



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8

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Ref: 8EPR-ER

MAY 24 2018

ACTION MEMORANDUM

SUBJECT: Approval and Funding for a Removal Action and Exemption from the 12-month and \$2-million Statutory Limits for a CERCLA Removal Action at the Nelson Tunnel/Commodore Waste Rock Pile Superfund Site in Mineral County, Colorado

FROM: Craig Myers *For R/M 5/2/2018*
Federal On-Scene Coordinator

for Joy Jenkins *Thomas 5/3/18*
Remedial Project Manager

THRU: Laura Williams, Unit Leader *L Williams 5/3/18*
Emergency Response

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Superfund Remedial and Federal Facilities Program

TO: Betsy Smidinger
Assistant Regional Administrator
Office of Ecosystems Protection and Remediation

Site ID# 08MB

I. PURPOSE

The purpose of this Action Memorandum is to request and document approval of the removal action described herein for the Nelson Tunnel/Commodore Waste Rock Pile Superfund Site (Site) in Mineral County, Colorado, and for exemption from the 12-month and \$2 million statutory limits for a removal action. This time-critical removal action involves the stabilization of sections of the

Commodore Level 5 Tunnel¹ and stabilization of certain vertical connections to the Nelson Tunnel to reduce the risk of an increased fluid hazard in Nelson Tunnel. Nelson Tunnel discharges acid mine drainage (AMD) at approximately 300 gallons per minute and is known to have three natural impoundments that contain over 21 million gallons of AMD water.

The Commodore Level 5 Tunnel is located above Nelson Tunnel and is connected by vertical mine workings. As water levels periodically fluctuate in the largest mine pool (Upper Mine Pool) of the Nelson Tunnel, water flows into the Commodore Level 5 Tunnel, allowing pressure relief on the largest impoundment before water returns to the Nelson further downgradient. In this way, the stability of the Commodore Level 5 Tunnel is critical to the stability of the largest Nelson Tunnel impoundment. Conditions existing at the Site present a threat to public health or welfare or the environment and meet the criteria for initiating a removal action under 40 CFR 300.415(b)(2) of the National Contingency Plan (NCP).

This removal action involves no nationally-significant or precedent-setting issues. This time-critical removal action will not establish any precedent for how future response actions will be taken and will not commit the US Environmental Protection Agency (EPA) to a course of action that could have a significant impact on future responses or resources.

II. SITE CONDITIONS AND BACKGROUND

Site Name:	Nelson Tunnel/Commodore Waste Rock Pile Superfund Site
Superfund Site ID (SSID):	08MB
NRC Case Number:	N/A
CERCLIS Number:	CON000802630
Site Location:	Mineral County, Colorado
Lat/Long:	37.877852/-106.936723
Potentially Responsible Party (PRP):	See Enforcement Addendum
NPL Status:	Final Sept. 3, 2008
Removal Start Date:	TBD FY18/4

A. Site Description

1. Removal Site Evaluation

The Removal Site Evaluation consisted largely of a review of existing reports and other Remedial documentation but included a short Removal Site inspection to assess current conditions inside the Commodore Level 5 Tunnel.

Nelson Tunnel is the lowest level of the mine complex, which includes but is not limited to, Nelson Tunnel, Commodore Mine, Amethyst Mine, Happy Thought Mine, and Last Chance Mine. Nelson Tunnel was driven to serve as a drainage and haulage tunnel for the complex in the 1890s. Shortly after that, the owner of Commodore Mine

¹ Commodore Level 5, Commodore 5 Level, and Commodore 5 are all names used by various entities over the history of the Site. All refer to the mining feature referred to as the "Commodore Level 5 Tunnel" in this document.

drove the Commodore Level 5 Tunnel to serve as a haulage tunnel for Commodore ore and to compete with the Nelson Tunnel.

Commodore Level 5 Tunnel is approximately 50 feet higher in elevation than Nelson Tunnel at its portal, though it was driven at a lesser slope along the same mineralized vein as Nelson Tunnel, resulting in the two tunnels joining inside the mountain approximately 11,000 feet from the surface. The two tunnels are connected by numerous vertical workings (called winzes, raises, or shafts) along the accessible length of the Commodore Level 5 Tunnel. Working sequentially from the portal, these are Bachelor Shaft, Daylight Winze, Commodore Shaft, No-Name/YO2 Winze, Del Monte Raise, and Berkshire Shaft (see Attachment 1).

The Nelson Tunnel portal is substantially collapsed, creating an impoundment of water that is draining at a rate of approximately 300 gallons per minute. The depth of Nelson Portal Pool (~1.2 million gallons) can be measured by accessing the Nelson Tunnel through Bachelor Shaft; however, ladders and platforms in this shaft were installed by the Colorado Division of Reclamation, Mining and Safety (DRMS) over ten years ago, are at the end of their useful service life and present a fall hazard to anyone entering the Commodore Level 5 Tunnel. There is a second collapsed area approximately 2,000 feet into Nelson Tunnel that partially blocks the tunnel, creating the Lower Mine Pool (~1.4 million gallons) which can be accessed for water level monitoring via Daylight and No-Name/YO2 winzes. This Lower Mine Pool blockage creates a weir-type dam within Nelson Tunnel, creating an impoundment of water while still allowing water to flow freely over the top of it into Nelson Portal Pool. Similar to Bachelor Shaft, ladders and platforms in Daylight and No-Name/YO2 winzes are all at the end of their service lives and present fall hazards to anyone entering the tunnel. Raise covers have also deteriorated significantly.

The Commodore Shaft is located at a slight offset to Commodore Level 5 and Nelson tunnels, connecting to Nelson Tunnel via a short stub drift and is not currently used to access either tunnel. It is shown in Attachment 1.

Lastly in Nelson Tunnel, there is a complete blockage at approximately 5,000 feet that creates the Upper Mine Pool (~19.5 million gallons). The water level can be measured at the Del Monte Raise. If the pool elevation rises high enough, it discharges from Del Monte Raise and flows down Commodore Level 5 Tunnel, re-entering the Nelson Tunnel Lower Mine Pool at the No-Name/YO2 and Daylight winzes. The relationship between the pools and various shafts, winzes, and raises is shown in Attachment 1.

DRMS and the Colorado Department of Public Health and Environment (CDPHE) are currently under contract with EPA's Remedial Program for management and technical assistance. DRMS provides underground monitoring and inspections for EPA and CDPHE. This underground monitoring effort is focused on both the Nelson and Commodore Level 5 tunnels, and has resulted in the elevations and behavior of the three mine pools being relatively well understood and documented. DRMS monitored water levels and condition of the workings in for several years and more recently

reported that conditions in the Commodore Level 5 Tunnel were deteriorating at an increasing rate. Continuing to allow the workings to deteriorate without performing stabilization soon will result in potentially unsafe conditions. Further rock fall would impound water from the Commodore and other sources and would be expected to completely block the flow path between Del Monte Raise and No Name and Daylight winzes, thus eliminating the effective “pressure relief” flow path that controls the elevation of the Upper Mine Pool. If this flow path is blocked, the pressure on the Upper Mine Pool blockage in Nelson Tunnel would increase and a large, sudden, uncontrolled release would become a reality. An uncontrolled release from the Commodore Level 5 Tunnel would also become a likely possibility.

Water quality information on the various Nelson Tunnel mine pools and small impoundments in the Commodore Level 5 Tunnel are illustrated in Attachment 2. The mine pools are heavily mineralized with elevated levels of zinc and cadmium.

2. Physical Location

Though the removal action is intended to reduce the risk of an increased fluid hazard in the Nelson Tunnel, all activities will be conducted within the Commodore Level 5 Tunnel and associated winzes and shafts that connect to Nelson Tunnel. Those areas will be the extent of the Removal Site. The Commodore Level 5 Tunnel entrance, or portal, is located at 37.870571/-106.929326. The Town of Creede, Colorado, is immediately downstream and could be impacted if Nelson Tunnel were to have a large, sudden uncontrolled release that overtopped the banks of the concrete channelized section of Willow Creek that flows through town. A large uncontrolled release would also very likely impact the floodplain just south of town that was recently partially cleaned and revegetated with Non-Point Source and Brownfields grant funding. As of the 2010 Census, the population of Creede was 290.

3. Site Characteristics

The Removal Site consists of the Commodore Level 5 Tunnel and associated winzes and shafts that connect to Nelson Tunnel. There are also numerous historic structures near the tunnel portals that will not be impacted by this removal action.

West Willow Creek flows directly south of Commodore Level 5 Tunnel and Nelson Tunnel portals approximately one-half mile to its confluence with East Willow Creek, approximately one-half mile north of Creede. From there, Willow Creek flows an additional three miles south, passing through Creede, to its confluence with the Rio Grande. The Rio Grande then flows south towards the Town of South Fork.

