STATE OF NEW MEXICO
WATER QUALITY CONTROL COMMISSION

IN THE MATTER OF THE PETITION FOR A VARIANCE TO APPROVE ALTERNATIVE ABATEMENT STANDARDS FOR THE PECOS MINE OPERABLE UNIT

No. WQCC 18-03(V)

CYPRUS AMAX MINERALS COMPANY,
Petitioner

STATEMENT OF INTENT TO PRESENT TECHNICAL EVIDENCE

Cyprus Amax Minerals Company ("Cyprus") submits this Statement of Intent to Present Technical Evidence in accordance with the Scheduling Order issued for this matter and 20.1.3.17.E NMAC.

1. Name of the person filing the statement:

   Cyprus Amax Minerals Company ("Cyprus")

2. Support or opposition to Petition:

   Cyprus is the Petitioner in this matter and supports the granting of the Petition.

3. Name of each witness:

   a. Alicia Voss

   b. Neil Blandford

   c. Beth Salvas

4. Estimate of the length of the direct testimony of each witness:

   a. Alicia Voss—30 minutes

   b. Neil Blandford—1 hour

   c. Beth Salvas—1 hour

5. List of exhibits to be offered into evidence at the hearing:

a. Petition for a Variance to Approve Alternative Abatement Standards (filed April 27, 2018)

b. New Mexico Environment Department's Response to Petition for Alternative Abatement Standards (Filed June 27, 2018)

c. Resume of Alicia Voss (Will be provided at hearing)

d. Resume of Neil Blandford

e. Resume of Beth Salvas

f. Administrative Order on Consent (1992)

g. Decision Document (NMED 1998) (Appendix A to Petition)

h. Feasibility Study Report (NMED 1997) (Appendix A to Petition)

i. PMOU 2016 Compliance Monitoring Report (Appendix B to Petition)

j. NMDGF Groundwater Monitoring Data (Appendix C to Petition)

k. Mann-Kendall Statistical Evaluations (Appendix D to Petition)

l. PMOU Long-Term Operation and Maintenance Plan (S.E.T. in association with DBS&A, 2018)

6. Summary or outline of the anticipated direct testimony of each witness:

a. Alicia Voss

Ms. Voss is an employee of Freeport-McMoRan Inc., to which Cyprus is a subsidiary. She will provide her credentials and discuss her role regarding, and the history of, the site and the Administrative Order on Consent (AOC) that governs the investigation and remediation of the Pecos Operable Unit. She will address the requirements of the AOC and the work performed by Cyprus including the remedial investigation, feasibility study, selection, preparation of plans and construction of the remedy, subsequent monitoring and maintenance, and preparation of a long-term operation and maintenance plan for the site. She will address the oversight, review,

and approvals of the Environment Department, reviews by other agencies involved in the Pecos Operable Unit, and public involvement under the AOC. Finally, she will address the reasons why Cyprus is petitioning for alternative abatement standards.

b. Neil Blandford

Mr. Blandford is a Senior Vice President and Principal Hydrologist at Daniel B. Stephens & Associates, Inc. and will testify regarding his credentials and involvement regarding the Pecos Mine Operable Unit and his and his firm's involvement in the site and the Petition. He will testify regarding the site hydrogeology, as described in the Petition, and its importance in the Commission's consideration of the Petition. He will discuss the remedy that was developed and constructed under the AOC, including how it was selected and its performance with regard to achieving abatement for ground water quality, as discussed in the Petition. He will identify abatement standards under the AOC and the Commission's rules and the extent to which those standards have not been achieved. Mr. Blandford will discuss whether there are any technically feasible actions that can be taken to achieve ground water quality standards, how that evaluation was done, and why there are no technical feasible actions to achieve standards, as discussed in the Petition. He will identify the three-dimensional area proposed for alternative abatement standards in the Petition, and will address whether ground water contamination in excess of standards could migrate outside of that area. He will discuss why granting alternative abatement standards will not pose a threat to any water supply, will not pose a hazardous to public health, and will not result in undue damage to property, all as addressed in the Petition. He will discuss how the proposed alternative abatement standards are feasible and justified from a cost-benefit standpoint.

c. Beth Salvas

Ms. Salvas is a Senior Hydrologist and an employee of Daniel B. Stephens & Associates, Inc. who has been involved in compliance monitoring and other activities regarding the Pecos Mine Operable Unit and who assisted in preparing the Petition. She will provide her credentials. Ms. Salvas will testify regarding notices given to surrounding landowners and residents regarding the Petition as well as the public notice of the hearing. Ms. Salvas will testify regarding ground water monitoring at the site, including monitoring locations and constituents and analytical results, as presented in the Petition. She will testify regarding the extent to which ground water quality standards have been met at site monitoring locations and the extent to which standards continue to be exceeded. Ms. Salvas will testify regarding geochemical conditions at the site, how those conditions affect the chemistry of ground water at the site, and how they control the concentrations of metals and other constituents, as discussed in the Petition. She will testify regarding the levels proposed in the Petition for alternative abatements standards and how those levels were developed.

Respectfully Submitted,

GALLAGHER & KENNEDY, P.A.

Dalva L. Moellenberg, Esq.
Rikki-Lee G. Chavez
1239 Paseo de Peralta
Santa Fe, NM 87501
(505) 982-9523
(505) 983-8160
DLM@gknet.com

Counsel for
Cyprus Amax Minerals Company

CERTIFICATE OF SERVICE

I certify that a copy of the foregoing Petition for a Variance to Approve Alternative Abatement Standards was served on August 31, 2018 via email to the following:

New Mexico Environment Department
Office of General Counsel
Lara Katz
P.O. Box 5469
1190 St. Francis Drive
Santa Fe, New Mexico 87502
Lara.katz@state.nm.us

New Mexico Department of Game & Fish
Attn: Matthew Wunder
1 Wildlife Way
P.O. Box 25112
Santa Fe, New Mexico 87504
Matthew.Wunder@state.nm.us

Rikki-Lee G. Chavez

STATE OF NEW MEXICO
WATER QUALITY CONTROL COMMISSION

IN THE MATTER OF THE PETITION FOR A VARIANCE TO APPROVE ALTERNATIVE ABATEMENT STANDARDS FOR THE PECOS MINE OPERABLE UNIT

No. WQCC 18-03 (V)

Cyprus Amax Minerals Company,
Petitioner

PETITION FOR A VARIANCE TO APPROVE ALTERNATIVE ABATEMENT STANDARDS

Cyprus Amax Minerals Company ("CAMC") petitions the Water Quality Control Commission ("Commission") to approve Alternative Abatement Standards ("AAS") for the Pecos Mine Operable Unit ("PMOU"), also commonly known as the Terrero Mine, near Terrero, New Mexico in San Miguel County. The enclosed Petition for Alternative Abatement Standards prepared by Daniel B. Stephens & Associates, Inc. ("Petition") contains the information required by 20.6.2.1210.A and 20.6.2.4103.F NMAC.

1. The PMOU is the subject of an Administrative Order on Consent ("AOC") entered into on December 2, 1992 with the New Mexico Environment Department ("Department") by Amax Resource Conservation Company, a predecessor of CAMC, and the State of New Mexico, as Respondents. The State of New Mexico is a Respondent because the New Mexico Department of Game and Fish ("NMDGF") owns the subject property. The Department is responsible for enforcement of the AOC and oversight of the work conducted thereunder.

2. Under the AOC, CAMC was responsible for conducting a Remedial Investigation ("RI") and Feasibility Study ("FS") to assess the extent of groundwater and surface water contamination and the actions to be taken to remediate the PMOU. The RI and FS were

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submitted to the Department for review. Based upon the RI/FS and public comments, the Department issued a Decision Document in 1998 specifying the required remediation and abatement. Copies of the Decision Document and the Feasibility Study are provided as appendices to the Petition.

3. CAMC implemented construction of the remedy, including abatement to achieve applicable water quality standards as required under the Decision Document, between 1999 and 2004. The Department has reviewed and approved the completion of that work, and the CAMC has continued to monitor the PMOU as required by the AOC. Monitoring has demonstrated that applicable water quality standards have been met at all but a few monitoring locations.

4. CAMC petitions the Commission to approve AAS within the area defined in the enclosed Petition (Figure 2) to a depth of 1,900 feet below ground surface for barium, cadmium, and fluoride, constituents for which ground water quality standards are established under 20.6.2.3103.A NMAC; iron, manganese, total dissolved solids, and zinc, constituents for which ground water quality standards are established under 20.6.2.3103.B NMAC; and cobalt, for a ground water quality standards is established under 20.6.2.3103.C NMAC.

5. The proposed AAS for the above constituents are set forth in the following table, as further discussed and described in the attached Petition:

CONSTITUENT	STANDARD UNDER 20.6.2.3103 NMAC	PROPOSED ALTERNATIVE ABATEMENT STANDARD
BARIUM	1.0 MG/L	4.0 MG/L
CADMIUM	0.01 MG/L	0.10 MG/L
COBALT	0.05 MG/L	0.10 MG/L
FLUORIDE	1.6 MG/L	2.0 MG/L
IRON	1.0 MG/L	40.0 MG/L
MANGANESE	0.2 MG/L	8.0 MG/L
TOTAL DISSOLVED SOLIDS	1,000 MG/L	1,700 MG/L
ZINC	10 MG/L	40 MG/L

6. This Petition is with the Commission pursuant to 20.6.2.1210.A NMAC. In addition, pursuant to 20.1.3.18.A NMAC. A copy of this petition is being served on the Department through counsel to accomplish filing with the Secretary under 20.6.2.4103(F)(2) and for its review and issuance of its recommendation pursuant to 20.1.3.18.A(3) NMAC. CAMC has shared drafts of this Petition with the Department for its review in advance of this filing, and requests that the Department issue its recommendation as soon as possible.

7. The Game & Fish Department ("NMGDF") has concurred with the filing of the Petition. A copy of the Petition also is being served on NMGDF.

8. If the Commission grants the Petition, CAMC and the Department intend to request that the State Engineer issue an Order restricting the construction of wells within the area covered by AAS in order to assure that compliance with the proposed AAS will not create a present or future has to public health. CAMC, the Department, and NMGDF have consulted with the State Engineer and understand that he is willing to issue such an Order following the Commission's action on the Petition.

9. CAMC respectfully requests that the Commission set a date for a public hearing on the enclosed Petition at its earliest convenience.

Respectfully Submitted,

GALLAGHER & KENNEDY, P.A.

Dalva L. Moellenberg, Esq.
1239 Paseo de Peralta
Santa Fe, NM 87501
(505) 982-9523
(505) 983-8160
DLM@gknet.com

Counsel for Cyprus Amax Minerals Company

CERTIFICATE OF SERVICE

I certify that a copy of the foregoing Petition for a Variance to Approve Alternative Abatement Standards was served on April 27, 2018 via hand delivery to the following:

New Mexico Environment Department
Office of General Counsel
Lara Katz
P.O. Box 5469
1190 St. Francis Drive
Santa Fe, New Mexico 87502
Lara.katz@state.nm.us

New Mexico Department of Game & Fish
Attn: Matthew Wunder
1 Wildlife Way
P.O. Box 25112
Santa Fe, New Mexico 87504
Matthew.Wunder@state.nm.us

Respectfully Submitted,

Dalva L. Moellenberg, Esq.

