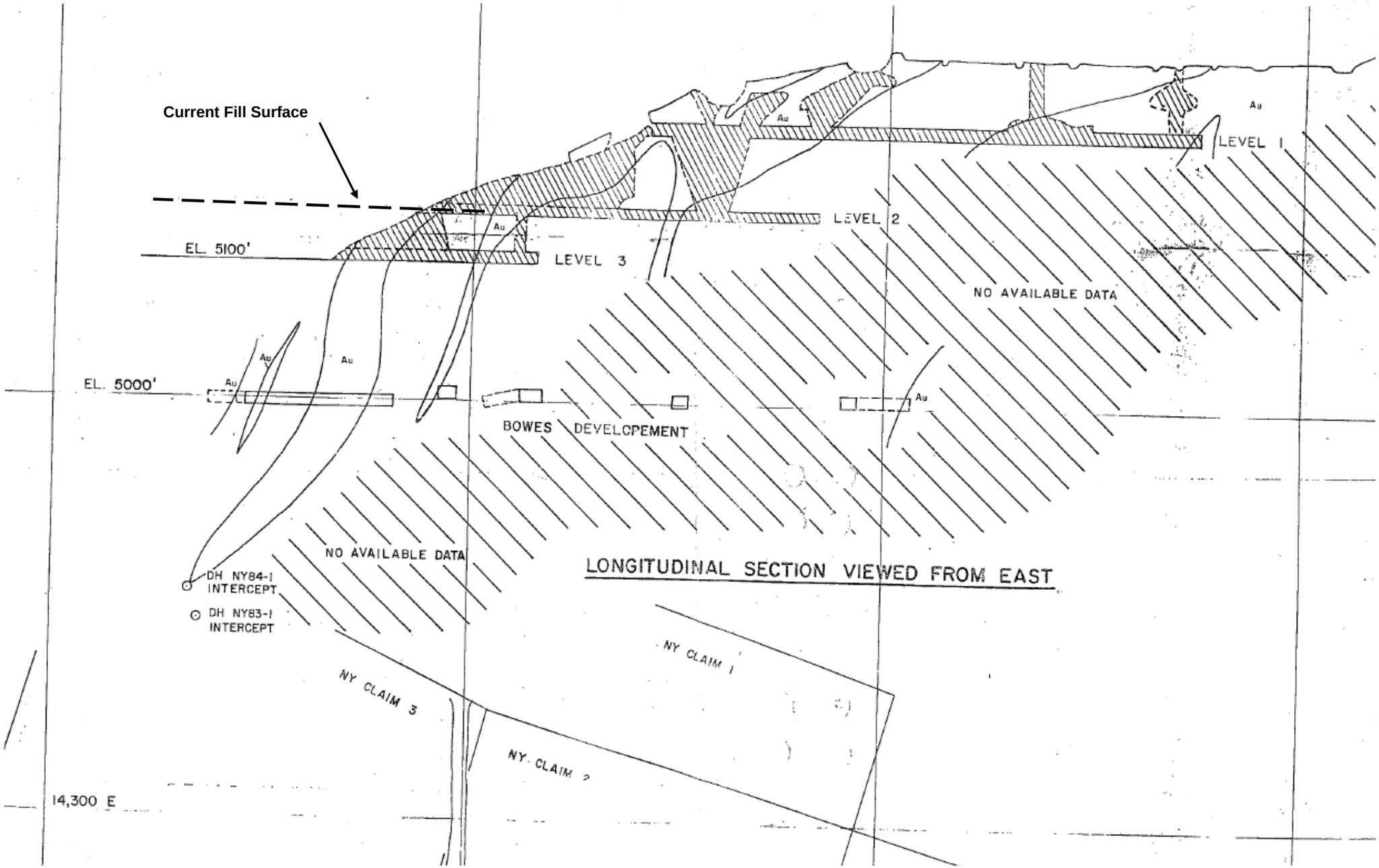
Photograph 36.
View Downstream at Station CG-5 (CES, June 2007).

Appendix B.

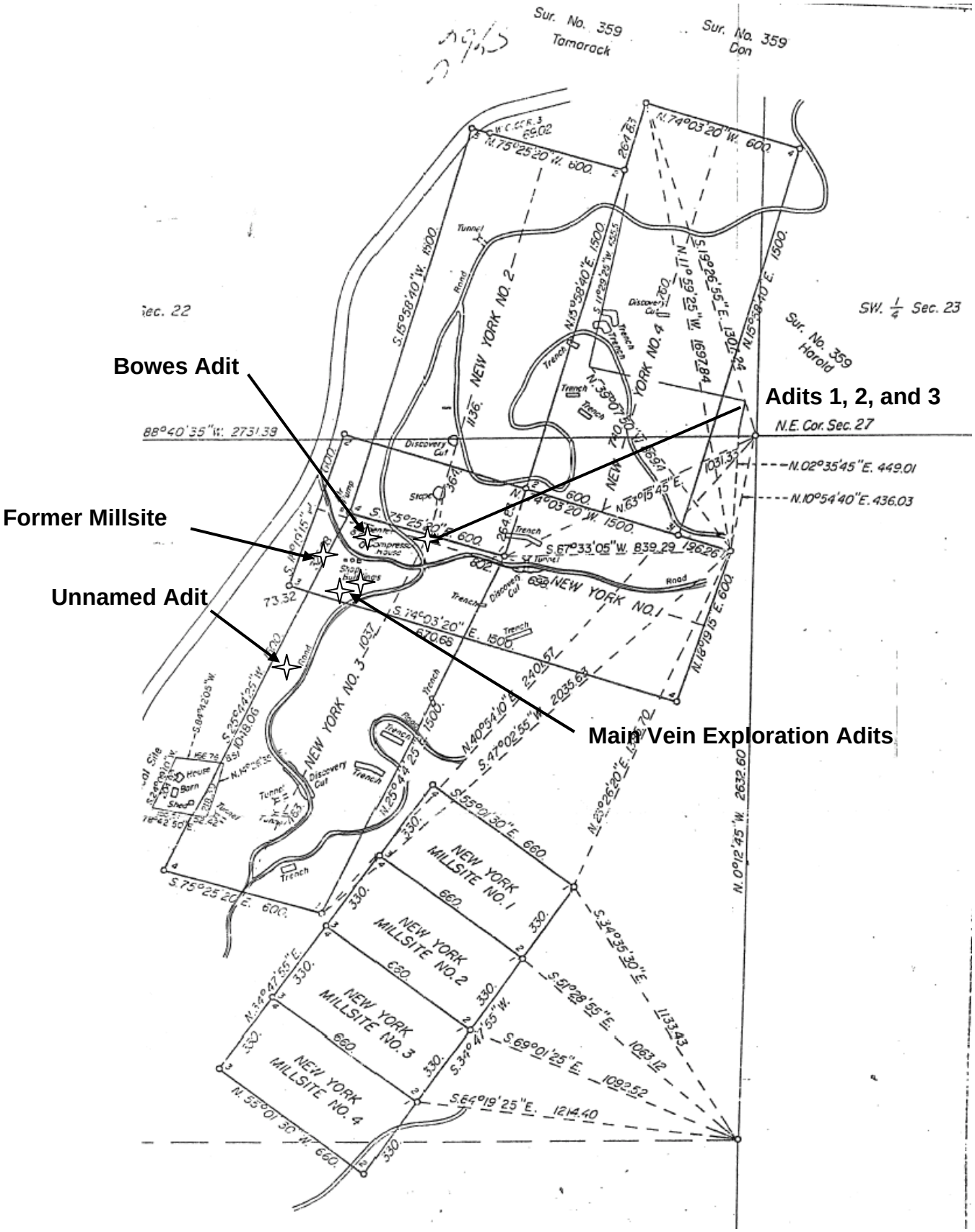
New York and Alaska Claim Groups
New York Mine Cross-Section
1979 New York Mine Claim Group



Appendix B-1. New York And Alaska Claim Groups Circa. 1937



Appendix B-2. New York Mine Cross-Section Including Bowes Development



Appendix B-3. 1980 New York Mine Patent Application Claims.

Appendix C.

Ecological Survey

AQUATIC ECOLOGICAL SURVEY

Aquatic surveys were conducted within Granite Creek and Chipman Gulch to assess the potential impacts of the three mine Sites on the instream habitat, benthic macroinvertebrate community, and presence of fish species due to the Site-related physical habitat alteration or chemical contamination.

In the vicinity of East Eddy mine complex Chipman Gulch is a perennial first order (Armantrout 1998) stream, approximately one to two feet wide and less than a foot deep. Immediately downstream of the East Eddy mine complex Chipman Gulch flows into Granite Creek. The investigated length of Granite Creek is a perennial second order (Armantrout 1998) stream, approximately six to nine feet wide and up to one foot deep. Approximately 1 kilometer (km; 0.6 miles) downstream from its confluence with Chipman Gulch, Granite Creek flows adjacent to the Independence Mill and then past the New York Mine complex, which is approximately 0.3 km (0.2 miles) downstream from Independence Mill. Granite Creek flows into the North Fork John Day River approximately 10 miles downstream from the New York Mine Complex. At the time of our investigation in June, flow was moderate in the two streams and likely at normal base flow.

Five approximately 50 meter long stream reaches (CG-01 through CG-05) were established on Chipman Gulch and eight (GC-01 through GC-08) on Granite Creek. Stream reach locations are shown in Figure 1 in the Site Inspection (SI) Report (CES, 2007). Reaches CG-01 and CG-02 are upstream of the East Eddy complex with CG-01 near the headwaters of Chipman Gulch, and CG-03, -04, and -05 in the vicinity of East Eddy Mine influences. Reach GC-11 is on Granite Creek, upstream of the confluence with Chipman Gulch; GC-12 is on Granite Creek between Chipman Gulch and Lucas Gulch; GC-13 is between Lucas Gulch and China Gulch; GC-14 is between China Gulch and the Independence Mill; GC-15 is adjacent to Independence Mill; GC-16 is between Independence Mill and the New York Mine complex; GC-17 is adjacent to the New York Mine Complex; and GC-18 is downstream of the New York Mine Complex. These locations were chosen to represent reference conditions (CG-01, CG-02, and GC-11) and to isolate potential influences of the three sites and of other potentially significant stream inflows. An attempt was made to conduct benthic macroinvertebrate sampling in both riffle and pool habitats in each of the stream reaches. However, no pools were present in or near the established sampling reaches at CG-01 through -05, GC-11, GC-12, or GC-14 through -16.

Numeric habitat ratings were developed for each reach using U.S. Environmental Protection Agency (USEPA) Rapid Bioassessment Protocol - Habitat Assessment Field Data Sheets for High Gradient Streams (Barbour 1999). Using this method, ten instream and riparian habitat parameters are each scored separately and then these individual habitat scores are summed to provide a habitat total score. The individual habitat parameter scores were used to differentiate habitat quality between stream reaches. Additional instream characterization was conducted with the Physical Characterization Field Data Sheet (Barbour 1999), and field notes. The following habitat conditions were noted:

- Habitat total scores were 134, 169, 162, for reference reaches CG-01, CG-02 and GC-11; and were 132, 122, 128, 158, 165, 140, 145, 141, 142, and 151 at CG-03, CG-04, CG-05, GC-12, GC-13, GC-14, GC-15, GC-16, GC-17, and GC-18, respectively. This indicates the overall instream physical habitat conditions were suboptimal at CG-01, CG-03, CG-04, CG-05, GC-12, GC-14, GC-15, GC-16, GC-17, and GC-18 and optimal for CG-02, GC-11, and GC-13.

- Substrate was rated poor at CG-01 and CG-05, and marginal at GC-14, GC-16 and GC-18.

- Embeddedness was rated poor at CG-04, CG-05, GC-14, GC-15, GC-16, and GC-18, and marginal at CG-01, CG-03 and GC-17.

- Velocity/depth regime was rated poor at CG-03, CG-04, CG-05, GC-11, GC-14, GC-15 GC-16, and GC-18 due to the presence of only one regime (fast/shallow). This regime was marginal at CG-01, CG-05, GC-13, and GC-17 with two depth regimes present (fast/shallow and slow/shallow).

- Sediment deposition was rated marginal at CG-03 and GC-14.

- Bank stability was rated marginal at CG-04.

- Riparian vegetation width was rated marginal at CG-01, GC-12, and GC-17.

The habitat scores are more indicative of riffle habitat quality, and may not be correlated with pool habitat quality. Overall, stations CG-02, GC-11, GC-12, and GC-13, had similar riparian and instream conditions, with the remaining stations having softer substrate, higher deposition, and higher embeddedness at the other stations. CG-01 was in a meadow that had evidence of recent cattle grazing. At CG-03, CG-04, and CG-05, the channel was small and incised. Riparian vegetation was grazed meadow at CG-01, primarily mature mixed coniferous/deciduous forest at CG-02, CG-03, and GC-11, and successional/disturbed mixed coniferous/deciduous forest at GC-12 through GC-18.

Large woody debris (LWD) was absent at CG-01, common at stations GC-14, 16, and 18, and abundant CG-02 through 05, GC-11, GC-12, GC-13, GC-15, and GC-17. Channel pattern of Chipman Gulch was good along the upper reaches, but apparently straightened from GC-04 to the confluence with Granite Creek. The Granite Creek channel appeared to have been straightened along most of its investigated length, possibly due to the adjacent roadway and/or mining activities.

Pools were absent along much of the straightened portions of both streams. The only stations with pools were GC-13, 17, and 18. All of the Ochoco Creek pools were similar in nature along the sides of the stream. However, the pool at GC-18 extended off-channel and was larger and had more fine sediment and organic material compared to GC-13 and 17.

The riffle substrate at CG-01 appeared different than all other stations with predominantly organic material characteristic of a low gradient channel formed in a meadow. At CG-02 the substrate was a mix of cobble, gravel, and sand. Stations CG-03, 04, and 05 had a mostly sand and/or silt substrate. At GC-11 and 12, the substrate was an appropriate mix of cobble, gravel, and sand. The deeper substrate at reach GC-13 was similar to GC-11, but had a notably higher amount of silt around the cobble and gravel. The remaining Granite Creek reaches relatively low amounts of cobble and high amounts of sand and/or silt. , The downstream Granite Creek stations (excluding GC-11 and GC-12) had high amounts of moss-like "wads" of submergent vegetation that had trapped a great deal of silt. When disturbed these wads would erupt and release a large silt load. After the silt was carried away by the current, the gravel/cobble substrate would be exposed below. The lower amount of moss in upstream portions of Granite Creek may be related to both the higher gradient noted at Stations GC-11 and 12 and the higher degree of anthropogenic stream influence with progressive distance downstream.

Obvious mine-related channel disruption (braiding and straightening) and erosional features were noted in both streams Overall, the instream and riparian habitat conditions appeared well-developed at CG-02, GC-11, and GC-12, but apparently disturbed and relatively poor at other stations. No fish barriers were noted in Ochoco Creek between the sample reaches. Fish up to approximately 6 inches long were noted in the creek and in one small man-made reservoir downstream from GC-18.

Laboratory enumeration was completed to the species level, when possible, for at least 500 individuals in riffle samples and 300 in pool samples. The identified benthic macroinvertebrates are listed in Table C-1. Abundance, diversity, and several biological indices were examined for the benthic macroinvertebrates

present in each pool and riffle sample, and qualitatively compared between stations. Pool data were only compared to other pool data and riffle data were only compared to other riffle data. No rare, threatened, or endangered (RTE) benthic macroinvertebrate species were identified.

The abundance and diversity data provide understanding of the number of individual benthic macroinvertebrates and the number of species, respectively, at each station. The metals tolerance index was developed in Montana (Montana Department of Environmental Quality [MTDEQ], 1995) and is based upon a correlation of benthic macroinvertebrate species present in known metals contaminated streams versus those present in unpolluted streams. A higher metals tolerance index value indicates that a higher percentage of the benthic macroinvertebrate species present are known to be tolerant of the presence of metals contamination. The Shannon-Weaver index is a measure of the number of species (i.e., diversity) and the number of individuals within each species (i.e., evenness). A higher Shannon-Weaver index indicates more diversity and a lower likelihood of impacted benthic macroinvertebrate populations. The fine sediment biotic index is a measure of the number of species present that are tolerant of increased sediment in the stream substrate. A higher fine sediment biotic index indicates there are more sediment tolerant species present in the sample. The intolerant species index is a measure of how many pollution sensitive species are present in each sample. A lower number in intolerant species suggests the benthic macroinvertebrate population may be impacted. The Oregon Level III evaluation provides an understanding of how the potentially impacted stream compares to unimpacted streams in Oregon.

The results of the benthic macroinvertebrate investigation in pool (P) habitats show that:

- The estimated numbers of all benthic macroinvertebrates were 1723, 3312, and 3820 at GC-13P, 17P, and 18P, respectively.

- Diptera (primarily Chironomidae) were clearly predominant at GC-13P, but were approximately similar in abundance to Oligochaeta at GC-17P and 18P. In addition, Nematoda (nematode) or Pisidium (clam) species were between 10 and 23 percent of the total number of invertebrates found at GC-17P and 18P, higher than that found at GC-13P. The first dominant species percentage was similar at each station, but not if chironomids were grouped together, in which case the first dominant genus would be much higher for GC-13P. These results are shown on Figure C-1.

- Species diversity was higher at GC-13P, but the overall pattern of species diversity was similar at all three pool stations (Figure C-2). In addition, the number of Ephemeroptera, Plecoptera, and Trichoptera (EPT) species were equal to the number of Chironomidae species at GC-18P.

- The distributions of different functional feeding groups were similar between the stations except for a higher than expected number of predators at GC-17P. However, predator species diversity was highest at GC-13P. No trends were noted between the stations. Gatherers were most common at GC-13P, predators were most common at GC-17P, and filterers were most common at GC-18P (Figure C-3).

- The Shannon-Weaver (Log e) index of species distribution was consistent but low at all stations. The metals tolerance index was consistent and relatively high at all stations. The number of species adapted to living in fine sediment was similar at all stations. The number of tolerant species was notably higher at GC-13P. These results are shown in Figure C-4.

Other than Chironomidae, the abundance of invertebrates was fairly similar between the stations (Figure C-1). Other slight differences in the percentage of each species are likely related to instream conditions. Specifically, the very high Chironomidae percentage at GC-13P is indicative of decreased habitat quality

at this station, while the steady increase in Pisidium numbers indicates a potential for increasing habitat quality with increasing distance downstream. Further evidence of this trend is provided by the consistent species diversity (Figure C-2) and similar but slightly differently distributed functional groups (Figure C-3) present at all pool stations.

The high number of tolerant species present at GC-13P (Figure C-4) is consistent with the high number of Chironomidae shown in Figure C-1 and suggests habitat quality is not good at GC-13P. In addition, while habitat quality appears to be increasing with increasing distance downstream, the relatively low Shannon-Weaver Index, combined with a relatively high Metals Tolerance and Fine Sediment Indices suggests that overall instream pool habitat (i.e., sediment) quality is low and that mining-related contamination may be present in the pools. Physical disturbance of the stream channel and high sedimentation (potentially related to mining and/or road building) have also occurred and may be influencing pool invertebrate populations.

Results of the benthic macroinvertebrate investigation in riffle (R) habitats suggest that:

- The numbers of benthic macroinvertebrates were 2197, 1076, 1379, 3222, 798,1467, 395, 908, 879, 1354, 713, and 2097 at stations CG-02R (Chipman Gulch reference reach), CG-03R, CG-04R, CG-05R, GC-11R (Granite Creek reference reach), GC12R, GC-13R, GC-14R, GC-15R, GC-16R, GC-17R, and GC-18R, respectively.