As with much of Colorado’s mountain country, the area described above is a seasonal hotspot for families to camp, fish and enjoy other outdoor recreation and sees a significant population increase due to seasonal tourism. The Rio Grande is a Gold Medal fishery in the vicinity of South Fork and is heavily fished by residents and tourists alike.

4. Release or Threatened Release into the Environment of a Hazardous Substance, Pollutant, or Contaminant

The collapses that have occurred in Nelson Tunnel have impounded a relatively well known and understood volume of water. However, these collapses are neither engineered nor designed to withstand any given amount of water pressure and, as such, it is impossible to know or understand what amount of pressure will cause them to fail. Therefore, a sudden, large, uncontrolled release of the AMD impounded within Nelson Tunnel and associated workings could happen at any time. Such a release would result in human and ecological exposure to contaminated water and sediments discharged to surface water, groundwater, and stream and river bed substrates. If a large uncontrolled release from Nelson Tunnel were to occur, it could cause the migration of metals, primarily zinc and cadmium, further downstream of the Site than currently occurs. Zinc and cadmium are both listed hazardous substances in 40 CFR 302.4.

Metals contamination would migrate directly as dissolved constituents in the water, as well as in sediments that could be carried further downstream by a larger flow. Recontamination of the reclaimed floodplain south of Creede could also occur as a result of such a release.

The Remedial Investigation (RI) indicated that there are ecological risks in Willow Creek downstream of Nelson Tunnel, and that these risks are driven by a variety of metals including cadmium and zinc. Ecological risks were also indicated for water column invertebrates, trout and aquatic insectivorous birds in the Rio Grande River downstream of Willow Creek. A benthic survey of the Rio Grande River below its confluence with Willow Creek indicates only mild mine water-related impacts to invertebrates based on the Multimetric Index Model results for assessing invertebrate populations in creeks and rivers. A sudden large uncontrolled release of AMD from Nelson Tunnel has the potential to increase the impacts to aquatic life. See Section III for more details.

Cadmium

According to the Agency for Toxic Substances and Disease Registry (ATSDR), cadmium is a cumulative toxin and has a very long half-time in the body; exposure to children in even low amounts may have long-term consequences. Studies in animals suggest that children may be more susceptible than adults to cadmium-induced bone damage. In laboratory animals, cadmium causes decreases in fetal or pup body weight, skeletal malformations, and behavioral alterations.

Zinc

Also according to ATSDR, zinc is a naturally occurring element. Exposure to high levels of zinc occurs mostly from eating food, drinking water, or breathing workplace air that is contaminated. Low levels of zinc are essential for maintaining good health.

Exposure to large amounts of zinc can be harmful. It can cause stomach cramps, anemia, and changes in cholesterol levels.

Environmental effects of cadmium and zinc

Cadmium and zinc are often found together in the environment and generally in conjunction with lead-containing ores. They typically exist in the aquatic environment as a salt of the +2 valence state or as a metal (MeO), with many cadmium and zinc salts being readily soluble in freshwaters with low organic carbon levels. The free divalent ion of these metals is thought to be primarily responsible for their toxicity to aquatic organisms. The mechanism varies slightly by metal but generally occurs by competitive disruption of calcium receptors on the surface of the gill. This inhibits the ability of the organism to maintain ionic balance with the surrounding environment (US EPA, 2016, Smith, 2015). Additional toxicities from chronic cadmium exposures can result in negative alterations to the gill, kidney, liver, increased free radical production and immune suppression (USEPA, 2016).

5. NPL Status

This Removal Site is part of the Nelson Tunnel/Commodore Waste Rock Pile Superfund Site. It was listed on the National Priorities List in 2008.

6. Maps, Pictures, Other Geographic Representations

A map of the Site, as well as the relationship between Nelson Tunnel and Commodore Level 5 Tunnel workings, is in Attachment 1. Relevant Site photos are shown in Attachment 3, in the Site file, and in the administrative record for the removal action.

B. Other Actions to Date

1. Previous Actions

Since 2008, the Site has been subject to numerous sampling and assessment activities. Additionally, DRMS has conducted regular inspections of Commodore Level 5 Tunnel to record elevations of the various distinct mine pools present in Nelson Tunnel. These sampling events, assessments, and inspections have all contributed towards an interim Record of Decision (currently in draft) to begin mitigation of threats posed by this Site.

However, as mentioned in the Removal Site Evaluation section above, DRMS inspectors recently noted increasing rock falls and small collapses from the back, or ceiling, of the Commodore Level 5 Tunnel workings making the proposed time-critical removal action more urgent.

2. Current Actions

There are no current activities on the Site beyond actions discussed in this memorandum.

C. State and Local Authorities' Role

1. State and Local Actions to Date

Local authorities have provided assistance wherever possible, generally surrounding road maintenance and, when required, snow removal to facilitate access. Colorado is currently participating by consulting on removal and remedial activities at the Site and by being the support agency.

2. Potential for Continued State/Local Response

State and local entities do not have the resources to conduct this removal action in the required timeframe. DRMS will remain involved in a consultation role only.

III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

Conditions at the Site present a threat to public health and the environment and meet the criteria for initiating a removal action under 40 CFR 300.415(b)(2) of the NCP.

EPA has considered all the factors described in 40 CFR 300.415(b)(2) of the NCP and determined that the following factors apply at the Site.

“(i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, or pollutants or contaminants:”

As stated earlier in this document, EPA and other state agencies observed deterioration of the Commodore Level 5 Tunnel including new areas of rock-fall which could lead to unsafe conditions in the mine. A section of Commodore Level 5 Tunnel between Del Monte Raise and No-Name Winze, identified on the attached documentation as “44 Raise,” has already suffered a rock fall that is impounding water. Events like this one are likely to continue, ultimately blocking the flow path and eliminating the effective “pressure relief” that controls the elevation of the Upper Mine Pool in Nelson Tunnel. If the flow path is blocked, the pressure on the Upper Mine Pool blockage in Nelson Tunnel would increase and a large, sudden, uncontrolled release would be even more likely. An uncontrolled release from Commodore Level 5 Tunnel would also become a possibility. The impact of a smaller release just from the Commodore Level 5 Tunnel may only affect Willow Creek and the floodplain south of Creede while a large, sudden uncontrolled release from Nelson Tunnel impoundments would likely have detrimental impacts extending to the Rio Grande River. The Rio Grande is widely known as a trout fishery, with the stretch of river between South Fork and Del Norte carrying a Gold Medal designation. It is heavily fished by residents and tourists alike.

If Commodore Level 5 Tunnel is left unaddressed, a large, sudden, uncontrolled release of either tunnel could happen resulting in AMD exposure to residents and wildlife downstream, and potentially visitors to the Site. Photos of the deteriorating conditions of the Commodore Level 5 Tunnel are in Attachment 4.

“(v) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released:”

As discussed above, the EPA and state agencies observed deteriorating conditions in the Commodore Level 5 Tunnel. High flow or runoff in spring seasons could add to the volume and pressure of the mine pools behind the natural impoundments making an uncontrolled release increasingly likely. Additionally, increased loads of zinc and cadmium are seen in Willow Creek during high flow or other seasonal variances.

“(vii) The availability of other appropriate federal or state mechanisms to respond to the release:”

Local and state governments do not have the capability to conduct the action in a timely manner. DRMS will remain involved in a consultation role only.

“(viii) Other situations or factors that may pose threats to public health or welfare of the United States or the environment.”

A sudden release coincident with obstructions in the concrete channel through Creede could result in the banks of that channel overtopping and flooding the local area. This could deposit metals-laden sediments in off-site residential areas and other areas that may not currently be impacted by mine waste. Additionally, the physical safety of individuals recreating on or near West Willow Creek or Willow Creek could be impacted in a high flow event.

IV. EXEMPTION FROM STATUTORY LIMITS

Consistency Exemption

Deterioration of the Commodore Level 5 Tunnel stability at the Site has been observed and documented by DRMS. Since a substantial amount of AMD is contained by natural impoundments in Nelson Tunnel, the Remedial Program is working toward an Interim Record of Decision (ROD) to further stabilize the Nelson and Commodore Level 5 Tunnel system to prevent additional deterioration of the Commodore Level 5 Tunnel and avoid a likely release of some or all of the impounded AMD within the Nelson Tunnel. This stabilizing action is appropriate and will allow the Remedial Program to evaluate a flow control bulkhead structure in Nelson Tunnel as well as further stabilization and flow control in the Commodore Level 5 Tunnel. This removal action is necessary to stabilize the tunnel system while the longer-term interim Record of Decision (ROD) is developed and implemented. This removal will facilitate the design efforts anticipated under the interim ROD, and will not foreclose the implementation of any future remedial actions.