STATE OF NEW MEXICO
WATER QUALITY CONTROL COMMISSION

IN THE MATTER OF THE PETITION FOR A VARIANCE TO APPROVE ALTERNATIVE ABATEMENT STANDARDS FOR THE PECOS MINE OPERABLE UNIT

No. WQCC 18-03(V)

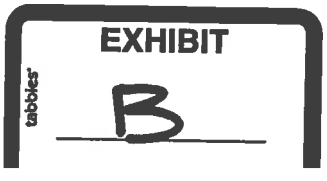
Cyprus Amax Minerals Company,
Petitioner.

NEW MEXICO ENVIRONMENT DEPARTMENT'S
RESPONSE TO PETITION FOR ALTERNATIVE ABATEMENT STANDARDS

Pursuant to the Water Quality Control Commission's ("Commission's") abatement regulations at 20.6.2.4103 NMAC, and the Commission's Adjudicatory Procedures at 20.1.3.18(A)(3) NMAC, the New Mexico Environment Department ("NMED" or "Department") submits this response to the Petition for a Variance to Approve Alternative Abatement Standards ("Petition") for the Pecos Mine Operable Unit ("PMOU"), commonly known as the Terrero Mine. Cyprus Amax Minerals Company ("CAMC" or "Petitioner") filed this Petition on April 27, 2018. The Petition requests alternative abatement standards for the PMOU, near Terrero, New Mexico in San Miguel County. The Department supports the requested alternative abatement standards and recommends that the Commission grant the Petition.

I. BACKGROUND

CAMC is the successor company to Amax Resource Conservation Company, which in turn is the successor corporation to the American Metal Company Limited ("AMC"). In 1925, AMC and the Goodrich-Lockhart Company formed a corporation called the American Metal Company of New Mexico ("AMCNM"). From 1926 through 1939, AMCNM developed and operated a lead and zinc mine located approximately 16 miles north of the Village of Pecos at the confluence of Willow Creek and the Pecos River, as well as a mill, located about two miles northwest of the Village of



Pecos, which was used to process the ore mined at the Pecos Mine.

The PMOU, which is the subject of the Petition, consists of the reclaimed historical mine site. In the mid-1980s, NMED conducted a study of the surface water near the mine, and found elevated metals concentrations in springs and other surface water features discharging from around the Pecos Mine area. Subsequent investigations showed that mine waste was also used between the 1930s and 1970s to develop and maintain roads and campgrounds at various locations in the Pecos area. In 1992, the Department entered into an Administrative Order on Consent ("AOC") with AMC and the State of New Mexico as Respondents. The State of New Mexico is a Respondent because the New Mexico Department of Game and Fish currently owns the subject property. The AOC required investigation and remediation of the Pecos Mine consistent with the requirements of the federal Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"). The Department is responsible for enforcement of the AOC and oversight of the work conducted thereunder.

The AOC defined five "operable units" within the greater Pecos area: (1) Pecos Mine ("PMOU"); (2) El Molino ("EMOU"); (3) State Recreation Use Areas; (4) State Highway 63; and (5) Lisboa Springs Fish Hatchery. The Petition is for the PMOU only.

Under the AOC, CAMC was responsible for conducting a Remedial Investigation ("RI") and Feasibility Study ("FS") to assess the extent of groundwater and surface water contamination and the actions that needed to be taken to remediate the PMOU and address the water quality impacts. The RI and FS were submitted to the Department for review and were made available for public comment. Based upon the RI/FS and public comments, the Department issued a Decision Document in 1998 specifying the required remediation and abatement for the site. Thereafter, CAMC implemented the remedy, including source control for abatement of water contamination through

consolidation of mine waste and subsequent reclamation of the waste rock stockpile, between 1999 and 2004. The Department reviewed and approved the satisfactory completion of the reclamation and remediation work required under the AOC.

Monitoring of the ground water and surface water in the area conducted since completion of the PMOU remediation, along with other activities required by the Decision Document, indicate that while applicable water quality standards have been met at most monitoring locations, some groundwater monitoring locations continue to exceed the standards of 20.6.2.3103 NMAC for certain constituents. Thus, CMAC has petitioned the Commission for alternative abatement standards based on technical infeasibility.

II. STANDARD FOR GRANTING ALTERNATIVE ABATEMENT STANDARDS

Alternative abatement standards fall within the Commission's authority to grant a variance from any requirement of the water quality regulations. Section 74-6-4(H) of the Water Quality Act provides that the Commission:

> [M]ay grant an individual variance from any regulation of the commission whenever it is found that compliance with the regulation will impose an unreasonable burden upon any lawful business, occupation or activity. The commission may only grant a variance conditioned upon a person effecting a particular abatement of water pollution within a reasonable period of time. Any variance shall be granted for the period of time specified by the commission. The commission shall adopt regulations specifying the procedure under which variances may be sought, which regulations shall provide for the holding of a public hearing before any variance may be granted.

NMSA 1978, § 74-6-4(H).

The Commission's abatement regulations provide that a responsible person may submit a petition for approval of AAS any time after submission of a Stage 2 abatement plan. The Commission may approve the AAS if the petitioner demonstrates the following:

> (a) compliance with the abatement standard(s) is/are not feasible, by the maximum use of technology within the economic capability of the responsible

person; OR there is no reasonable relationship between the economic and social costs and benefits (including attainment of the standards set forth in Section 20.6.2.4103 NMAC) to be obtained;

(b) the proposed alternative abatement standard(s) is/are technically achievable and cost-benefit justifiable; and

(c) compliance with the proposed alternative abatement standards will not create a present or future hazard to public health or undue damage to property.

20.6.2.4103(F)(1) NMAC.

An AAS petition must provide the information required under Subsection 20.6.2.4103(F)(2) of the abatement regulations, as well as that required for variance petitions under Subsection 20.6.2.1210(A) NMAC. 20.6.2.1210(A) NMAC requires that the petition:

(1) state the petitioner's name and address;
(2) state the date of the petition;
(3) describe the facility or activity for which the variance is sought;
(4) state the address or description of the property upon which the facility is located;
(5) describe the water body or watercourse affected by the discharge;
(6) identify the regulation of the commission from which the variance is sought;
(7) state in detail the extent to which the petitioner wishes to vary from the regulation;
(8) state why the petitioner believes that compliance with the regulation will impose an unreasonable burden upon his activity; and
(9) state the period of time for which the variance is desired.

Subsection 20.6.2.4103(F)(2) NMAC requires that an AAS petition also specify

the water contaminant(s) for which alternative standards(s) is/are proposed, the alternative standard(s) proposed, the three-dimensional body of water pollution for which approval is sought, and the extent to which the abatement standard(s) set forth in Section 20.6.2.4103 NMAC is/are now, and will in the future be, violated.

Under the Commission's Adjudicatory Procedures, the Department must review a petition for variance within sixty days after receipt and file a recommendation with the Commission to grant, grant with conditions, or deny the petition. 20.1.3.300(B) NMAC. If the Department recommends granting the petition, the Commission must hold a public hearing on whether to grant the AAS.

III. DEPARTMENT'S RECOMMENDATION

The Department has reviewed the Petition and recommends that the Commission grant the Petition in full. Because the Department recommends granting the Petition, the Commission must hold a public hearing. 20.1.3.18(B) NMAC. The Department and Petitioner requested a hearing, and on May 8, 2018, the Commission granted that request and appointed Hearing Officer Erin Anderson. The matter has been referred to the Hearing Officer to schedule the hearing, which the Department and Petitioner have requested to take place in August of 2018, the Commission's docket permitting. *See* Order Appointing Hearing Officer, WQCC 18-03(V) (May 13, 2016).

IV. REASONS

The Petition sets forth all the required information under 20.6.2.1210(A) NMAC (variance petitions) and 20.6.2.4103(F)(2) NMAC (alternate abatement standard petitions). The Department finds that Petitioner has made the demonstrations required for approval of alternate abatement standards under 20.6.2.4103(F)(1) NMAC, as discussed below.

A. Compliance with the applicable abatement standards is not technically achievable

Petitioner has demonstrated that the following abatement standards at 20.6.2.4103 NMAC are not technically achievable:

- Barium (Ba): 1.0 milligram per liter (mg/L)
- Cadmium (Cd): 0.01 mg/L
- Fluoride (Fl): 1.6 mg/L
- Iron (Fe): 1.0 mg/L
- Manganese (Mn): 0.2 mg/L
- Total Dissolved Solids (TDS): 1,000 mg/L
- Zinc: 10 mg/L

- Cobalt: 0.05 mg/L

The remedy for the PMOU has been implemented as required under the Decision Document. The final remedy was selected based on a detailed evaluation of five remedial alternatives, as documented in the Decision Document. The overall strategy for remediation was to minimize contact between water and the acid-generating waste rock so as to minimize the formation of contaminated discharge that could emanate from the waste rock stockpile. Measures taken to control the discharge of impacted water at the PMOU site include the following:

- Consolidation and grading of the waste rock pile
- Removal of waste rock from the Willow Creek floodplain
- Construction of an underdrain interceptor and a surface drainage channel to intercept and divert upgradient surface water around the waste rock pile
- Construction of a series of grass- and rock-lined surface water control and diversion structures to route runoff across and away from the waste rock pile
- Covering the waste rock pile with a cap system consisting of a geosynthetic clay liner overlain by a 2-foot vegetative layer to minimize infiltration into the waste rock
- Capping of the main shaft

These and other measures are summarized in the Petition. The costs of implementation and subsequent monitoring and maintenance of remedial measures at the PMOU site total approximately $12,233,674 through 2016.

There is no known feasible, cost-effective technology that would lead to a significant reduction in groundwater contaminant concentrations beyond that achieved at PMOU as a result of the previously-implemented remedial measures. Minimization of water infiltration through the waste rock pile and diversion of surface water runoff away from or across the pile has been implemented at

the PMOU site. Further efforts to improve groundwater quality would require disturbance of the waste rock pile cover system and/or NM 63 to construct a groundwater extraction system and, if attempted, may not be effective given the low permeability of the bedrock aquifer at the site, which makes efficient extraction of groundwater likely infeasible.

B. There is no reasonable relationship between the economic and social costs and benefits to be obtained

Petitioner has also demonstrated that there is no reasonable relationship between the costs and benefits of continuing abatement and the social costs and benefits of doing so. *See* 20.6.2.4103(F)(1)(a) NMAC. Even if groundwater extraction were feasible, there is no reasonable relationship between the cost of constructing and implementing such measures and the benefits of treating the small quantity of impacted groundwater (estimated to be approximately 2 gallons per minute (gpm) or less) that flows through the shallow portion of the fractured bedrock aquifer. In addition, construction of such a system would be detrimental to the waste rock cover system, which has been constructed and is stable and well-established, and to wetlands that exist west of the reclaimed waste rock pile.