- EPT and Coleoptera species were most abundant at the Chipman Gulch reference reach, whereas Oligochaeta were most abundant at the Granite Creek reference reach. In Chipman Gulch, EPT species numbers remain high until CG-05R, but Coleoptera numbers decrease and Dipteran numbers increase. All species except Oligochaeta are depressed in number at CG-05R. In Granite Creek, Coleoptera numbers are relatively lower at all reaches compared to upstream Chipman Gulch reaches. EPT and Diptera numbers are similar and decreasing between GC-11R and GC-15R, then between GC-15R and GC-18R, EPT numbers increase while Diptera numbers continue to decrease. Oligochaeta numbers are more variable and higher in Granite Creek reaches compared to Chipman Gulch, and highest at reference reach GC-11R. These findings are shown graphically in Figure C-5.

- As displayed in Figure C-6, the diversity of species in all reaches were remarkably similar, with slightly lower than expected diversity at CG-04R, GC-14R, GC-16R, and GC-18R. Clinger richness declined at consecutive downstream stations in Chipman Gulch, and then varied within Granite Creek.

- Except for “clingers”, the distributions of different functional groups were generally similar between the stations with somewhat lower numbers of gatherers at CG-04R and GC-16R, somewhat higher numbers of predators at downstream stations, and slightly more scrapers downstream in Granite Creek. In Chipman Gulch, Clinger numbers decreased with increasing distance downstream from the reference sample. Clinger numbers were variable at the different reaches in Granite Creek. Figure C-7 shows the distributions of functional feeding groups at each riffle station.

- The Shannon-Weaver species diversity index (log e) was relatively consistent across all stations, but was lowest at CG-05R (Figure C-8). The metals tolerance index was low and consistent, with slightly higher values at the Granite Creek reference station (GC-11R) and several downstream Granite Creek Stations (Figure C-8). The number of intolerant taxa varied greatly with the lowest number at CG-04R, GC-14R, and GC-18R (Figure C-8).

The benthic macroinvertebrates assemblage at CG-01R was very different than at all other stations. Given the differences in habitat at this station compared to the other downstream stations in both Chipman Gulch and Granite Creek, the invertebrate data from CG-01R were removed from this analysis.

The abundance of invertebrates in Chipman Gulch as shown in Figure C-6 suggests declining instream habitat quality with increasing distance downstream from the reference sample (CG-02R). Overall, there were more invertebrates in Chipman Gulch than in Granite Creek and the Granite Creek reference station (GC-11R) had the lowest number of invertebrates for any reach in either stream. This suggests a potential for influences upstream of the Granite Creek reference station, and indeed, there are potential mine-related influences in the upper Granite Creek watershed. The species diversity data for both EPT species and Clingers (Figure C-7) suggest lower quality habitat in the downstream Chipman Gulch reaches and varying habitat quality in Granite Creek, with the lowest quality indicated for GC-14R, GC-16R, and GC-18R. Generally, the functional grouping data (Figure C-8) show a good deal of variability, potentially indicative of varying or changing habitat conditions in both streams. However, compared to the reference station, the percentages of clingers in downstream reaches were consecutively lower, indicating worsening riffle conditions. The indices shown in Figure C-8 indicate similar overall species diversity in both streams a slightly higher metals tolerance index at GC-14R and GC-15R, and lower than expected numbers of intolerant (i.e., sensitive) species at CG-05R, GC-14R, GC-16R, and GC-18R. Combined this data suggests decreasing instream quality (but not necessarily related to mine contamination) in Chipman Gulch, and inconsistent instream quality in Granite Creek. In addition, invertebrate populations in Granite Creek may be influenced by stream quality upstream of the currently investigated reaches. Generally, riffle habitats are representative of instream water quality, but apparent high sedimentation within both streams may also be involved in invertebrate population differences among the reaches.

An Oregon Level III multi-metric evaluation was completed for riffle habitats. A benthic index of biological integrity (B-IBI) was calculated for each reach and these are shown on Figure C-8. A B-IBI greater than 39 indicates no impairment; between 30 and 39 indicates slight impairment; between 20 and 29 indicates moderate impairment; and less than 20 indicates severe impairment. The results of the Oregon Level III multi-metric analysis suggests slight to no impairment in the upstream portions of Chipman Gulch, moderate impairment at CG-05R, slight impairment at GC-11R, GC-12R, GC-13R, GC-15R, GC-16R, and GC-17R, and moderate impairment at GC-14R and GC18R. A rating of slight impairment is not uncommon for first order streams such as Chipman Gulch because of the very small nature and limited water volume present in such streams. Similar to the other data in this investigation, the B-IBI evaluation show somewhat lower habitat quality in the downstream portion of Chipman Gulch and in much of Granite Creek. The lack of improvement at subsequent stations also suggests instream conditions are not improving with distance downstream, within the investigated portion of Granite Creek.

The stream invertebrate populations were also examined using the DEQ Predictive Assessment for Oregon Streams (PREDATOR) model (ODEQ, 2007). The PREDATOR model is a multivariate comparison of observed invertebrate populations to those expected in a reference stream within the same ecoregion. The originally enumerated invertebrate species were grouped to match the DEQ Taxon Codes required as a model input. Then a habitat file was developed which provides the necessary model inputs for comparison to the appropriate reference stream condition. The enumerated invertebrate and habitat files were run through the PREDATOR model for the Western Cordillera and Columbia Plateau (WCCP) ecoregion to obtain the observed to expected (O/E) invertebrate ratio for randomly selected species. An O/E ratio of less than one indicates a loss/reduction of species compared to reference conditions and a ratio of greater than one indicates an increase/enrichment of species. The ODEQ thresholds for impacted streams are the 5th and 25th percentile of reference condition invertebrate distributions. For the WCCP ecoregion, these percentiles correspond to O/E ratios of 0.73 and 0.92. Therefore, sites with an O/E ratio of less than 0.73 are considered to be in poor condition, between 0.77 and 0.92 are in fair condition, and above 0.92 are in good to enriched condition. The O/E ratio results from the landfill PREDATOR model calculations are shown in Table C-2. The results confirm that CG-01 is notably different from the other

stations as described above. CG-02 was the only station rated as being in good condition; CG-03 was rated as fair condition, but CG-04 and CG-05 were rated as poor condition. Granite creek stations GC-12, 13, 15, and 17 were rated as good condition, but GC-11, 14, 16, and 18 were all rated as fair condition. When combined with the other results described above for stream invertebrate abundance and diversity, the weight-of-evidence suggest that the potential for notable impacts exists primarily at CG-04 and 05, but some lower level of impact may be occurring at GC-11, 14, 16, and 18.

Fish were observed in a man-made pond along and hydraulically connected to Granite Creek. These appeared to be cutthroat (*Oncorhyncus clarki*) but hybridization with rainbow trout (*Oncorhyncus mykis*) has been documented in the North Fork John Day River (ODFW, 2002). Other fish that may inhabit Granite Creek include redband trout (*Oncorhyncus mykis*), threatened middle Columbia River summer run steelhead (*Oncorhyncus mykiss*), and threatened bull trout (*Salvilinus confluentus*). Brook trout (*Salvelinus fontinalis*), longnose and speckled dace (*Rhinichthys* spp.), bridgelip and largescale suckers (*Catastomus* spp), sculpin (*Cottus* spp), and brown bullhead (*Ictalurus nebulosus*) are also know to inhabit the region (USFS, 2004).

TERRESTRIAL ECOLOGICAL SURVEY

Terrestrial habitats and animals that are present or likely at, and surrounding, the mine were documented during the ecological survey and via communication with regional biologists. Four 30-minute bird surveys were conducted. During the field effort: first the Site was inspected to determine the dominant vegetation communities at and surrounding the mines; then the dominant plant species were identified (Cooke, 1997; Hitchcock and Cronquist, 1978; Niehaus and Ripper 1976, Pojar and Mackinnon, 1994; Little, 1980) within each of the communities and documented on field forms. Qualitative surveys also were conducted at and surrounding the mine for presence or sign of mammals, reptiles, amphibians, and invertebrates. The rare, threatened, or endangered (RTE) plants and animals likely or known to be present in the vicinity of the Site were obtained from the U.S. Forest Service (USFS) and Oregon Natural Heritage Program (ONHP) and are listed in Table C-3.

The mine site is within the Blue Mountains portion of the Middle Rocky Mountain Steppe ecoregion (Bailey 1995). This ecoregion is characterized by a relatively mild (compared to mountains to the east) semi-arid climate with 20 to 30 inches of precipitation per year. The majority of the precipitation falls in the winter, primarily as snow. Vegetation in this ecoregion varies from Douglas fir (*Pseudotsuga menziesii*) forest at higher elevations, grand fir (*Abies grandis*) and ponderosa pine (*Pinus ponderosa*) forest at middle elevations, and a sagebrush steppe at lower elevations. The Site is within the grand fir zone, comprised predominantly of a grand fir/elk sedge plant association common to the Blue Mountains (ONHP 2001). Three distinct plant communities were observed on or adjacent to the mines including disturbed mine, open coniferous forest, and riparian. The three mining areas had similar vegetation although the riparian areas were widest on Chipman Gulch due primarily to the presence of the forest road. The terrestrial RTE plant species potentially present near the mines are listed in Table C-3; no listed RTE plants were observed during the site visit. The species identified within the three observed plant communities are listed in Table C-4.

The disturbed mine areas were primarily waste rock or excavated/disturbed gravelly soil. Numerous colonizing and weedy species were present, with no canopy layer, and a patchy herbaceous layer. Young ponderosa pine, young larch (*Larix occidentalis*), and grasses were the dominant species. Other common species included young grand fir, California buttercup (*Rannunculus californicus*), cleavers (*Galium aparine*), Richardson's geranium (*Geranium richardsonii)*, and fireweed (*Epilobium angustifolium*).

The open coniferous forest was dominated by grand fir and elk sedge. Other common species included Engelmann's spruce (*Picea engelmannii*), larch, grasses (*Festuca* and *Agrostis* species), Prince's pine (*Chimaphila umbellate*), and huckleberry (*Vaccinium sp.)*.

The riparian corridor along the streams varied in width from 0 (steep banks) to approximately 75 ft. and primarily consisted of short trees, shrubs, and grasses. The dominant species were Sitka alder (*Alnus sinuata*), pacific willow (*Salix lucida*), small-flowered bulrush (*Scirpus macrocarpus*), and slough sedge (*Carex obnupta*).

Generally, the mine/mill areas were within the forest community and adjacent to the riparian community. There was a distinct difference between the onsite and offsite plant communities and variations in frequency and percent cover of individual species appeared to be dependent on proximity to past mining activity, particularly wasterock. The riparian community along both streams was impacted. It appeared that past mining activities had occurred immediately adjacent to and within Chipman Gulch, particularly in the vicinity of CG-04 and CG-05. It seems likely that both mining and road-building activities have impacted Granite Creek.

Terrestrial invertebrates noted on and near the mine included ants, butterflies, moths, mosquitos, beetles and many small black flies. None of these or any other invertebrates in the vicinity of the mine are known RTE species. The terrestrial invertebrate species observed, expected, or possible in the vicinity of the mine are listed in Table C-5

One bird survey station each was established at the three mine areas (New York Mine, Independence Mine, and East Eddy Mines) within hearing distance of all three habitat types. Two 15 minute surveys were conducted from the New York Mine and Independence Mill areas and one survey was conducted near the East Eddy Mines. Birds observed during the surveys or during the vegetation, mammal, or stream surveys, and birds expected or possible at the Site are listed in Table C-6. The three-toed woodpecker (*Picoides tridactylus*) was the only RTE species documented by the ONHIC for the area within 3.2 kilometers of the site. No RTE bird species were observed but several other RTE bird species may be expected or possible at the Site as shown in Table C-6.

Big game trails were present at the mines providing evidence of mule deer (*Odocoileus hemionus*) and elk (*Cervus canadensis*) at and surrounding the mine sites. No RTE mammal species were listed by the ONHIC for the area within 3.2 kilometers of the site. As shown in Table C-3, several RTE mammal species are possible, but none were observed or expected. No bats have been documented in the mine workings. Other mammals expected or possible at the Site are listed in Table C-7.

No reptiles or amphibians were observed during the field effort. The Columbia spotted frog (*Rana luteiventris*) was the only herpetile species listed by the ONHIC for the area within 3.2 kilometers of the site. Other herpetiles observed, expected, or possible at the Site are listed in Table C-8.

Chemical impacts to terrestrial species would be expected only if they reside or are consistently feeding within the disturbed mine area. Thus, immobile or relatively immobile species such as plants, terrestrial invertebrates, and small mammals are the species most at risk. However, while individuals may be at risk, impacts to populations of these species are unlikely; and because the mining-related disturbed areas at the Site are small in relation to the available surrounding undisturbed habitat, impacts to most mobile terrestrial species are not expected. Thus, individuals of observed or expected RTE plant and terrestrial invertebrate species would be a primary concern, when present, and other RTE species are the secondary concern.

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FIGURES

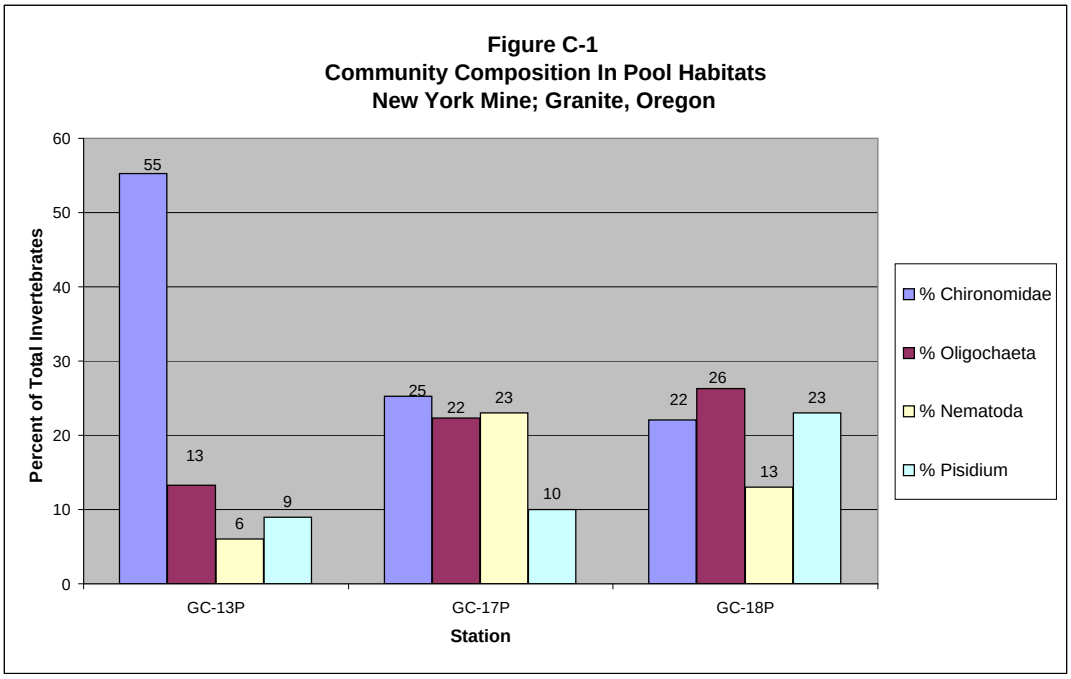
Figure C-1
Community Composition In Pool Habitats
New York Mine; Granite, Oregon
Percent of Total Invertebrates
60
50
40
30
20
10
0
55
13
6
9
25
22
23
10
22
26
13
23
GC-13P
GC-17P
GC-18P
Station
% Chironomidae
% Oligochaeta
% Nematoda
% Pisidium

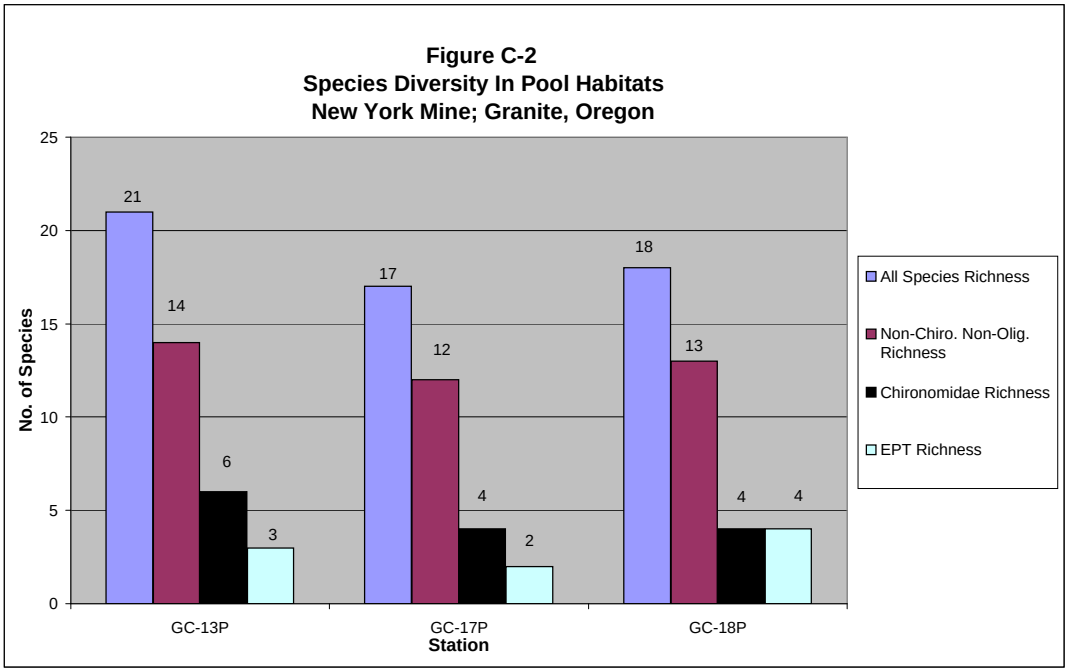
Figure C-2
Species Diversity In Pool Habitats
New York Mine; Granite, Oregon
No. of Species
25
20
15
10
5
0
21
14
6
3
17
12
4
2
18
13
4
4
GC-13P
GC-17P
GC-18P
Station
All Species Richness
Non-Chiro. Non-Olig. Richness
Chironomidae Richness
EPT Richness

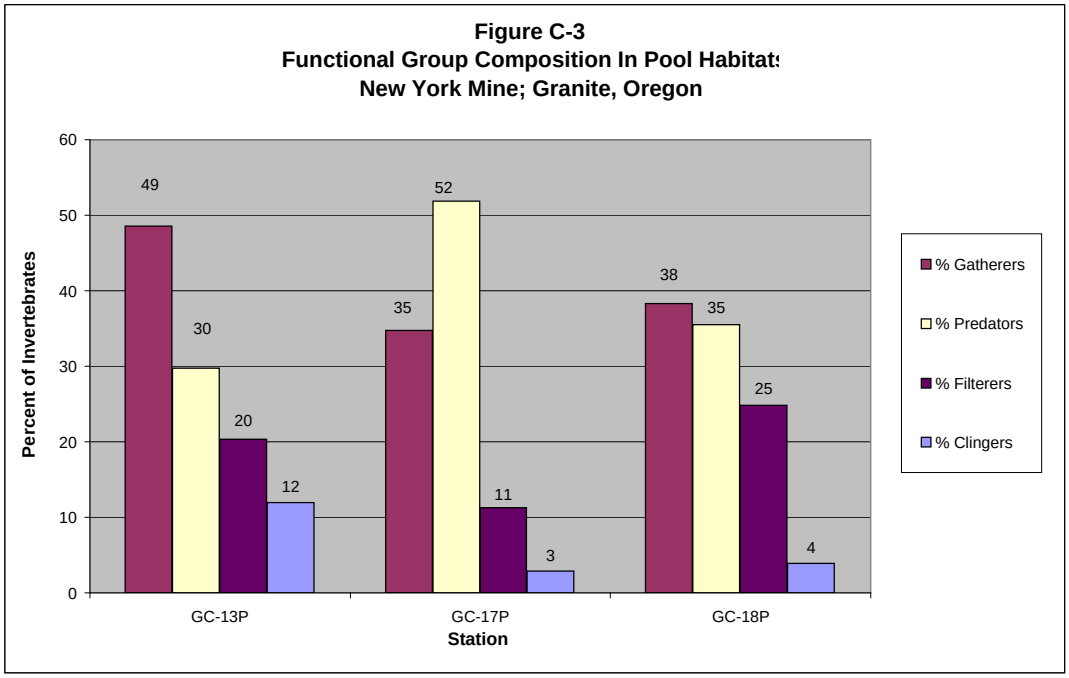
Figure C-3
Functional Group Composition In Pool Habitats
New York Mine; Granite, Oregon
Percent of Invertebrates
60
50
40
30
20
10
0
49
30
20
12
35
52
11
3
38
35
25
4
GC-13P
GC-17P
GC-18P
Station
% Gatherers
% Predators
% Filterers
% Clingers