V. PROPOSED ACTIONS AND ESTIMATED COSTS

A. Proposed Actions

1. Proposed Action Description

The overall objective of this removal action is to prevent water from impounding in the Commodore Level 5 Tunnel, which will preserve current conditions and prevent further pressure from building on the Nelson Tunnel impoundments. Work will include:

- stabilizing areas of Commodore Level 5 Tunnel with steel sets or other support systems to prevent further deterioration,
- clearing muck and debris such as rock fall from the tunnel roof or walls from the floor of the tunnel to prevent water from impounding,
- maintaining and keeping open vertical connections from the Commodore Level 5 Tunnel to the Nelson Tunnel below to allow the passage of water, which will prevent further water impoundment and pressure from building on Nelson Tunnel impoundments,
- maintaining physical access between Commodore Level 5 Tunnel and Nelson Tunnel at Bachelor Shaft and Daylight Winze to allow continued monitoring of water levels in Nelson Tunnel, and
- rehabilitating the portal and gate structure and maintaining the Commodore Level 5 Tunnel walls and roof for worker access for the pending interim ROD work.

The above broad tasks will be conducted according to design documents prepared and stamped by a professional engineer in the five segments of the Commodore Level 5 as shown in Attachment 1. The following segments will be completed, at a minimum, to maintain physical access to Nelson Tunnel through Bachelor Shaft and to keep a minimal flow path open between Del Monte Raise and Daylight Winze. A summary of this work by segment is in Attachment 4:

- Segments 1-4
- Segment 5 from Daylight Corner to 44 Raise
- Segment 5 stabilization beyond 44 Raise will be continued at the OSC and RPM's best professional judgement based on remaining available funds and progress of the interim ROD.

2. Contribution to Remedial Performance

This effort will, to the extent practical, contribute to any future remedial effort at the Superfund Site. It is intended to keep the Commodore Level 5 Tunnel open so it can relieve pressure on Nelson Tunnel impoundments and thereby reduce the likelihood of a large, sudden, uncontrolled release from the Nelson Tunnel.

3. Engineering Evaluation/Cost Analysis (EE/CA)

An EE/CA is not required for a time-critical removal action.

4. Applicable or Relevant and Appropriate Requirements (ARARs)

Removal actions conducted under CERCLA are required, to the extent practicable considering the exigencies of the situation, to attain ARARs. In determining whether compliance with an ARAR is practicable, the lead agency may consider appropriate factors, including the urgency of the situation and the scope of the removal action to be conducted. A table containing potential Site-specific ARARs is provided as Attachment 5 to this Action Memorandum.

5. Project Schedule

This removal action is proposed to start in the summer of 2018 and take approximately seven months. Completion is expected by January 1, 2019; however, this is based on assumptions to work multiple crews/shifts. This uncertainty is the primary driver for the 12-month statutory exemption.

B. Estimated Costs*

	Estimated Costs
ERRS contractor	\$3,250,000
START contractor	250,000
Other Extramural Costs (Strike Team, other Fed Agencies)	\$ 50,000
SUBTOTAL	\$3,550,000
Contingency costs (20% of subtotal)	\$ 710,000
Total Removal Project Ceiling	\$4,260,000

*EPA direct and indirect costs, although cost recoverable, do not count toward the Removal Ceiling for this removal action. Liable parties may be held financially responsible for costs incurred by the EPA as set forth in Section 107 of CERCLA

VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

A delay in action or no action at this Site would increase the actual or potential threats to the public health and/or the environment. If not implemented, the catastrophic release of over 21 million gallons of AMD is increasingly likely.

VII. OUTSTANDING POLICY ISSUES

None

VIII. ENFORCEMENT

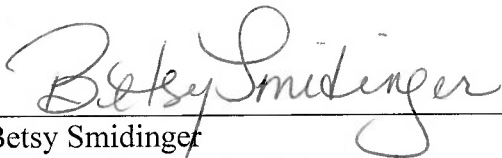
A separate Enforcement Addendum has been prepared providing a confidential summary of current and potential future enforcement activities.

IX. RECOMMENDATIONS

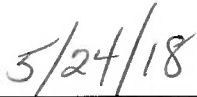
This decision document represents the selected removal action for the Nelson Tunnel/Commodore Waste Rock Pile Superfund Site in Mineral County, Colorado, developed in accordance with CERCLA as amended, and is not inconsistent with the NCP. This decision is based on the administrative record for the removal action.

Conditions at the Site meet the NCP section 300.415(b)(2) criteria for a removal action and the CERCLA section 104(c) consistency exemption from the 12-month and \$2 million statutory limitations, and we recommend your approval of the exemptions and for funding of the proposed removal action. The total project ceiling, if approved, will be \$4,260,000. Of this total, the first \$4,000,000 will be funded from the Nelson Tunnel/Commodore Waste Rock Pile Special Account and, if needed, the remaining \$260,000 will be funded from the Region's removal allowance.

APPROVE



Betsy Smidinger
Assistant Regional Administrator
Office of Ecosystems Protection and Remediation



Date

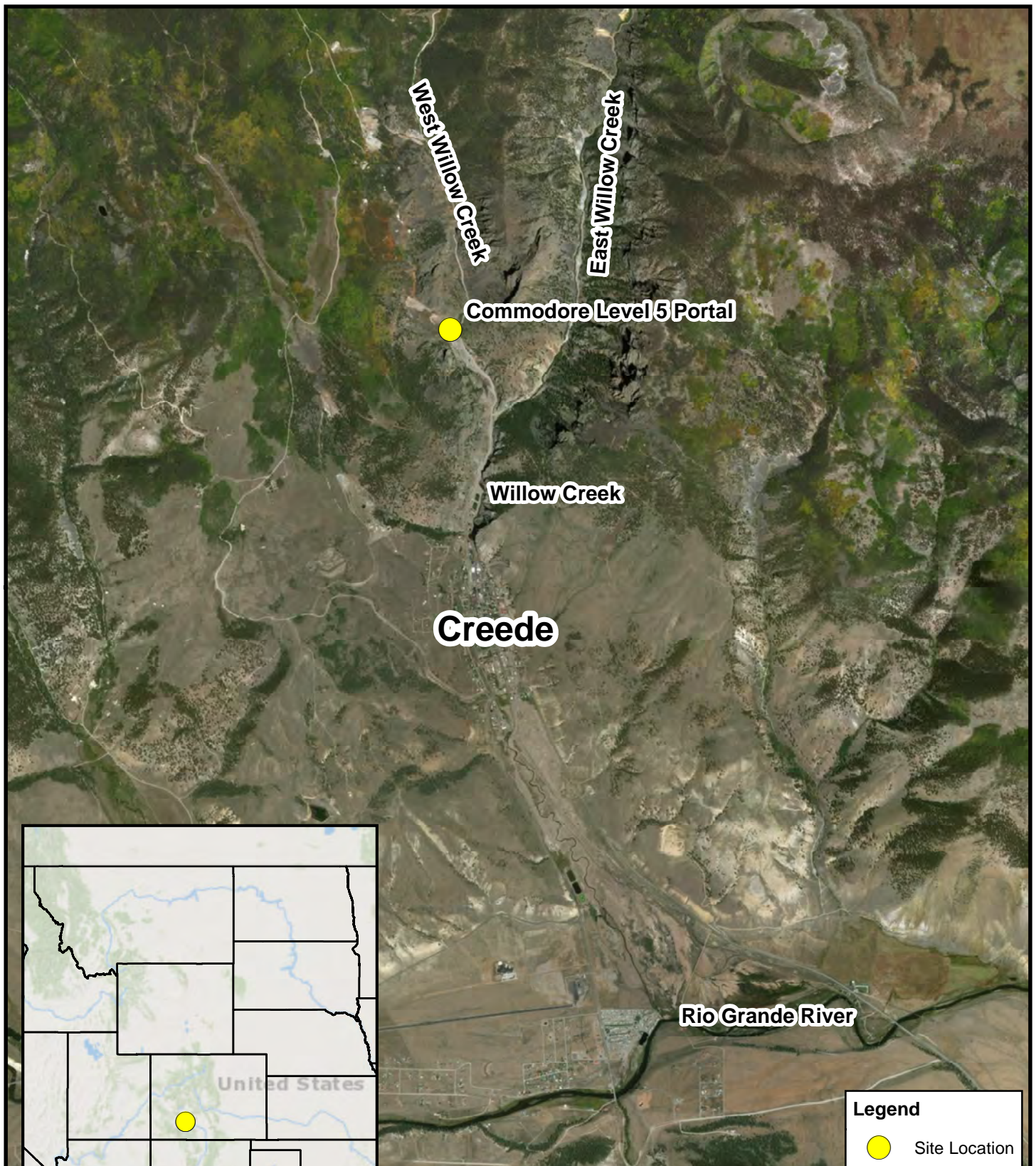
DISAPPROVE

Betsy Smidinger
Assistant Regional Administrator
Office of Ecosystems Protection and Remediation