Petitioner has proposed the following institutional and government controls to prevent future use of the bedrock aquifer as a source of potable water in order to mitigate social costs from the proposed AAS:

1. The Department will petition the New Mexico Office of the State Engineer ("OSE") under State Engineer regulation 19.27.5.13.A NMAC to issue an Order prohibiting construction of a well in the affected groundwater system. Figure 2 of the Petition includes the necessary information and documentation for the Department to prepare its recommendation for the Order under

19.27.5.13.A NMAC if the Commission approves the Petition. Pursuant to such Order, if a water well permit is requested within the designated area, the OSE will deny the permit.

2. The New Mexico State Engineer's regulations at 19.27.4 NMAC contain provisions that prevent construction of a water supply in contaminated groundwater. *See* 19.27.4.29 NMAC (requiring wells to be constructed to prevent contamination, inter-aquifer exchange of water, flood water contamination of aquifer, and infiltration of surface water); 19.27.4.29.D NMAC (requiring that all wells be set back from potential sources of contamination in accordance with NMED regulations and other applicable ordinances and regulations); 19.27.4.30.A NMAC (requiring annular seals when necessary to prevent flow of contaminated or low quality water); 19.27.4.30.A(4) NMAC (requiring annulus sealing and proper screening in wells which encounter non-potable, contaminated, or polluted water at any depth to prevent commingling of such water with any potable or uncontaminated water).

3. The PMOU is a historical mining property that is currently owned by, and will continue under the ownership of, the New Mexico Department of Game and Fish. There is no reason that water supply for human consumption would be required in the designated region. The existing campground area just northwest of the PMOU contains primitive camp sites with vault toilets, and no potable water is provided. Outside of the area for which AAS are requested, water quality standards will be met.

With the above institutional and government controls and requirements in place to prevent ingestion of groundwater in affected area, the AAS will allow the Department to close out abatement so that remediation of the PMOU can be deemed complete, and the site can be transferred to long-term monitoring and maintenance, to be carried out by NMDGF. Without the AAS, the PMOU would remain under abatement without any prospect of obtaining significant, additional reduction in

either seepage volume or constituent concentrations. Further site investigations and remedial actions would come at substantial costs and would likely lead to no significant improvement relative to current conditions, and would be an unwarranted expenditure of funds for both CAMC and the State of New Mexico which shares remediation costs with CAMC.

In sum, the costs of additional actions at the site, both in terms of dollars as well as negative environmental effects on reclamation measures that have already been completed, significantly outweigh any limited benefit that might be achieved. Therefore, the economic and social benefits of the proposed AAS (which include the above-described institutional and government controls), outweigh the benefits of continuing abatement which is unlikely to achieve 20.6.2.3103 NMAC standards.

C. The proposed AAS are technically achievable and cost-benefit justifiable

Petitioner proposes the following alternative abatement standards:

- Barium (Ba): 4.0 milligram per liter (mg/L)
- Cadmium (Cd): 0.10 mg/L
- Fluoride (F): 2.0 mg/L
- Iron (Fe): 40.0 mg/L
- Manganese (Mn): 8.0 mg/L
- Total Dissolved Solids (TDS): 1,700 mg/L
- Zinc: 40 mg/L
- Cobalt: 0.10 mg/L

The proposed AAS are based on the observed groundwater constituent concentrations collected at monitoring well locations over a period of more than 20 years, 12 years of which are representative of post-reclamation conditions. The proposed standards are therefore achievable, and because the

observed constituent concentrations have remained relatively steady (not increasing) and source controls have been implemented, future concentrations in groundwater are not likely to exceed the requested AAS. *See* 20.6.2.4103(F)(1)(b) NMAC. Reclamation of the site has already been performed, and approximately 12 years of post-reclamation monitoring and maintenance has occurred. Closure of the site will prevent unwarranted expenditure of funds by Petitioner, and by the State of New Mexico, which shares remediation costs with CAMC. Thus, the proposed AAS are cost-benefit justifiable.

D. The proposed AAS will not create a hazard to public health or undue damage to property

Of the constituents for which AAS are being requested, only barium, cadmium, and fluoride are listed as human health standards under 20.6.2.3103.A NMAC. Due to geography, land ownership, and institutional and government controls, there is no reason to anticipate that groundwater for which the AAS are sought will be used for human consumption. Much of the area within which the AAS are sought consists of the reclaimed waste rock stockpile, which has a steep benched slope. NM 63 runs adjacent to the base of the stockpile. The western margin of the AAS area west of NM 63 consists primarily of a low-lying, marshy area adjacent to the Pecos River, a portion of which is a wetland. It would be impractical and difficult to drill wells within these areas.

Further, the institutional and government controls outlined above will prevent human exposure to or ingestion of impacted groundwater, rendering the AAS protective of public health.

Likewise, no undue property damage will result from the approval of the AAS. The site is a historical mining property owned by NMDGF, and the property has been greatly improved through reclamation. Water quality standards will be met outside of the area for which AAS are requested, and therefore there will be no undue damage to adjacent regions.

VI. CONCLUSION

For the foregoing reasons, the Department recommends that the Commission grant the proposed alternate abatement standards as set forth in the Petition. Given this recommendation and the Commission's May 10, 2018 Order Appointing Hearing Officer, the Department requests that the Hearing Officer proceed with scheduling the hearing.

Respectfully submitted,

NEW MEXICO ENVIRONMENT DEPARTMENT

Lara Katz
Assistant General Counsel
New Mexico Environment Department
P.O. Box 5469
Santa Fe, New Mexico 87502
(505) 827-2885
Counsel for the New Mexico Environment Department

CERTIFICATE OF SERVICE

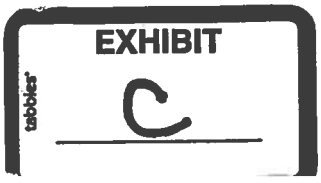
I hereby certify that a copy of this Response to Petition for Alternative Abatement Standards was filed with the Administrator of Boards and Commissions and was served on the following parties of record on June 27, 2018:

Dal Mollenberg
Gallagher & Kennedy, P.A.
1239 Paseo de Peralta
Santa Fe, New Mexico 87505-4074
DLM@gknet.com
Counsel for Petitioner

Stephen Vigil
Office of the Attorney General
P.O. Box 1508
Santa Fe, New Mexico 87504-1508
svigil@nmag.gov
Counsel for the Water Quality Control Commission

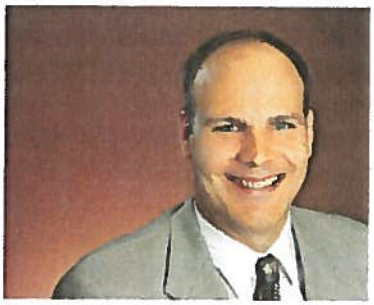
Lara Katz

To be provided at hearing



T. Neil Blandford, P.G.

Senior Vice President, Principal Hydrologist



EDUCATION

M.S., Hydrology,
New Mexico Institute of Mining and Technology, 1987

B.A., Environmental Science,
University of Virginia, 1984

PROFESSIONAL REGISTRATIONS

Professional Geoscientist,
Texas, No. 1034

Mr. Blandford specializes in water supply investigations and water rights analysis, numerical simulation of groundwater flow and contaminant transport, groundwater planning, computation of the effects of groundwater pumping on surface water, hydrogeologic evaluations at mine sites, wellhead protection area delineation and source water determination, remediation well field design, and expert testimony.

Site Investigation, Groundwater and Solute Transport Modeling and Post-Closure Monitoring at the Pecos Mine and El Molino Mill Tailing Impoundments, Cyprus Amax Minerals Corporation, Pecos, New Mexico
Project team member for site investigation activities and hydrogeologic analysis at the Pecos Mine and El Molino Mill and Tailing Operable Units (PMOU and EMOU). Principal investigator for development and application of a groundwater flow and solute transport model at EMOU, for quarterly sampling and reporting at both sites, and for the development of Compliance Monitoring Plans at both facilities. Developed proposal for alternative abatement standards for multiple constituents at PMOU, and developed the request for determination of background concentrations for selected constituents at the New Mexico Department of Game and Fish Campground adjacent to PMOU.

Development of Stage 2 Abatement Plan Proposal for the Tyrone Mine, Freeport McMoRan, Tyrone, Inc., Tyrone, New Mexico
Principal investigator for the development of the Stage 2 Abatement Plan Proposal for Tyrone Mine. The Plan includes a detailed overview of groundwater impacts at the mine, historical and predictive groundwater flow modeling accounting for the effects of open pits, stockpiles and other mine facilities, geochemical transport modeling of 14 constituents of concern, and proposed abatement measures for the mine site, an area of approximately 15 square miles. Plan has been approved and is being implemented.

Regional Assessment of Section 8 Groundwater Conditions and Conjunctive Use Evaluation, Navajo Nation, City of Gallup and Uranium Resources, Inc., San Juan Basin, New Mexico

Principal investigator for the assessment of hydrogeologic conditions in the vicinity of URI's proposed Section 8 uranium in situ recovery project, and determination of the risk that the proposed mining operation could adversely impact groundwater supplies to be developed as part of the Navajo-Gallup Water Supply Project.

Evaluation of Proposed Salt-Water Injection on Groundwater Resources, OWL SWD Operating, Southeast New Mexico
Principal investigator for consideration of the effects of salt-water injection on groundwater resources in aquifer units above and below the proposed injection interval for the Bobcat SWD No. 1 well. Conducted density-

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dependent fluid flow and solute transport modeling to evaluate the migration of injection water. Provided expert testimony at an administrative hearing.

Evaluation of Groundwater-Surface Interactions, Pecos Valley Artesian Conservancy District, New Mexico
Principal investigator for project to provide guidance to the District regarding the acquisition of groundwater rights in the Roswell and Carlsbad Basins, and the effects of acquisitions on Pecos River flow.

Capitan Underground Water Basin Water Rights Evaluations, Glenn's Water Well Service, Southeast New Mexico
Principal investigator for evaluation of multiple permits to appropriate groundwater in the Capitan Basin. Conducted hydrogeologic analysis and drawdown computations for the Santa Rosa aquifer at multiple sites.

Groundwater Model Development for Assessment of Groundwater Capture and Design of System Improvements for Sprague Road Groundwater Plume Superfund Site, U.S. Environmental Protection Agency Region 6, Odessa, Texas
Principal investigator for development and application of a revised groundwater flow and solute transport model to assess groundwater capture system effectiveness. Project involved evaluation of existing model and included significant modifications to the technical approach and input parameters to address initial model limitations. The updated model will be used to modify the pumping strategy to achieve better capture of multiple chromium plumes that exist at the site and to locate additional monitoring wells to ensure capture is complete.

Blaine Aquifer System Brackish Groundwater Analysis, Texas Water Development Board, North-Central Texas
Project manager for the assessment and evlaution of the fresh and brackish groundwater resources of the Blaine Aquifer system in north-central Texas. The aquifer system encompasses a region of about 10,000 square miles and is the sole source of supply for numerous communities, agriculture and industry. Project involved geologic and hydrogeologic mapping of aquifer units and production intervals, determination of groundwater quality, evalaution of the effects of potential well fields, and interaction with stakeholders.