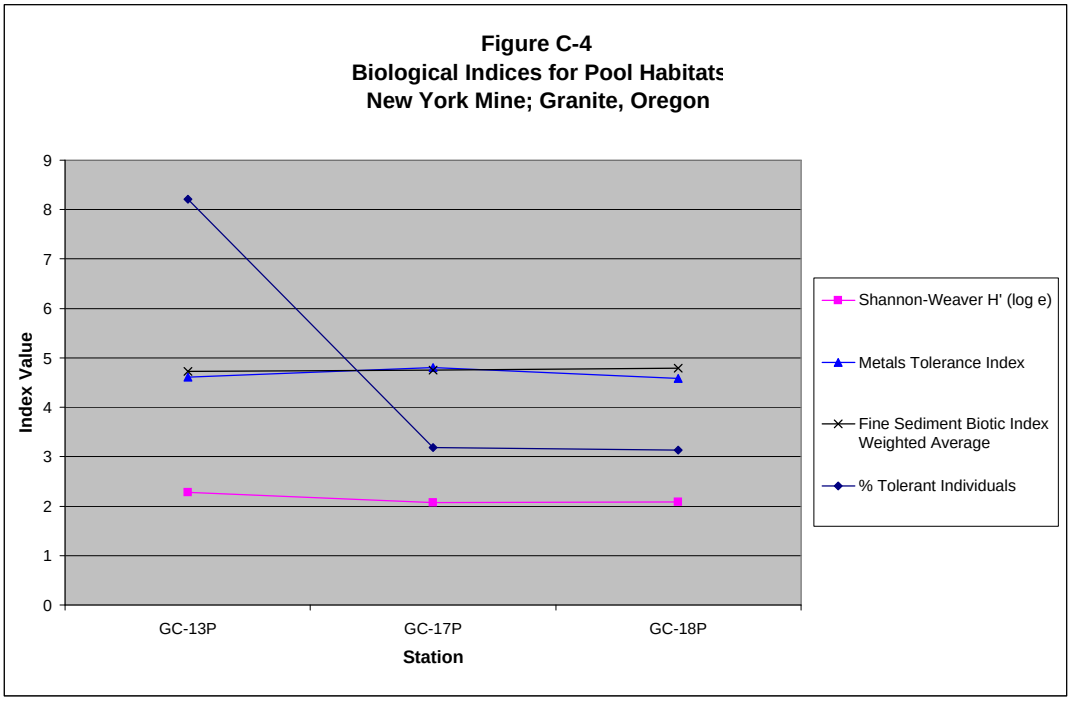
Figure C-4
Biological Indices for Pool Habitats
New York Mine; Granite, Oregon
Index Value
9
8
7
6
5
4
3
2
1
0
GC-13P
GC-17P
GC-18P
Station
Shannon-Weaver H' (log e)
Metals Tolerance Index
Fine Sediment Biotic Index Weighted Average
% Tolerant Individuals

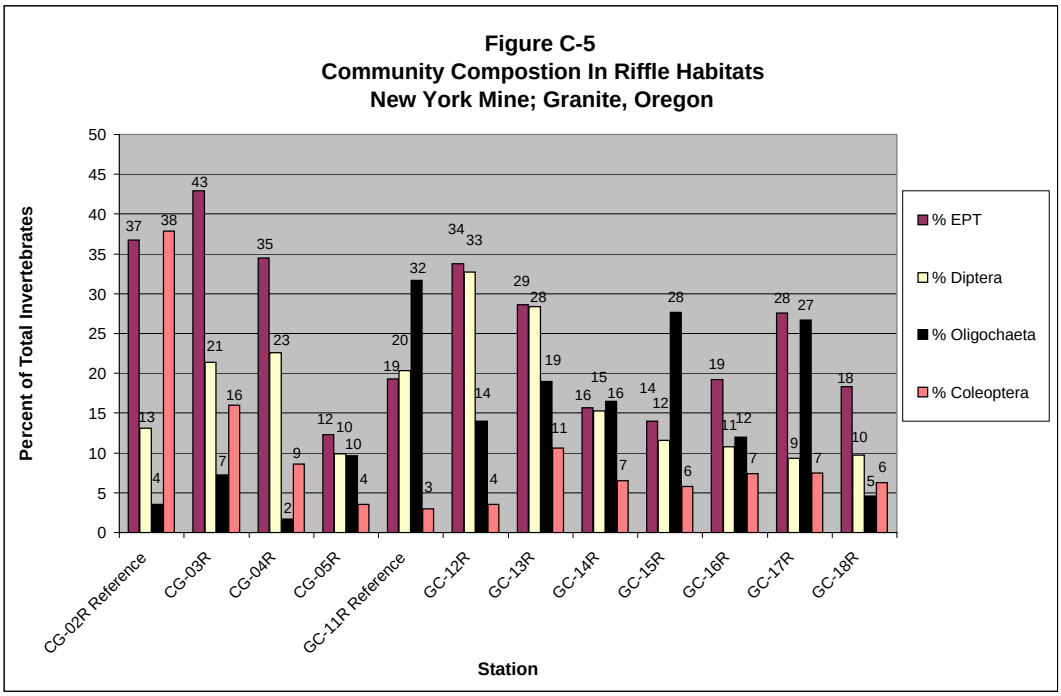
Figure C-5
Community Compostion In Riffle Habitats
New York Mine; Granite, Oregon
Percent of Total Invertebrates
Station
% EPT
% Diptera
% Oligochaeta
% Coleoptera
CG-02R Reference
CG-03R
CG-04R
CG-05R
GC-11R Reference
GC-12R
GC-13R
GC-14R
GC-15R
GC-16R
GC-17R
GC-18R

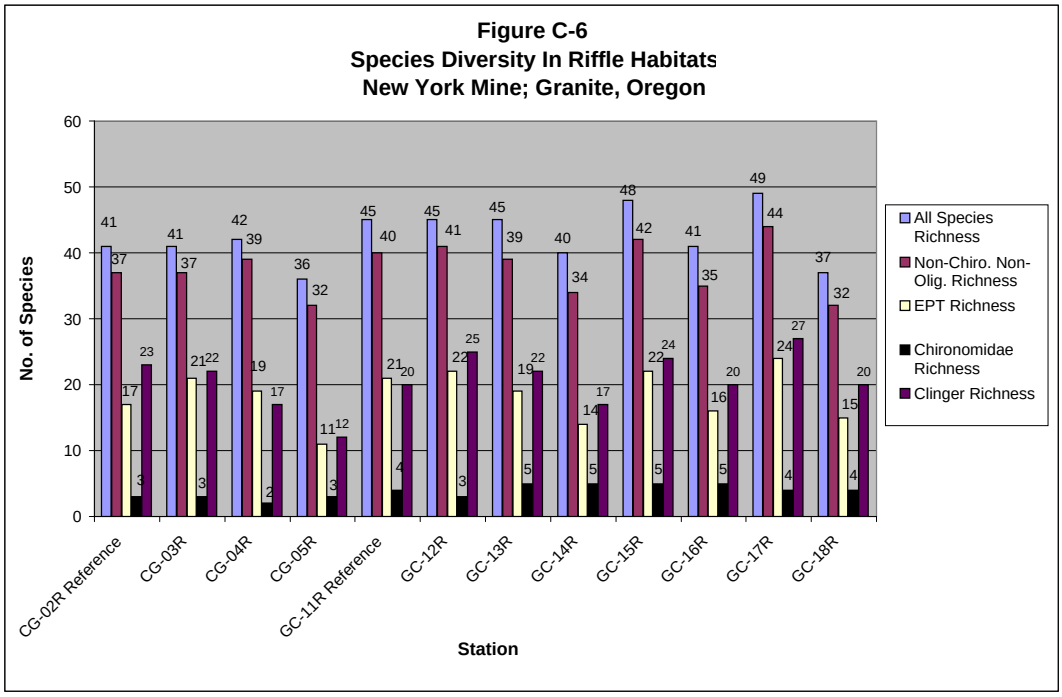
Figure C-6
Species Diversity In Riffle Habitats
New York Mine; Granite, Oregon
No. of Species
Station
All Species Richness
Non-Chiro. Non-Olig. Richness
EPT Richness
Chironomidae Richness
Clinger Richness
CG-02R Reference
CG-03R
CG-04R
CG-05R
GC-11R Reference
GC-12R
GC-13R
GC-14R
GC-15R
GC-16R
GC-17R
GC-18R

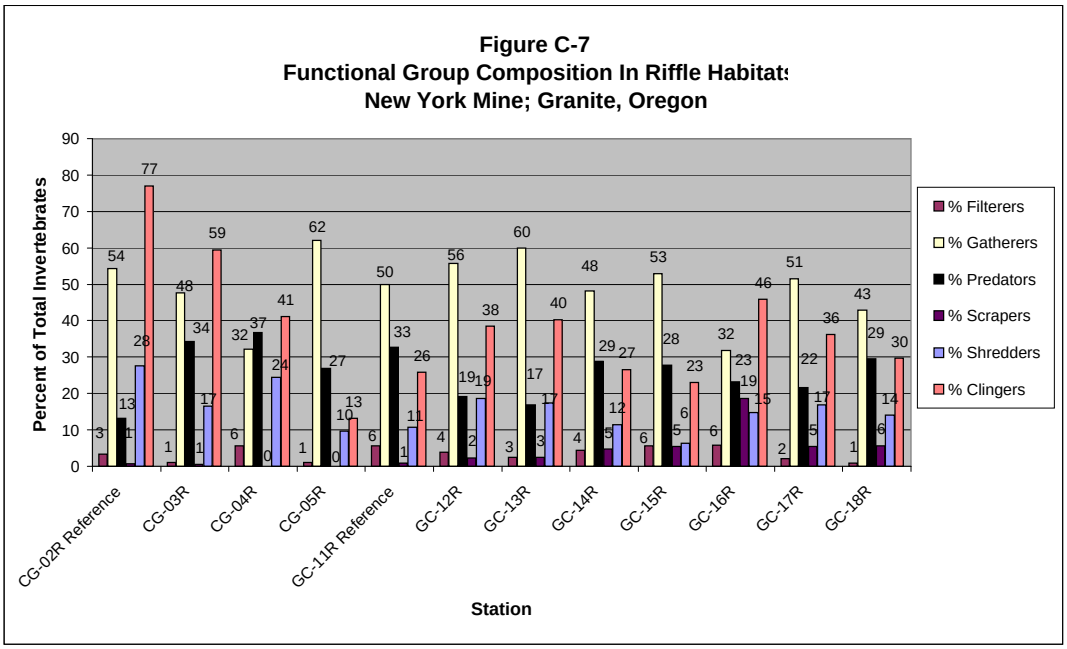
Figure C-7
Functional Group Composition In Riffle Habitats
New York Mine; Granite, Oregon
Percent of Total Invertebrates
Station
% Filterers
% Gatherers
% Predators
% Scrapers
% Shredders
% Clingers
CG-02R Reference
CG-03R
CG-04R
CG-05R
GC-11R Reference
GC-12R
GC-13R
GC-14R
GC-15R
GC-16R
GC-17R
GC-18R

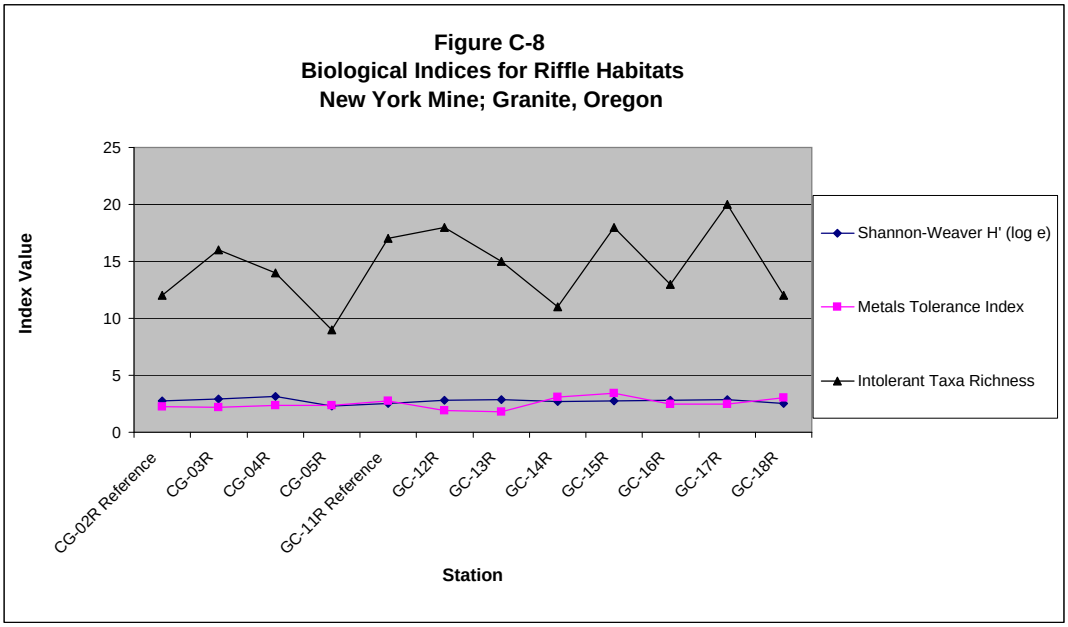
Figure C-8
Biological Indices for Riffle Habitats
New York Mine; Granite, Oregon
Index Value
Station
Shannon-Weaver H' (log e)
Metals Tolerance Index
Intolerant Taxa Richness
CG-02R Reference
CG-03R
CG-04R
CG-05R
GC-11R Reference
GC-12R
GC-13R
GC-14R
GC-15R
GC-16R
GC-17R
GC-18R

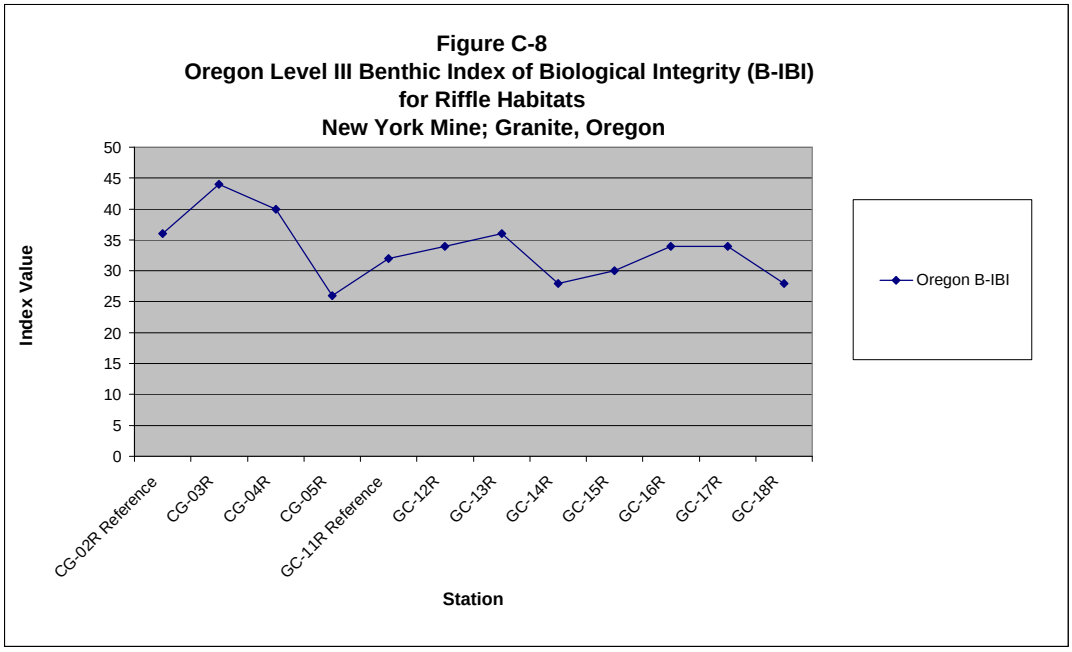
Figure C-8
Oregon Level III Benthic Index of Biological Integrity (B-IBI)
for Riffle Habitats
New York Mine; Granite, Oregon
Index Value
50
45
40
35
30
25
20
15
10
5
0
CG-02R Reference
CG-03R
CG-04R
CG-05R
GC-11R Reference
GC-12R
GC-13R
GC-14R
GC-15R
GC-16R
GC-17R
GC-18R
Station
Oregon B-IBI

TABLES

TABLE C-1
DOCUMENTED AQUATIC INVERTEBRATE SPECIES
NEW YORK MINE
GRANITE, OREGON

Taxonomic Group	Scientific Name	Taxonomic Group	Scientific Name
Ephemeroptera	Ameletus sp.	Diptera	Bezzia/Palpomyia sp.
	Baetis bicaudatus		Ceratopogoninae
	Baetis tricaudatus		Clinocera sp.
	Caudatella edmundsi		Dicranota sp.
	Caudatella hystrix		Dixa sp.
	Cinygma sp.		Erioptera sp.
	Cinygmula sp.		Forcipomyia sp.
	Diphetor hageni		Glutops sp.
	Drunella spinifera		Limnophila sp.
	Epeorus longimanus		Meringodixa sp.
	Ephemerella sp.		Neoplasta sp.
	Ironodes sp.		Probezzia sp.
	Leptophlebiidae		Prosimulium sp.
	Paraleptophlebia sp.		Rhabdomastix setigera gr.
	Serratella tibialis		Simulium sp.
	Siphlonuridae		Tipulidae
Plecoptera	Chloroperlidae	Diptera-Chironomidae	Chironomini
	Doroneuria sp.		Diamesinae
	Hesperoperla pacifica		Orthocladiinae
	Isoperla sp.		Prodiamesinae
	Malenka sp.		Pseudochironomini
	Paraleuctra sp.		Tanypodinae
	Paraperla sp.		Tanytarsini
	Perlidae	Coleoptera	Cleptelmis addenda
	Perlodidae		Heterlimnius sp.
	Sweltsa sp.		Lara sp.
	Visoka cataractae		Narpus sp.
	Yoraperla sp.		Optioservus sp.
	Zapada columbiana		Sanfillipodytes sp.
	Zapada frigida		Zaitzevia sp.
	Zapada oregonensis gr.	Megaloptera	Sialis sp.
Trichoptera	Amiocentrus aspilus	Bivalvia	Pisidium sp.
	Brachycentrus americanus		Sphaeriidae
	Cryptochia sp.	Acari	Acari
	Hydroptila sp.		Arrenurus sp.
	Lepidostoma sp.		Atractides sp.
	Limnephilidae		Aturus sp.
	Micrasema sp.		Estelloxus sp.
	Neophylax sp.		Hydrachna sp.
	Parapsyche sp.		Hydryphantidae
	Philopotamidae		Hygrobates sp.
	Psychoglypha sp.		Lebertia sp.
	Rhyacophila alberta gr.		Mideopsis sp.
	Rhyacophila betteni gr.		Nautarachna sp.
	Rhyacophila brunnea gr.		Oribatei
	Rhyacophila narvae		Protzia sp.
	Rhyacophila pellisa/valuma		Sperchon sp.
	Rhyacophila sp.		Sperchonopsis sp.
	Uenoidae		Testudacarus sp.
	Wormaldia sp.		Torrenticola sp.
Gastropoda	Hydrobiidae	Crustacea	Ostracoda
	Lymnaeidae	Other Organisms	Nematoda
	Pristinicola hemphilli		Polycelis sp.
Annelida	Oligochaeta		