Date

Attachments:

- Attachment 1: Site Maps
- Attachment 2: Sampling Results
- Attachment 3: Site Photos
- Attachment 4: Excerpts from the Commodore 5 Level Tunnel Rehabilitation Concept
- Attachment 5: Applicable or Relevant and Appropriate Requirements



Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
 Projection: Mercator Auxiliary Sphere
 Datum: WGS 1984

Source:
 Site Boundary: Georeferenced Aerial (Google Earth 2017)
 Background: ESRI USA Topo Maps (2017)

0 0.45 0.9 1.8 Miles



Prepared for:
 U.S. EPA - Region 8



Contract: EP-S8-13-01
 TO/TDD: 0001/1801-01

Prepared By:
 Weston Solutions, Inc.
 START IV
 Suite 100
 1435 Garrison St.
 Lakewood, CO



FIGURE 1
SITE LOCATION MAP
COMMODORE LEVEL 5 PORTAL
CREEDE
MINERAL COUNTY,
COLORADO

Date: 2/14/2018



Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
 Projection: Mercator Auxiliary Sphere
 Datum: WGS 1984

Source:
 Site Boundary: Georeferenced Aerial (Google Earth 2017)
 Background: ESRI USA Topo Maps (2017)

0 0.0125 0.025 0.05 Miles



Prepared for:
 U.S. EPA - Region 8



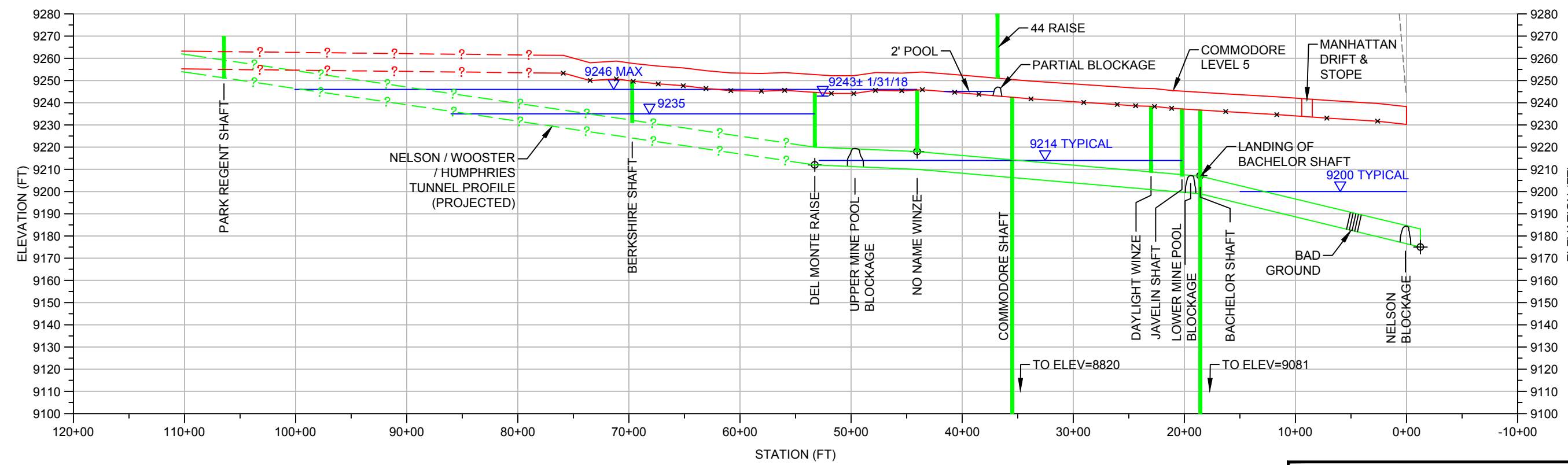
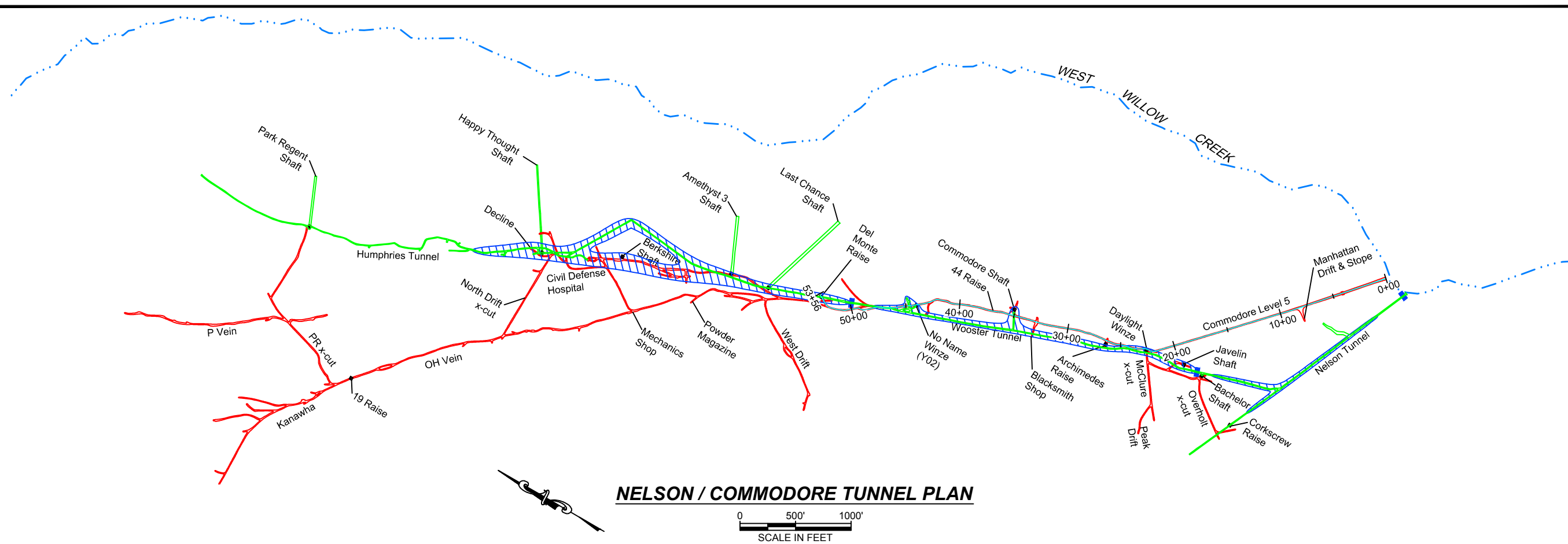
Contract: EP-S8-13-01
 TO/TDD: 0001/1801-01

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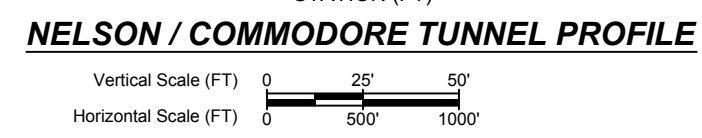