Evaluation of Groundwater Resources, Texas General Land Office, Texas
Principal investigator for the evaluation of the groundwater resources associated with over 2,000 General Land Office properties throughout Texas. GIS database was constructed that included aquifer type, groundwater volume, well yield, water quality, aquifer properties, and other attributes relevant to groundwater utilization potential.

Evaluation of Groundwater Modeling for Santee Basin Groundwater Recharge and Replenishment Project, Padre Dam Municipal Water District, Santee, California
Principal investigator for hydrogeologic evaluation and feasibility modeling of indirect potable reuse (IPR) project. Effort included development and evaluation of multiple implementation scenarios, simulation of IPR water injection and extraction, interaction of surface water and groundwater, computation of residence time to meet state regulations and identification of critical flaws. Provided recommendations on aquifer testing and well design.

Evaluation of Hydrogeology and Hydrogeochemistry at the Portales Dairy Products Plant, Portales Dairy Products, LLC, Portales, New Mexico
Principal investigator for hydrogeologic and hydrogeochemical evaluation of groundwater conditions at the Portales Dairy Products Plant. The purpose of the project was to determine the source of elevated constituent

concentrations in groundwater near the plant. Based on the results of the project, Portales Dairy Products was able to obtain a groundwater discharge permit from the New Mexico Environment Department.

Groundwater Resource Evaluation, Online Water Well Management System, and Water Well Inventory, University Lands, Midland, Texas
Principal-in-charge for evaluation of multiple brackish aquifers underlying University Lands in west Texas. Project included database development, construction of three-dimensional geologic models, and hydrogeologic analysis of multiple aquifers, including production zones, expected well yield and water quality. The water well management system allows oil and gas operators and other University Lands leaseholders to apply for water supply well permits and upload completed water well information, such as well diagrams, geophysical logs, and water quality. GIS development for the groundwater resource evaluation included compiling data related to several thousand oil and gas geophysical logs, water well logs, and cable-tool driller reports obtained from University Lands, Texas Railroad Commission and the Bureau of Economic Geology well log libraries. Also compiled and mapped water levels, water quality, and water well production capacities.

Groundwater Appropriation, Carlsbad Basin, BOPCO L.P., Carlsbad, New Mexico
Principal-in-charge for application to appropriate 2,000 acre-feet per year of groundwater in the Carlsbad Basin, New Mexico. Conducted geologic and hydrogeologic analysis, and developed a three-dimesional groundwater flow model to assess the effects of the appropriation on groundwater and surface water resources, which included Pecos River flows and interstate compact compliance issues.

Groundwater Appropriation Protest, Lea County Basin, Multiple Protestants, Lea County, New Mexico
Provided expert hydrologic and geologic analysis on behalf of multiple protestants opposed to multiple applications for approproiation of groundwater in the Lea County Underground Water Basin.

Region O Water Plan, Llano Estacado Regional Water Planning Group and the High Plains Underground Water Conservation District, Lubbock, Texas
Principal-in-charge for development of a 50-year regional water supply plan to meet drought-of-record demands for Region O. The plan includes evaluation of existing water supplies, identification of potentially feasible water management strategies, selection and detailed evaluation of selected strategies, and prioritization for selection of funding.

Water Resources Support for Goliad County Groundwater Conservation District, Goliad, Texas
Principal investigator for assessment of the potential effects of in-situ leach uranium mining. Project involved hydrogeologic evaluation of site data, regional, and local groundwater flow and solute transport modeling for the Evangeline Aquifer and other hydrogeologic analysis, and expert testimony in a TCEQ administrative hearing. Provided technical support regarding District's petition to EPA regarding aquifer exemption and comments on rule making. Also assisted the District with evaluation of background water quality and an assessment of surface water -groundwater interaction.

Hood vs. Bounds, Black River Village, New Mexico
Conducted expert geologic and hydrologic analysis to determine sources of groundwater and spring flow and the fate of irrigation water within a local aquifer system in the vicintiy of Black River Village, New Mexico.

Clint Texas Dewatering Case, Snapka Law Firm, Clint, Texas
Conducted expert hydrologic analysis of extent of dewatering conducted to construct a sewer line and pump station in the Town of Clint. Multiple homeowners, businesses and a historic church alleged structural damage due to subsidence.

Municipal Well Field Development and Sustainability Analysis, Colorado River Municipal Water District, Ward County, Texas
Principal investigator for due diligence analysis for a large water right purchase in Ward County, Texas. The water right purchase was followed by a program of test drilling, construction and aquifer testing of 21 high-capacity, raw water supply wells. The well field build-out was required to supplement existing groundwater supplies and was completed on a highly expedited schedule. A groundwater flow model was constructed to assist with well field operations, evaluation of well-field sustainability and water quality, and groundwater resources planning.

Groundwater Analysis and Planning Support, Colorado River Municipal Water District, West Texas
Principal-in-charge or principal investigator for multiple groundwater analysis and planning projects, including evaluation of the Snyder well field, assistance with development and evaluation of desired future conditions for multiple aquifers, evaluation of alternative and additional sources of water supply, and evaluation of potential sources for groundwater contamination within or near existing well fields.

Investigation and Characterization of Deep Saline Water, Hideout of Lincoln County, LLC, Lincoln County, New Mexico
Project manager for completion and testing of two deep (greater than 2,500 feet) exploratory brackish aquifer water supply wells. Project included well design, permitting, and reporting; drilling oversight; aquifer testing design; implementation and analysis of results; collection of water quality and isotope samples for geochemical fingerprinting for the determination of water sources; and groundwater flow modeling for the assessment of hydrologic effects of utilization of the deep brackish groundwater.

Simulation of Groundwater Flow for Aquifer Storage and Recovery Project Permitting, Cities of Rio Rancho and Albuquerque, Bernalillo County, New Mexico
Conducted numerical simulations of aquifer storage and recovery in support of State Engineer permitting requirements for multiple projects. Two projects involve injection wells and one project involves surface infiltration. Conducted analysis of effects of aquifer storage and recovery on surface water balance of the Rio Grande in conjunction with water right permit conditions.

Analysis of Municipal Water Supply Sources from the Southern Ogallala Aquifer, City of Lubbock, Texas
Project manager and principal investigator for assessment of sustainability of the City's Bailey County well field and pumping groundwater from beneath the City to assist with meeting peak water demands. Ogallala aquifer water quality beneath the City was also considered, as was the contributing zone for proposed water supply wells. Project included the development of historical water level maps and other hydrogeologic analysis, along with development of detailed groundwater flow models for the City of Lubbock area and the Bailey County well field area. Study results were used by the City to make key water planning decisions.

Development of Groundwater Availability Model for Edwards-Trinity (High Plains) Aquifer, Texas Water Development Board, West Texas
Principal investigator for the development of a numerical groundwater flow model of the Edwards-Trinity (High Plains) aquifer in Texas and New Mexico. Project involved extensive data collection and development of the geologic framework of four lower Cretaceous hydrogeologic units based on geophysical and geologic well logs and development of new conceptual models of groundwater flow. Information was employed to develop a three-dimensional groundwater flow model that will be used by groundwater conservation districts and regional water planning groups to evaluate future groundwater availability.

Expert Testimony Regarding Municipal Appropriation of Water in the Middle Rio Grande Basin, City of Rio Rancho, New Mexico
Provided expert analysis and testimony on behalf of the City of Rio Rancho against an adjacent water utility that sought to appropriate 26,000 acre-feet per year of groundwater. Conducted detailed numerical modeling and other hydrologic analysis to illustrate adverse effects on Rio Rancho. The adjacent water utility's application was denied by the State Engineer.

Hydrogeologic Analysis of City of San Angelo Hickory Aquifer Well Field, City of San Angelo, Texas
Provided senior-level review and support for hydrogeologic analysis of the City's Hickory aquifer well field. Project tasks included groundwater sampling, borehole geophysical logging, and hydrogeologic mapping and analysis of key geologic units and water quality constraints.

Update and Recalibration of Rose Valley Groundwater Model for Permit Evaluation, County of Inyo, California
Principal investigator forcomprehensive update and recalibration of an existing groundwater flow model in accordance with Mitigation Monitoring and Reporting Program of Conditional Use Permit 2007 003. Updates included conducting a basin-wide recharge estimate, refinement of the model grid and boundary conditions, improved calibration to historical water levels, and consideration of major historical stresses on the basin (reservoir construction and pumping for irrigation) from 1915 through 2010. The updated model was used to reevaluate future pumping amounts and associated drawdown trigger levels at monitor wells that could occur without exceeding the allowable reduction in groundwater outflow to a terminal lake at the southern end of the valley.

Expert Testimony Regarding Numerical Groundwater Flow Modeling and Evaluation of Salinity Encroachment, City of Alamogordo, Tularosa Basin, New Mexico
Provided expert review and testimony regarding evaluation of multiple groundwater flow models, then applied the model results to predict hydrologic effects of a proposed groundwater appropriation of 10,000 acre-feet per year by the City of Alamogordo. Also conducted an assessment and provided testimony regarding the potential for encroachment of saline groundwater due to pumping the well field, and effects of groundwater pumping on spring flow.

Groundwater Supply Evaluation for the Eastern New Mexico Regional Water System, CH2M Hill, Inc., East Central New Mexico
Applied regional groundwater flow modeling to evaluate the sustainability of future municipal water demand in Curry and Roosevelt Counties, eastern New Mexico. Groundwater from the Ogallala aquifer was one alternative evaluated as part of a long-term regional water supply study.

Assistance with Development of Groundwater Management Strategies, Hemphill County Underground Water Conservation District, Canadian, Texas
Assisted the district with evaluation of existing hydrogeologic data and groundwater management approaches, and provided recommendation regarding alternative approaches and application of the Northern Ogallala GAM. Assisted with defense of desired future conditions selected by Groundwater Management Area 1 to preserve surface water flows.

Water Supply Analysis and Expert Testimony for Water Rights Applications, Mesa Verde Enterprises, Inc., Tularosa Basin, Alamogordo, New Mexico
Principal investigator and expert witness for multiple water rights applications in the Tularosa Basin. Project involved analytical and numerical groundwater flow modeling, evaluation of local and regional hydrogeologic

conditions, application of Tularosa Basin administrative guidelines, well field design, and assistance with plan of replacement negotiations in support of application to appropriate water.

Development of Groundwater Availability Model for Southern Ogallala Aquifer, Texas Water Development Board, High Plains of Texas and New Mexico
Principal investigator for development and application of numerical groundwater flow model for the Southern Ogallala aquifer in Texas and New Mexico, an area that exceeds 29,000 square miles. Project involved extensive data collection and incorporation into a numerical groundwater flow model using a geographic information system (GIS), model calibration and verification, presentation at public meetings, and detailed study documentation. The model was used by groundwater conservation districts, municipalities and other stakeholders to assist with water-supply planning efforts.

