ALTERNATIVE REMEDY FOR THE REYNOLDS ADIT, SITE OU-5 SUMMITVILLE MINE SUPERFUND SITE RIO GRANDE COUNTY, COLORADO

Prepared for:

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TETRA TECH

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1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) has requested an evaluation of alternatives for the permanent closure of the Reynolds Adit at the Summitville Mine Superfund Site (SMSS). The EPA requested that this evaluation be completed for the March 2009 EPA Prioritization Panel review. The purpose of the adit closure is to address one of the outstanding items identified in the SMSS Operable Unit (OU) 5 Record of Decision (ROD) (CDPHE, 2001).

1.1 Background

The Reynolds Adit was driven in the late 1890s through early 1900s at the location shown on Figure 1. The adit was to dewater the upper workings (thereby facilitating mining) in South Mountain and used to serve as an ore-haulage route for ore produced from these upper workings. During the most recent mining operations at South Mountain (1984 through 1992), Summitville Consolidated Mining Company Incorporated (SCMCI) developed the South Mountain mineral reserves as an open pit, heap leach gold mine. Development of the two mine pits focused the infiltration of snow melt and rainwater over the area drained by the adit. The advancement of the mine pits also decreased the time between infiltration and discharge as the groundwater flow pathways were shortened due to mining and exposure of historical underground mine workings. As a result of SCMCI's mining activities, the rate of water discharging from the adit increased (Figure 2) and the concentrations of metals in the adit discharge also increased (Figure 3).

EPA assumed responsibility for the SMSS in December 1992. At that time, the adit was the largest point source of copper loading to offsite surface water resources. EPA plugged the adit with a bulkhead in 1994 as part of their emergency response actions. The Chandler Adit, located approximately 180 feet above the Reynolds Adit, was also plugged to retain the mine pool that formed behind the Reynolds plug. A pressure transducer was installed in 2000 to monitor the mine pool elevations behind the bulkhead (Figure 4).

As-constructed plans for the Reynolds Adit bulkhead are not available as of this writing. However, the bulkhead is reportedly 7 to 8 feet long and appears to be keyed a few inches into the bedrock. The bulkhead was designed with a Factor of Safety of 2, assuming a pressure of 152 psi. Recorded pressure readings since 2000 have reached 153 psi or 353 feet of water. The bulkhead has been exposed to seasonal pressure cycles since its installation.

1.2 OU5 ROD Selected Remedy

The OU5 ROD (CDPHE, 2001) included the following description for the selected remedy for the Reynolds Adit (Section 7.2, Component 12):

> *Reynolds Adit Rehabilitation and Control Valve – Rehabilitation of the Reynolds Adit will include a new concrete portal structure, a new pipeline from the bulkhead to portal, a coarse gravel bed and drain pipe over the adit floor for drainage and mechanical accessibility, and replacement of all support sets and lagging. A long-term O&M plan of annual inspections and periodic replacement of deteriorated supports will be implemented. A new control valve will be*

installed on the pipeline at the bulkhead with controls at the portal. The mine pool elevation will be regularly monitored using a pressure transducer; the mine pool discharge will be directed to the on-site impoundment. Discharge will be regulated either at the portal by installing a manual gate valve and flow meter, or by valves at the plug. Management of the mine pool will be accomplished by releasing water from the Reynolds Adit pipeline to the on-site impoundment. By maintaining a mine pool elevation below the Chandler Adit, rehabilitation in the Chandler Adit will not be necessary.

Recent discussions between Tetra Tech, the CDPHE (Austin Buckingham), the EPA (Ken Wangerud) and the Colorado Division of Reclamation Mining and Safety (Bruce Stover) have focused on an alternative for the Reynolds Adit that differs slightly from that described in the selected remedy. The modifications to the Reynolds Adit rehabilitation discussed herein, if implemented, may require the issuance of an Explanation of Significant Difference (ESD) for the OU5 ROD.

1.3 Organization

Section 2 of this document presents historical information related to the plugging of the adit and subsequent work performed at the site related to the adit. The alternatives developed to address the closure of the adit, the bulkhead (plug), the pipeline and the portal structure are described in Section 3. The effectiveness, constructability, and costs of the alternatives are evaluated in Section 4. A proposed sequencing for the construction is presented in Section 5.

2.0 EXISTING ADIT

The alignment of the adit and other major subsurface mine workings are illustrated in Figure 1 along with other mine site features. The Reynolds Adit is plugged with a bulkhead at a location approximately 1,265 feet inside the portal. A pipe extends through the bulkhead and is connected to a pipeline that runs along the adit invert to the portal. The elevation of the portal is approximately 11,318 feet. Based on pipeline pressure readings made at the portal and the bulkhead, the elevation of the invert at the bulkhead is estimated to be approximately 11,327 feet. The adit has an average grade of approximately 0.7 percent. A photographic log of the existing conditions is shown in Appendix A. As-built conditions of the adit are shown on Figure 4. There is not a detailed as-built drawing of the bulkhead.

2.1 Bulkhead and Pipeline

SCMCI's preliminary plan for plugging the adit system called for three bulkheads: two bulkheads in the adit and a third in the Dexter Cross-cut (SCMCI, 1992). The first bulkhead location was approximately 1,240 to 1,280 feet from the portal and the second approximately 600 to 660 feet from the portal. The Dexter Cross-cut, which joins the adit approximately 120 feet from the portal, was to be opened and evaluated for a bulkhead location. Other than rehabilitating the tunnel in 1992, SCMCI did not pursue installation of these bulkheads prior to declaring bankruptcy.

In February 1993, the EPA issued a Request for Proposal (RFP) to plug the adit. The selected contractor, Intermountain Mine Services (IMS), proposed to install two bulkheads in the adit: one at 1,265 feet and the other at 625 feet from the portal. Based on recommendations from the interagency team assisting the EPA, the EPA also requested that IMS clear and design a bulkhead for the Dexter Cross-cut.

The follow construction history for plugging the Reynolds Adit system is taken from Devarajan, et al. (1995).

November 22, 1993: IMS initiates work on the adit by excavating loose rock from the area of the 12+65 station bulkhead.

December 9, 1993: This work continued until a significant ground movement occurred at the 2+30 station and prevented access to the 12+65 station while this caved material was cleared and a limited segment was re-timbered for support. This work occurred along with excavation through the Dexter Cross-cut caved material.

December 14, 1993: IMS proceeded to clean the [12+65 station] location for the bulkhead and drill the grout holes into the rock. Twenty six (26) holes were drilled at radial angles.

December 17, 1993: Grouting began with a 5:1 ratio grout. A maximum of 60-65 psi pressure was used to inject grout into holes drilled 6 feet deep. The performance objective for formation grouting was considered unacceptable by IMS due to excessive leakage through fractures or permeable rock so the decision to drill 16-foot grout holes was made. A second ring of holes four feet in front of the 16-foot ring were drilled to a depth of 10 feet each. Each ring consisted of 26 radial holes.

December 28, 1993: The drilling work was completed and the grouting work began.

December 30, 1993: All grouting was completed.

January 6, 1994: Work on the bulkhead began and was completed.