TABLE C-2
PREDATOR MODEL RESULTS:
OBSERVED TO EXPECTED STREAM INVERTEBRATE NUMBERS
NEW YORK MINES
GRANITE, OREGON

Station	Observed Number of Invertebrate Species	Expected Number of Invertebrate Species	Observed-to-Expected Ratio	Stream Condition
CG-01	8.00	14.26	0.560992	Poor
CG-02	14.00	14.28	0.980377	Good
CG-03	13.00	14.28	0.91035	Fair
CG-04	9.00	14.28	0.630243	Poor
CG-05	10.00	14.28	0.70027	Poor
GC-11	13.00	14.28	0.91035	Fair
GC-12	14.00	13.80	1.014528	Good
GC-13	14.00	13.80	1.014528	Good
GC-14	11.00	13.80	0.797129	Fair
GC-15	15.00	13.80	1.086994	Good
GC-16	12.00	13.80	0.869595	Fair
GC-17	14.00	13.80	1.014528	Good
GC-18	12.00	13.80	0.869595	Fair

TABLE C-3
SUMMARY OF RARE, THREATENED, OR ENDANGERED SPECIES IN THE VICINITY
NEW YORK MINES
GRANITE, OREGON

Common Name	Species Name	Oregon State Status	Federal Status	U.S. Forest Service Status	Observed/ Expected/ Possible
AQUATIC INVERTEBRATES					
None					
FISH					
Inland Columbia Basin red-band trout	*Oncorhyncus mykiss gairdnerii*	Vulnerable/Rare	Concern	Sensitive	**Expected**
Bull trout (Columbia Basin)	*Salvelinus confluentus*		Threatened		Possible
Steelhead (Middle Columbia River)	*Oncorhynchus mykiss*		Threatened		Possible
PLANTS					
Brandegee's onion	*Allium brandegei*			Sensitive	Possible
Sierra onion	*Allium campanulatum*			Sensitive	Possible
Triangular-lobed moonwort	*Botrychium ascendens*	Imperiled	Concern	Sensitive	Possible
Crenulate Moonwort (grape-fern)	*Botrychium crenulatum*	Candidate/Imperiled	Concern	Sensitive	Possible
Low northern sedge	*Carex concinna*			Sensitive	Possible
Ground cedar	*Lycopodium complanatum*			Sensitive	Possible
Small northern bog-orchid	*Platanthera obtusata (habenaria)*				Possible
TERRESTRIAL INVERTEBRATES					
None Identified					
REPTILES AND AMPHIBIANS (HERPETILES)					
Columbia spotted frog	*Rana Lutieventris*	Candidate/ Imperiled	Concern		Possible
BIRDS					
Northern Flicker	***Colaptes auratus (Colaptes cafer)***			**MIS**	**Observed**
Lewis' Woodpecker	***Melanerpes lewis (Asyndesmus lewis)***	**Candidate/Imperiled**	**Concern**	**Sensitive**	**Expected**
loggerhead shrike	***Lanius ludovicianus***	**Vulnerable/Rare**	**Concern**		**Expected**
olive-sided flycatcher	***Contopus borealis***	**Vulnerable/Rare**	**Concern**		**Expected**
Pileated woodpecker	***Dryocopus pileatus***			**MIS**	**Expected**
three-toed woodpecker	***Picoides tridactylus***	**Candidate/Rare**		**Sensitive**	**Expected**
white-headed woodpecker	***Picoides albolarvatus (Dendrocopos albolarvatus)***	**Candidate/Imperiled**	**Concern**	**Sensitive**	**Expected**
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Threatened	Sensitive	Possible
black-backed woodpecker	*Picoides arcticus*	Candidate/Rare		Sensitive	Possible
ferruginous hawk	*BUTEO REGALIS*	Candidate/Rare	Concern	Sensitive	Possible
golden eagle	*Aquila chrysaetos*			Sensitive	Possible
gray flycatcher	*Empidonax wrightii*			Sensitive	Possible
Northern goshawk	*Accipiter gentilis*	Candidate/ Imperiled	Concern	Sensitive	Possible
American peregrine falcon	*Falco peregrinus anatum*	Endangered/Imperiled	Concern	Sensitive	Possible
Swainson's Hawk	*Buteo swainsoni*	Vulnerable/Rare			Possible
White-headed woodpecker	*Picoides albolarvatus*			MIS	Possible
MAMMALS					
Canada lynx	*Lynx canadensis*		Threatened	Sensitive	Possible
Gray wolf	*Canis Lupus*		Threatened	Sensitive	Possible
long-eared myotis	*Myotis evotis*		Concern	Sensitive	Possible
long-legged myotis	*Myotis volans*	Rare	Concern	Sensitive	Possible
Townsend big-eared bat	*Plecotus townsendii townsendii*	Candidate/Imperiled	Concern	Sensitive	Possible
wolverine	*Gulo gulo luteus*	Threatened	Concern	Sensitive	Possible
yuma myotis	*Myotis yumanensis*		Concern		Possible

Notes:

Bold indicates a rare, threatened, or endangered species observed or expected at or near the Site.

Blank status indicates the species is not rare, threatened, or endangered under that jurisdiction.

TABLE C-4
OBSERVED PLANT SPECIES
NEW YORK MINES
GRANITE, OREGON

Common Name	Scientific Name	Habitat Type	Oregon Status	Federal Status	U.S. Forest Service Status
TREES					
ponderosa pine	*Pinus ponderosa*	Disturbed - Mine			
lodgepole pine	*Pinus contorta*	Disturbed - Mine			
western larch (tamarack)	*Larix occidentalis*	Disturbed - Mine			
grand fir	*Abies grandis*	Disturbed - Mine			
black cottonwood	*Populus trichocarpa*	Disturbed - Mine			
grand fir	*Abies grandis*	Forest			
Engelmann's spruce	*Picea engelmannii*	Forest			
western larch (tamarack)	*Larix occidentalis*	Forest			
Engelmann's spruce	*Picea engelmannii*	Riparian			
Sitka alder	*Alnus sinuata*	Riparian			
lodgepole pine	*Pinus contorta*	Riparian			
SHRUBS					
Pacific willow	*Salix lucida*	Disturbed - Mine			
oval-leaved blueberry	*Vaccinium deliciosum*	Forest			
black huckleberry	*Vaccinium membranaceum*	Forest			
Pacific willow	*Salix lucida*	Riparian			
red osier dogwood	*Cornus stolinifera*	Riparian			
GROUNDCOVER					
California buttercup	*Ranunuculus californicus*	Disturbed - Mine			
common horsetail	*Equisetum arvense*	Disturbed - Mine			
dandelion	*Taraxicum officianale*	Disturbed - Mine			
Falkland Island sedge	*Carex macloviana*	Disturbed - Mine			
fireweed	*Epilobium angustifolium*	Disturbed - Mine			
grass, bulbous bluegrass	*Poa bulbosa*	Disturbed - Mine			
grass, Idaho fescue	*Festuca idahoensis*	Disturbed - Mine			
grass, Kentucky bluegrass	*Poa pratensis*	Disturbed - Mine			
grass, mountain hairgrass	*Vahlodea atropurpurea*	Disturbed - Mine			
grass, orchardgrass	*Dactylis glomerata*	Disturbed - Mine			
grass, slender hairgrass	*Deschampsia elongata*	Disturbed - Mine			
Harkness's flaxflower	*Linanthus bicolor*	Disturbed - Mine			
Indian paintbrush	*Castilleja angustifolia*	Disturbed - Mine			
lupine	*Lupinus sp.*	Disturbed - Mine			
Menzie's larkspur	*Delphinium menziesii*	Disturbed - Mine			
mullein	*Verbascum thapsus*	Disturbed - Mine			
Rector's rockcress	*Arabis rectissima*	Disturbed - Mine			
Richardson's geranium	*Geranium richardsonii*	Disturbed - Mine			
sheep sorrel	*Rumex acetosella*	Disturbed - Mine			
small-flowered penstamon	*Penstemon attenuatus*	Disturbed - Mine			
white clover	*Trifolium repens*	Disturbed - Mine			
wild strawberry	*Fragaria virginiana*	Disturbed - Mine			
woolly eriophyllum	*Eriophyllum lanatum*	Disturbed - Mine			
yarrow	*Achillea millefolium*	Disturbed - Mine			
early blue violet	*Viola adunca*	Forest			
sedge, elk	*Carex geyeri*	Forest			
wild strawberry	*Fragaria virginiana*	Forest			
blunt-leaved sandwort	*Moehringia lateriflora*	Forest			
parrot's beak	*Pedicularis racemosa*	Forest			
grass, Idaho fescue	*Festuca idahoensis*	Forest			
prince’s pine	*Chimaphila umbellate*	Forest			

TABLE C-4
OBSERVED PLANT SPECIES
NEW YORK MINES
GRANITE, OREGON

Common Name	Scientific Name	Habitat Type	Oregon Status	Federal Status	U.S. Forest Service Status
American speedwell (brooklime)	*Veronica americana*	Riparian			
cleavers	*Galium aparine*	Riparian			
common horsetail	*Equisetum arvense*	Riparian			
cow parsnip	*Heracleum lanatum*	Riparian			
fireweed	*Epilbium angustifolium*	Riparian			
hooded lady's tresses	*Spiranthes romanzoffiana*	Riparian			
large leaved avens	*Geum macrophyllum*	Riparian			
Lyall's bittercress	*Cardamine lyalli*	Riparian			
meadowrue	*Thalictrum sp.*	Riparian			
Pacific ninebark	*Physocarpus capitatus*	Riparian			
polemonium	*Polemonium sp.*	Riparian			
slough sedge	*Carex obnupta*	Riparian			
smallflower buttercup	*Ranunculus parviflorus*	Riparian			
small-flowered bulrush	*Scirpus macrocarpus*	Riparian			
spreading rush	*Juncus patens*	Riparian			
tall bluebells	*Mertensia paniculata*	Riparian			
thistle, short-styled	*Circium brevistylum*	Riparian			

Notes:

Blank status indicates the species is not rare, threatened, or endangered.

TABLE C-5
TERRESTRIAL INVERTEBRATES
NEW YORK MINES
GRANITE, OREGON

Common Name	Scientific Name	Federal Status	State Status	U.S. Forest Service Status	Observed/ Expected/ Possible
bees	Order *Hymenoptera*				Observed
black carpenter ants	*Camponotus pennsylvanicus*				Observed
black flies	*Simulium* sp.				Observed
common black ground beetle	*Pterostichus* sp.				Observed
centipedes	Order *Chilopoda*				Observed
mosquitos	Family *Culicidae*				Observed
butterflies and moths	Order *Lepidoptera*				Observed
red ants	*Formica* sp.				Observed
spiders	Order *Araneae*				Observed
wasps	Order *Hymenoptera*				Expected
yellow jackets	*Vespula* sp.				Expected
alderflies	*Sialis* sp.				Expected
grasshoppers and crickets	Order *Orthoptera*				Expected
mayflies	Order *Ephemeroptera*				Expected
mites and ticks	Order *Acarina*				Expected
daddy-long-legs	Order Opiliones				Possible

Notes:

Bold indicates regulated or managed species observed or expected at the site.

Blank status indicates the species is not rare, threatened, or endangered.

TABLE C-6
DOCUMENTED OR EXPECTED BIRDS
NEW YORK MINES
GRANITE, OREGON

Common Name	Scientific Name	Oregon Status	Federal Status	U.S. Forest Service Status	Observed/ Expected/ Possible
American robin	*Turdus migratorius*				Observed
black-capped chickadee	*Parus atricapillus*				Observed
Brewer's Blackbird	*Euphagus cyanocephalus*				Observed
chipping sparrow	*Spizella passerine*				Observed
Clark's nutcracker	*Nucifraga columbiana*				Observed
common raven	*Corvus corax*				Observed
dark-eyed junco (slate-colored)	*Junco hyemalis*				Observed
dusky flycatcher (Wright's flycatcher)	*Empidonax oberholseri*				Observed
golden-crowned kinglet	*Regulus satrapa*				Observed
hermit thrush	*Catharus guttatus (Hylochichla guttata)*				Observed
mountain chickadee	*Parus gambeli*				Observed
northern flicker	*Colaptes auratus (Colaptes cafer)*			**MIS**	**Observed**
olive-sided flycatcher	***Contopus borealis***	**Vulnerable/Rare**	**Concern**		**Observed**
red-breasted nuthatch	*Sitta canadensis*				Observed
ruby-crowned kinglet	*Regulus calendula*				Observed
Steller's jay	*Cyanocitta stelleri*				Observed
Swainson's thrush	*Catharus ustulata (Hylocichla ustulata)*				Observed
Townsend's solitaire	*Myadestes townsendi*				Observed
Townsend's warbler	*Dendroica townsendi*				Observed
warbling vireo	*Vireo gilvus*				Observed
western tanager	*Piranga ludoviciana*				Observed
Williamson's sapsucker	*Sphyrapicus thyroideus*				Observed
yellow-rumped warbler	*Dendroica coronata*				Observed
American crow	*Corvus brachyrhynchos*				Expected
American dipper	*Cinclus mexicanus*				Expected
barred owl	*Strix varia*				Expected
belted kingfisher	*Megaceryle alcyon*				Expected
Black-billed Magpie	*Pica pica*				Expected
black-headed grosbeak	*Pheucticus melanocephalus*				Expected
Bohemian Waxwing	*Bombycilla garrula*				Expected
brown creeper	*Certhia familiaris*				Expected
brown-headed Cowbird	*Molothrus ater*				Expected
Calliope hummingbird	*Stellula calliope*				Expected
cedar waxwing	*Bombycilla cedrorum*				Expected
common nighthawk	*Chordeiles minor*				Expected
downy woodpecker	*Picoides pubescens (Dendrocopos pubescens)*				Expected
flammulated owl	***Otus Flammeolus***	**Candidate**			**Expected**
fox sparrow	*Passerella iliaca*				Expected
great horned owl	*Bubo virginianus*				Expected
hairy woodpecker	*Picoides villosus (Dendrocopos villosus)*				Expected
Hammond's flycatcher	*Empidonax hammondii*				Expected
Lewis' Woodpecker	***Melanerpes lewis (Asyndesmus lewis)***	**Candidate/Imperiled**	**Concern**	**Sensitive**	**Expected**
loggerhead shrike	*Lanius ludovicianus*	**Vulnerable/Rare**	**Concern**		Expected
MacGillivray's warbler	*Oporornis tolmiei*				Expected
orange-crowned warbler	*Vermivora celata*				Expected
pileated woodpecker	***Dryocopus pileatus***	**Candidate**		**MIS**	**Expected**
pine siskin	*Carduelis pinus (Spinus pinus)*				Expected
poor-will	*Phalaenoptilus nuttallii*				Expected
pygmy nuthatch	*Sitta pygmaea*				Expected
pygmy owl	*Glaucidium gnoma*				Expected
red crossbill	*Loxia curvirostra*				Expected
red-tailed hawk	*Buteo jamaicensis*				Expected
red-winged blackbird	*Agelaius phoeniceus*				Expected
saw-whet owl	*Aegolius acadicus*				Expected
screech owl	*Otus asio*				Expected
sharp-shinned hawk	*Accipiter striatus*				Expected
song sparrow	*Melospiza melodia*				Expected
spotted towhee	*Pipilo erythrophthalmus*				Expected
three-toed woodpecker	***Picoides tridactylus***	**Candidate/Rare**		**Sensitive**	**Expected**
turkey vulture	*Cathartes aura*				Expected
varied thrush	*Ixoreus naevius*				Expected
violet-green Swallow	*Tachycineta thalassina*				Expected
western bluebird	*Sialia mexicana*				Expected
western flycatcher	*Empidonax difficilis*				Expected
western wood pewee	*Contopus sordidulus*				Expected
white-breasted nuthatch	*Sitta carolinensis*				Expected
white-crowned sparrow	*Zonotrichia leucophrys*				Expected

TABLE C-6
DOCUMENTED OR EXPECTED BIRDS
NEW YORK MINES
GRANITE, OREGON

Common Name	Scientific Name	Oregon Status	Federal Status	U.S. Forest Service Status	Observed/ Expected/ Possible
white-headed woodpecker	***Picoides albolarvatus (Dendrocopos albolarvatus)***	**Candidate/Imperiled**	**Concern**	**Sensitive**	**Expected**
willow flycatcher (Traill's flycatcher)	*Empidonax traillii*	**Rare**	**Concern**	**Sensitive**	Expected
yellow warbler	*Dendroica petechia*				Expected
yellow-bellied sapsucker	*Sphyrapicus varius*				Expected
American peregrine falcon	*Falco peregrinus anatum*	Endangered/Imperiled		Sensitive	Possible
American redstart	*Wetophaga ruticilla*				Possible
ash-throated flycatcher	*Myiarchus cinerascens*				Possible
bald eagle	*Haliaeetus leucocephalus*	Threatened	Threatened	Sensitive	Possible
band-tailed pigeon	*Columba fasciata*	Rare	Concern	Sensitive	Possible
black-backed woodpecker	*Picoides arcticus*	Candidate/Rare		Sensitive	Possible
black-chinned hummingbird	*Archilochus alexandri*				Possible
black-throated gray warbler	*Dendroica nigrescens*				Possible
blue grouse	*Dendragapus obscurus*				Possible
bushtit	*Psaltriparus minimus*				Possible
Cassin's Finch	*Carpodacus cassinii*				Possible
Cooper's hawk	*Accipiter cooperii*				Possible
evening grosbeak	*Hesperiphona vespertina*				Possible
golden eagle	*Aquila chrysaetos*			Sensitive	Possible
gray flycatcher	*Empidonax wrightii*		Threatened	Sensitive	Possible
gray jay	*Perisoreus canadensis*				Possible
Lazuli Bunting	*Passerina amoena*				Possible
Lincoln's Sparrow	*Melospiza lincolnii*				Possible
long-eared owl	*Asio otus*				Possible
mountain bluebird	*Sialia currucoides*				Possible
northern goshawk	*Accipiter gentilis*	Candidate/Imperiled			Possible
northern oriole (Bullock's oriole)	*Icterus galbula (Icterus bullockii)*				Possible
northern shrike	*Lanius excubitor*				Possible
osprey	*Pandion haliaetus*				Possible
purple finch	*Carpodacus purpureus*				Possible
red-breasted sapsucker	*Sphyrapicus ruber*				Possible
red-naped sapsucker	*Sphyrapicus nuchalis*				Possible
ruffed grouse	*Bonasa umbellus*				Possible
rufous hummingbird	*Selasphorus rufus*				Possible
Say's phoebe	*Sayornis saya*				Possible
solitary vireo	*Vireo solitarius*				Possible
Swainson's Hawk	***Buteo swainsoni***	**Vulnerable/Rare**			**Possible**
turkey	*Meleagris gallopavo*				Possible
western kingbird	*Tyrannus verticalis*				Possible
white-winged crossbill	*Loxia leucoptera*				Possible
Wilson's warbler	*Wilsonia pusilla*				Possible

Notes:

Bold indicates regulated or managed species observed or expected at the site.

Blank status indicates the species is not rare, threatened, or endangered.