Evaluation of Current and Historical Underflow Across Newport-Inglewood Uplift, West Basin Water Association, Southern California
Project manager for evaluation of the historical underflow of groundwater between the Central Basin and West Coast Basin (CBWCB) across the Newport-Inglewood Uplift. Project involved review and analysis of numerous historical reports regarding the hydrogeology and history of WBCB areas, groundwater modeling and other types of hydrogeologic analysis.

Application for Appropriation of Groundwater, Aquifer Science, LLC, Sandia Basin, New Mexico
Responsible for hydrogeologic investigations, construction and testing of exploratory production wells, recharge analysis, groundwater model development and application, and expert testimony related to an application to appropriate 350 acre-feet per year of groundwater in the Sandia Basin. Critical issues involved effect of groundwater pumping on surface water and drawdown at adjacent wells.

Groundwater Flow and Pit Water Quality Analysis for Little Rock Mine, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Principal investigator for development of a groundwater flow model to assess future hydrologic conditions at the Little Rock Mine and computation of open pit water quality post-mining.

Water Rights Technical Support, Denver Water, Denver, Colorado
Conducted quantitative analysis and expert review of stream depletion computations using numerical and analytical methods.

Assessment of Seawater Intrusion, Confidential Client, Southeast Atlantic Coast
Project manager for the evaluation of seawater intrusion related to an industrial facility near the coastline of the southeastern United States. Considered multiple potential sources of seawater intrusion and directed the simulation of density-dependent groundwater flow and solute transport modeling.

Development of Groundwater Flow and Solute Transport Model to Assess the Effects of Property Development, Basic Remediation Company, Henderson, Nevada
Developed a groundwater flow and solute transport model to assess the effects of proposed development on groundwater levels for property adjacent to the Las Vegas Wash. Model considers multiple water-bearing zones, multiple sources of recharge that vary over time, and heterogeneous aquifer conditions. Transport simulations include multiple plume constituents. Model work plan and simulation results were reviewed and approved by Nevada Department of Environmental Protection prior to application to predict future conditions.

Investigation of Water Rights and Water Supply Issues for Multiple Power Plants, Xcel Energy, Texas and New Mexico
Principal investigator for the review and analysis of various water rights and water supply issues related to multiple power plants in the southwest.

Instructor for Vadose Zone Short Course on Coal Bed Methane, State of Wyoming, Sheridan, Wyoming
Developed and taught modeling portion of coal bed methane vadose zone course developed for Wyoming state regulators.

Municipal Water Supply Investigation, BASCOR Engineering, City of Truth or Consequences, New Mexico
Principal investigator for evaluation of potential sites for water resources development. Provided recommendations regarding sites for potential groundwater development considering impacts to existing water rights, State Engineer policy, and likelihood of obtaining sufficient water supply. Planned and oversaw implementation of aquifer testing and analysis. Provided testimony regarding water supply at public City Commission meeting.

Brine Plume Remediation Well Field Design and Expert Testimony, Pioneer Natural Resources, East Poplar Well Field, Montana
Principal investigator for hydrogeologic assessment and development of numerical groundwater flow and solute transport model for remediation well field design. Client used the results of the study to implement remedial action to limit plume migration and ensure that municipal wells would not be impacted. This effort was a significant component of a larger project that received the 2008 Department of the Interior Environmental Achievement Award. Also served as an expert witness in related cost-recovery case regarding hydrogeology, brine transport, and timing of releases to the environment, and assisted with negotiations with U.S. EPA regarding sampling requirements and a proposed Administrative Order on Consent.

Applied Hydrologic Modeling Course Instructor, New Mexico Institute of Mining and Technology, Socorro, New Mexico
Served as course instructor for several sessions of a graduate-level hydrologic modeling course. Developed and presented course materials on numerical groundwater model development and application.

Independent Review of Assessment of Hydrologic Impacts, Village of Galisteo through Commonweal Conservancy, Santa Fe County, New Mexico
Provided an independent review and opinion regarding the effects of a proposed development on the water supply of the Village of Galisteo. Reviewed available data, literature, and reports of other professionals. Village relied on findings to help determine how to proceed with a water rights transfer protest.

Evaluation of District-Wide Hydrogeology and Mine Expansion, Confidential Client, New Mexico
Led project team to evaluate mine site hydrogeology and the source of existing and future groundwater inflows to existing and proposed open mine pits. Analysis was conducted using field investigations, geochemical fingerprinting, and numerical groundwater flow modeling. The project results assisted the client with making key operational and regulatory decisions.

Little Colorado River Adjudication, The Hopi Tribe, Hopi Indian Reservation, Arizona
Serving as groundwater hydrology expert representing the Hopi Tribe in litigation and settlement negotiations regarding groundwater and surface-water resources under past and future conditions. Tasks have included evaluation of groundwater resources for multiple aquifer systems, development of aquifer management plans and concepts, providing guidance regarding production well placement and expected long-term yield,

developing predictions of the effects of groundwater pumping on aquifer conditions and surface water flows (streams and springs), review and comment on work conducted by other experts, and expert testimony.

Return Flow Analysis and Expert Testimony, Berrendo Cooperative Water Users Association, Roswell, New Mexico
Planned and supervised test drilling and used finite element variably saturated flow modeling and other hydrogeologic analyses to assess the volume and timing of return flow from septic leach fields for a large water cooperative with more than 1,500 service connections. Provided expert testimony regarding timing and volume of return flow for a variety of hydrogeologic conditions that occur within the cooperative service area.

Monitor Well Construction and Hydraulic Testing, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Project manager for the design, permitting, installation, and development of 26 monitor wells completed 200 to 900 feet deep in granite and conglomerate. Conducted hydraulic (aquifer) testing and analysis of aquifer parameters for 10 wells.

Evaluation of New Mexico Office of the State Engineer Administrative Model for Lea County Underground Water Basin, Lea County Water Users Association, Lea County, New Mexico
Assisted with evaluation of the OSE administrative model developed for the High Plains aquifer of the Lea County Basin. Purpose of the evaluation was to determine the suitability of the model for predictive water resources analysis. Project included evaluation and comparison of aquifer base elevation values and assignment of aquifer hydraulic properties.

Design of Groundwater Capture System for State Road 114 Superfund Site, Texas Commission on Environmental Quality, Levelland, Texas
Principal investigator for development and application of a groundwater flow and solute transport model to design a remediation well field for the State Road 114 Superfund Site. An existing regional model for the Southern High Plains (the Southern Ogallala groundwater availability model [GAM]) was modified to improve the historical calibration in Hockley County, and a nested, multi-layer local model was developed to simulate groundwater flow in the vicinity of the dichloroethane (DCE) plume and used to design a groundwater capture system. Simulation results were used by the EPA to design and cost the groundwater plume extraction system.

Instructor for Groundwater Sampling Short Course, Freeport McMoRan, Inc., Chino and Cobre Mines, New Mexico
Co-developed and taught groundwater sampling short course for environmental staff at the Tyrone, Chino and Cobre copper mines near Silver City, New Mexico. Provided classroom and field instruction.

Expert Testimony Regarding Water Rights Transfer in Indian Basin, Glenn's Water Well Service, New Mexico
Conducted hydrogeologic analysis and provided expert testimony regarding source of water, hydrologic effects of a proposed transfer, discharge areas of subject water, and effects of groundwater use on a major spring.

Assessment of Water Rights Purchase, Confidential Client, West Texas
Provided recommendation regarding purchase of Ogallala aquifer groundwater rights in West Texas. Reviewed aquifer conditions and hydraulic parameters, assessed effects of nearby pumping, and conducted predictive groundwater flow modeling to evaluate expected drawdown.

Development of Stage 1 Abatement Plan for Tyrone Mine, New Mexico, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico

Principal investigator for development and submission of Stage 1 Abatement Plan for the Tyrone Mine. The plan consists of a comprehensive evaluation of groundwater and hydrogeologic conditions, and delineation of the extent of impacted groundwater. Assisted the client with planning and execution of additional work and negotiations with the regulatory agency.

Tyrone Mine Closure/Closeout and Technical Hydrology Support, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Provided technical oversight, served as project manager, and conducted numerous technical studies and tasks at the Tyrone Mine related to groundwater issues. Examples include aquifer testing of monitor and production wells, development and execution of site investigation and corrective action studies, evaluation of sources of groundwater contamination and the nature and occurrence of groundwater at the mine, and assistance with various legal and regulatory issues related to groundwater.

Litigation and Negotiation Support Regarding Natural Resource Damage Assessments, New Mexico, Two Confidential Clients
Provided expert advice and testimony regarding Natural Resource Damage Assessments issues for two clients in New Mexico. Both cases involved the assessment of potential impacts of contaminants to groundwater resources.

Expert Testimony Regarding Mine Closure/Closeout Issues, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Provided expert testimony during New Mexico Environment Department and New Mexico Water Quality Control Commission hearings. Areas of testimony included groundwater hydrology of the Tyrone Mine area under current and closure/closeout conditions, locations of reasonably foreseeable future use in the vicinity of the mine, and the potential for mining operations to have adverse impacts on groundwater resources and adjacent users. Testimony was based on modeling and other quantitative analyses of seepage through stockpiles and tailing impoundments, and the influence of multiple open pits on groundwater flow.

Evaluation of Proposed Groundwater Appropriations on Remediation Well Field Effectiveness, Lynx Ltd., NASA White Sands Test Facility, New Mexico
Evaluated potential effects of several applications for appropriation of groundwater on remediation system effectiveness in the Jornada Basin in New Mexico. Conducted drawdown, capture zone, and sensitivity analyses for several alternative water development scenarios.

Litigation Support and Modeling, Tucson Airport Authority, Tucson, Arizona
Technical leader and task manager for more than five major modeling tasks for cost allocation and litigation support at a major Superfund site. Modeling tasks included historical calibration of groundwater flow and solute transport models, predictive simulations, and local-scale multiphase (air, water, dense nonaqueous-phase liquids) simulation. Advanced geostatistical techniques (block kriging and indicator kriging) were applied during model development.

Groundwater and Surface Water Impact Analysis and Expert Testimony, Hubbard Enterprises, Inc., Lincoln County, New Mexico
Developed three-dimensional groundwater flow model of upper reaches of Hondo Underground Water Basin for groundwater and surface water (streams and springs) impact analyses. GIS was used as an integral component of model development. Provided expert testimony in State Engineer hearing regarding groundwater and surface water impacts.

Expert Review of Water Supply Studies and Hydrologic Analyses, City of Albuquerque, New Mexico
Provided expert third-party review of modeling and other studies conducted by another consultant on behalf of the City to support its water resources management strategy and associated water rights application for combined surface water and groundwater use.

Evaluation of Return Flow of Treated Effluent, Rancho Encantado, Tesuque, New Mexico
Planned and supervised test drilling and associated laboratory analysis for the assessment of potential return flow at a commercial facility. Assisted with development of innovative techniques (high-pressure injection into clay units) for subsurface disposal of treated effluent.

Groundwater Modeling Assessment of Alumina Refinery, ALCOA, Ludwigshafen, Germany
Principal investigator for groundwater modeling assessment of the potential for impacted seepage from a closed alumina refinery to impact a public water supply well field. A combined semi-analytical capture zone and solute transport model was applied to identify wells that could potentially be impacted and the timing of possible impacts.