FIGURE 2
SITE VICINITY MAP
COMMODORE LEVEL 5 PORTAL
CREEDE
MINERAL COUNTY,
COLORADO

Date: 1/24/2018



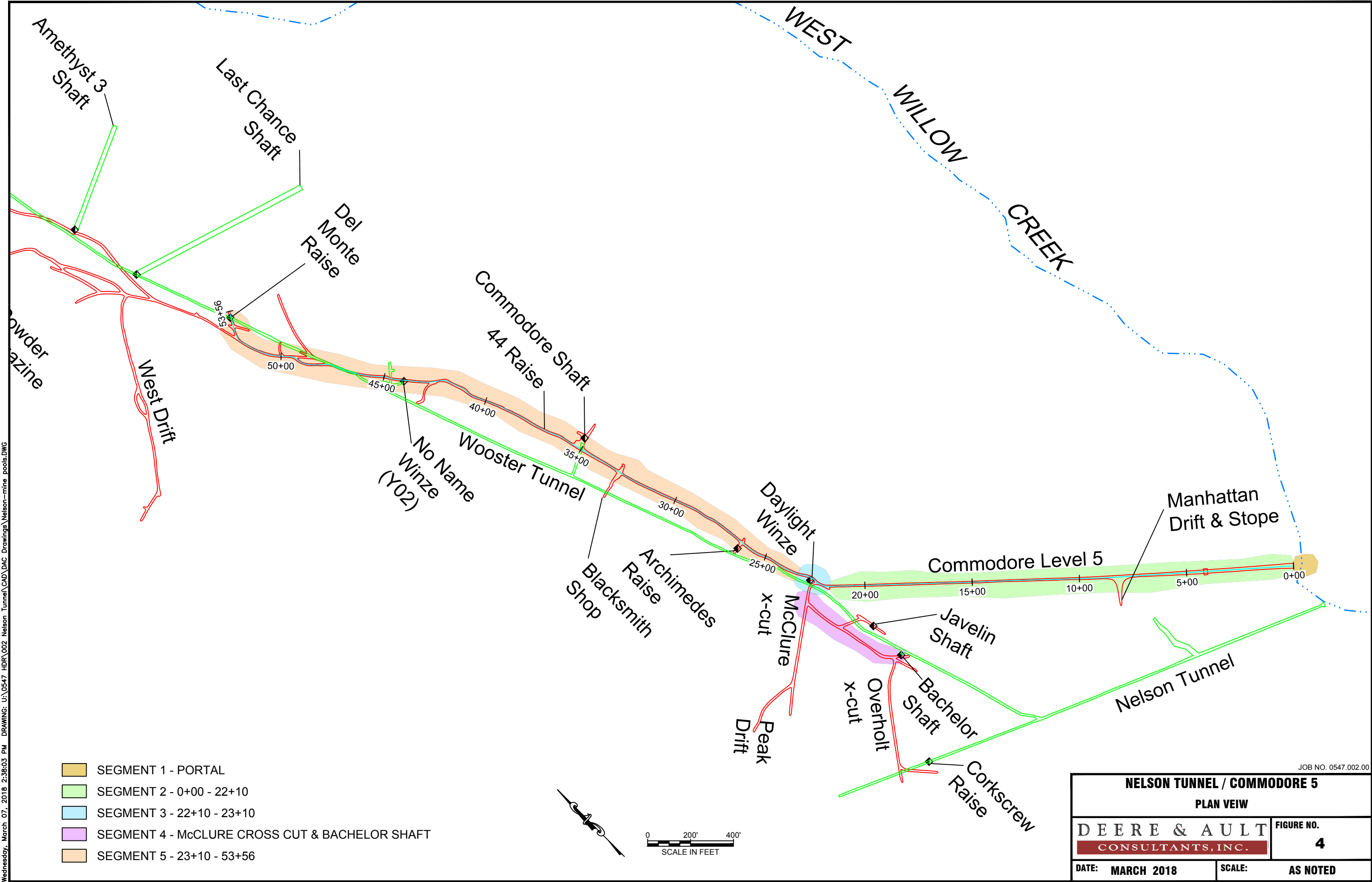
NOTES:
BASE MAP BY CDRMS
× COMMODORE TUNNEL ELEVATION SURVEY POINTS
⊕ NELSON TUNNEL ELEVATION SURVEY POINTS



NELSON TUNNEL / COMMODORE 5	
PLAN & PROFILE	
DEERE & AULT CONSULTANTS, INC.	FIGURE NO. 3
DATE: MARCH 2018	SCALE: AS NOTED

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JOB NO. 0547.002.00



Wednesday, March 07, 2018, 2:38:03 PM DRAWING: U:\0547 HDR\002 Nelson Tunnel\CAD Drawings\Nelson-mine_pools.DWG

JOB NO. 0547.002.00

NELSON TUNNEL / COMMODORE 5	
PLAN VIEW	
DEERE & AULT CONSULTANTS, INC.	FIGURE NO. 4
DATE: MARCH 2018	SCALE: AS NOTED

Attachment 2: Sample Results

	CM-ME-NT-20180131	CM-GW-44R-20180131-01	CM-GW-44R-20180131-02	CM-GW-NTU-20180131	CM-GW-NTU-20180131A	CM-FB-01-20180131
	Nelson Tunnel Effluent	Retained Water - Undisturbed	Retained Water - Disturbed	Upper Mine Pool	Upper Mine Pool Duplicate	Field Blank
Total Metals (ug/L)						
Aluminum	407	7180	7820	9120	9170	13.7 BJ
Antimony	0.754 U	0.82 J	14	0.774 J	0.754 U	0.754 U
Arsenic	8.06	5.94	101	2.29	3.44	0.51 J
Barium	14.9	17.5	297	6.59 B	8.42	0.36 U
Beryllium	3.62 B	6.29	6.35	3.81	3.9	0.12 U
Cadmium	113	1360	1400	703	705	0.16 U
Calcium	192000 V	46300	46500	147000	146000	46 U
Chromium	0.54 U	0.597 J	1.45 J	0.54 U	0.54 U	0.54 U
Cobalt	31.9	78.5	77.8	137	139	0.26 U
Copper	24.4	2350	2570	1080	1100	0.927 J
Iron	2910	15100	22500	861	1200	15 U
Lead	1260	2020	3760	1420	1450	0.959 BJ
Magnesium	12600	8530	8530	21300	21000	100 U
Manganese	14600	12600	11800	70100	66600	3.88 BJ
Mercury	0.049 U	0.16 J	2.1	0.049 U	0.0502 J	0.049 U
Nickel	12.6	31.5	31.5	66.2	64.1	0.379 J
Potassium	4890 B	16400	16700	11000	10800	37 U
Selenium	2.83 B	0.851 J	1.35 J	2.04	1.72 J	0.38 U
Silver	0.31 U	5.9	58.6	1.59 J	1.81 J	0.31 U
Sodium	53100	22600	22400	54500	52900	295 J
Thallium	3.38 B	11.9	12.9	14.1	14.5	0.19 U
Vanadium	0.18 U	0.762 BJ	4.6 J	0.18 U	0.18 U	0.18 U
Zinc	47600	103000	104000	218000	213000	28.9
Dissolved Metals (ug/L)						
Aluminum,Dissolved	415	7140	7310	9270	9060	16.2 J
Antimony,Dissolved	0.754 U	0.754 U	0.758 J	0.754 U	0.754 U	0.754 U
Arsenic,Dissolved	8.52	4.14	4.77	1.79 J	1.45 J	0.495 J
Barium,Dissolved	15	14.7	15.8	6.82	6.96	0.73 J
Beryllium,Dissolved	3.76	6.64	6.97	4.15	4.13	0.12 U
Cadmium,Dissolved	115	1360	1370	704	705	0.16 U
Calcium,Dissolved	191000	46100	46600	148000	148000	46 U
Chromium,Dissolved	0.54 U	0.54 U	0.54 U	0.54 U	0.54 U	0.54 U
Cobalt,Dissolved	33.2	78.8	79.4	142	140	0.26 U
Copper,Dissolved	24.4	1940	1990	1090	1070	2.62 J
Iron,Dissolved	3100	15300	14800	673	659	15 U
Lead,Dissolved	1310 V	2000	2220	1460	1450	2.28
Magnesium,Dissolved	12900	8970	9000	22600	22200	100 U
Manganese,Dissolved	15100	10800	10400	67600	67400	36.8
Mercury,Dissolved	0.049 U	0.059 J	0.0577 J	0.049 U	0.049 U	0.049 U
Nickel,Dissolved	12.9	31.1	31.2	67.3	67.1	0.35 U
Potassium,Dissolved	5110	16400	16400	11400	11200	37 U
Selenium,Dissolved	2.79	2.57	2.66	5.7	5.1	0.38 U
Silver,Dissolved	0.386 J	1.42 J	0.324 J	0.821 J	0.859 J	0.31 U
Sodium,Dissolved	53100	22700	22600	51500	50300	110 U
Thallium,Dissolved	3.44	12.4	12.6	15	15.2	0.19 U
Vanadium,Dissolved	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
Zinc,Dissolved	47800	110000	119000	229000	228000	183
Anions (ug/L)						
Chloride	1060	1400	1580	1410	1390	201 J
Sulfate	617000	409000	404000	908000	922000	77.4 U
pH (su) / Alkalinity (ug/L)						
pH	4.08 T8	3.64 T8	3.63 T8	3.48 T8	3.48 T8	5.12 T8
Alkalinity	2710 U	2710 U	2710 U	2710 U	2710 U	2710 U

Notes:

Lab Qualifiers:	B - The same analyte is found in the associated blank. J - The identification of the analyte is acceptable; the reported value is an estimate. T8 - Sample(s) received past/too close to holding time expiration. U - Analyte is undetected. V - The sample concentration is too high to evaluate accurate spike recoveries.
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su: Standard Unit
ug/L: micrograms/liter