TABLE C-7
DOCUMENTED OR EXPECTED MAMMALS
NEW YORK MINES
GRANITE, OREGON

Common Name	Scientific Name	Washington Status	Oregon Status	Federal Status	U.S. Forest Service Status	Observed/ Expected/ Possible
douglas squirrel (chickaree)	*Tamiasciurus douglasi*					Observed
golden-mantled ground squirrel	*Spermophilus lateralis*					Observed
mule deer	*Odocoileus hemionus hemionus*					Observed
Rocky Mountain Elk	***Cervus canadensus nelsoni***				**MIS**	**Observed**
big brown bat	***Eptisicus fuscus***				**Sensitive**	**Expected**
black bear	*Ursus americanus*					Expected
bobcat	*Lynx rufus*					Expected
Canada lynx	***Lynx canadensis***	**Threatened**		**Threatened**	**Sensitive**	**Expected**
coyote	*Canis latrans*					Expected
deer mouse	*Peromyscus maniculatus*					Expected
least chipmunk	*Eutamias minimus*					Expected
longtail weasel	*Mustela frenata*					Expected
mink	*Mustela vision*					Expected
mountain cottontail	*Sylvilagus nuttalli*					Expected
cougar (mountain lion)	*Felis concolor*					Expected
mountain vole	*Microtus montanus*					Expected
raccoon	*Procyon lotor*					Expected
red fox	*Vulpes fulva*					Expected
yellow pine chipmunk	*Eutamias amoenus*					Expected
badger	*Taxidea taxus*					Possible
beaver	*Castor canadensis*					Possible
big freetail bat	*Tadarida molossa*					Possible
bushytail woodrat	*Neotoma cinerea*					Possible
California myotis	*Myotis californicus*					Possible
fisher	*Martes pennanti*	Endangered	Critical	Concern	Sensitive	Possible
fringed myotis	*Myotis thysanodes*	Vulnerable		Concern	Sensitive	Possible
gray fox	*Urocyon cinereoargenteus*					Possible
gray wolf	*Canis lupus*		Endangered	Threatened	Sensitive	Possible
hoary bat	*Felis concolor*					Possible
little brown myotis	*Myotis lucifugus*				Sensitive	Possible
long-eared myotis	*Myotis evotis*			Concern	Sensitive	Possible
long-legged myotis	*Myotis volans*		Rare	Concern	Sensitive	Possible
longtail vole	*Microtus longicaudus*					Possible
marten	*Martes americana*				Sensitive	Possible
Merriam's Shrew	*Sorex merriami*					Possible
northern grasshopper mouse	*Onychomys leucogaster*					Possible
northern pocket gopher	*Thomomys talpoides*					Possible
Pacific fringe-tailed Bat	*Myotis thysanodes vespertinus*				Sensitive	Possible
pallid bat	*Antozous pallidus*	Vulnerable	Vulnerable/Imperiled	Concern	Sensitive	Possible
River Otter	*Lutra canadensis*					Possible
shorttail weasel (ermine)	*Mustela erminea*					Possible
silver-haired bat	*Lasionycteris noctivagans*				Sensitive	Possible
small-footed myotis	*Myotis leibii*		Rare	Concern		Possible
spotted skunk	*Spilogale putorius*					Possible
striped skunk	*Mephitis mephitis*					Possible
Townsend big-eared bat	***Plecotus townsendii townsendii***	**Candidate**	**Candidate/Imperiled**	**Concern**	**Sensitive**	**Possible**
vagrant shrew	*Sorex vagrans*					Possible
westerm pipistrel	*Pipistrellus hesperus*					Possible
western big-eared bat	*Plecotus townsendii*	Critical		Concern	Sensitive	Possible
wolverine	*Gulo gulo luteus*		Threatened	Concern	Sensitive	Possible
yellow-bellied marmot	*Marmota flaviventris*					Possible
yuma myotis	*Myotis yumanensis*			Concern		Possible

Notes:

Bold indicates regulated or managed species observed, or expected at the site.

Blank status indicates the species is not rare, threatened, or endangered.

MIS = Management Indicator Species

TABLE C-8
DOCUMENTED OR EXPECTED AMPHIBIANS AND REPTILES
NEW YORK MINES
GRANITE, OREGON

Common Name	Scientific Name	Federal Status	Washington Status	Oregon Status	U.S. Forest Service Status	Observed/ Expected/ Possible
AMPHIBIANS						
Pacific treefrog	*Hyla regilla*					Expected
western toad	***Bufo boreas***	**Concern**	**Candidate**	**Vulnerable/Rare**		**Expected**
Great basin spadefoot	*Scaphiopus intermontanus*					Possible
long-toed salamander	*Ambystoma macrodactylum*					Possible
northern leopard frog	*Rana pipiens*			Critical		Possible
Columbia spotted frog	*Rana luteiventris*			Candidate/ Imperiled	Sensitive	Possible
REPTILES						
common garter snake	*Thamnophis sirtalis*					Expected
rubber boa	*Charina bottae*					Expected
Western garter snake	*Thamnophis elegans*					Expected
Western skink	*Eumeces skiltonianus*					Expected
Gopher snake (bull snake)	*Pituophis melanoleucus*					Possible
Western fence lizard	*Sceloporus occidentalis*					Possible
Western rattlesnake	*Crotalus viridis*			Vulnerable		Possible

Notes:

Bold indicates regulated or managed species observed OR expected at the site.

Blank status indicates the species is not rare, threatened, or endangered.

Appendix D.

Human and Ecological Risk Assessments

1.0 INTRODUCTION

As part of a Site Inspection (SI; CES 2007), potential human health and ecological risks associated with mining-related contamination at the New York Mine/Independence Mill/East Eddy Group complex (Site) were assessed using a streamlined risk assessment process. The Site is located approximately 4.5 kilometers (km; 3 miles) north of Granite, Oregon. Due to the proximity of the three mining areas to each other and along Granite Creek, data sets were combined for purposes of the risk evaluation. The risk assessment process follows U.S. Environmental Protection Agency (USEPA, 1991; 1992; 1997; 1998) and Oregon Department of Environmental Quality (ODEQ, 1998; 2001; 2007) guidelines. Potential risks were evaluated using site-specific concentrations of chemicals of interest (COIs) compared to risk-based screening concentrations, for selected exposure pathways. Section 2.0 describes the data used for the risk analysis. The human health risk assessment (HHRA) and ecological risk assessment (ERA) are presented in Sections 3.0 and 4.0, respectively. Conclusions and recommendations based on the results of the risk assessments are presented in Section 5.0. All appendices are located in the USFS Project File.

2.0 RISK ASSESSMENT DATA AND INITIAL SCREENING

This section describes the analytical data set used in this risk analysis and the preliminary screening for the HHRA and ERA. The analytical data used in the risk assessment are from soil, wasterock, tailings, surface water, pore water, and sediment samples collected in June 2007. Soil, wasterock, and tailings (all considered as "soil" in this risk assessment) samples were selectively collected in areas where contamination was known or suspected to occur. Therefore, the soil data is skewed towards an understanding of the highest onsite COI concentrations rather than to provide characterization across and surrounding the extent of mine-related impacts. Surface water, pore water, and sediment data were collected from streams (Granite Creek and Chipman Gulch) adjacent to the mining areas, at locations upstream, adjacent to, and downstream of potential mining-related impacts. Overall, the samples were collected from locations that are likely to overestimate the concentrations found across the Site because samples were located to represent the areas of highest COI concentrations, not areas representative of overall human and ecological receptor exposure. This is a conservative approach that is appropriate for screening level risk assessments. Because of the metals mining that occurred at the Site, metals were selected as the COIs.

Fortyone surface soil samples (includes soil, wasterock, and tailings), 1 subsurface soil sample, 16 surface water samples (11 from Granite Creek, 5 from Chipman Gulch), five adit seep/side drainages water samples, 16 pore water samples (11 from Granite Creek, 5 from Chipman Gulch), and 16 sediment samples (11 from Granite Creek, 5 from Chipman Gulch) were analyzed for the COIs. Background COI concentrations were represented in eight soil samples, five surface water samples (three in Granite Creek, two in Chipman Gulch), five pore water samples (three in Granite Creek, two in Chipman Gulch), and five sediment samples (three in Granite Creek, two in Chipman Gulch). Total or total recoverable COI concentrations were analyzed in soil, surface water, and sediment samples. Dissolved COI concentrations were measured in pore water samples. Standard laboratory quality control procedures were applied and analytical results were quality assured by the laboratory. Qualifiers were applied to the data by the laboratory and these were incorporated into determinations of the usability of the data for the risk assessment. The soil, surface water, pore water, and sediment data were then used in the initial screening and the HHRA and ERA as described in sections 3.0 and 4.0, respectively.

Initially, all data collected during the SI and deemed appropriate for use in the risk assessment were used to calculate the 90% upper confidence level on the arithmetic mean ($90\%_{UCL}$) for all samples in each medium. The $90\%_{UCL}$ is an upper-bound (i.e., conservative) estimate of mean chemical concentration and is specified as an appropriate EPC in Oregon's Revised Cleanup Rules (OAR 340-122-084). If fewer than 10 samples are available in a given medium, it is inappropriate to calculate a $90\%_{UCL}$ (USEPA 2003). In these cases and if the calculated $90\%_{UCL}$ exceeded the maximum detected concentration, the maximum

detected concentrations was used as an appropriate substitute for the $90\%_{UCL}$. The equations used to calculate the $90\%_{UCL}$ are provided by the USEPA (1997). A data summary, including the calculated $90\%_{UCL}$ is provided in Tables D1-1 through D1-5 in Appendix D1.

Then the data were then screened using the ODEQ's Guidance for Conduct of Deterministic Risk Assessments (1998), which allows for prescreening of COIs based on the following criteria:

- Essential Nutrients: calcium, magnesium, potassium, and sodium were removed from further assessment because they are considered to be essential nutrients.
- Frequency of Detection: COIs in each medium that were detected in 5% or less of the samples site-wide were removed from further assessment. This includes assurance that the detection limits of undetected COIs are below risk-based screening and background concentrations.
- Background: $90\%_{UCL}$ or maximum (as described above) concentrations of naturally-occurring chemicals that were present at concentrations less than maximum background concentrations were eliminated from further assessment.

The results of these initial screening procedures for each potential exposure medium are also shown in Tables D1-1 through D1-5 in Appendix D1. The tables also show a sample reporting limit screening to ensure that undetected chemicals had detection limits below background and lowest applicable risk-based screening concentrations. Those chemicals that met the screening criteria were removed from further consideration. The remaining COIs were further evaluated in the human health and ecological risk assessment sections of the report.

3.0 HUMAN HEALTH RISK ASSESSMENT

A human health risk evaluation is an analysis of the potential adverse health effects that could result from current or future exposures to hazardous substances released from a site, in the absence of any action to control or mitigate these releases. The objective of this evaluation is to incorporate analytical data and information on potential human exposure to the COIs in order to provide a baseline assessment of the potential for human health risks to be realized due to Site-related contamination. The following are primary elements of the HHRA:

- **Hazard Identification and Selection of Contaminants of Potential Concern (COPCs)**
  Evaluation of site data and identification of elevated concentrations of COIs in human health exposure media.

- **Exposure assessment**
  Identification of areas that pose human health risks under current or potential future site uses and conservative estimation of exposure.

- **Toxicity assessment**
  Quantification of the relationship between chemical exposure and adverse effects.

- **Risk characterization**
  Development of quantitative risk estimates using exposure and toxicity information previously developed for the contaminants of potential concern (COPCs).

3.1 HAZARD IDENTIFICATION AND SELECTION OF COPCS

This section presents the rationale for the selection of the COPCs. Prescreening of the COIs was described in Section 2.0. The media of interest for human health included soil (including wasterock and

tailings), surface water, and sediment. Those COIs that were retained for further assessment following the initial screening are shown in the last column of Tables D1-1 through D1-4 for surface soil, subsurface soil, surface water (including adit water samples), and sediment, respectively. Maximum or 90 UCL concentrations of these COIs were screened against USEPA Region IX Preliminary Remediation Goals (PRGs). Industrial PRGs were selected as the most appropriate screening criteria for soils and sediment; and tap water PRGs represent a very conservative screen for surface water and groundwater. In addition to individual screening, as per ODEQ guidelines, consideration was provide of potential risks due to multiple chemicals and, where more than one medium is contaminated, multiple media. Table D2-1 presents the PRG screening and results, respectively. Based on this screening, arsenic, and lead were identified as COPCs for the Site.

3.2 EXPOSURE ASSESSMENT

Assessing the chemical exposure at a given site includes the identification of potentially exposed populations, the selection of relevant exposure pathways, and the calculation of exposure point concentrations and chronic daily intakes.

3.2.1 Potentially Exposed Population

The New York Mine complex consists of the New York Mine, the Independence Mill area, and the East Eddy Group. A gravel road passes through the New York Mine area. This area includes 5 adits and approximately 2 acres of disturbed soils, wasterock, and tailings. A roadside interpretive sign is present adjacent to the Independence Mill but any access to the dilapidated mill building must be on foot and the mill building is built into a steep hill, making access more difficult. An old gravel roadway leads to the East Eddy Group but access is limited to off-road vehicles or walking. The uppermost adit areas are steep and mostly covered by forest. The lower adit area includes an approximately ½ acre area of disturbed soils and historic placer mining spoils.

One adit seep emanates from the both the New York Mine (Adit 2) and East Eddy Group (Adit 1). The East Eddy Group is adjacent to Chipman Gulch while the Independence Mill and New York Mine are adjacent to Granite Creek. There are no onsite workers, or occupied structures on the Site. Access is currently not restricted by fencing, nor were any “No Trespassing” signs observed. In general, land uses in this area are limited to recreation (hiking, fishing, camping, hunting, etc.).

3.2.2 Identification of Exposure Pathways

This section evaluates and selects potential pathways for human exposures to the identified COPCs. In general, an exposure pathway consists of four elements: a source of chemical release into the environment (e.g., mining), an environmental medium for transport of the chemical (e.g., air, surface water, groundwater or soil), a point of potential human exposure (exposure point) and a route of exposure of the chemical into the body (e.g., breathing, eating, drinking or skin [i.e., dermal] contact). Given the types of human uses of the site as described above, long-term exposure to Site-related contaminants is considered very unlikely. However, the ingestion, dermal contact and air exposure pathways are considered potentially complete, because hikers, hunters, and campers have the potential to access the Site. Fish consumption was eliminated as a potential pathway of concern because it was determined that the number of fish in Granite Creek is too few to support even a recreational fisher scenario. The human health conceptual exposure model is presented in Figure 3-1.

Human exposures to COPCs were evaluated for all complete pathways for which there was a receptor. These pathways were determined to be inhalation of soil particulates, dermal contact with soil, incidental ingestion of surface soil, dermal contact with stream water, incidental ingestion of stream water, dermal contact with sediment, and incidental ingestion of sediment.

3.2.3 Current and Potential Future Receptors

The Site is not currently occupied, nor is it expected to be occupied or developed in the near future. The only likely exposed populations are current and future recreational receptors such as hikers, campers, hunters, and mine seekers.

3.2.4 Exposure Assumptions

Neither USEPA nor ODEQ have developed default scenarios for recreational or camping exposure scenarios. Therefore, recreational exposure assumptions developed by USEPA for the Upper Tenmile Creek Mining Area Superfund site (CDM, 2000) were reviewed and deemed appropriate for the New York Mines. The exposure factors and assumptions used in this risk assessment are presented in Table D2-2.

3.2.5 Exposure Point Concentrations

An exposure point concentration (EPC) is needed to calculate the Average Daily Dose (ADD) of a contaminant. Generally, the EPC is not the maximum concentration detected because, in most situations, it is not reasonable to assume long-term contact with the maximum concentration. When sufficient data exists, statistical average concentrations are used because toxicity criteria are based on lifetime average exposures, and an average concentration is most representative of the concentration contacted over time, based on the assumption that an exposed individual moves randomly across an exposure area. Use of the arithmetic mean is used for central tendency exposure (CTE) and the $90\%_{UCL}$ provides an upper bound estimate for reasonable maximum exposure (RME). The equations used to calculate the EPC and ADD are found in USEPA, 1997.

Risk calculations were based on 41 surface soil, wasterock, and tailings samples. 15 surface water samples and 10 sediment samples. Initial risk calculations indicated potential unacceptable excess cancer risk from sediment. Therefore, sediment samples from Chipman Gulch (3 samples) and Granite Creek (7 samples) were segregated to quantify potential risks due to potential exposure in each of the streams. Where data was limited to less than 10 samples, the maximum detected concentration was used as the EPC for the RME scenario. Where the data set contained greater than 10 samples, the $90\%_{UCL}$ was calculated and used as the EPC as described in Section 2.0. The EPCs calculated for COPCs in the HHRA are presented in Table 3-1 below.

Table 3-1
Exposure Point Concentrations

Contaminant of Potential Concern	n	Maximum Concentrations	Central Tendency Exposure[1]	Reasonable Maximum Exposure[2]	Exposure Point Concentration
Surface Soil (mg/kg)					
Arsenic	41	1.6E+04	1.1E+03	7.2E+03	90UCL
Lead	41	1.6E+04	4.3E+02	1.2E+03	90UCL
All Sediments (mg/kg)					
Arsenic	10	1.1E+03	2.8E+02	5.3E+02	90UCL
Granite Creek Sediment (mg/Kg)					
Arsenic	7	1.86E+02	1.24E+02	1.86E+02	MAX
Chipman Gulch Sediments (mg/kg)					
Arsenic	3	1.1E+03	6.5E+02	1.1E+03	MAX
Surface Water (ug/L)					
Arsenic	15	3.13E-01	5.63E-02	1.44E-01	90UCL

3.2.6 Summary Intake Factors

While presented individually in exposure equations, USEPA Region X allows for the calculation of Summary Intake Factors (SIFs). The SIFs are calculated using generic intake equation, using the site-specific exposure parameters (Table D2-2). They represent a sum of lifetime exposure to contaminated soil, water or air and account for all risk calculation input factors, except the chemical EPC. The SIFs are shown in Table D2-4. In addition, dermal absorption factors are required to calculate dermal exposures to surface water and these are shown in Table D2-5.

3.3 TOXICITY ASSESSMENT

The purpose of the toxicity assessment is to present the critical toxicity values for the COPCs. Toxicity is defined as the ability of a chemical to induce adverse effects at some dosage in biological systems. The purpose of the toxicity assessment is twofold:

- To identify the carcinogenic (cancer) and non-carcinogenic (non-cancer) effects that may arise from direct or indirect exposure of humans to the COPCs; and,
- To provide an estimate of the quantitative relationship between the magnitude and duration of exposure, and the probability or severity of adverse effects.

3.3.1 Toxicity Values

Toxicity values are used to quantitatively describe the relationship between the extent of exposure to a COPC and the potential increased likelihood and severity of adverse effects. The sources used to obtain toxicity information and methods for deriving toxicity criteria and estimated potential adverse effects are presented below. The following USEPA sources have been used to obtain toxicity values for most of the COPCs.

- Integrated Risk Information System (IRIS) computer database (USEPA, 2004)
- Health Effects Assessment Summary Table (HEAST) (USEPA, 1997)

Both carcinogenic and non-carcinogenic health effects were quantitatively evaluated. The endpoints for these two different types of effects are assessed differently because the mechanisms by which chemicals cause cancer are assumed to be fundamentally different from the processes that cause non-carcinogenic effects. The principal difference reflects the assumption that non-carcinogenic effects are assumed to exhibit a threshold dose below which no adverse effects occur, where USEPA assumes no such threshold exists for carcinogenic effects. Because exposure to some chemicals may result in both carcinogenic and non-carcinogenic effect, both endpoints associated with a COPC were evaluated quantitatively because sufficient toxicity data are available (Tables D2-6 and D2-7).