Technical Assistance for Water Rights Transfer, Santa Fe Opera, Santa Fe, New Mexico
Analyzed hydrologic impacts of water rights transfer and designed return flow plan critical to proposed project's viability. Also developed subregional groundwater flow and solute transport models. Technical interface with the OSE and the NMED.

Technical Assistance and Expert Testimony for Water Rights Protest, Village of Corrales, New Mexico
Provided technical assistance to the Village of Corrales regarding its protest of a major water rights application made by an adjoining municipality. Analyzed groundwater models developed by applicant and OSE, conducted a well survey within the Village, and provided expert testimony.

Water Rights, Hydrologic, and Environmental Analysis, Pueblo of Acoma, New Mexico
Conducted hydrologic water rights analyses, provided training on hydrologic issues and water resources, developed spring sampling plan, conducted detailed review and analysis of complex regional groundwater flow model, and assisted with development of water quality standards and water code.

Remediation Well Field Design and Contaminant Transport Simulation, AlliedSignal Technical Services, NASA White Sands Test Facility, White Sands, New Mexico
Project manager and principal investigator for design of remediation well field for multi-component contaminant plume that extends several miles from source areas within alluvial sediments and adjoining, structurally complex, fractured rock. Alternative well field designs were tested using three-dimensional groundwater flow, groundwater pathline tracking, and solute transport models. Model was also used to support site risk assessment.

Pit Lake Formation Modeling, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Principal investigator for the development of three-dimensional numerical pit lake formation model for multiple open mine pits that intersect regional groundwater. The model was both calibrated and validated to historical changes in pit water levels, accounting for groundwater seepage, surface water inflow, and evaporation. The model has been used to predict pit lake water levels and capture zones under various closure/closeout conditions and has guided high-level decision-making regarding both mine closure and mine expansion alternatives.

Remediation Well Field Design, New Mexico Environment Department, Hobbs, New Mexico
Developed a three-dimensional groundwater flow model for municipal wells at an underground storage tank (UST) site. Model was applied to determine remediation well locations and pumping rates to maximize contaminant mass removal, provide plume containment, and provide wellhead protection to four municipal water supply wells in the plume vicinity.

Expert Opinion on Mine Application, Mining and Minerals Division of the New Mexico Energy, Minerals and Natural Resources Department, Copper Flat Mine, New Mexico
Conducted detailed review and provided expert opinion on impact analysis modeling and other hydrogeologic analyses conducted for mine permit application.

Hydrologic and Contaminant Transport Analysis, Confidential Client, Southern California
Project team member for multi-million-dollar cost allocation analysis for Superfund site. Assignments included innovative hydrogeological analysis, development and application of transient groundwater pathline tracking code, evaluation of effects of retardation on historical contaminant migration, and evaluation/critique of previous simulation efforts.

Hydrogeologic Analysis and Groundwater Flow Modeling, Waste Management, Inc., San Juan County, New Mexico
Conducted hydrogeologic studies and sustained yield modeling for permitting of a regional landfill. Analyzed aquifer test and other hydrogeologic data, and conceptualized and simulated groundwater flow within multiple sandstone units.

Sustained Yield Analysis, Texzona Cattle Feeders, West Texas
Conducted groundwater modeling to determine sustainable groundwater resources of cattle feedlot. Planned and managed three-day aquifer test at site. Technical conclusions were used in support of negotiations during real estate transaction.

Capture Zone Modeling, Various Clients and Sites
Applied or reviewed application of various computer models for delineation of extraction well capture zones at several UST sites in New Mexico and Virginia. Modeling approaches ranged from simple analytical models to complex numerical codes.

Three-Dimensional Groundwater Flow Modeling, New Mexico Office of the State Engineer, Roswell, New Mexico
Participated in construction, calibration, and verification of multi-layer numerical model of Roswell Groundwater Basin to assist State Engineer with water rights adjudication and water resources planning. Modeling simulated impacts to Pecos River flows resulting from changes in groundwater pumping.

Water Resources Analysis, County of Santa Fe, New Mexico
Participated in review and analysis of County groundwater resources and assisted with development of recommendations for future groundwater management strategies and policy.

Little Colorado River Sediment Transport, The Hopi Tribe, Northern Arizona
Investigated primary sources and transport mechanisms/characteristics of suspended and bedload sediment in Little Colorado River (LCR) system. Tasks included development of rainfall-runoff relationships and simulation of sediment yield throughout LCR basin.

Borehole Geophysical Analysis, The Hopi Tribe, Kykotsmovi, Arizona
Task manager and lead investigator for application of borehole geophysical techniques to determine the potential for interaquifer leakage and groundwater quality degradation for three 1,000-foot-deep water supply wells.

Public Supply Well Wellhead Protection, Southwest Florida Water Management District, Hernando County, Florida
Project manager and principal investigator for delineation of wellhead protection areas (WHPAs) for approximately 60 major public supply wells. Conducted methods comparison study using semi-analytical modeling, flowpath delineation, and three dimensional numerical groundwater flow modeling combined with three-dimensional particle tracking to delineate WHPAs. Presented final recommended WHPAs to Hernando County Board of County Commissioners and Southwest Florida Water Management District in a public hearing and incorporated them into the County's comprehensive Water Resource Protection Plan. District used results of comparative analysis to guide WHPA delineation efforts in other counties.

Model Development and User Support, U.S. EPA Office of Solid Waste, Washington, D.C.
Provided regulatory support and modeling-related tasks for EPA Office of Solid Waste. Developed Monte Carlo simulation module for implementation in EPACMS (EPA Composite Model for Surface Impoundments) groundwater flow and solute transport code. Supervised statistical analysis of nationwide hydraulic conductivity data set for contaminated sites. Developed graphical postprocessor for EPACMS code, analyzed model sensitivity, and implemented code modifications.

Saltwater Intrusion Modeling, St. Johns River Water Management District, Orange County, Florida
Project manager and principal investigator in evaluation of regional groundwater resources using density-dependent groundwater flow and solute transport simulation techniques. Phases included development and calibration of regional, three-dimensional groundwater flow model (MODFLOW), delineation of WHPAs for major municipal supply wells, and cross-sectional and three-dimensional simulations of density-dependent groundwater flow and contaminant transport.

Model Development, Documentation, and Testing, U.S. EPA Office of Ground Water Protection, Washington, D.C.
Project manager for EPA-sponsored development and application of PC based, user-friendly computer code to delineate WHPAs for commonly encountered hydrogeologic settings. Code incorporates state-of-the-art analytical groundwater flow solutions, uses particle tracking to delineate several types of capture zones, and includes module that allows assessment of the effects of uncertain input parameters on the extent of capture zones. EPA distributes the WHPA code developed in this project nationwide for use by state and local technical staff.

Modeling Short Course Development and Presentation, EPA Office of Ground Water Protection, Washington, D.C.
Project manager and principal investigator for development and presentation of nationwide workshops on capture zone modeling and application of EPA WHPA code. Developed and presented modeling portion of two-day courses on delineation of WHPAs in fractured, confined, and karst aquifers.

Regulatory Support and Permit Evaluation, Florida Water Management Districts, Central Florida
Supervised and conducted modeling and review tasks, including critical reviews of modeling studies submitted in support of permit renewal for major municipal well fields and development and assessment of proposed saltwater intrusion criteria for determination of saltwater intrusion impacts. Supervised and reviewed cross-

sectional density-dependent groundwater flow and solute transport modeling to determine extent of proposed Water Use Caution Area (WUCA). Conducted quasi three dimensional sharp-interface saltwater intrusion modeling in support of WUCA determination.

Model Development, Documentation and Testing, EPA Office of Ground Water and Drinking Water, Washington, D.C.
Project manager for development, validation, and application of VIRALT and CANVAS groundwater flow and viral transport computer codes developed for EPA Office of Ground Water and Drinking Water (OGWDW). Codes incorporate composite modeling approach: one-dimensional groundwater flow and solute transport modules for unsaturated zone are linked with two-dimensional simulation modules in saturated zone. Codes include menu-driven pre-processor and graphical post-processor. OGWDW staff used models in development of Ground Water Disinfection Rule.

Groundwater Flow Modeling, City El Paso, Texas
Applied USGS MODFLOW code to free surface water table and other complex boundary conditions to analyze impacts of municipal well field on multi layer aquifer system. Major issues were effects of groundwater pumping on surface water and water level declines in the aquifer.

Model Parameter Estimation and Uncertainty Analysis, New Mexico Water Resources Research Institute, Columbus, New Mexico
Conducted parameter estimation and uncertainty propagation analysis for Columbus Basin using finite element modeling, geostatistics, and non-linear optimization techniques. Managed project from data collection through documentation of model results. Calculated uncertainties in predicted model heads using first-order techniques.

Development of Surface Impoundment Transport Model, Washington, D.C., U.S. EPA Office of Solid Waste
Developed and applied Monte Carlo driver coupled with semi-analytical groundwater flow and transport code (EPACMS). Code was used to examine effects of uncertain parameter inputs on magnitude of aquifer contamination caused by leaky surface impoundments.

Contaminant Transport Modeling, Confidential Client, Seattle, Washington
Applied transient, semi-analytical particle tracking code to assess propensity of petroleum-based contaminants released in aquifer to reach major municipal supply well.

Model Development, Testing, and Application, Los Alamos National laboratory, New Mexico
Developed, tested, and applied Monte Carlo uncertainty analysis module for Disposal Unit Source Term (DUST) code for Mixed Waste Disposal Facility. Developed new simulation approach that resulted in reduced simulation run times. Assisted with screening analyses to rank radionuclide mobility and toxicity

Additional Professional Training

Capture Zone Analysis for Pump and Treat Systems, U.S. EPA Region 6 Training Course, 2007

Numerical Model Calibration and Predictive Analysis Using PEST and MODFLOW 2000, 2001

Introduction to ArcView GIS, 1998

Assessing Passive Biodegradation at Leak Sites, 1997

Dissolved Organic Contaminants in Ground Water, 1994

Diagnosis and Remediation of DNAPL Sites, 1993

Digital Geographic Information Systems, 1989

Wellhead Protection Area Delineation, 1989

Selected Publications and Presentations

Blandford, N., 2017. Session moderator for Technical and Regulatory Aspects of Enhanced Aquifer Recharge Using Surface and Near-Surface Facilities. American Ground Water Trust 2017 Annual Texas Groundwater Conference. Austin, Texas, May 4, 2017.

Blandford, N., 2016. Overview of the University Lands Groundwater Resource Evaluation Project. Presentation to Environmental Study Group of the Society of Petroleum Engineers. Midland, Texas. April 28, 2016.

Schnaar, G., Blandford, N., 2015. Not Under My Back Yard: The Looming Battle Over Underground Injection. Presentation at the American Bar Association Fall Conference, Chicago, Illinois. October 28-31, 2015.

Umstot, T., Schnaar, G., Blandford T.N., Cullen, S., Kaiser, P., Ayarbe, J., 2015. Recharge estimates from a soil water-balance model improve groundwater model calibration. Presentation at the MODFLOW and More 2015: Modeling a Complex World conference. May 31 - June 3, 2015. Golden, Colorado.