January 9, 1994: Installation of the 6" High Density Polyethylene (HDPE) pipe was started and work on the Dexter Cross-cut continued.

Note: It appears from subsequent documentation that the piping was only completed to the location of the second bulkhead at this time

January 11, 1994: A recommendation to install a stiffer steel-reinforced system in the Dexter Cross-cut was made and approved.

January 13, 1994: IMS completed construction of the adit bulkhead design with contact grouting. During this time they also cleared the caved material at the Dexter and found it to be related to a major fault containing a high-clay content gouge material which could not be contained with conventional three-piece timber construction.

The Dexter Cross-cut was found to terminate about 350 feet from the cave in area. Consequently, all work was suspended on the Dexter.

January 20, 1994: IMS began preparing the 6+20 station in the adit for the second bulkhead.

January 24, 1994: IMS began drilling the 26 grout holes for the 6+20 station bulkhead. The holes were drilled in the same manner as the 12+65 station plug.

Inspection of the 12+65 station bulkhead showed minor seeps from the adit walls and two wet areas near the interface with the floor but no noticeable water migration. A pressure gauge installed to measure pressure behind the bulkhead showed no accumulation at this time.

January 25, 1994: USEPA instructed USBR and ECC to discontinue work on the 6+20 station bulkhead based on the low flow in the adit, and performance exceeding expectations at the 12+65 station bulkhead. The requirement for the second bulkhead was found to be unnecessarily redundant and was subsequently deleted from the contract scope.

February 1994: IMS completed the installation of the bulkhead in the Chandler Adit and demobilized from the site.

November 1994: IMS returned to the site to complete the installation of the adit pipeline to the portal. IMS also installed an electronically controlled valve at the bulkhead and replaced some carbon steel bolts with "Alloy 20" bolts. The pipeline was completed and pressure tested on November 23, 1994.

November 1994 to February 1995: IMS also repaired the ventilation system, replaced numerous timber sets and lagging, and repaired the boardwalk.

2000 and 2001: Mining & Environmental Services (MES) replaced limited timber sets and repaired the boardwalk.

2.2 Annual Inspections

Annual inspections of the adit have been performed to document the integrity of the bulkhead and piping, and the functionality of the automatic gauge and the pressure transducer. The inspections were performed under confined space entry protocol.

The adit has been entered and inspected on an annual basis since 1996 with the exception of 2000 and 2002 as shown in Table 1.

Table 1 – Adit Inspections

Year	Inspector
1996	Environmental Chemical Corporation
1997	Environmental Chemical Corporation
1998	Rocky Mountain Consultants
1999	Rocky Mountain Consultants
2000	No Inspection
2001	Rocky Mountain Consultants
2002	No Inspection
2003	Tetra Tech
2004	Tetra Tech
2005	Tetra Tech
2006	Tetra Tech
2007	Tetra Tech
2008	Tetra Tech

3.0 ALTERNATIVES

Maintaining the primary control (automatic valve) for the adit pipeline at the bulkhead has necessitated that the adit remain accessible. The failure of the pressure transducer seal in early 2008 demonstrated the need to access the bulkhead to facilitate repairs. Additionally, the adit HDPE pipeline was not protected against rock fall when installed; periodic rehabilitation would be required to minimize the threat posed by rockfall to the pipeline. In summary, the current configuration of the adit pipeline and associated valves requires that the full 1,265 feet of the adit be maintained to allow safe entry and to protect the pipeline infrastructure. As noted in the annual inspections, the rock and timber conditions in the adit continue to deteriorate. Consequently, periodic rehabilitation of the adit will be required to maintain the current adit configuration.

As discussed in Section 1.2, the OU5 ROD (CDPHE, 2001) included the following Reynolds Adit components in the selected remedy:

1. A new concrete portal structure
2. A new pipeline from the bulkhead to portal with a new control valve at the bulkhead and controls at the portal
3. A coarse gravel bed and drain pipe over the adit floor for drainage and mechanical accessibility
4. Replacement of all support sets and lagging.

The OU5 ROD also called for a long-term O&M plan for the adit, which would include annual inspections and periodic replacement of deteriorated supports (e.g., timbers, lagging, spilling).

In the Fall of 2008, CDPHE and EPA requested that Tetra Tech develop and evaluate an alternative for the final adit remedy that would not require access to the pipeline and/or

bulkhead, thereby eliminating the need for annual (intrusive) inspections and periodic rehabilitations. The following subsections present the components of the alternative.

3.1 Bulkhead and Valves

Review of the original design calculations indicate the existing bulkhead was designed to be eight feet long, with a Factor of Safety of 2 when resisting 152 psi. Since 2000, a maximum pressure of 153 psi has been recorded behind the bulkhead (Figure 4). The data indicates pool levels could be higher in significant snow years. We have preliminarily calculated bulkhead lengths for pressures greater than 153 psi. The calculation results are summarized in Table 2 below.

Table 2 – Required Bulkhead Lengths vs. Pressure Relationship Factor of Safety of 2

Pressure (psi)	Water Height (feet)	Bulkhead Length (feet)
170	395	8.5
185	430	9.0
200	465	10.0
220	511	12.0

For cost estimate purposes, Tetra Tech has developed two alternative remedies. In both alternatives, the pressure transducer and the automatic valve would be removed and the manual valve would be left open. Under the scenario presented in Section 3.1.1, cellular concrete would be placed around the remaining manual valve to protect it from rockfall. Under the scenario presented in Section 3.1.2, a secondary bulkhead six feet in length would be installed immediately outside the existing bulkhead. In both scenarios, six feet of cellular or Type V concrete are placed below the existing bulkhead to protect the discharge pipe and to mitigate air exposure and deterioration of the rock below the existing bulkhead. The alternatives are shown on Figure 6.

3.1.1 Alternative 1 – Pipe Encapsulation in Cellular Concrete

Cellular concrete would be used to protect the manual valve and pipeline where it emerges from the bulkhead from rockfall. This alternative would not provide any substantial support to the existing Reynolds Adit bulkhead. In general, the alternative would be constructed as follows:

- The surface of the existing bulkhead would be pressure washed.
- The floor would be cleared of free rock and accumulated debris for a distance 10 feet outside the bulkhead.
- The adit crown, walls and floor would be scaled of loose and severely altered rock for a distance of six feet outside the bulkhead.
- The manual valve would be shut.
- The pressure transducer and the automatic valve would be removed.
- A length of 24-inch HDPE pipe would be slipped over the 6-inch HPDE pipe.

- A section of stainless steel pipe would be installed where the pressure transducer and the automatic valve were previously located.
- The manual valve would be reopened, thereby pressure testing the new blank section of pipe.
- The manual valve would be left open and the valve handle removed (if possible).
- The 24-inch diameter HDPE pipe would be slipped to butt against the outside face of the bulkhead and supported with steel wire, rebar, etc. thereby providing secondary containment[1] over the section of the pipeline containing the manual valve.
- Forms would be constructed six feet outside the bulkhead and the adit between the form and the bulkhead would be filled with cellular concrete.