3.3.1.1 Carcinogenic Critical Toxicity Factors

Carcinogenic toxicity is not assumed to have a threshold concentration below which adverse effects do not occur. Therefore, carcinogenic risk from exposure to a COPC is expressed in terms of the probability that an exposed receptor will develop cancer over their lifetime. Contaminant-specific dose response curves are used to establish slope factors (SFs) that represent an upper-bound excess cancer risk from a lifetime exposure. Dose response curves for human carcinogens are developed from tumorgenic and laboratory studies; the SF is generated from the $90\%_{UCL}$ of the extrapolated dose curve using probabilistic methods and represents a conservative upper-bound estimate of the potential risk associated with exposure. Based on USEPA guidelines documents, critical toxicity data for arsenic is presented in Table 3-3 (refer to USEPA, 1986; 1999 for additional information).

Table 3-2
Critical Toxicity Values for the Carcinogenic COPCs.

	Slope Factor (mg/kg/day)-1		Weight of Evidence Classification	Type of cancer	Basis of Slope Factor
Contaminant	**Oral**	**Inhalation**	**Ingestion/Inhalation**	**Ingestion/ Inhalation**	**oral/inhalation**
Arsenic	1.5E+00	1.5E+01	A	Skin	EPI Studies

COPCs = Chemicals of Potential Concern
CAS Number = Chemical Abstracts Scientific (Registration) Number
A = Known Human Carcinogen

3.3.1.2 Non-Carcinogenic Critical Toxicity Values

Reference doses (RfDs) are critical toxicity values for chemicals that exhibit adverse non-carcinogenic health effects. An RfD represents an estimated intake rate that is unlikely to produce measurable adverse effects over a lifetime of exposure (USEPA, 1989a). RfDs are determined by the USEPA RfD Work Group or from the health effects assessment documents developed by the USEPA Office of Research and Development. USEPA-established RfDs have been verified by a USEPA-directed peer review of available information.

An RfD assumes a threshold for adverse non-carcinogenic effects; doses or exposures below this threshold are considered unlikely to cause adverse health effects. An RfD is expressed in units of mg/kg-day. RfDs are route-specific; that is, RfDs may differ for ingestion, inhalation or other routes of exposure. RfDs are derived using uncertainty factors (UFs) and modifying factors (MFs). The UFs reflect scientific judgment regarding the data used to estimate an RfD. A UF of 10 is usually used to account for variation in human sensitivity among populations. An additional 10-fold factor is used to account for each of the uncertainties assumed when extrapolating from animal data to humans, when extrapolating from a lowest-observed adverse effect level (LOAEL) to a no-observed-adverse-effect-level (NOAEL) and when extrapolating from subchronic to chronic exposure. To reflect professional assessment of the uncertainties of the study and the database not explicitly addressed by the above UFs, an additional UF or

MF ranging from >0 to 10 can be applied. The default value for MF is 10. The Critical Toxicity Factors for the non-carcinogenic COPCs are presented in Table 3-2.

Table 3-3
Critical Toxicity Values for the Non-carcinogenic COPCs

Contaminant	Chronic RfD (mg/kg-day)		Confidence in RfD	Endpoint
	Oral	Inhalation		
Arsenic	0.0003		Medium	hyperpigmentation, vascular

* RfD value from Region IX PRG Tables
COPCs = Chemicals of Potential Concern
RfD = Non-carcinogenic reference dose

3.3.1.3 Lead Critical Toxicity Values

Meaningful oral and inhalation critical toxicity values have not been developed for lead. Many of the non-carcinogenic effects Many of the noncancer effects associated with lead may not exhibit a threshold, especially in young children. USEPA considers Lead to be a B2 carcinogen. In lieu of a reference dose or slope factor, USEPA has developed the Integrated Exposure Uptake/Biokinetic Model (IEUBK) and the Adult Lead Model (ALM) which correlate dose with blood lead levels.

The LOAEL of lead is considered to be 10 micrograms per deciliter (ug/dl) in children and fetuses and 30 ug/dl in adults. Empirically-derived ratios of 0.16 and 0.04 ug/dl per ug/day ingested by children and adults respectively, recommended by USEPA (1986) and FDA (1990), are used predict concentrations in young children and adults. Applying an uncertainty factor of 10 results in provisional tolerable intake levels of 6 ug/day for children six or less, 15 ug/day for children over six, 25 ug/day for pregnant women and 75 ug/day for men.

3.4 RISK CHARACTERIZATION

Potential human health impacts associated with exposure to COPCs at the Site were evaluated by estimating both non-carcinogenic and carcinogenic effects. The following sections discuss the assessment of non-carcinogenic hazards, carcinogenic risks, and lead risk associated with exposure to COPCs at the Site. The sampling locations were selected as locations where levels of concentrations were suspected to be the highest. Targeted sampling identifies the worst-case situations, and is intended to be conservative data set that is sufficient for the specific purposes of risk assessment.

3.4.1 Carcinogenic Hazard Assessment

Carcinogenic risk is estimated as the probability that a compound will produce a carcinogenic effect. The excess lifetime carcinogenic risk is the incremental increase in the probability of developing cancer compared to the background incremental probability of developing cancer with no exposure to site contaminants. An excess cancer risk (ECR) of 1×10^{-6}, for example, represents the probability that one person in one million exposed to a carcinogen over a lifetime (70 years) will develop cancer. Estimates of carcinogenic risk using the slope factors developed by USEPA are generally upper-bound estimates; actual risks from exposures to chemical constituents at the Sites would likely be lower than the risks estimated herein.

For estimating carcinogenic risk from exposure to more than one carcinogenic chemical from a single exposure route, risks from each individual chemical are summed to estimate total cancer risk through a single route.

3.4.2 Non-Carcinogenic Hazard Assessment

Non-carcinogenic hazard is estimated as the ratio of the non-carcinogenic chemical intake (CI) of a compound through a specific exposure route to the chronic (or subchronic) RfD for that exposure route. For example, intakes from the ingestion route are compared to oral RfDs. The CI is calculated by multiplying the chemical concentration in a given media by the media specific intake factor for the specific exposure pathway.

The CI divided by the RfD for an individual chemical is termed the Hazard Quotient (HQ). HQs greater than 1.0 indicate the potential for adverse health effects because the intake exceeds the RfD (USEPA, 1986b). An HQ is calculated for each chemical that elicits a non-carcinogenic health effect if an RfD is available for the chemical and exposure route. The sum of all individual chemical-specific HQs is termed the Hazard Index (HI) and is calculated under each exposure pathway.

The HI considers exposure to a mixture of chemicals having non-carcinogenic effects based on the assumption that the effects of chemical mixtures are additive (USEPA, 1986b). An HI greater than 1.0 indicates the potential for adverse non-carcinogenic effects. When the HI is greater than 1.0, the USEPA guidance allows for segregating HIs by critical effect categories. Major categories of critical effects include neurotoxicity, developmental effects and effects on target organs to name a few.

3.4.3 Risk and Hazard Estimates for the Recreational Receptor

Risk and hazard estimates are provided for carcinogens and non-carcinogens.

3.4.3.1 Discussion of Carcinogenic risks

The following provides a brief summary of the carcinogenic risks for each medium. The ECRs for each medium are outlined in Table D2-8.

- Soil, Wasterock, and Tailings. The only carcinogenic constituent identified was arsenic. The average concentration and the $90\%_{UCL}$ concentrations were used as the EPCs for the CTE and RME exposures, respectively. The ECR did not exceed the regulatory standard of 1×10^{-6} under CTE exposure conditions. However, under the RME exposure condition, ECRs for ingestion (5×10^{-5}) and dermal contact (4×10^{-6}) of arsenic exceeded the regulatory standard of 1×10^{-6}. Therefore, a carcinogenic risk is possible for exposure to arsenic impacted soil, wasterock, and tailings under the RME exposure scenario.

- Sediments. The only carcinogenic constituent identified in sediment is arsenic. The ECRs for arsenic in sediment ranged from 2×10^{-6} (RME) to 4×10^{-7} (CTE). Because 2×10^{-6} exceeds the acceptable threshold, sediment samples from Chipman Gulch and Granite Creek were segregated and quantitatively evaluated (Table D2-9). The ECRs for Granit Creek did not exceed the regulatory standard of 1E-06 under CTE and RME exposure conditions. Therefore, no carcinogenic risk is expected from exposure to sediments in Granite Creek. The ECRs from exposure to sediments in Chipman Gulch were 9E-07(CTE) and 4E-06 (RME). No unacceptable risks are expected from exposure to sediments in Chipman Gulch under CTE exposure conditions. Under the RME exposure conditions (using the maximum detected concentrations in Chipman Gulch), the ECRs for ingestion and dermal contact were 4×10^{-6} and 2×10^{-9} respectively. Therefore, a carcinogenic risk is possible for exposure to arsenic impacted sediments in Chipman Gulch only for ingestion of sediment under the RME exposure scenario.

- Surface Water and Air: No unacceptable human health cancer risk is anticipated due to COIs in surface water or air.

The risk characterization determined no unacceptable human health cancer risks due to COIs in surface water or air. No unacceptable excess cancer risks were predicted due to exposure to COIs in soil, wasterock, tailings, or sediment under CTE exposure conditions. However, there is a potential for unacceptable cancer risk from ingestion of arsenic in soil, wasterock, and tailings under RME conditions. The risk characterization determined no unacceptable excess cancer risks from exposure to sediment in Granite Creek under both CTE and RME conditions, nor in Chipman Gulch under CTE exposure conditions. But there was a predicted potential for unacceptable cancer risk from ingestion of arsenic in the sediment of Chipman Gulch under RME conditions.

3.4.3.2 Discussion of Non-Carcinogenic Risk

The following provides a brief summary of the non-carcinogenic risks for each media. HQs are outlined in Table D2-10.

- Soils, Wasterock, Tailings. Arsenic and lead were identified as the COPCs for this media. The $90\%_{UCL}$ concentrations were used as the EPCs. None of the constituents exceeded the regulatory standard of a hazard index of 1.0 under CTE and RME exposure conditions.

- Sediments. Arsenic was quantitatively evaluated in sediments. The HQs are below the regulatory standard of 1.0 for all constituents under both the RME and CTE exposure scenarios.

- Surface water: Arsenic was quantitatively evaluated in surface water. The HQs are below the regulatory standard of 1.0 for all constituents under both the RME and CTE exposure scenarios.

The HI, sum of the HQs, did not exceed the regulatory standard of 1.0 for noncarcinogens under CTE or RME conditions. Therefore no unacceptable noncancer health effects are anticipated.

Table 3-4
Summary of Non-Carcinogenic HIs for
Recreational Receptors by Critical Health Effects

Chemical of Potential Concern	Critical Effect	Central Tendency Exposure	Reasonable Maximum Exposure
Arsenic	Hyperpigmentation, vascular	3.E-02	9.E-01

3.4.3.3 Estimation of Potential Human Health Impacts from Exposure to Lead

The USEPA's lead models simulate soil lead exposures at a single location. Two models have been developed, the IEUBK model and the ALM. These models require a minimum of three months of continuous exposure of at least one day per week. Three months is considered to be the minimum exposure to produce a quasi-steady-state lead concentration. The reliability of the models for predicting lead concentrations for exposure durations shorter than 3 months has not been assessed. In order to address non continuous exposures, the USEPA Office of Solid Waster and Emergency Response (OSWER) has developed a guidance document for evaluating intermittent exposures to lead for scenarios such as recreational users and trespassers. Since the exposure frequency is less than three months, predicted intake values were compared with the provisional values discussed in Section 3.3.2.3. Table 3-5 (and Table D2-11) presents the results of the lead intake calculations and lead screening. Only the ingestion pathway is quantified.

Table 3-5
Lead Intake Screening

Concentration in Soil (mg/kg)		Intake		Predicted Intake (mg/day)		Provisional Intake Value (mg/day)
Central Tendency Exposure	**Reasonable Maximum Exposure**	**Central Tendency Exposure**	**Reasonable Maximum Exposure**	**Central Tendency Exposure**	**Reasonable Maximum Exposure**	
4.28E+02	**1.21E+03**	**1.0E-08**	**4.4E-08**	**4.3E-06**	**5.4E-05**	7.5E-02

Conservatively assuming that the total intake from dermal and inhalation exposure is equal to the intake from ingestion, the predicted intakes for the Site does not exceed the USEPA provisional intake values. Therefore, risk to recreational receptors from exposure to lead impacted soil and sediment is not expected.

With respect to lead in surface water, the USEPA maximum containment level (MCL) for lead is 15 ug/L. The maximum concentration of lead was 12.8 ug/L in East Eddy Adit Seep. The highest concentration detected in surface water was 0.7 ug/L in Chipman Gulch. Therefore, exposure to lead in drinking water is not expected to be a risk.

3.5 CALCULATION OF CLEANUP GOALS

Site specific cleanup goals protective of the RME recreational users were calculated for soil, wasterock, and tailings based on the regulatory standard of 1×10^{-6} ECR. The site-specific cleanup goals for arsenic in surface soil and sediment were calculated to be 144 mg/kg and 266 mg/kg respectively.

3.6 DETERMINATION OF POTENTIAL HOTSPOTS

The 1995 amendments to Oregon Revised Statute [ORS 465.315] and 1997 amendments to the Hazardous Substance Remedial Action Rules [OAR 340-122], commonly referred to as the Environmental Cleanup Rules, require that certain actions be taken for "hotspots" of contamination. These actions are: a) the identification of hotspots as part of the Remedial Investigation and Feasibility Study, and b) the treatment of hotspots, to the extent feasible, as part of a remedial action selected or approved by the Director of the ODEQ. The intent of the hotspot rule is to require treatment only for the worst contamination, as opposed to preferring treatment for all contamination at the Site. A hotspot is generically defined as an area where the contamination is highly concentrated, highly mobile or cannot be reliably contained.

The assessment of "highly concentrated" hotspots is performed by comparing the concentration of each individual site contaminant to its "highly concentrated" hotspot level. The "highly concentrated" hotspot levels correspond to a lifetime excess cancer risk of 1×10^{-4} for carcinogens and a hazard quotient of 10 for non-carcinogens. Only arsenic in surface soil exceeded the regulatory standards for carcinogenic health effects. Therefore the hotspot evaluation was conducted for surface soil only. The results of the hotspot evaluation are presented in Table D2-11 in Appendix D-2. Using an ECR of 1×10^{-4} a soil hotspot concentration for arsenic was calculated to be 14,394 mg/kg. This concentration was compared with the sampling results at the Site. One hotspot was identified in sample IM-S-5 at the Independence Mill. A sediment hotspot concentration for arsenic was similarly calculated to be 26,643 mg/kg. No hotspots were identified in sediment.

3.7 SUMMARY OF HUMAN HEALTH RISKS

Based on current and future land use, individuals who might come in contact with site related contaminants through recreational activities such as hunting, hiking and camping were the only potential receptors identified. Two individual metals (arsenic and lead) were identified as COPCs in surface soil, wasterock, and tailings. No individual COPCs were identified in subsurface soil. Arsenic was identified as a COPC in sediment and surface water. ODEQ guidance also requires a multiple media screening and only arsenic was identified as a COPC on this basis.

No unacceptable non-carcinogenic health risks were predicted due to arsenic or lead. Arsenic was the only carcinogenic COPC identified at the site. Under RME exposure conditions, the ingestion of arsenic impacted soil, waste rock, and tailings, and Chipman Gulch sediment both exceeded the ODEQ's regulatory standard of 1 x 10-6 excess cancer risk. The risk based cleanup goals for arsenic were calculated to be 144 mg/kg for surface soil, wasterock, and tailings, and 266 mg/kg for sediment.

Because of the elevated concentrations of several metals in the original background surface water, pore water, and sediment samples in Granite Creek and Chipman Gulch, and the availability of recently collected data for the same media farther upstream in Granite Creek, new upstream background data were available after the human health risks had been determined with the original data. The use of the newer background data resulted in the addition of antimony as a COI in surface water. Concentrations of antimony did not exceed the screening value for tap water and therefore antimony was not identified as a potential COPC for the site. Therefore the inclusion of the newer background data had no impact on the results and conclusions of the HHRA.

4.0 ECOLOGICAL RISK ASSESSMENT

The goal of the ERA is to provide an understanding of the potential for ecological risks due to Site-related contamination and to determine whether there is a need for more detailed ecological risk assessment. This report consists of:

- Description of the ecology of the Site and potential ecological receptors (including rare, threatened or endangered [RTE] species) at or near the Site;
- Presentation of the conceptual ecological exposure model (CEEM), which provides a summary of potential and likely exposure media and pathways;
- Delineation of assessment and measurement endpoints;
- Ecological risk-based screening; and
- Risk characterization to describe the potential for ecological effects due to Site related COIs.

An ecological survey was conducted as part of the SI. The SI ecological survey report documented ecological features and conditions at and near the Site. In addition, the potential for Site impacts was assessed via an examination of stream benthic macroinvertebrate abundance and diversity. Ecological information collected and reported during the SI has been incorporated into this risk assessment as appropriate. An ODEQ ecological scoping checklist was completed for this ERA, based on the SI ecological survey, and is provided in Appendix D3.

4.1 PROBLEM FORMULATION

The physical and chemical characteristics of the Site and the important ecological habitats, plants, invertebrates, fish, and wildlife that exist are described in this section. This information is utilized to identify the COIs, the ecological receptors of concern, exposure pathways, and the exposure media. This in turn, allows development of the CEEM which graphically depicts the expected fate and transport of

chemicals at the Site, the potential exposure media, and likely exposure pathways for ecological receptor types of concern. The problem formulation concludes with identification of the ecological endpoints that delineate the objectives of the remainder of the ERA. Generally, problem formulation includes a description of the Site and summary of previous investigations; however, this information is provided in the SI, and is not repeated herein.

4.1.1 Ecological Stressors

Ecological receptors may be affected through exposure to chemicals (i.e., toxicity), physical stresses (i.e., destruction of habitat), and biological stresses (i.e., viruses and bacteria). While biological stressors may affect ecological receptors, they are more frequently associated with waste food or human waste and in areas where wildlife congregate in large numbers. Because the remote nature of the Site limits human presence and wastes, they are not considered to pose a threat to ecological receptors. Because of the lack of suitable habitat, ecological receptors are also unlikely to congregate in the vicinity of the Site in numbers that could result in significant biological infection or passage of wildlife diseases. Thus, biological stressors are unlikely to be a significant factor and are not considered further.

Past physical disturbances include development and operation of the mines and supporting structures, and possibly historical logging operations. Because the Site has been abandoned for decades and vehicle access is limited, current physical disturbance is reduced to a relatively low number of recreational users that visit the Site. Given the relatively remote nature of the Site within the Wallowa-Whitman National Forest, other than the existing lack of vegetation in previously disturbed areas, the ecological impacts of current physical disturbances are very limited.

As described in Section 2.0, the primary chemicals of interest at the Site are metals that are potentially related to mining activities that occurred at the Site. The metals included as COIs for the ERA are listed in Tables D1-1 through D1-5 in Appendix D1.

4.1.2 Ecological Setting

The regional and Site-specific ecology are briefly described in this section to provide an understanding of the climate, plants, invertebrates, wildlife, and fish that may inhabit the Site and surrounding region. Other than rare, threatened, or endangered species that must be considered on an individual level, a particular species must be potentially present on or utilize the Site in numbers adequate to allow an exposure level that may result in effects to the species' population. Such significant exposure to Site related COIs will only occur for those species known or expected to use the Site on a regular basis and in high numbers or that bioaccumulate or bioconcentrate metals to a significant degree. Detailed information on the regional and Site ecology, sensitive environments, and RTE species is presented in the SI. Only rare and/or sensitive species are expected to be found at the Site; no threatened or endangered species (i.e., protected) were observed or are expected at the Site (Table D4-1).