Attachment 3: Relevant Site Photos



Photo 5: Portal Gate to be replaced



Photo 6: First Air Door to be replaced

Attachment 3: Relevant Site Photos



Photo 7: Floating rail ties and poor drainage near 1+00



Photo 8: Typical rail, ditch, and invert in Commodore 5 Cross Cut

Attachment 3: Relevant Site Photos



Photo 17: Daylight Winze with rotten wood cover



Photo 18: Looking down Daylight Winze: Note smooth footwall, ladder, and landing

Attachment 3: Relevant Site Photos



Photo 27: Bachelor Shaft looking up



Photo 28: : Bachelor Shaft looking up to second landing

Attachment 3: Relevant Site Photos



Photo 29: Bachelor Shaft bottom and second landing seen from far side of Nelson Tunnel

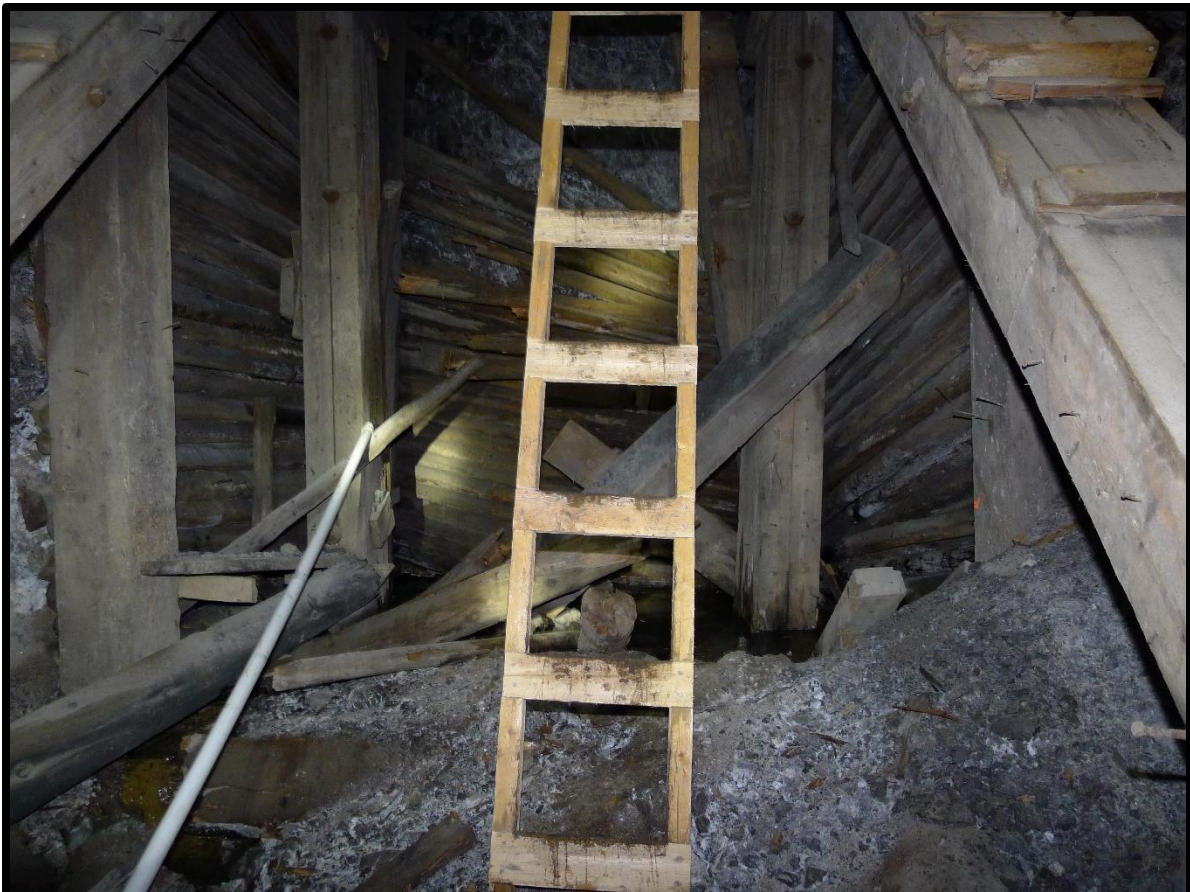


Photo 30: Bachelor Shaft at Nelson Tunnel landing

Attachment 3: Relevant Site Photos



Photo 31: Collapsed Timbers at Bachelor Shaft Nelson Tunnel landing



Photo 32: Decayed rail ties near 25+00; Note staining from water

Attachment 3: Relevant Site Photos



Photo 33: Measuring Archimedes Raise dimensions 26+64



Photo 34: Close up of Archimedes Raise steel posts; Note corrosion and delamination

Attachment 3: Relevant Site Photos



Photo 35: Typical timber stulls; Note hanging wall, Amethyst vein, and foot wall



Photo 36: Steel rail stulls with rotten timber lagging 30+50

Attachment 3: Relevant Site Photos



Photo 37: Looking up raise at 30+20



Photo 38: Debris from actively raveling raise near 32+00; Note water backed up behind



PHOTOGRAPH LOG

Project Name: Commodore Level 5: January 2018 Site Walk	Site Location: Creede, Mineral County, Colorado	Project No. TDD 0001/1801-01
-------------------------------------------------------------------	-----------------------------------------------------------	----------------------------------------

Photo No. 13	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Northeast	
Description: Roof fall material in the tunnel. DRMS noted that this is fresh material since the last entry in November 2017.	



Photo No. 14	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Southeast	
Description: Looking back at fresh roof fall material. Note small amount of water retained behind roof fall.	



Attachment 3: Relevant Site Photos



Photo 39: Steel pipe stulls near 32+20; Note pipe cribbing



Photo 40: Failed timber stulls near 32+80

Attachment 3: Relevant Site Photos



Photo 41: Debris pile at very active 44 Raise 36+82



Photo 42: Debris pile at 44 Raise 36+82 looking outby; Note water ponded behind pile



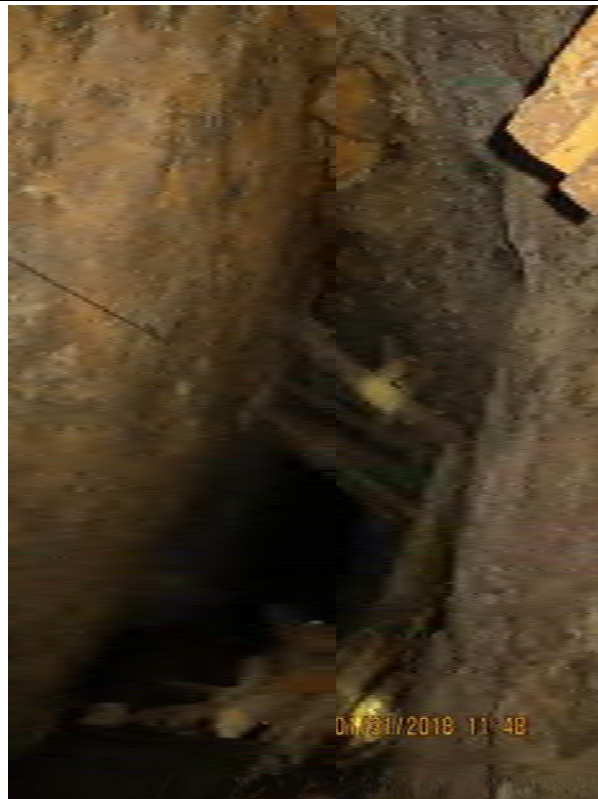
PHOTOGRAPH LOG

Project Name: Commodore Level 5: January 2018 Site Walk	Site Location: Creede, Mineral County, Colorado	Project No. TDD 0001/1801-01
-------------------------------------------------------------------	-----------------------------------------------------------	----------------------------------------

Photo No. 17	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Northeast	
Description: In tunnel roof fall at the 44 Raise. This fall is acting as a coffer dam and is holding back water. If this were be removed the water would flow outby to the Daylight Winze, and back into the Nelson Tunnel.	





Photo No. 18	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Up	
Description: Looking up the 44 Raise.	





PHOTOGRAPH LOG

Project Name: Commodore Level 5: January 2018 Site Walk	Site Location: Creede, Mineral County, Colorado	Project No. TDD 0001/1801-01
-------------------------------------------------------------------	-----------------------------------------------------------	----------------------------------------

Photo No. 19	Date: 01/31/2018	
Photo Coordinates		
Lat	--	
Long	--	
Direction Photo Taken: Southeast		
Description: Looking outby at the roof fall at the 44 Raise. Note the water built up behind the roof fall.		
Photo No. 20	Date: 01/30/2018	
Photo Coordinates		
Lat	--	
Long	--	
Direction Photo Taken: Southeast		
Description: Area inby the 44 Raise where stope timbers and roof fall have occurred.		