3.1.2 Alternative 2 – 6-Foot Bulkhead Augmentation and Encapsulation

The existing bulkhead would be extended approximately six feet. The pressure transducer and automatic valve would be removed as described in Section 3.1.1. The manual valve would be encapsulated in 4,000 psi sulfate resistant (Type V) cement. In general, the alternative would be constructed as follows:

- The surface of the existing bulkhead would be pressure washed and roughened.
- The adit crown, walls and floor would be scaled of free rock, accumulated debris, and severely altered rock for a distance six feet outside the bulkhead.
- The manual valve would be shut.
- The pressure transducer and the automatic valve would be removed.
- A length of 24-inch HDPE pipe would be slipped over the 6-inch HPDE pipe.
- A section of stainless steel pipe would be installed where the pressure transducer and the automatic valve were previously located.
- The manual valve would be reopened, thereby pressure testing the new blank section of pipe.
- The manual valve would be left open and the valve handle removed (if possible).
- The 24-inch HDPE pipe would be slipped to butt against the outside face of the bulkhead and supported with steel wire, rebar, etc. thereby providing secondary containment[1] over the section of the pipeline containing the manual valve.
- New bulkhead forms would be constructed six feet outside the existing bulkhead.
- Type V sulfate resistant concrete would be pumped in a single pour forming the extended bulkhead.

3.2 Pipeline and Adit Drainage

A new six-inch drain pipe will extend from the bulkhead to the portal. The existing six-inch discharge pipe would be repaired as necessary. These pipes will be covered with angular gravel to provide rockfall protection. This work will include the following:

[1] The use of the pipe as secondary containment is to protect the surrounding cement/concrete from erosion and channeling due to high pressure water escaping from the valve should it corrode.

- Remove any accumulated floor debris and boardwalk.
- Establish free drainage along right side (entering) of adit possibly requiring excavation of a small ditch.
- Install drainage pipe from new bulkhead to portal.
- Repair discharge pipe as necessary from new bulkhead to portal.
- Install gravel over drainage and discharge pipes as shown on Figure 7.
- Install flume outside the portal to measure flow.

3.3 Portal Structure

A new cement portal will be installed at the adit as shown on Figure 7. The portal will feature header and wingwalls as well as a grated closure door. Rock bolts, welded wire fabric, and shotcrete will used to stabilize slopes above the crown and other areas as necessary.

4.0 ALTERNATIVE EVALUATIONS

The existing bulkhead appears to be performing well based on observations made during construction and subsequent adit inspections. The relatively small amount of seepage around the bulkhead indicates the grout curtain is performing well. For that reason no additional grout curtain is proposed in the alternatives discussed herein. Review of the available information indicates the bulkhead is seven to eight feet long. The bulkhead was designed in 1993 using concrete sheer calculations with load factors outlined by American Concrete Institute. These calculation methods have not changed. The bulkhead was designed for a mine pool 350 feet (152 psi) above the bulkhead. Since 2000, the mine pool has reached elevations of 353 feet (153 psi) above the bulkhead.

A plan to improve the portal and to protect the discharge pipe and provide adequate drainage along the length of the adit is shown on Figure 7. In addition, the plan shows design alternatives to protect the pipe near the existing bulkhead and to improve stability of the existing bulkhead. These bulkhead alternatives are shown on Figure 6 and are listed as follows:

Alternative 1 – Pipe encapsulation in 6-foot length of cellular concrete
Alternative 2 – Pipe encapsulation and bulkhead support with 6 feet of concrete

The following section discusses the effectiveness of the bulkhead design alternatives. Also discussed in this section is the constructability of the alternatives and the preliminary Engineer's Opinion of Costs to construct the alternatives.

4.1 Effectiveness

4.1.1 Alternative 1 – Pipe Encapsulation in Cellular Concrete

Alternative 1 encases the pipe adjacent to the bulkhead in a six-foot length of cellular concrete. Alternative 1 offers protection of the pipe and the valve that is to remain in place adjacent to the existing bulkhead. However, the cellular concrete adds little mass to the existing bulkhead. The

cellular concrete will cover bedrock adjacent to the bulkhead minimizing exposure to air and slowing the weathering and deterioration of the bedrock.

4.1.2 Alternative 2 – 6-Foot Bulkhead Augmentation and Encapsulation

Alternative 2 encases the pipe and supports the bulkhead with six feet of concrete. Alternative 2 offers both protection to the pipe and valve and increased stability of the existing bulkhead. The additional six-foot length of concrete results in a bulkhead capable of resisting anticipated potential pressures and also protects the adit rock walls from deterioration due to exposure to the elements.

4.2 Constructability

Construction of the bulkhead alternatives and the adit and portal improvements is considered feasible. While the SMSS is remote, significant construction has been completed at the site since 1994. The previous work has included adit rehabilitation and bulkhead construction indicating the work proposed herein can be accomplished. Work within the confined adit will tend to be labor intensive and will require good ventilation and adherence to confined space safety protocols.

Past experience indicates concrete will either have to be batched on-site or placed dry in cement trucks with final mixing either en-route or after arrival at the site. Concrete would likely have to be transported to the bulkhead in carts or tremied from the ground surface through a borehole. Cellular concrete would be batched at the portal and pumped to the bulkhead.

Gravel for the adit rehab may have to be delivered to the site though it may be possible to quarry and crush Andesite rock at the site. Manufactured construction items and any necessary support timbers would have to be delivered to the site.

4.3 Cost

The Preliminary Engineer's Opinion of Costs to construct each of the alternatives is included on Table 2. Unit costs were based on unit prices received for work at the site for the 2008 construction season.

TABLE 3
SUMMITVILLE MINE SITE OU-5
REYNOLDS ADIT REHABILITATION
ENGINEER'S OPINION OF COSTS, JANUARY 2009

		Alternative 1			Alternative 2		
Item	*Units*	*Quantity*	*Cost*	*Extension*	*Quantity*	*Cost*	*Extension*
Mobilization/Demobilization/Site Prep	LS	1	$80,000.00	$80,000	1	$80,000.00	$80,000
Portal Rockbolts	LF	192	$60.00	$11,520	192	$60.00	$11,520
Portal Shotcrete	CY	5	$1,600.00	$8,000	5	$1,600.00	$8,000
Portal Type 5 Concrete	CY	6	$1,600.00	$9,600	6	$1,600.00	$9,600
Portal Grated Door	LS	1	$7,000.00	$7,000	1	$7,000.00	$7,000
Remove Portal Building	LS	1	$20,000.00	$20,000	1	$20,000.00	$20,000
Flume on Drain Discharge	LS	1	$5,000.00	$5,000	1	$5,000.00	$5,000
Adit Stabilization	LS	1	$30,000.00	$30,000	1	$40,000.00	$40,000
Adit Remove Boardwalk/Grade Floor	LS	1	$20,000.00	$20,000	1	$20,000.00	$20,000
Adit Remove Ventilation Duct	LS	1	$10,000.00	$10,000	1	$10,000.00	$10,000
Adit Drain Pipe	LF	1265	$30.00	$37,950	1265	$30.00	$37,950
Adit Replace Damaged Discharge Pipe	CY	127	$40.00	$5,080	127	$40.00	$5,080
Adit Gravel Pack	CY	600	$70.00	$42,000	600	$70.00	$42,000
Bulkhead Prepare Bedrock Surface	LS	1	$10,000.00	$10,000	1	$12,000.00	$12,000
Bulkhead Cellular Concrete	CY	20	$1,600.00	$32,000	0	$1,600.00	$0
Bulkhead Type 5 Concrete	CY	0	$2,000.00	$0	25	$2,000.00	$50,000
Bulkhead Contact Grout	LS	0	$30,000.00	$0	1	$30,000.00	$30,000
Bulkhead Extend Stainless Steel Pipe	LF	1	$500.00	$500	1	$500.00	$500