4.1.3 Conceptual Ecological Exposure Model

The CEEM (Figure 4-1) graphically depicts the sources of contamination, contaminant release and transport mechanisms, impacted exposure media, and exposure routes for ecological receptor types observed or expected at the Site. Based on current understanding of Site conditions, the potentially contaminated exposure media for ecological receptors include:

- Surface soil (including wasterock and tailings) in the vicinity of the Site;
- Surface water in Granite Creek, Chipman Gulch, and the Adit drainages at East Eddy and New York Mines;
- Pore water within Granite Creek and Chipman Gulch; and
- Sediment in Granite Creek and Chipman Gulch.

Given these exposure media, the possible and likely ecological receptors include:

- Terrestrial plants and invertebrates exposed to COIs in surface soil;
- Terrestrial wildlife (including birds, mammals, reptiles, and amphibians) exposed to COIs in surface soil, surface water, and sediment; and
- Aquatic life (including fish, benthic macroinvertebrates, and aquatic plants) exposed to COIs in surface water, pore water; and
- Benthic (i.e. sediment dwelling) invertebrates and wildlife (i.e., birds and mammals) exposed to COIs in sediment.

4.1.4 Assessment Endpoints and Measures

Assessment endpoints and measures are developed based on the results of the problem formulation, are qualitative or quantitative expressions of the environmental values to be protected and, therefore, assessed in the ERA. As such, assessment endpoints link the ecological risk assessment and risk management processes by highlighting ecological aspects that are of concern to risk managers.

4.1.4.1 Assessment Endpoints

Within a screening level ERA, assessment endpoints are generalized to reflect the risk-based screening process and protective ERBSCs. The assessment endpoints for this ERA include:

- Protection of the reproduction and survival of plants, terrestrial invertebrates, birds, mammals, reptiles, and amphibians due to COIs in surface soil at the Site;
- Protection of the reproduction and survival of birds and mammals that may drink from Granite Creek or Chipman Gulch;
- Aquatic life exposed to COIs in surface and pore water within Granite Creek, Chipman Gulch, and adit drainages;
- Protection of reproduction and survival of benthic macroinvertebrates exposed to COIs in sediment within Granite Creek and Chipman Gulch; and
- Protection of reproduction and survival of birds and mammals exposed via the aquatic/benthic food chain, to COIs in sediment within Granite Creek and Chipman Gulch.

4.1.4.2 Assessment Measures

Assessment measures are characteristics of the Site, selected ecological receptors, or ecosystem aspects that are measured through monitoring or sampling activities and then related qualitatively or quantitatively to the selected assessment endpoint(s) to determine whether an ecological effect is occurring. For this ERA, the assessment measures are comprised of the following:

- Measured COI concentrations in soil (includes wasterock and tailings), surface water, pore water, and sediment; and
- Readily-available ERBSCs for selected ecological receptor groups.

4.2 ECOLOGICAL RISK-BASED SCREENING

Ecological risk-based screening begins with a list of COIs in the media of concern, determination of EPCs, and comparison of the EPCs to ERBSCs with consideration of exposure to multiple chemicals and media, reporting limit adequacy, and inordinate contribution of individual chemicals to the overall receptor group risk. The result is a list of Site-related chemicals or chemicals of potential ecological concern (COPECs) with the potential to pose risks to ecological receptors at the Site.

An initial COI screening was completed in Section 2.0. The chemicals retained as ecological COIs are presented in Table 4-1 below. The calculation of EPCs was described in Section 2.0. Generally, the ERBSCs used in the risk-based screening were screening level values (SLVs) provided by the ODEQ (ODEQ 2001; 2006). When an SLV was not available for a given COI, then an alternative ERBSC was selected from peer-reviewed literature or a surrogate chemical ERBSC was substituted when appropriate. The ERBSCs are listed in Table D4-2 and detailed screening results are shown in Tables D4-3 through D4-6.

As per ODEQ guidance (2001), the EPCs for each medium were compared to the ERBSCs for each chemical and receptor group in each medium, resulting in chemical-specific risk ratios (R_{ij} in Tables D4-3 through D4-6). These risk ratios were summed for all chemicals within a given medium/receptor group to obtain receptor group-specific risk ratios (R_j in Tables D4-3 through D4-6). The potential for bioaccumulation of each COI was assessed and the inordinate contribution of any given chemical to the overall receptor group risk was determined. Risk ratios greater than 1 were considered unacceptable and indicative of potential risks for protected (i.e., threatened or endangered) ecological receptors (none were observed or are expected at the Site), aquatic life, and benthic macroinvertebrates. Risk ratios greater than 5 were considered unacceptable for other ecological receptors. The COIs for which potential ecological risks were indicated became COPECs for the Site.

Table 4-1
Contaminants of Interest in Exposure Media

Surface Soil	Surface Water	Pore Water	Sediment
Antimony			
Arsenic III	Arsenic III	Arsenic III	
Arsenic V	Arsenic V		
Arsenic, total	Arsenic, total		Arsenic, total
	Beryllium		
Cadmium	Cadmium		Cadmium
Copper	Copper		
Iron	Iron	Iron	Iron
Lead	Lead		Lead
Manganese	Manganese	Manganese	Manganese
Mercury	Mercury	Mercury	Mercury
		Mercury, Methyl	
Nickel		Nickel	
Selenium	Selenium	Selenium	
Silver	Silver		Silver
Zinc	Zinc		Zinc

The risk ratios for receptor groups exposed to COPECs in the exposure media are shown in Tables 4-2 through 4-5 below. Overall, these results suggest a potential for the exposure of multiple ecological receptors to unacceptable concentrations of multiple COPECs in soil, wasterock, tailings, surface water, pore water, and sediment.

Table 4-2. Chemicals of Potential Ecological Concern and Risk Ratios For Surface Soil, Wasterock, and Tailings

COPECs	Terrestrial Plants (R_{ij})	n/N*	Terrestrial Invertebrates (R_{ij})	n/N*	Birds (R_{ij})	n/N*	Mammals (R_{ij})	n/N*
Antimony	**6**	**5/41**	2	0/41	No ERBSC	0/41	0.8	0/41
Arsenic III	**7**	**1/10**	1	0/10	Bioaccumulation	1/10	Bioaccumulation	0/10
Arsenic V	**289**	**9/10**	**48**	**8/10**	**161**	**9/10**	**56**	**9/10**
Total Arsenic	**1,618**	**30/41**	**270**	**20/41**	**720**	**30/41**	**248**	**25/41**
Cadmium	0.8	0/41	0.2	0/41	Bioaccumulation	0/41	Bioaccumulation	0/41
Iron	**6,410**	**24/41**	**321**	**24/41**	No ERBSC	0/41	No ERBSC	0/41
Lead	**322**	**2/41**	**32**	**1/41**	**76**	**7/41**	Bioaccumulation	0/41
Manganese	**6**	**3/41**	**31**	**16/41**	0.3	0/41	0.1	0/41
Mercury	**6**	**6/41**	**18**	**20/41**	Bioaccumulation	0/41	Bioaccumulation	0/41
Selenium	**5**	**3/41**	0.7	0/41	Bioaccumulation	1/41	Bioaccumulation	0/41
Silver	**14**	**1/41**	0.5	0/41	No ERBSC	0/41	No ERBSC	0/41
Zinc	**10**	**6/41**	2	1/41	**4**	5/41	0.01	0/41
Total Receptor Group Risk (Rj)	**8,698**		**730**		**967**		**306**	

Bold = COPEC with risk ratio greater than acceptable levels (>5 for unprotected species; >1 for protected species - none are expected)
Non-bold = selected as COPECs for reasons other than exceedance of an ERBSC.
* n = number of samples with unacceptable exceedance of an ERBSC / Total number of samples.

Table 4-3. Chemicals of Potential Ecological Concern and Risk Ratios For Surface Water

COPECs	Aquatic Life (R_{ij})	n/N*	Birds (R_{ij})	n/N*	Mammals (R_{ij})	n/N*
Arsenic III	0.6	0/3	Bioaccumulation	0/3	Bioaccumulation	0/3
Arsenic V	1	0/3	Bioaccumulation	0/3	Bioaccumulation	0/3
Total Arsenic	1	2/15	Bioaccumulation	0/15	Bioaccumulation	0/15
Beryllium	0.01	0/15	No ERBSC	0/15	No ERBSC	0/15
Cadmium	0.1	0/15	Bioaccumulation	0/15	Bioaccumulation	0/15
Iron	**3**	**4/15**	No ERBSC	0/15	No ERBSC	0/15
Lead	1	2/15	Bioaccumulation	0/15	Bioaccumulation	0/15
Manganese	**2**	**4/15**	0.00004	0/15	0.0004	0/15
Mercury	0.03	0/15	Bioaccumulation	0/15	Bioaccumulation	0/15
Selenium	0.04	0/15	Bioaccumulation	0/15	Bioaccumulation	0/15
Silver	1	2/15	No ERBSC	0/15	No ERBSC	0/15
Total Receptor Group Risk (Rj)	**12**		**0.02**		**0.07**	

Bold = COPEC with risk ratio greater than acceptable levels (>1 for aquatic life, >5 for unprotected species).
Non-bold = selected as COPECs for reasons other than exceedance of an ERBSC.
* n = number of samples with unacceptable exceedance of an ERBSC / Total number of samples.

Table 4-4. Chemicals of Potential Ecological Concern and Risk Ratios for Pore Water

COPECs	Aquatic Life (R_{ij})	n/N*	Birds (R_{ij})	n/N*	Mammals (R_{ij})	n/N*
Arsenic III	0.3	0/10	Bioaccumulation	0/10	Bioaccumulation	0/10
Manganese	**6**	3/10	0.00009	0/10	0.003	0/10
Mercury	0.02	0/10	Bioaccumulation	0/10	Bioaccumulation	0/10
Methyl Mercury	No ERBSC	0/10	0.0000009	0/10	0.0000002	0/10
Selenium	0.07	0/10	Bioaccumulation	0/10	Bioaccumulation	0/10
Total Receptor Group Risk (R_j)	**6**		0.003		0.01	

Bold = COPEC with risk ratio greater than acceptable levels (>1 for aquatic life; >5 for unprotected species).
Non-bold = selected as COPECs for reasons other than exceedance of an ERBSC.
* n = number of samples with unacceptable exceedance of an ERBSC / Total number of samples.

Table 4-5. Chemicals of Potential Ecological Concern in Sediment

COPECs	Benthic Invertebrates (R_{ij})	n/N*	Birds and Mammals (R_{ij})	n/N*
Total Arsenic	**67**	2/10	**76**	2/2
Cadmium	**7**	2/10	**13**	2/10
Iron	No ERBSC	0/10	No ERBSC	0/10
Lead	1	2/10	**6**	2/10
Manganese	**3**	1/10	No ERBSC	1/10
Mercury	**3**	2/10	**10**	2/10
Zinc	**2**	2/10	**177**	2/10
Total Receptor Group Risk (R_j)	**84**		**282**	

Bold = COPEC with risk ratio greater than acceptable levels (>1 for aquatic species; >5 for unprotected species).
Non-bold = selected as COPECs for reasons other than exceedance of an ERBSC.
* n = number of samples with unacceptable exceedance of an ERBSC / Total number of samples.

4.3 ECOLOGICAL RISK CHARACTERIZATION

Risk characterization includes risk description and uncertainty analysis. These are presented in the following sections.

4.3.1 Risk Description

Risk description involves examining the predicted risks in each medium to determine whether they are likely, or artifacts of the risk assessment process.

4.3.1.1 Soil, Wasterock, and Tailings

The COPECs for surface soil, wasterock, and tailings were listed in Table 4.2. Ten of twelve COPECs had EPCs that exceeded at least one of the ERBSCs. Arsenic V, total arsenic, iron, lead, manganese, and mercury had exceedances of two or more ERBSCs at multiple sample locations. This suggests that these COPECs are present at elevated concentrations in multiple sample locations.

Cadmium and selenium did not have EPCs that exceeded ERBSCs but were selected as COPECs due only to their potential to bioaccumulate. Arsenic III, lead, and mercury also have the potential to bioaccumulate. However, except for lead in sample IM-5-7, the synthetic precipitation leaching procedure and toxicity characteristic leaching procedure results for these COPECs (CES 2007) strongly suggest they are bound to the soil, wasterock, and tailings particles, and thus, are not readily bioavailable at all but one sample location, making it unlikely they will bioaccumulate to any significant degree. Given this information, cadmium and selenium are not considered to present a significant risk to terrestrial ecological receptors, and arsenic III and mercury are unlikely to present a significant risk to terrestrial birds and mammals.

Antimony, arsenic III, silver, and zinc had EPCs that exceeded only their respective ERBSCs for plants in a maximum of 6 (out of 41) samples with relatively low risk ratios. Terrestrial risks due to these COPECs are considered to be low. Iron, manganese and mercury had EPCs that exceeded both the plant and invertebrate ERBSCs in up to 20 samples and given the magnitude of the risk ratios, terrestrial risks are considered to be moderate for iron (a ubiquitous metal) and low to moderate for manganese and mercury. The lead EPC exceeded plant, invertebrate, and bird ERBSCs but only in 2, 1, and 7 samples, respectively. Given the magnitude of the risk ratios, lead is considered to present a moderate to high risk to terrestrial ecological receptors. Arsenic V and total arsenic both had EPCs that exceed plant, invertebrate, bird, and mammal ERBSCs in up to 30 samples, with high risk ratios. These two COPECs are considered to present the highest risk to terrestrial ecological receptors.

Total arsenic and iron contributed an inordinate amount to the overall receptor group risk ratios. Iron had the highest risk ratio of any COPEC, but because most ecological receptors are able to bio-regulate iron concentrations, and because iron is not generally toxic between soil pHs of 5 and 8 (USEPA, 2007), iron is considered to be only a moderate risk for plants and invertebrates. However, total arsenic likely has the most potential to present risks to ecological receptors.

In summary, given the multiple exceedances of ERBSCs by multiple chemicals at multiple stations, it seems likely that some ecological risks are posed by COPECs in soil, wasterock and tailings, primarily by arsenic V, total arsenic, iron, lead, manganese, and mercury. The most significant risk would be posed to plants and terrestrial invertebrates that inhabit the wasterock and tailings in the immediate vicinity of the mine/mill workings. Mobile and wide-ranging wildlife species are unlikely to spend large amounts of time on or around the wasterock and tailings, and thus, are less likely to be impacted by the COPECs. Given the magnitude of the risk ratios and the number of sample locations where concentrations exceeded ERBSCs, the metals of most concern are total arsenic, arsenic V, and lead.

4.3.1.2 Surface Water

The COPECs for surface water were listed in Table 4-3. Iron and manganese were the only COPECs with EPCs that exceeded an ERBSC. These two COPECs also contributed an inordinate amount to the overall risks for aquatic life. However, all ERBSC exceedances occurred in adit drainage samples (NY-AS-1, EE-AS-02, EE-AS-03, and EE-AS-04) and only for aquatic life. The adit drainages are very small (averaging less than 6 inches wide x less than 1 inch deep), often disappearing into the substrate. The lack of any exceedances of ERBSCs in Granite Creek and Chipman Gulch suggests that any elevated concentrations of iron and manganese are not reaching, and are not likely to impact aquatic life in, these streams.

Beryllium, iron, and silver were selected as COPECs solely because there were no ERBSCs for birds or birds and mammals, respectively. Beryllium was detected at a very low concentration (0.0004 mg/L) in only one adit seep sample (EE-AS-02). Similarly, silver was only detected in two adit seep samples (EE-AS-02 and EE-AS-03) at a maximum concentration of 0.52 ug/L. Given that these COPECs were not detected in all but one or two adit seep samples, at adequately low detection limits, no significant ecological effects are predicted as a result of their presence. Iron was detected in four adit seep samples at relatively high concentrations ranging from 2,100 to 12,000 ug/L) compared to other samples. These four samples all had iron present at concentrations that were more than ten times the background concentrations. However, as with beryllium and silver, the very limited area of contamination also limits the potential for exposure of ecological receptors, especially birds and mammals that range widely.

The remaining COPECs for surface water were selected solely due to their potential to bioaccumulate. All but one of the detected concentrations of these COPECs that exceeded background concentrations by more than a factor of two were in adit seeps EE-AS-02, -03, and -04 where there is little potential for population level exposure of birds and mammals. Arsenic V was detected at concentrations greater than 2 times its background concentrations at CG-SW-5.

Given this information, iron and manganese at East Edit adit seeps 2, 3, and 4, and arsenic V at CG-SW-5 are the only locations where COPEC concentrations are slightly elevated. These locations represent a very small area of potential exposure.

4.3.1.3 Pore Water

The COPECs for pore water were listed above in Table 4-4. Manganese was the only COPEC with an unacceptable risk ratio, due to elevated concentrations at GC-PW-16, -18, and CG-PW-05. Of these stations, only GC-PW-18 and CG-PW-05 had detected concentrations more than two times the background concentrations. Methyl mercury was selected as a COPEC due to a lack of an ERBSC for aquatic life. The detected (and estimated) concentrations were very low (0.00000002, 0.000000048, and 0.000000043 mg/L, respectively) at GC-PW-15, -17, and CG-PW-05.

The remaining COPECs were selected due to their potential to bioaccumulate. The locations where these COPECs exceeded background concentrations by a factor of more than two were GC-PW-16 (selenium), GC-PW-17 (arsenic III and mercury), CG-PW-04 (mercury), and CG-PW-05 (arsenic III). The maximum exceedance of background was 173 times for arsenic III at CG-PW-05. The remaining background exceedances were in the range of 10 times or less.

Overall, the ERA suggests there is a slight potential for pore water related ecological impacts posed to aquatic species exposed to a few COPECs, primarily arsenic III, manganese, mercury, and/or selenium at GC-PW-16, -17, -18 (vicinity of Independence Mill and New York Mine), and CG-PW-04 and-05 in the downstream portion of the East Eddy Mines.

4.3.1.4 Sediment

The COPECs for sediment were listed above in Table 4-5. All COPECs except iron had exceedances of ERBSCs, with total arsenic and zinc exhibiting the highest risk ratios. All of the exceedances of ERBSCs were at CG-SS-03, CG-SS-04, and GC-SS-18. All of the COPEC concentrations that exceeded ERBSCs were 2 times or less than background concentrations, except mercury at CG-SS-03 which was approximately 12 times the background sediment mercury concentration. There were no ERBSCs for iron but this COPEC exceeded its background concentration at only one station (CG-SS-04) by less than a factor of two.

Given this information, potential risks were predicted at only three stations but mercury at CG-SS-04 was the only COPEC that significantly exceeded background concentrations. Benthic macroinvertebrate enumeration and analysis presented in the SI suggested notable impacts may exist at CG-04 and 05, but some lower level of impact may be occurring at GC-SS-11, -14, -16, and -18. When combined, the sediment risk assessment and invertebrate analysis results suggest mine-related chemical impacts may be occurring at CG-SS-03, CG-SS-04, CG-SS-05, and GC-SS-18.

4.3.2 Ecological Hotspots

At the Site, there were ecological hotspots (concentration > 10 times the ERBSCs) antimony, arsenic V, total arsenic, cadmium, iron, lead, manganese, mercury, selenium, silver, and zinc. The majority of the hot spots were in waste rock samples. Locations of the hot spots in each medium are shown in Table 4-6.