Attachment 3: Relevant Site Photos



Photo 44: Large loose slabs in hanging wall near 38+10; View is outby

Attachment 3: Relevant Site Photos



Photo 50: Cathedral near 43+50; Note loose muck in right rib and rotten timber lagging

Attachment 3: Relevant Site Photos



Photo 53: No Name/Y02 Winze 44+60



Photo 54: Looking down No Name/y02 Winze

Attachment 3: Relevant Site Photos



Photo 57: Area of clay gouge in left rib near 47+10; Note heavy steel rail lagging



Photo 58: Area of clay gouge in left rib near 47+10 looking outby; Note timber lagging

Attachment 3: Relevant Site Photos



Photo 59: Typical draft near 50+00; Note high water line from upper mine pool overflow



Photo 60: Del Monte Raise 53+15; Note sampling platform

Rehabilitation

We have divided the rehabilitation into five segments. The first is the portal area including access across West Willow Creek. The second segment is the Commodore 5 Cross cut to the Daylight Corner (0+00 to 22+10). The third is the Daylight Corner intersection and Daylight Winze (22+10 to 23+10). The fourth the McClure Cross cut and Bachelor Shaft (**Figure 5**). The fifth segment is the Commodore 5 from the Daylight Winze to the Del Monte Raise (23+10 to 53+27). Segments one through four are needed no matter what action is taken in the future and require relatively little effort. Segment five will require significant effort and should only be undertaken if a long-term solution is deemed to be many years out. Detailed descriptions of observed ground conditions and recommended rehabilitation by station are found in **Table 1**. Survey spad locations and elevations are listed for reference. Selected photographs of each segment are found in **Appendix A**.

Segment 1: Portal Area

At this time, work in the portal area will be limited to activities the contractor will need for access and staging during construction. The key issue is that the existing bridge is narrow with aging wooden planks. Access to the bridge is a narrow trail, inadequate for equipment larger than a small skid steer loader. The contractor should install a temporary bridge of appropriate size and capacity for their equipment and to accommodate seasonal creek flow changes. Other portal area work such as installing generators, lights, storage, offices, etc., would be included in a mobilization cost. See Photos 1-4.

Segment 2: Commodore 5 Cross Cut Portal to Daylight Corner 0+00 to 22+10

Segment 2 consists of the cross cut adit from the portal to the Daylight Corner where the adit intersects the Amethyst Vein. The first half of the segment was driven through slabby, closely spaced vertically jointed rhyolitic tuff. The second half is in a much more densely welded and massive rhyolitic tuff that eventually becomes the footwall of the Amethyst Vein (specifically the Willow Creek Member of the Bachelor Mountain Tuff). See the Geologic Map in Figure 6. Both areas were dry during our site visit. No ground support is currently installed. The track was generally in good shape after the first 200 feet. Several gallons per minute of water flowed through a ditch at the side of the track. See Photos 5-11.

Rehabilitation in this segment will consist of scaling, mucking, debris removal, ditch cleaning, track repair, replacement of the portal gate, and the installation of two air doors. The Manhattan Drift and another smaller room, near station 12+00, can serve as storage during construction.

Segment 3: Daylight Corner Intersection and Daylight Winze 22+10 to 23+10

Segment 3 consists of a small but critical area where the Commodore 5 turns and starts drifting on the vein. Here it is almost directly above the Nelson Tunnel where they connect through a collapsed raise and the Daylight Winze. This segment also includes the intersection with the McClure Cross cut. See Photos 12-19.

While the rock is generally good, the large span of the intersection and importance of keeping this area accessible leads us to recommend scaling, pattern bolting (6' long), and installing wire mesh. The same applies at the wide section where the collapsed raise from the Nelson intersects the floor (22+10). Two small but high stopes in the middle of this segment should have steel sets, lagging, and foam installed underneath them to limit raveling.

Attachment 4: Excerpts from the Commodore 5 Rehabilitation Concept

Significant work is also needed at the Daylight Winze and the raise above it. Due to its importance of acting as the last drain into the Nelson Tunnel, the Daylight Winze should be fully rehabilitated by scaling, bolting, and installing new ladders and landings made of non-decaying or corroding material such as fiber reinforced plastic (FRP). This work would take place above the Nelson Tunnel without impacting the impounded mine pool areas. A cover capable of supporting vehicle traffic and allowing water inflow should also be installed. We anticipate the cover consisting of a concrete collar with coated steel beam supports and grated FRP cover.

Segment 4: McClure Cross Cut to Bachelor Shaft 22+68 to 28+68 (separate stationing)

The rock in the McClure Crosscut, in the hanging wall, consists of massive rhyolitic tuff, specifically the Campbell Mountain Member of the Bachelor Mountain Tuff. It was dry during our site visit and contained some ore chutes from upper levels. No ground support was noted but there was a moldy wood canopy possibly providing protection from small debris. See Photos 20-31.

Based on our observations, only minimal cleanup work will be required in the McClure Cross Cut area. The moldy canopy may have to be removed and replaced with bolts and wire mesh, depending on the ground conditions behind it. The bulk of the work will be in the Bachelor Shaft where the untreated wood ladders and landings should be replaced with fiber glass reinforced plastic ladders and landings, anchored into the rock wall. Figure 5 shows the Bachelor Shaft in cross section. Note that the work would be limited to the Bachelor Shaft and landing, without impacting or accessing the Nelson Tunnel.

Segment 5: Daylight Winze to Del Monte Raise 23+10 to 53+27

From the Daylight Winze to the Commodore Shaft, the Commodore Level 5 main haulage tunnel generally follows the Amethyst Vein. While mined in some areas, the Amethyst Vein is often visible as hard, silicified breccia with altered, clayey gouge material near its edges. The hanging wall and foot wall are well defined in many areas and dip steeply to the West. Occasional roof falls are visible and range in volume from a few cubic feet to a few cubic yards. During our site visit, the tunnel was moist with water visible as minor pools behind collapses and dipping from various stopes and the Archimedes Raise. Timber ground support was failing at various stopes.

The Commodore Shaft area consists of two large underground chambers, neither of which had any ground support. This demonstrates the generally good rock quality in the foot wall in this area. North of the Commodore Shaft, the ground becomes blockier and weaker. A large roof fall by the 44 Raise caused mine pool two to three feet deep to build up behind it. At various locations, the tunnel curves around sections of bad ground where the main drive had been abandoned. North of the No Name (Y02) Winze, iron staining is visible on the floor. When the Upper Mine Pool elevation exceeds that of the Del Monte Raise collar, the mine water flows from the Del Monte Raise to the No Name Winze where it drops back into the Nelson Tunnel. See Photos 32-62.