Estimated Construction Total	$328,650	**Estimated Construction Total**	$388,650
20% Contingency	$65,730	**20% Contingency**	$77,730
Construction Subtotal	$394,380	**Construction Subtotal**	$466,380
Engineering and Administration at 15%	$59,157	**Engineering and Admin at 15%**	$69,957
Const Mgmnt and Inspection at 15%	$59,157	**Const Mgmnt and Insp at 15%**	$69,957
Total	$512,694	**Total**	$606,294
Total (rounded to nearest $1,000)	***$513,000***	***Total (rounded to nearest $1,000)***	***$606,000***

5.0 CONSTRUCTION SEQUENCING

This section covers items of work to complete engineering design and construction of the chosen alternative.

5.1 Survey and Bid Preparation Work

Construction plans and specifications will be prepared. The plans and specifications will have to be approved by the EPA, CDPHE, and the DRMS. The bid package and final contract documents will be prepared by CDPHE.

5.2 Adit Stabilization

Some preparation of the adit will have to be performed to provide safe access to the work areas. This work will likely include removal of rock fall or caved material, installation of local support, measures to control water flow, installation of lighting, and clearing of the floor so that adequate access of personnel, equipment and material can be achieved.

5.3 Bulkhead and Encapsulation

The bulkhead and encapsulation construction will be completed prior to the installation, repair and covering of the discharge and drain pipes. Temporary measures to protect the discharge pipe and adit from construction traffic will be necessary. Roadways above the adit may have to be suitably maintained to allow drilling and cement truck access if bulkhead concrete is tremied via a boring.

5.4 Pipelines and Adit

Once construction of the bulkhead is complete, the adit rehabilitation can proceed. This work will include grading the tunnel invert, installing the drain pipe, locally repairing the discharge pipe, covering the invert and pipes in gravel, and removing the ventilation duct.

5.5 Portal

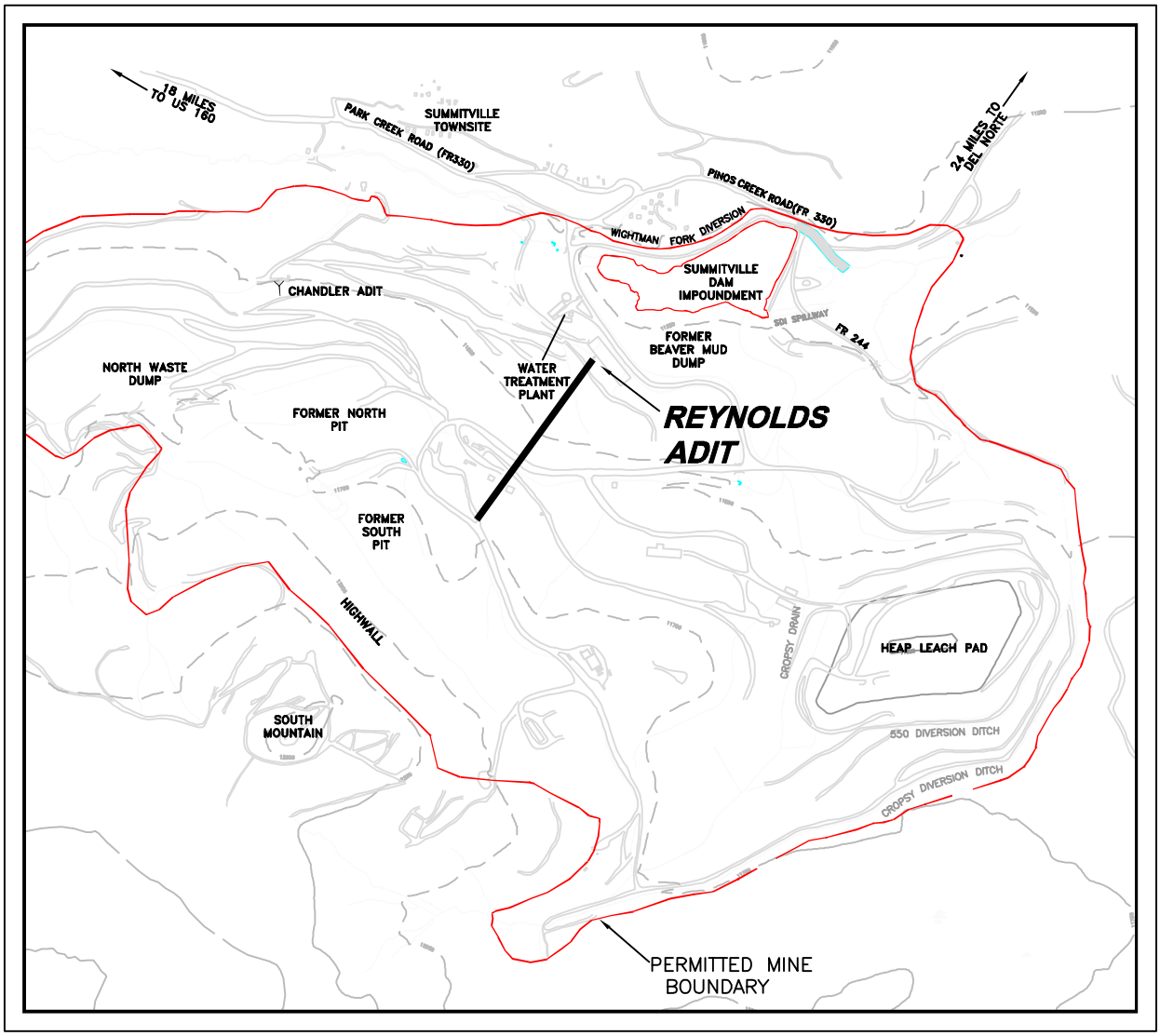
Portal improvements can take place at any time during the construction period. The contractor may elect to perform the portal improvements at the start of the project; or at a minimum, remove the existing building to provide a larger, more accessible construction staging area. The electrical service should be removed at the end of the construction.

6.0 REFERENCES

CDPHE, 2001, Record of Decision for Summitville Mine Final Site-Wide Remedy, Operable Unit 5, Summitville Mine Superfund Site, Rio Grande County, Colorado, September.

Devarajan, R., Trela, J., Hanley, J., and Whitlock, C., 1995, Interim Project Report, Reynolds Adit Control Program, in Proceedings: Summitville Forum ’95, Posey, H., Pendleton, J and Van Zyl, D., eds., Colorado Geological Survey Special Pub. 38, pp. 127-133.