Blandford, N., 2015. Overcoming Water Rights Challenges. New Mexico Chapter of the Society for Marketing Professional Services. Albuquerque, New Mexico, April 21, 2015.

Blandford, T.N. 2014. Aquifer Replenishment Projects in New Mexico—Technical Considerations, Challenges, and Permitting. Law Seminars International: New Mexico Water Law. Santa Fe, New Mexico, September 11, 2014.

Blandford, T.N. 2014. Effective Tools for Resolving Water Rights and Damages Issues. Law Seminars International: Hydrology and the Law. Santa Fe, New Mexico, July 23, 2014.

Marley, R., N. Blandford, A. Ewing, L. Webb, and K. Yuhas. 2014. Managed Aquifer Recharge as a Solution to Water Scarcity and Drought, European Geosciences Union General Assembly, Vienna, Austria. April 27 - May 2, 2014.

Marley, R. and N. Blandford. 2014. Water Rights Administration for Aquifer Replenishment Projects in New Mexico. NGWA Conference on Hydrology and Water Scarcity in the Rio Grande Basin. Albuquerque, New Mexico.

Blandford, T.N., T. Umstot, R. Marley, C. Wolf and G. L. Bushner. 2012. A Case Study of Exploration and Characterization of Deep Fractured Rock Aquifers for New Groundwater Development, New Mexico, U.S.A. Presentation to the International Conference on Groundwater in Fractured Rocks. Prague, Czech Republic, May 21-24, 2012.

Blandford, T.N. 2009. An Overview of Groundwater Management Approaches and Implications for MAG Permitting. Invited presentation to the Texas Alliance of Groundwater Districts. Arlington, Texas, September 29, 2009.

Blandford, T.N. and M. Kuchanur. 2008. Consideration of administrative management constraints in the development of groundwater supply strategies. Invited presentation to the Joint Meeting of the Geological Society of America, Soil Science Society of America, American Society of Agronomy, and Crop Science Society of America. Houston, Texas, October 5-9, 2008.

Blandford, T.N., M. Kuchanur, and R. Smith. 2008. Groundwater modeling of the Southern High Plains Aquifer: Effects of pre- and post-development recharge on water availability. Invited presentation to the Joint

Meeting of the Geological Society of America, Soil Science Society of America, American Society of Agronomy, and Crop Science Society of America. Houston, Texas, October 5-9, 2008.

Earley, D. III, E.A. Salvas, and N. Blandford. 2008. Stockpile Characterization and Hydrogeochemical Seepage Modeling for Mine Closure. 2008 National Ground Water Association / U.S. EPA Remediation of Abandoned Mine Lands Conference, October 2008.

Blandford, T.N. and D.J. Blazer. 2008. Effects of historical pumping distributions and changes in recharge for evaluation of municipal groundwater supply: A case study for the Southern High Plains of West Texas. Presented at MODFLOW and More: Ground Water and Public Policy. Golden, Colorado, May 19-21, 2008.

Blandford, T.N. 2007. Surface water-groundwater interaction, some technical considerations. Presented at Texas Water Conservation Association. San Antonio, Texas, October 11-12, 2007.

Blandford, T.N., D.J. Blazer, and A. Dutton. 2005. The effect of a priori knowledge on conceptual model refinement through numerical model development: A case study for the Southern High Plains of the United States. Invited presentation to ModelCARE 2005, Fifth International Conference on Calibration and Reliability in Groundwater Modeling, From Uncertainty to Decision Making. The Hague, The Netherlands, June 6-9, 2005.

Blandford, N. and N. Sweetland. 2005. Is your remediation system a source of groundwater contamination? Southwest Hydrology 4(3):10-11.

Blandford, T.N. 2005. Evaluation of return flow to groundwater in New Mexico. In Proceedings of New Mexico Water Law Conference. CLE International. Santa Fe, New Mexico, August 15-16, 2005.

Blandford, T.N., M.J. Ronayne, D. Earley III, and T. Shelley. 2004. Lake formation at multiple pits - model development, verification and application for closure. Presented at US EPA Office of Research and Development Pit Lakes, 2004 Conference, Reno, Nevada.

Blandford, T.N., D.J. Blazer, A.R. Dutton, and R. Smith. 2004. Regional groundwater availability modeling of the Southern Ogallala aquifer of West Texas and Eastern New Mexico. In Rainwater, K.A. and T.M. Zobeck (eds.), 2004 High Plains Groundwater Resources: Challenges and Opportunities, Conference Proceedings. Lubbock, Texas, December 7-9, 2004.

Blandford, T.N. and R. Smith. 2004. Conceptual model evaluation and refinement through numerical model development: A case study for the Southern High Plains of the United States. Presented at Finite Element Models, MODFLOW, and More: Solving Groundwater Problems Conference. Karlovy Vary, Czech Republic, September 13-16, 2004.

Blandford, T.N. and D.J. Blazer. 2004. Hydrologic relationships and numerical simulations of the exchange of water between the Southern Ogallala and Edwards-Trinity aquifers in southwest Texas. In Aquifers of the Edwards Plateau, Mace, R.E., E.S. Angle, and W.F. Mullican, III (eds.), Texas Water Development Board Report 360:115-131. February 2004.

Stephens, D.B. and N. Blandford. 2004. Hydrogeologic analysis, transport and modeling for environmental litigation: A case study. Presented at National Ground Water Association Ground Water and Environmental Law Conference. Chicago, Illinois, May 5-6, 2004.

Blandford, T.N., D.J. Blazer, K.C. Calhoun, A.R. Dutton, T. Naing, R.C. Reedy, and B.R. Scanlon. 2003. Groundwater availability of the Southern Ogallala aquifer in Texas and New Mexico: Numerical simulations through 2050. Prepared for the Texas Water Development Board. 160p.

Blandford, T.N., D.J. Blazer, A.R. Dutton, and T. Naing. 2003. Regional groundwater availability modeling of the Southern High Plains aquifer of west Texas and eastern New Mexico. In Proceedings of MODFLOW and More, 2003—Understanding through Modeling. Sponsored by International Ground Water Modeling Center, Colorado School of Mines, Golden, Colorado, September 16-19, 2003.

Blazer, D.J., K.C. Calhoun, and T.N. Blandford. 2003. Development of the Southern Ogallala groundwater availability model using GIS. In Proceedings of MODFLOW and More, 2003—Understanding through Modeling. Sponsored by International Ground Water Modeling Center, Colorado School of Mines, Golden, Colorado, September 16-19, 2003.

Blandford, T.N. 2003. What is a groundwater flow model and how do you know if you have a good one? In Proceedings of New Mexico Water Law Conference. Sponsored by CLE International, Santa Fe, New Mexico, August 18-19, 2003.

Blandford, T.N. and N.T. Sweetland. 2003. Rethinking traditional approaches to hydraulic capture in preparation for the next series of emerging chemicals of concern in groundwater. Poster presentation at the 1,4 Dioxane and Other Solvent Stabilizer Compounds in the Environment, Groundwater Resources Association of California, December 10, 2003, San Jose, California.

Blandford, T.N., D.J. Blazer, A.R. Dutton and T. Naing. 2003. Regional groundwater availability modeling of the southern High Plains Aquifer of west Texas and eastern New Mexico. In Proceedings of MODFLOW and More, 2003 - Understanding through Modeling. Sponsored by International Ground Water Modeling Center, Colorado School of Mines, September 16-19, 2003, Golden, Colorado.

Blandford, T.N., D.J. Blazer, and A.R. Dutton. 2003. Regional groundwater availability modeling of the Southern Ogallala aquifer of west Texas and eastern New Mexico. Presented at New Mexico Symposium on Hydrologic Modeling. Socorro, New Mexico, August 12, 2003.

Blandford, T.N., D.J. Blazer, A.R. Dutton, and R.M. Smith. 2003. Regional groundwater availability modeling of the Southern Ogallala aquifer in West Texas and Eastern New Mexico. Presented at National Ground Water Association Southwest Focus Conference—Water Supply and Emerging Contaminants. Phoenix, Arizona, February 20-21, 2003.

Blandford, T.N., M.J. Ronayne, and T.L. Shelley. 2003. Lake formation at multiple mine pits: Model development and application. Presented at National Ground Water Association Southwest Focus Conference—Water Supply and Emerging Contaminants. Phoenix, Arizona, February 20-21, 2003.

Blandford, T.N., D.J. Blazer, A.R. Dutton, and R.C. Reedy. 2002. Regional groundwater flow modeling of the Southern High Plains aquifer: Conceptual models applied and insights gained. Presented at Geological Society of America Annual Conference Special Session on Hydrogeology and Water Resources of the High Plains Aquifer: Issues for Public Policy Over the Next 50 Years. Denver, Colorado, October 27-30, 2002.

Blandford, T.N., M.J. Ronayne, and D. Earley, III. 2001. Simulation of lake formation at multiple mine pits in a block faulted porphyry copper deposit. In Proceedings of MODFLOW 2001 and Other Modeling Odysseys, An International Ground Water Modeling Conference and Workshops. Sponsored by International Ground Water Modeling Center, Colorado School of Mines, Golden, Colorado, September 11-14, 2001.

Stephens, D.B. and T. N. Blandford. 2001. Hydrogeologic analysis, transport and modeling for environmental litigation, a case study. Presented at the First International Congress on Petroleum Contaminated Soils,

Sediments, and Water Analysis, Assessment and Remediation. London, United Kingdom, August 14-17, 2001.

Ronayne, M.J., T.N. Blandford, D. Earley, and R. Schmidt-Petersen. 1999. Simulation of mine pit lake recovery in a block-faulted porphyry copper deposit. Presented at the Annual Meeting of the Geological Society of America. Denver, Colorado, October 25, 1999.

Hsu, K.-C., D. Jordan, T.N. Blandford, D.W. Reaber, and J.L. Wilson. 1998. Evaluation of local-scale contaminant migration within a heterogeneous alluvial basin in the southwest. Presented at National Ground Water Association 1998 annual convention and exposition. Las Vegas, Nevada, December 13-16, 1998.

Stephens, D.B., K.-C. Hsu, M.A. Prieksat, M.D. Ankeny, T.N. Blandford, T.L. Roth, J.A. Kelsey, and J.R. Whitworth. 1998. A comparison of estimated and calculated effective porosity. In Hydrogeology Journal 6(1):156-165.

Jordan, D.L., T.N. Blandford, and R.J. MacKinnon. 1996. Source term analysis for a RCRA mixed waste disposal facility. In Proceedings of the International Topical Meeting on Nuclear and Hazardous Waste Management Spectrum '96. Seattle, Washington, August 18-23, 1996.

Blandford, T.N., N.-S. Park, and P.S. Huyakorn. 1994. Comment on "Well catchments and time-of-travel zones in aquifers with recharge" by D.N. Lerner. Water Resources Research 30(5):1627-1628. May 1994.