Attachment 4: Excerpts from the Commodore 5 Rehabilitation Concept

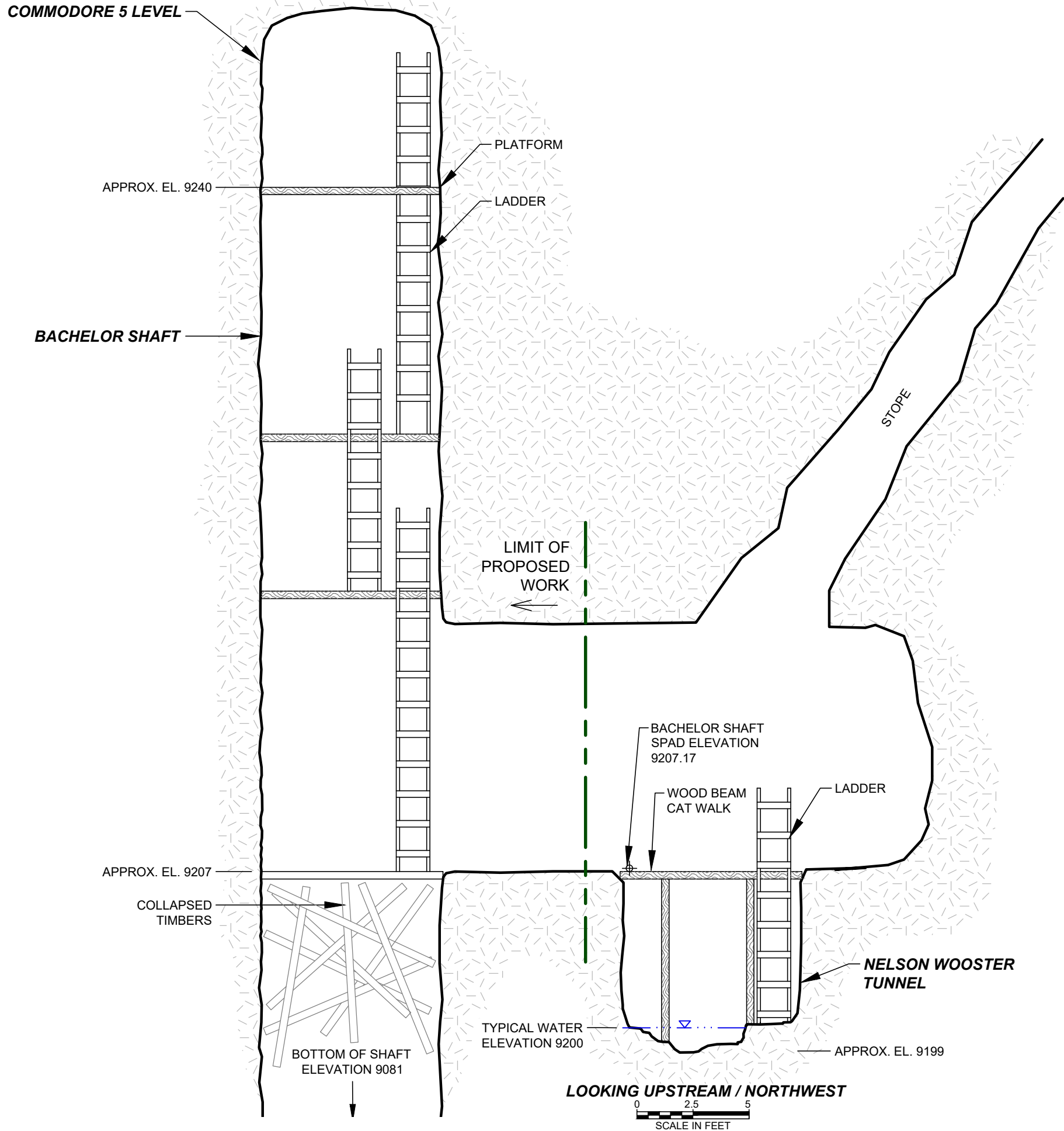
Rehabilitation work in this segment will require considerable time, cost, and effort. While the removal of the wood and rock debris from the floor is a significant undertaking, the main cost will be in the installation of steel stulls and steel sets. At numerous locations, the back has been stoped up and supported with timber posts. Most of these are rotting and need to be replaced. Removing and disposing of the timber will also be a major cost factor, particularly if they must be removed from site. There are also several raises that ravel down material. For safety and to keep the Commodore 5 open, these areas will need lagged steel sets with foam backfill across the openings. For safety, this work will have to be carried out sequentially from the Daylight Winze to the Del Monte Raise.

The area of greatest concern for keeping the “overflow” from the Del Monte Raise to the No Name/Y02 Winze open is a section of clay gouge between stations 47+10 and 47+40. It is supported by rail posts, rail lagging, and wood lagging. If the lagging fails in this area, the drift would likely be blocked, leading to higher water pressures and water volume in the upper mine pool.

Due to its importance of acting as the overflow for the upper mine pool, the No Name/Y02 Winze should be fully rehabilitated by scaling, bolting, and installing new ladders and landings, much like the Daylight Winze. This work would take place above the Nelson Tunnel without impacting the impounded mine pool areas. A cover capable of supporting vehicle traffic and allowing water inflow should also be installed. We anticipate the cover consisting of a concrete collar with coated steel beam supports and grated FRP cover.

The collar at the Del Monte Raise should have an elevated platform installed above the high water line to allow safe and efficient sampling without hindering the flow of the mine pool. This platform would also be made of FRP or similar material.

Monday, February 26, 2018 10:04:59 AM DRAWING: U:\0547 HDR\002 Nelson Tunnel\CAD\DAC Drawings\Bachelor Shaft Cross Section.DWG



JOB NO. 0547.002.00		
NELSON TUNNEL / COMMODORE 5		
BACHELOR SHAFT CROSS SECTION		
DEERE & AULT		FIGURE NO.
CONSULTANTS, INC.		5
DATE:	FEB. 2018	SCALE:
		AS NOTED

Attachment 5: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Federal ARARs

Standard, Requirement, or Criteria	Description	Type	Applicable or Relevant and Appropriate	Comment
Resource Conservation and Recovery Act of 1976 (RCRA), Hazardous Waste Management System, 40 CFR Parts 260-270, pursuant to 42 USC § 6901 <i>et seq.</i>	Identifies hazardous wastes that are restricted from land disposal and defines those limited circumstances under which an otherwise prohibited waste may continue to be land disposed.	Action	Applicable	Mineral extraction wastes are categorically exempt from hazardous waste regulation pursuant to the RCRA Bevill Amendments. A hazardous waste determination will be made for any waste disposed off-site.
RCRA Criteria for Classification of Solid Waste Disposal Facilities and Practices, 40 CFR Part 257, pursuant to 42 USC § 6901 <i>et seq.</i>	Establishes criteria for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health.	Action	Applicable	Applicable to on-site disposal of solid waste where "disposal" includes the placement of solid waste into the environment.
National Historic Preservation Act (NHPA), 16 USC § 470; 40 CFR 6.301(b); 36 CFR Parts 63, 65, and 800	Requires the preservation of historic properties included in or eligible for the National Register of Historic Places and to minimize harm to National Historic Landmarks.	Location	Applicable	The site is part of the Creede National Historic District, and the NHPA is applicable to potential impact to historic properties included or eligible for listing within this district.

Attachment 5: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

State ARARs

Standard, Requirement, or Criteria	Description	Type	Applicable or Relevant and Appropriate	Comment
Colorado Hazardous Waste Regulations, Identification and listing of Hazardous Waste, 6 C.C.R. 1007-3 Part 261, pursuant to the Colorado Hazardous Waste Act, C.R.S. § 25-15-101 <i>et seq.</i>	Identifies solid wastes subject to regulation as a hazardous waste under the Colorado Hazardous Waste Act and Regulations.	Action	Applicable	The tunnel debris has been derived directly or indirectly from extraction of ore and thus meet the exclusion requirements for identification as a hazardous waste indicated in 6 C.C.R. 1007-3 § 261.4(b)(7) commonly known as the "Bevill" exclusion. For off-site disposal purposes, these regulations are applicable for characterizing any solid wastes prior to off-site shipment and acceptance at a regulated solid waste disposal facility.
Colorado Solid Waste Disposal Sites and Facilities Regulations, 6 CCR 1007-2, section 1 (general provisions) and section 2 (minimum standards) pursuant to the Colorado Solid	Establishes minimum requirements for "solid waste disposal facilities."	Action	Relevant and Appropriate	Pursuant to the Solid Wastes Disposal Sites and Facilities Act, C.R.S. § 30-20-102(4), mining operations, including reclamation activities, with approved reclamation plans

Waste Sites and Facilities Act, C.R.S. § 30-20-100.5 <i>et seq.</i>				under a Colorado Mined Land Reclamation Board (MLRB) permit may dispose of solid wastes generated by such operations within the permitted area without obtaining a Certificate of Designation. CDPHE interprets this provision to exempt CERCLA response actions similar to mined land reclamation activities described in the MLRB's Regulations, 2 C.C.R. 407-1 Rule 3 (Reclamation Performance Standards), from Colorado's regulations pertaining to solid waste disposal.
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Colorado Mined Land Reclamation Board Regulations Reclamation Performance Standards, 2 C.C.R. 407-1, Rule 1.1 (definitions) and Rule 3.1.5(5), (10), and (11) (Reclamation Performance Standards, pursuant to the Colorado Mined Land Reclamation Act), C.R.S. § 34-32-101 <i>et seq.</i>	Establishes reclamation performance standards related to grading, backfilling, erosion, acid drainage, unauthorized release of pollutants, and safety and protection of wildlife.	Action/Location	Relevant and Appropriate	The removal action shall comply with the performance standards set forth in these regulations.
Colorado Fugitive Dust Control Plan/Opacity, Regulation No.1, 5 CCR 1001-3, pursuant to Colorado Air Pollution Prevention and Control Act, CRS § 25-7-101 <i>et seq.</i>	Establishes regulations concerning fugitive emissions from construction activities, storage and stockpiling activities, and transportation.	Action	Applicable	Applicable to all activities generating dust.
Colorado Noise Abatement Statute, CRS §§ 25-12-101, 110	Establishes maximum permissible noise levels for particular time periods and land use zones.	Action	Applicable	Applicable to all construction, transport, and backfilling activities.