SCMCI, 1992, Remedial Measures Plan, Appendix F-1, Preliminary Design of the Plug or the Reynolds Adit, Volume IV, November.



SITE MAP

NOT TO SCALE

N

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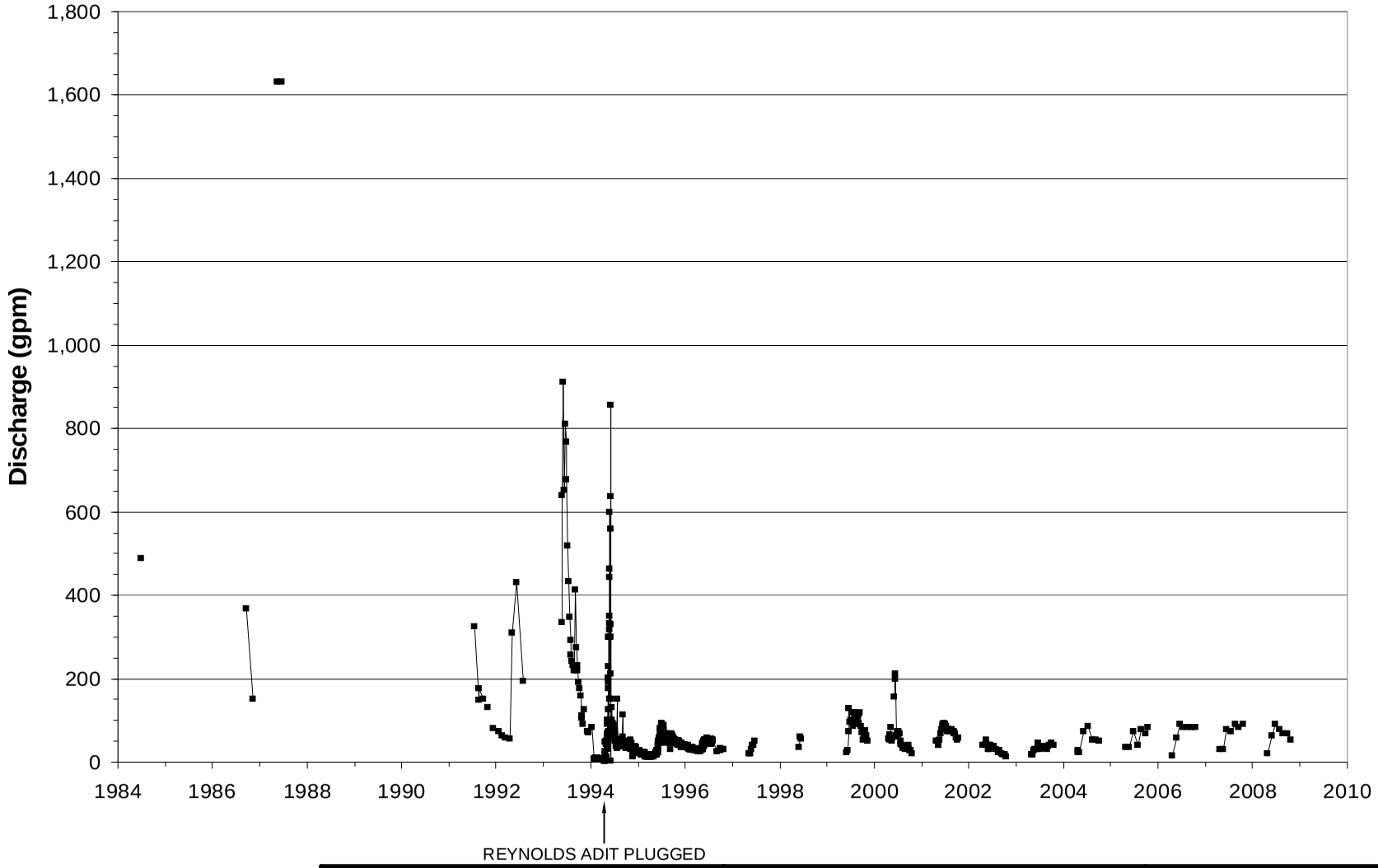
Drawing Description

SUMMITVILLE MINE SITE
REYNOLDS ADIT
LOCATION MAP

Project No.:	133-01149-08002
Date:	JAN 16, 2009
Designed By:	RJT

FIGURE

1



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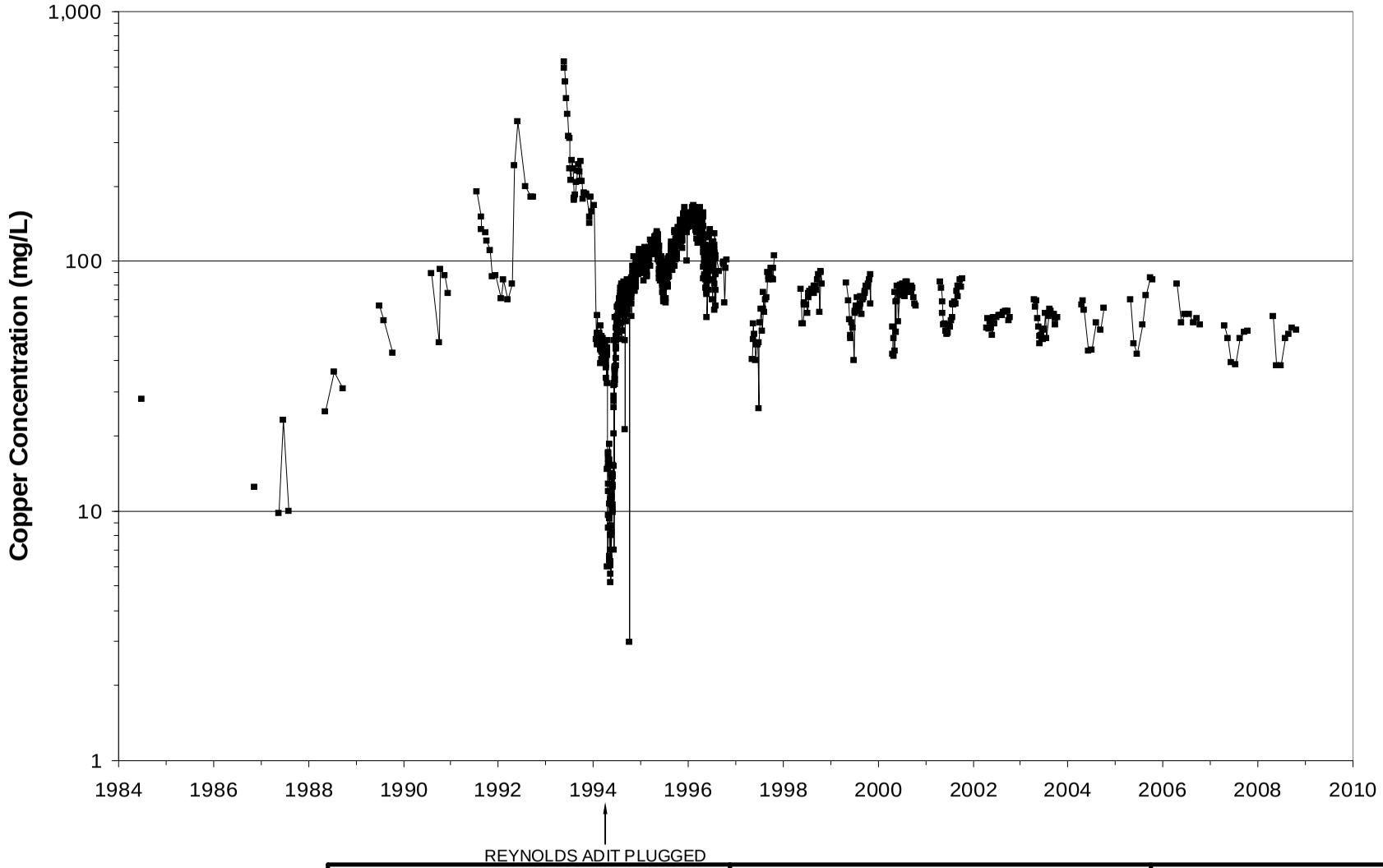
Drawing Description