Table 4-6. Location of Ecological Hot Spot Concentrations for Chemicals of Potential Ecological Concern

COPECs	Soil	Surface Water	Pore Water	Sediment
Antimony	NY-S-4	No Hot Spots	No Hot Spots	No Hot Spots
Arsenic V	IM-WR1-1, IM-WR3-1, IM-TP1-1, NY-S-6, NY-WRA2-2, NY-WRA3-1, NY-WRM-WR1-1, NY-WRM-R2-1, NY-MILL-TP1-2	No Hot Spots	No Hot Spots	No Hot Spots
Total Arsenic	IM-S-1, -2, -3, -4, -5, IM-WP1-2, IM-WR1-1, IM-WR3-1, IM-WR3-2, IM-TP1-1, EE-WRA1-2, EE-WRA1-3, NY-S-1, NY-S-4, NY-S-6, NY-WRA2-2, NY-WRA3-1, NY-WRM-WR1-1, NY-WRM-WR1-3, NY-WRM-WR2-1, NY-WRM-WR2-3, NY-MILL-TP1-1, NY-MILL-TP1-2, NY-MILL-TP2-1	No Hot Spots	No Hot Spots	CG-SS-03, CG-SS-04
Cadmium	No Hot Spots	No Hot Spots	No Hot Spots	CG-SS-03, CG-SS-04
Iron	IM-S-1, IM-S-4, IM-S-5, IM-WR3-2, IM-TP1-1, EE-WRA1-1, EE-WRA1-3, EE-WRA1-5, NY-S-1, NY-S-4, NY-S-6, NY-WRA2-1, NY-WRA3-1, NY-WRA3-2, NY-WRM-WR1-1, NY-WRM-WR1-3, NY-WRM-WR2-1, NY-WRM-WR2-3, NY-MILL-WR3-1, NY-MILL-WR4-1, NY-MILL-TP1-1, NY-MILL-TP1-2, NY-MILL-TP2-1	EE-AS-02	No Hot Spots	No Hot Spots
Lead	IM-S-7	No Hot Spots	No Hot Spots	No Hot Spots
Manganese	EE-WR1-1, EE-WRA1-2, EE-WRA1-3, EE-WRA1-5, NY-S-4, NY-S-6, NY-WRA2-1, NY-WRA2-2, NY-WRA3-2, NY-WRM-WR1-3, NY-WRM-WR2-1, NY-WRM-WR2-3, NY-MILL-TP1-1, NY-MILL-TP1-2	No Hot Spots	CG-PW-05	No Hot Spots
Mercury	IM-S-5, NY-S-1, NY-S-6, NY-WRA3-1, NY-WRA5-2, NY-WRM-WR1-1, NY-WRM-WR1-3, NY-MILL-TP1-1, NY-MILL-TP1-2, NY-MILL-TP2-1	No Hot Spots	No Hot Spots	CG-SS-03
Selenium	NY-WRM-WR2-5,	No Hot Spots	No Hot Spots	No Hot Spots
Silver	IM-WR3-2	No Hot Spots	No Hot Spots	No Hot Spots
Zinc	NY-MILL-TP1-1, NY-MILL-TP1-2	No Hot Spots	No Hot Spots	CG-SS-03, CG-SS-04

4.3.3 Uncertainty Analysis

The uncertainty analysis lists the common uncertainties associated with ecological risk-based screening and assesses whether they are likely to over- or underestimate the potential for ecological risks to be realized at the Site. The primary uncertainties associated with this ecological risk-based screening and the impacts on the prediction of the potential for ecological risks are discussed below. This information is combined with that provided above in the risk description section to present conclusions and recommendations regarding ecological risks and the need for further investigation.

The risk-based screening assumes the receptors are constantly exposed to the chemical at a concentration equal to the EPC. While this may be true for immobile species such as plants and some terrestrial invertebrates, unless the contamination is widely and evenly spread, it is not realistic for wildlife species. Because the metals are primarily located around wasterock and tailings, and small centers of mining activity, the risks calculated above substantially overestimate the actual risks posed to wildlife.

Similarly, the use of maximum detected concentration or $90\%_{UCL}$ as the EPC is a conservative approach that is purposefully designed to result in some overestimation of the potential for ecological risks. Because of this, the risks predicted are likely to overestimate actual ecological risks at the Site.

Including a sample reporting limit screening is a conservative approach that includes COIs as COPECs when they are actually not-detected. Because the undetected COI is likely present at concentrations less than the reporting limit, possibly much less, including the COI as a COPEC result in an overestimation of the potential for ecological risks.

The lack of site specific bioavailability data does not allow for a formal assessment of risks due to some COPECs for upper trophic level receptors (i.e., birds and mammals). However, the fact that the metals were shown to be bound strongly to soil (and likely sediment particles) suggests that many of the metals may not be readily bioavailable. This combined with the amount of time the metals have been present and exposed to the weather suggests risks due to the bioaccumulation of COPECs are likely overestimated.

Except for benthic macroinvertebrates and aquatic life, the ERBSCs used for this ERA are intended to be no-observed-adverse-effect-levels (NOAELs). Because actual ecological effects occur at an unknown concentration somewhere between the NOAEL and the lowest observed adverse effect level (LOAEL), simply exceeding an ERBSC does not necessarily indicate the potential for significant ecological effects. Thus, the use of NOAEL-based ERBSCs likely results in an overestimation of the potential for ecological risk.

The lack of ERBSCs for some receptors precludes the calculation of risk for those receptors. This may result in an underestimation of the potential for ecological risks. The use of a bioaccumulation screening is a conservative measure used to assess the potential for risks posed to upper trophic level ecological receptors when appropriate ERBSCS are missing.

Within this ERA, predictions are made regarding the significance of ecological exposures under current conditions at the Site. Overall, the risk-based screening is designed to overestimate the potential for ecological risks.

4.4 SUMMARY OF ECOLOGICAL RISKS

Elevated concentrations of several COPECs are present in multiple sample locations in soil, wasterock, and tailings at the Site. The most significant risk would be posed to plants and terrestrial invertebrates that inhabit the wasterock and tailings in the immediate vicinity of the mine/mill workings. Populations of

mobile, wide-ranging wildlife species are unlikely to spend large amounts of time on or around the wasterock and tailings, and thus, are less likely to be impacted by the COPECs. Given the magnitude of the risk ratios and the number of sample locations where concentrations exceeded ERBSCs, the metals of most concern are total arsenic, arsenic V, and iron. Lead, manganese, and mercury both present a moderate but lesser potential for ecological risks. Numerous hot spot locations were identified for several COPECs in soil.

In surface water iron and manganese at East Eddy adit seeps -02, -03, and -04, and arsenic V at CG-SW-5 were the only locations where COPEC concentrations were slightly elevated. This is a relatively small area of potential exposure and therefore, aquatic life (i.e. aquatic plants, aquatic invertebrates, and resident fish), birds, and mammals are unlikely to be impacted due to COPECs in surface water. The iron concentration at EE-AS-02 was the only hot spot identified in surface water.

In pore water manganese was the only COPEC that had slightly elevated concentrations at GC-PW-16, -18 (vicinity of Independence Mill and New York Mine), and CG-PW-05 (vicinity of East Eddy Mines). These sample locations are in the downstream portions of the investigated portion of Granite Creek and of Chipman Gulch, respectively. Manganese at CG-PW-05 was the only hot spot identified in pore water.

In sediment potential risks were predicted at three sampling stations GC-SS-18, and CG-SS-03, and -04, but mercury at CG-SS-03 was the only COPEC that exceeded background concentrations by a factor of more than two. Benthic macroinvertebrate enumeration and analysis presented in the SI suggested notable impacts may exist at CG-04 and 05, and some lower level of impact may be occurring at GC-11, 14, 16, and 18. When combined, the sediment risk assessment and invertebrate analysis results suggest mine-related chemical impacts may be occurring at CG-SS-03, CG-SS-04, CG-SS-05, and GC-SS-18. Given the relatively limited distribution of the potential impacts, contaminated sediment impacts to bird and wildlife populations are considered unlikely.

Because of the elevated concentrations of several metals in the original background surface water, pore water, and sediment samples in Granite Creek and Chipman Gulch, and the availability of recently collected data for the same media farther upstream in Granite Creek, the ecological risks were recalculated using the newer upstream background data. This resulted in the following COI changes:

- Antimony became an additional COI in surface water;
- Antimony, arsenic V, total arsenic, cadmium, and zinc became additional COIs in pore water, and iron was removed from the COI list for pore water;
- Antimony, beryllium, total chromium, copper, methyl mercury, nickel, and selenium became additional COIs in sediment.

The resulting changes in calculated risks included:

- Antimony was included as a COPEC in surface water because there was no ERBSC for birds exposed to drinking water.
- Antimony was included as a COPEC in pore water because there was no ERBSC for birds exposed to drinking water, and arsenic V, total arsenic, and cadmium were included as COPECs solely because of their potential to bioaccumulate.
- Beryllium, methyl mercury, and selenium were included as COPECs in sediment due solely to a lack of ERBSCs.

Use of the new background/reference concentrations resulted in negligible changes in the hazard indices within each of the three affected media. Antimony was not detected in the new background surface water samples but was detected in all adit seep surface water samples, the lower three surface water and pore water samples on Chipman Gulch (CG-03, -04, and -05), and the pore water sample at GC-14, at a

maximum concentration of 2.1 ug/L (at surface water sample CG-03). This suggests antimony may be moving from the East Eddy adit seeps to Chipman Gulch, at low concentrations. Of the several chemicals selected as COPECS in pore water because of their potential to bioaccumulate, only total arsenic appeared to be consistently elevated above background concentrations at more than a few sample locations. Of the new COPECs in sediment beryllium did not exceed its background concentrations by more than a factor of two, while methyl mercury and selenium had several samples in both Granite Creek and Chipman Gulch that had concentrations greater than two times background. Use of the new background data did not result in the inclusion of any additional hot spots.

5.0 CONCLUSIONS AND RECOMMENDATION

The risk assessment determined that there are no unacceptable human health risks from exposure to soil, wasterock, tailings, and sediment under the CTE (i.e., average) exposure conditions. There is a potential for unacceptable risk for the RME exposure condition from ingestion and dermal contact with arsenic in soil, wasterock and tailings and sediment from Chipman Gulch. A hotspot analysis determined that there is one human health related hotspot at the Site, at the Independence Mill. A cleanup goal of 144 mg/kg (total arsenic) was developed for the Site soils and wasterock based on average background concentrations of arsenic. Removal or capping of wasterock and tailings with higher concentrations of arsenic would eliminate some potential pathways of exposure and therefore reduce intakes and potential adverse health impacts. A cleanup goal for sediment was calculated to be 266 mg/kg.

In this ERA, ecological impacts were predicted primarily for terrestrial plants and terrestrial invertebrates due to COPECs in wasterock and tailings. A slight potential for ecological impacts was also predicted for aquatic life exposed to surface water and pore water, primarily in the lower portions of Granite Creek and Chipman Gulch. Elevated concentrations of COPECs were noted in adit seep surface water from both the East Eddy and New York Mines, but other than antimony and arsenic, these did not appear to be resulting in noticeably elevated concentrations of the same COPECs in the adjacent streams. Benthic macroinvertebrates in the lower portions of Granite Creek and Chipman Gulch may be at risk due to site-related chemical and/or physical impacts. Overall, immobile or resident species inhabiting terrestrial and sediment habitats are the most likely species to be impacted. Further species-specific ecological assessment would be required to more accurately assess the potential for the predicted bird and mammal bioaccumulation risks to be realized. The decision whether to complete more detailed ecological assessment should be made in coordination with any removal action planning to select the most cost-effective approach. Remediation, removal, or reduced receptor exposure to COPECs in soil, wasterock and tailings and sediment would be necessary to adequately reduce the predicted impacts to ecological receptors. Preliminary cleanup goals for COPECs are the ERBSCs listed in Table D4-2.

It is important to note that there are additional mines upstream of the investigated portions of both Chipman Gulch and Granite Creek. The elevated concentrations of COIs in the original reference samples (collected just upstream of the investigated mines and mill) provides evidence that the mines located farther upstream have contributed notably to the concentrations of some metals within Chipman Gulch and Granite Creek.

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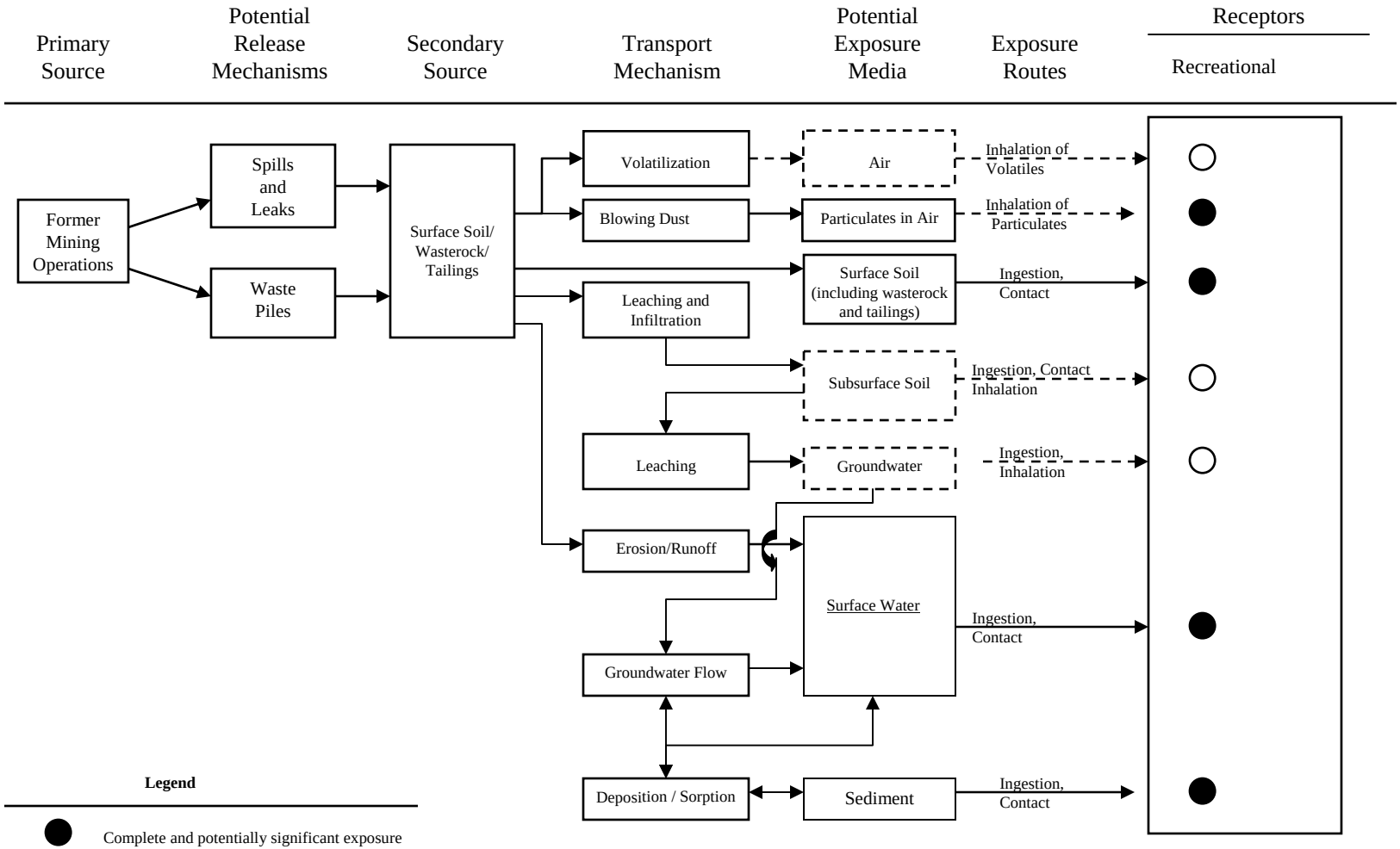
FIGURE 3-1: Conceptual Human Health Exposure Model



Legend

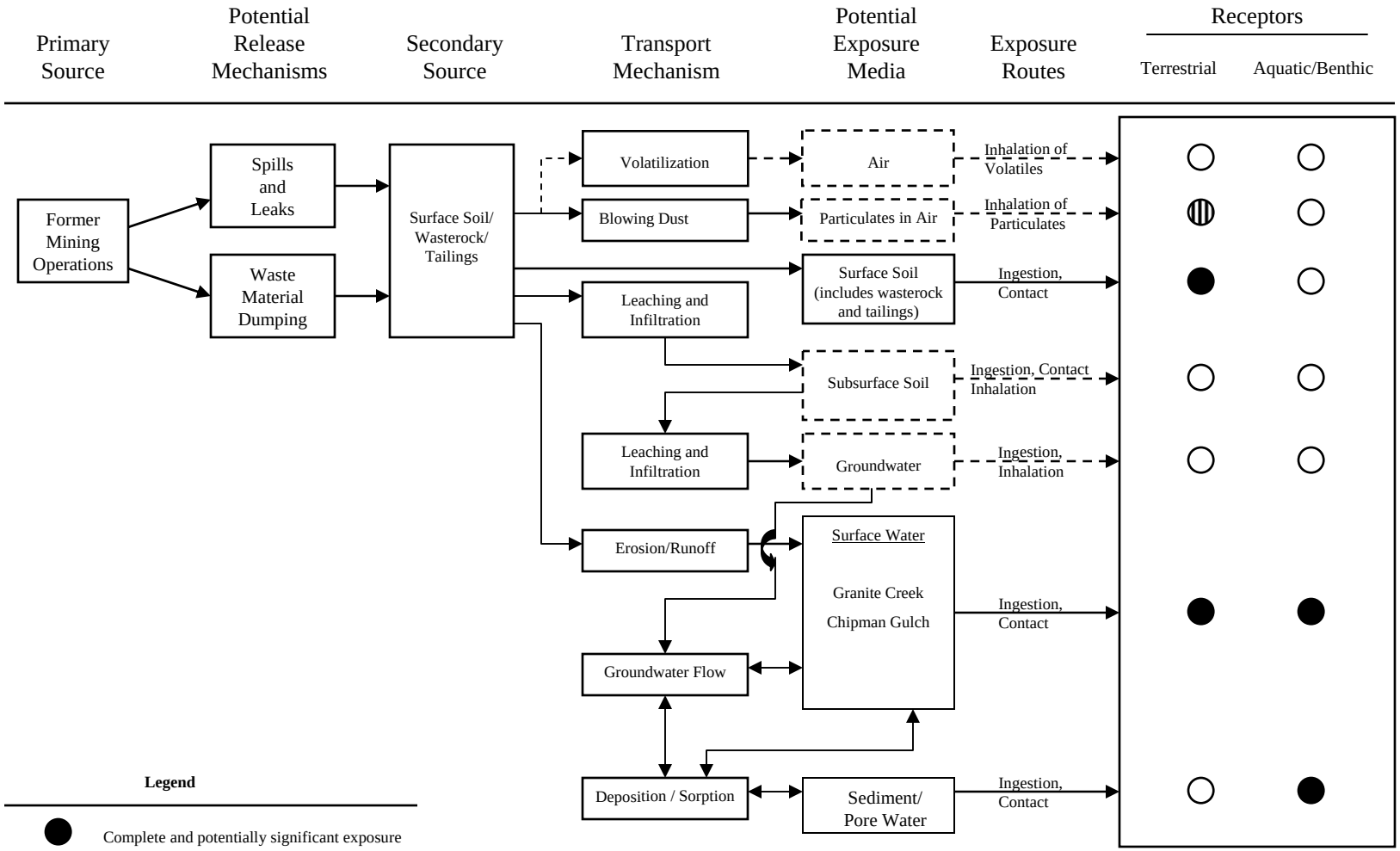
- Complete and potentially significant exposure
- Potentially Complete but insignificant exposure (not to be quantified)
- Incomplete Exposure (not to be quantified)
- Insignificant or Incomplete Pathway or Medium
- Complete and/or Significant Pathway or Medium

Figure 3- 1

Conceptual Human Exposure Model

New York Mines
Wallowa-Whitman National Forest
Grant County, Oregon

FIGURE 4-1: Conceptual Ecological Exposure Model



Legend

- Complete and potentially significant exposure
- Potentially Complete but insignificant exposure (not to be quantified)
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- Insignificant or Incomplete Pathway or Medium
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Figure 4-1

Conceptual Ecological Exposure Model

New York Mines
Wallow-Whitman National Forest
Grant County, Oregon