SUMMITVILLE MINE SITE OU-5
Reynolds Adit Rehabilitation

HISTORICAL FLOW MEASURED AT REYNOLDS ADIT PORTAL (AD-0)

Project No.:	133-01149-08002
Date:	01/15/09
Designed By:	MAM

FIGURE
2



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Drawing Description

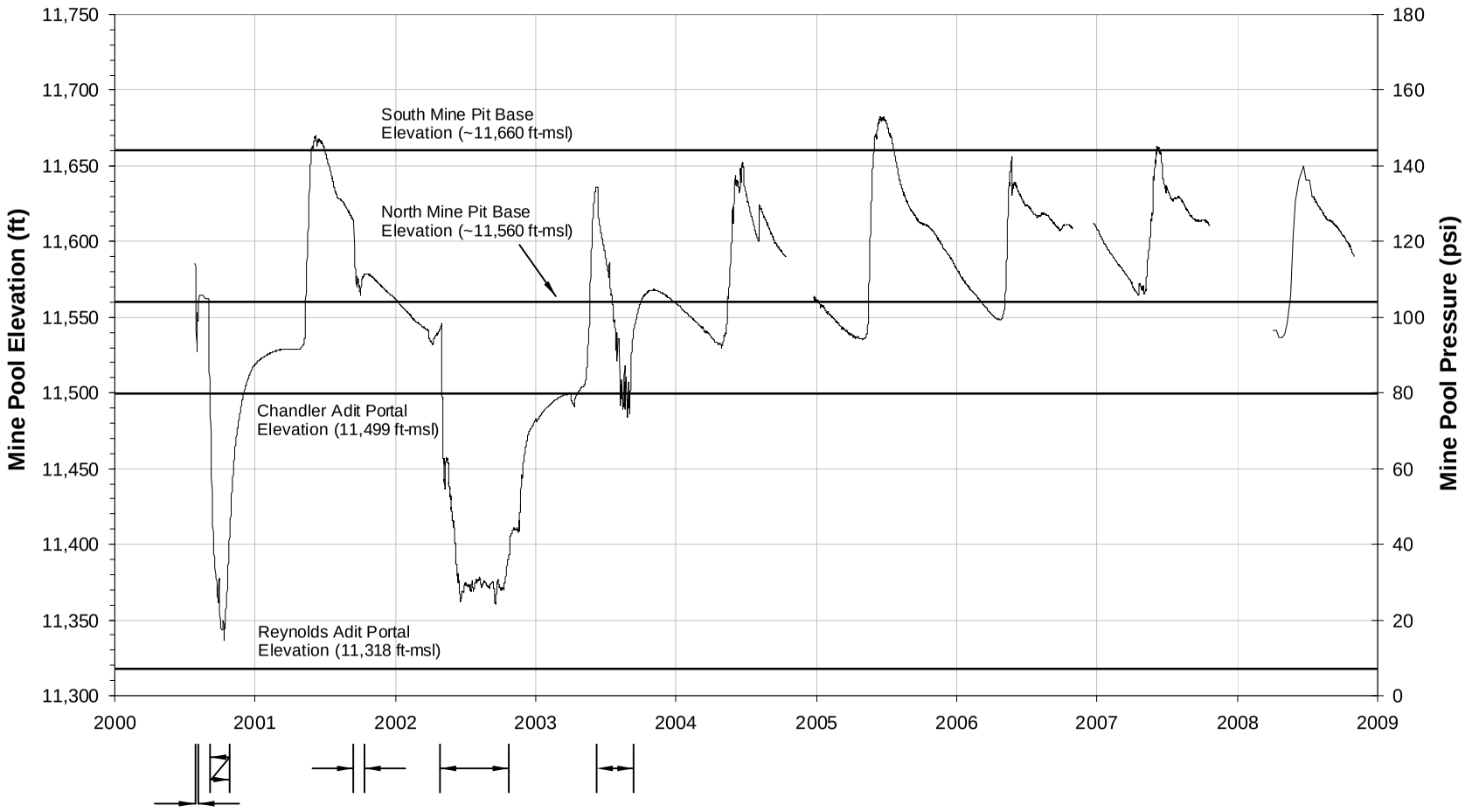
SUMMITVILLE MINE SITE OU-5
Reynolds Adit Rehabilitation

HISTORICAL COPPER CONCENTRATIONS MEASURED AT REYNOLDS ADIT PORTAL (AD-0)

Project No.:	133-01149-08002
Date:	01/15/09
Designed By:	MAM

FIGURE

3



LEGEND:

INDICATES START AND STOP OF MINE POOL RELEASES

NOTE:
PRESSURE TRANSDUCER MOUNTED ON REYNOLDS ADIT PIPELINE JUST DOWNSTREAM OF ADIT PLUG.

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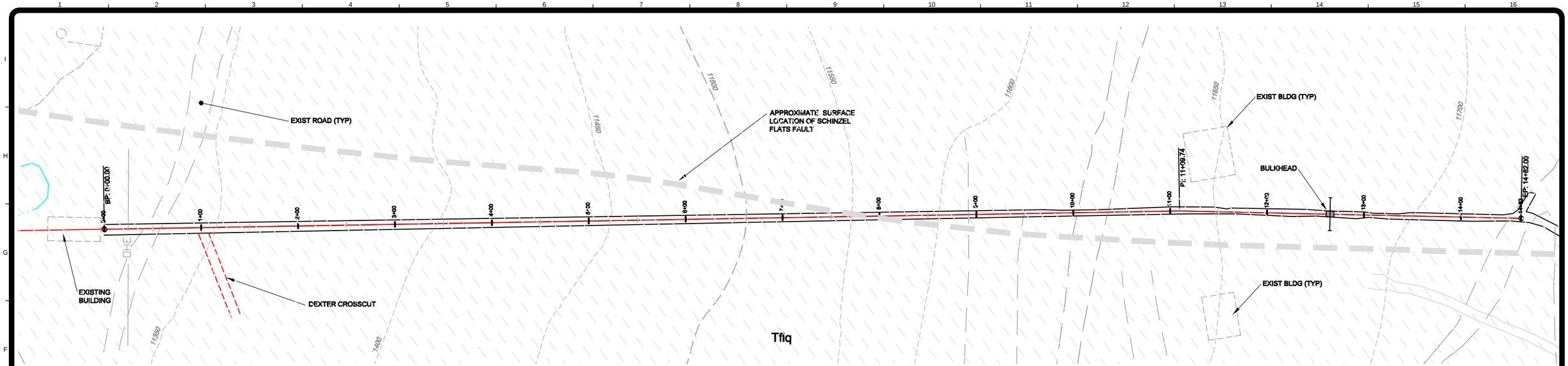
Drawing Description
SUMMITVILLE MINE SITE OU-5
Reynolds Adit Rehabilitation

MINE POOL ELEVATION

Project No.: 133-01149-08002
Date: 01/22/09
Designed By: MAM

FIGURE
4



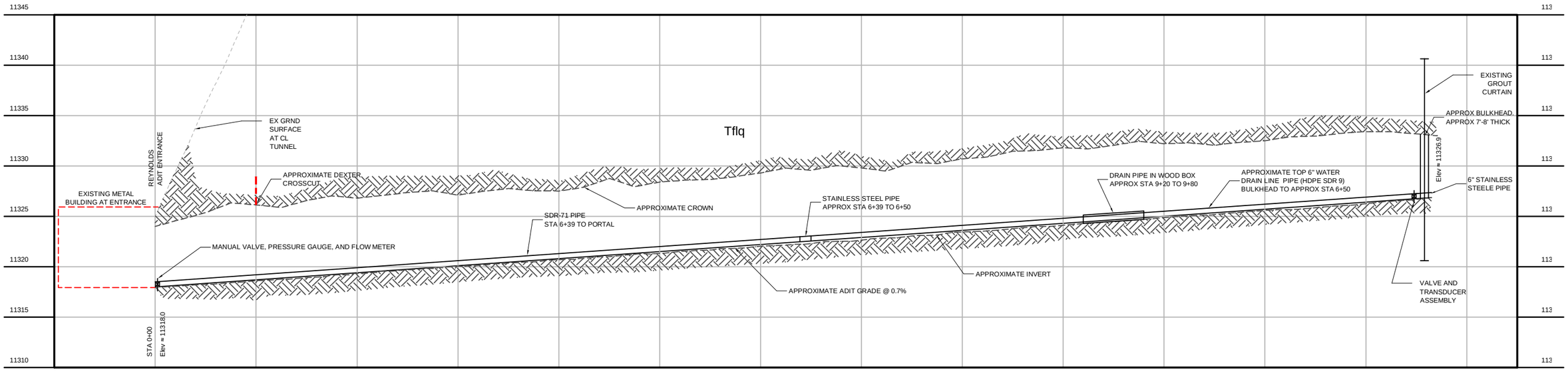
LEGEND

11500 GROUND SURFACE CONTOUR = 50'

Tflq — QUARTZ - LATITE LAVA
MASSIVE QUARTZ LATITE LAVA FLOW WITH LARGE SANIDINE PHENOCRYSTS AND AREAS OF ARGILLIC ALTERATION.

PLAN VIEW

0 25 50 100
HORIZONTAL SCALE



PROFILE

(VERTICAL EXAGGERATION= 10X)

0 25 50 100
HORIZONTAL SCALE

10 5 0
VERTICAL SCALE

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MARK	DATE	DESCRIPTION	BY

Client: CDPHE
Proj. Loc.: SUMMITVILLE MINE

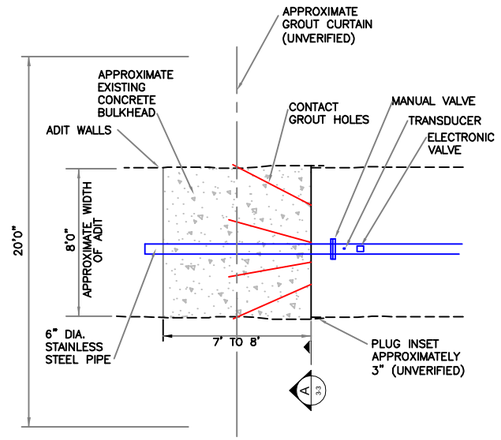
PLAN AND PROFILE
REYNOLDS ADIT
ALTERNATIVE REMEDY

Project No.:	133-01149-08002
Designed By:	GL
Drawn By:	RP
Checked By:	RJT

5

Thursday, January 22, 2009 10:54:01 AM DRAWING: P:\133_01149_08002 Summitville 2008\CAD\RefFiles\ModelFiles\15_ADITS-RI DWG LAYOUT: FIG 5 ADIT TUNNEL PLAN AND PROF USER NAME: BOB PERRY

EXISTING CONDITIONS

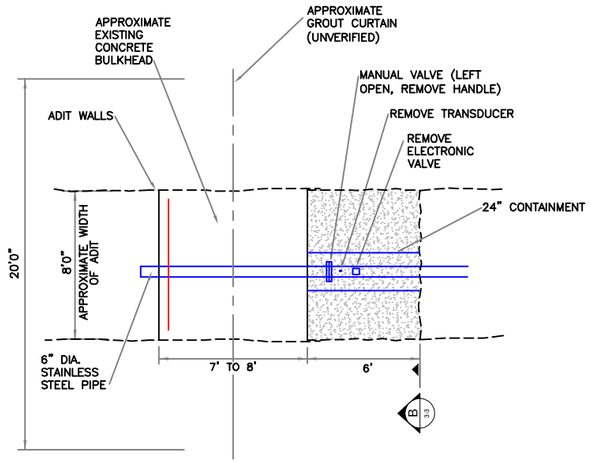


EXISTING BULKHEAD AND PIPING

PLAN VIEW

NOT TO SCALE

ALTERNATIVE 1

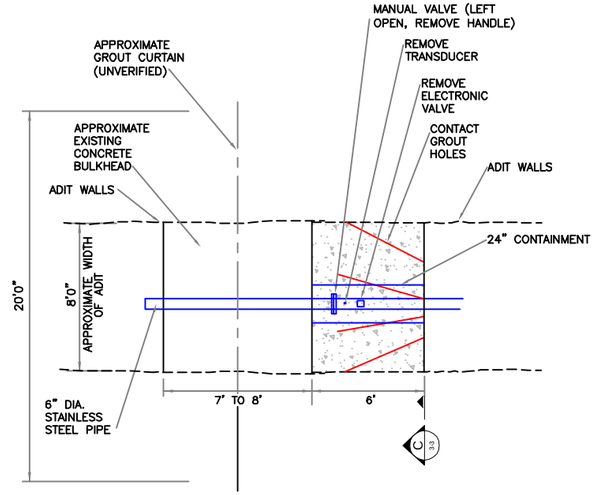


6' CELLULAR CONCRETE PIPE PROTECTION

PLAN VIEW

NOT TO SCALE

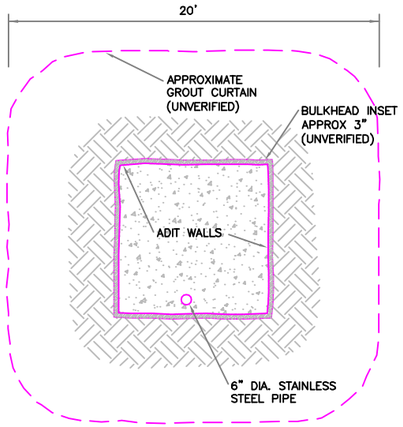
ALTERNATIVE 2



6" CONCRETE BULKHEAD AND PIPING

PLAN VIEW

NOT TO SCALE

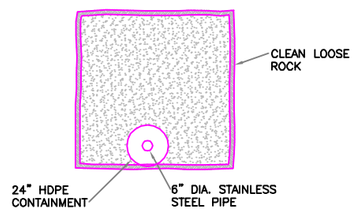


SECTION A

EXISTING BULKHEAD AND PIPING

CROSS-SECTIONAL VIEW

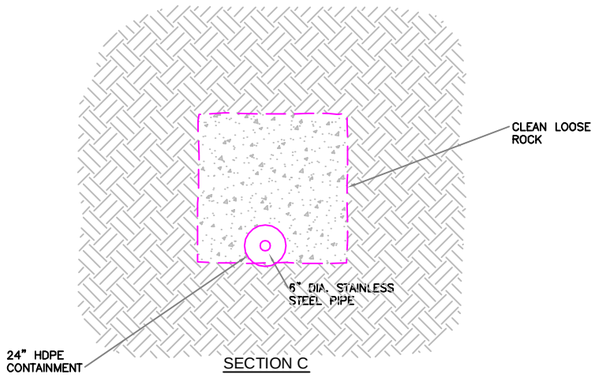
NOT TO SCALE



SECTION B

6' CELLULAR CONCRETE PIPE PROTECTION

NOT TO SCALE



SECTION C

6' PLUG ALTERNATIVE

CROSS-SECTIONAL VIEW

NOT TO SCALE

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BULKHEAD CLOSURE ALTERNATIVES

REYNOLDS ADIT
ALTERNATIIVE REMEDY

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Designed By:	GL
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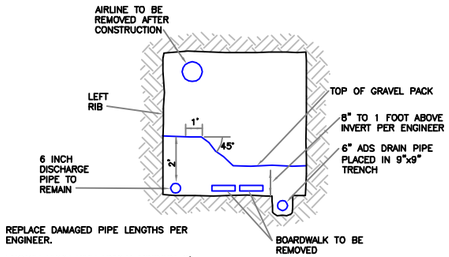
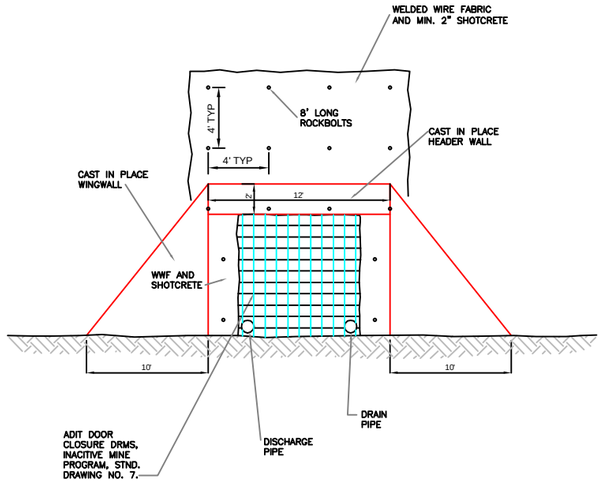
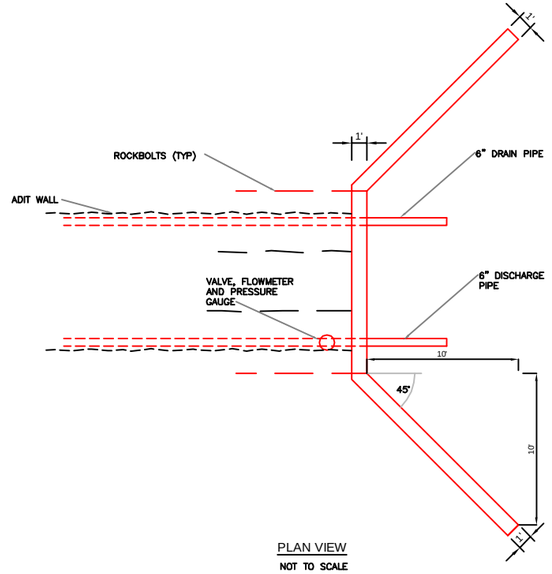


INVERT STABILIZATION
CROSS-SECTIONAL VIEW
NOT TO SCALE



FRONT VIEW
NOT TO SCALE



PLAN VIEW
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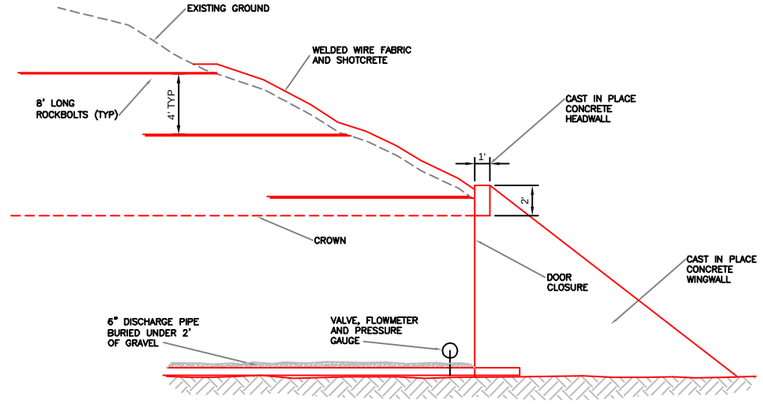

PROFILE VIEW
NOT TO SCALE

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MARK	DATE	DESCRIPTION	BY

Client:
Proj. Loc.: SUMMITVILLE MINE

ADIT AND PORTAL IMPROVEMENTS
REYNOLDS ADIT
ALTERNATIVE REMEDY

Project No.:	133-01149-08002
Designed By:	GL
Drawn By:	RP
Checked By:	RJT

7

Thursday, January 22, 2009 10:56:43 AM DRAWING: P:\133_01149_08002 Summitville 2008\CADRefFiles\ModelFiles\15_ADITS-RI .DWG LAYOUT: FIG 7 DETAILS USER NAME: BOB PERRY

APPENDIX A

PHOTOGRAPHIC LOG

ADIT ENTRANCE (2006)

INTERIOR OF ENTRANCE BUILDING (2001)

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REYNOLDS ADIT

Project No.:	133-01149-08002
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Designed By:	RJT

FIGURE

A-1

Sta 5+20 (2008)

STAINLESS STEEL PIPE STA 6+39 TO STA 6+50 (2001)

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FIGURE
A-2

Sta 8+15 (2008)

HDPE PIPE BETWEEN BULKHEAD AND STA 6+50 (2001)

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FIGURE
A-3

BULKHEAD AND VALVE (2008)

ELECTRONIC VALVE, TRANSDUCER AND MANUAL VALVE (2006)

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FIGURE
A-4