Birdie, T. and T.N. Blandford. 1994. Groundwater flow and solute transport modeling study for Seminole County, Florida, and adjoining regions. St. Johns River Water Management District Special Publication.

Blandford, T.N. and T. Birdie. 1993. Development of wellhead protection areas for the major public supply wells in Hernando County, Florida. Final report completed for the Southwest Florida Water Management District and Hernando County, Florida.

Huyakorn, P.S., J.B. Kool, and T.N. Blandford. 1993. An overview of modeling techniques for solute transport in groundwater. In Metals in groundwater, Allen, H., M. Perdue, and D. Brown (eds.). Lewis Publishers, Chelsea, Michigan.

Park, N., T.N. Blandford, and Y.S. Wu. 1993. CANVAS: A composite analytical-numerical model for viral and solute transport simulation. Code documentation prepared for U.S. EPA Office of Ground Water and Drinking Water.

Park, N., T.N. Blandford, and P.S. Huyakorn. 1992. VIRALT: A modular semi-analytical and numerical model for simulating viral transport in groundwater. Code documentation prepared for U.S. EPA Office of Ground Water and Drinking Water.

Blandford, T.N. and T. Birdie. 1992. Regional groundwater flow modeling for east-central Florida with emphasis on Orange and Seminole Counties. St. Johns River Water Management District Special Publication SJ92-SP17.

Blandford, T.N. 1991. Vertical cross-sectional modeling analysis of groundwater flow and saltwater transport in Orange and Brevard Counties, Florida. Prepared for St. Johns River Water Management District by HydroGeoLogic, Inc., Herndon, Virginia.

Blandford, T.N., T. Birdie, and J.B. Robertson. 1991. Regional groundwater flow modeling for east-central Florida with emphasis on eastern and central Orange County. St. Johns River Water Management District Special Publication SJ91-SP4.

Blandford, T.N. and P.S. Huyakorn. 1990. WHPA: A modular semi-analytical model for the delineation of wellhead protection areas. U.S. EPA Office of Ground Water Protection.

Blandford, T.N. and J.L. Wilson. 1988. Large scale parameter estimation and uncertainty propagation in the Columbus Basin, New Mexico. In EOS, Transactions of the American Geophysical Union 69(16):367.

Blandford, T.N. and J.L. Wilson. 1987. Large scale parameter estimation through the inverse procedure and uncertainty propagation in the Columbus Basin, New Mexico. New Mexico Water Resources Research Institute Report No. 226, Las Cruces, New Mexico.

Blandford, T.N. 1984. The mineralogy of an andesine anorthosite body near Montpelier, VA. In Rocks and Minerals 61(2):57-61.

Huyakorn, P.S. and T.N. Blandford. 1989. A comprehensive model for capture-zone delineation and particle tracking contaminant transport analysis. Presented at the 28th International Geological Congress. Washington, D.C.

Huyakorn, P.S., J.B. Kool, and T.N. Blandford. 1989. An overview of modeling techniques for metal transport in groundwater. Presented at Workshop on Metal Speciation and Transport in Groundwaters. Jekyll Island, Georgia.

Blandford, T.N. and P.S. Huyakorn. 1988. An interactive WHPA delineation model that incorporates a methodology for uncertainty analysis. Presented at Wellhead Protection Conference. New Orleans, Louisiana.

Blandford, T.N. 1986. Variogram estimation for transmissivity in the Columbus Basin, New Mexico. Presented at New Mexico Geological Society Conference. Socorro, New Mexico.

Beth Salvas, P.G.

Senior Hydrologist

Ms. Salvas has nearly 20 years of professional experience and has served as project manager for numerous mining and water resource related projects. She specializes in aqueous geochemistry, geochemical modeling, water quality sampling and assessments, surface water hydrology, water resources planning, in-stream flow and water balance modeling, and water supply and monitor well installation oversight and development.

EDUCATION

M.S., Hydrology, University of Arizona, 1998

B.S., Geology (with environmental geology option), New Mexico Institute of Mining and Technology, 1996

A.S., Geology, Casper College, 1993

PROFESSIONAL REGISTRATIONS

Professional Geologist, Wyoming, No. 3721

PROFESSIONAL AFFILIATIONS

American Water Resources Association

Pecos Mine and El Molino Operable Units, Cyprus Amax Minerals Corporation, Pecos, New Mexico

As project manager for both sites, responsible for coordination of sampling events with field staff and analytical laboratory, monthly inspections and maintenance activities for the reclaimed facilities, and technical and management oversight of the project team. Reviewed and analyzed data collected for trends and exceedances. Assisted with preparation of compliance monitoring plans and managed the overhaul and extensive QA/QC of a large, complex database of historical water quality information and source documents. Instrumental in identifying and implementing a strategy providing the framework for closure at both sites.

Geochemical Evaluation of In-Situ Copper Recovery Operations Florence Copper, Inc., Florence, Arizona

Conducted geochemical simulations and analyses to assist with the design of in-situ copper recovery operations of an oxide copper ore located in the subsurface and subsequent groundwater restoration. Evaluated acid-base accounting (ABA) data for rock samples from the site. Used PHREEQC and Geochemist Workbench modeling software to evaluate the geochemistry of process solutions and changes in water quality during rinsing with groundwater solutions.

Lisboa Springs Fish Hatchery Groundwater Monitoring, New Mexico Department of Game and Fish, Pecos, New Mexico

As project manager, prepared a groundwater monitoring Sampling and Analysis Plan for the fish hatchery and coordinated permitting and installation of a shallow groundwater monitor well. Awaiting monitoring results to prepare a water quality assessment report as to whether or not groundwater at the site is in compliance with existing New Mexico Water Quality Control Commission standards. If not, will provide recommendations regarding any necessary remedial actions, or outline the process for obtaining alternative abatement standards or a background determination, as appropriate, to achieve compliance with groundwater requirements.

Iron King Mine-Humboldt Smelter, Dewey-Humboldt, Yavapai County, Arizona

Prepared a technical memorandum regarding the conceptual understanding of the site. Compiled, reviewed, and summarized existing reports and sample data. Discussed the nature and extent of soil, subsurface soil, and sediment

EXHIBIT

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contamination.

Supplemental Mass Loading Study, Freeport McMoRan Chino, Inc., Chino Mine, Santa Rita, New Mexico
Compiled and analyzed stockpile material characterization results for paste pH, paste electrical conductivity, modified acid base accounting, meteoric water mobility procedure, mineralogy by x-ray diffraction, and bulk composition by x-ray fluorescence. Compiled stockpile monitoring data with depth for temperature and oxygen/carbon dioxide concentrations. Investigated effects of stockpile weathering and leaching by examining material characteristic trends as a function of stockpile age. Developed and calibrated a geochemical model using Geochemist's Work Bench to simulate stockpile seepage quality and determine annual mass loading to groundwater from seepage emanating from the stockpiles. Compared mass loading results between existing stockpile configurations and a closure plan. Performed a sensitivity analysis of several model parameters including temperature.

Revised Seepage Investigation, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Estimated stockpile runoff amounts using SCS curve number method and daily precipitation records. Developed and calibrated a geochemical model using Geochemist's Work Bench to simulate stockpile seepage quality and determined annual mass loading to groundwater from seepage emanating from leach and waste rock stockpiles. Compared seepage quality and mass loading results between existing stockpile configurations and a closure plan. Performed a sensitivity analysis of several model parameters.

Supplemental Materials Characterization Study, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Compiled and analyzed waste rock and leach ore stockpile material characterization results for paste pH, paste electrical conductivity, modified acid base accounting, meteoric water mobility procedure, mineralogy by x-ray diffraction, reflectance spectroscopy, and bulk composition by x-ray fluorescence. Compared supplemental information with results of previous studies. Compiled stockpile monitoring data with depth for temperature and oxygen/carbon dioxide concentrations. Investigated effects of stockpile weathering and leaching by examining material characteristic trends as a function of stockpile age.

Supplemental Groundwater Study, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Prepared completion report that included a description of monitor well installation activities, monitoring results, and updated conceptual models.

On-Site Staffing Support, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Responsible for management, reporting, and oversight of environmental compliance matters pertaining to ground and surface water as directed by the client. Prepared discharge permit quarterly and semiannual reports. Assisted mine staff with 404 permit and 401 certification issues. Performed additional environmental, administrative, oversight, or reporting duties, as needed.

Abatement Plan Proposal Addendum, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Participated in development and submission of Stage 1 Abatement Plan Proposal materials per New Mexico Environment Department regulations; provided responses to agency comments and assisted with determination and planning of additional field investigation activities.

Feasibility Study for Closure Alternatives, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Determined current water quality and pumping rates at existing interceptor systems and estimated future water quality and pumping rates at planned interceptor systems. Estimated leached and unleached stockpile seepage quality from available data.

Surface Impoundment Study Work Plan, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Prepared an updated and expanded work plan that provided a consistent approach to characterize and close existing surface impoundments not needed after mine closure.

Seepage Investigation Progress Reports, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Prepared progress reports summarizing field and monitoring activities conducted at a leach stockpile during the reporting period. Reviewed and analyzed data collected in perched seepage zones and regional aquifer. Provided recommendations to improve seepage collections systems.

New Mexico Regional Water Plan Updates, New Mexico Interstate Stream Commission, Santa Fe, New Mexico
Assisted in the analysis of current water supply and demand, and calculated the supply/demand gap for each of the 16 water planning regions, including under drought conditions. Prepared future water use projections for public water supply, self-supplied domestic and commercial, and reservoir evaporation water use categories.

Region O Water Plan, Llano Estacado Regional Water Planning Group and the High Plains Underground Water Conservation District, Texas
Assisted in preparation of a 50-year water supply plan to meet drought-of-record demands. Contacted municipalities and water suppliers for information regarding their water supply and demand, current and planned infrastructure, and conservation and drought management plans. Prepared chapter summarizing drought of record and current drought conditions, consolidated information on existing drought preparations, and provided recommendations for the region. Evaluated existing water supplies and identified potentially feasible water management strategies. Conducted detailed evaluation to select recommended and alternative water management strategies, including prioritization for funding purposes. Presented information at multiple water planning group meetings and public meeting. The final 2016 plan was adopted by the water planning group in November 2015, and accepted by the Texas Water Development Board in December 2015.

Taos 40-Year Water Plan, Town of Taos, New Mexico
Assisted in development of a 40-year water plan that included an analysis of the current water demand and calculation of future water demand projections. Compiled information on recent water meter and billing records and prepared water audit for years 2010 to 2013. Calculated the increase in water use during summer months and determined seasonal water use trends for each sector. Implemented the OSE GPCD calculator to calculate per capita use on a monthly basis and provided top water user analysis.

Santa Fe County 40-Year Water Development Plan, Santa Fe County, New Mexico
Compiled information on recent water meter and billing records and prepared water audit. Calculated the increase in water use during summer months and determined residential water use trends.

Deming 40-Year Water Plan, City of Deming, New Mexico
Assisted in development of the City of Deming's updated 40-year water plan. Evaluated water production, supply, and demand information. Assisted in development of a conservation plan and drought management. Prepared a summary of the local water supply and water quality, along with a description of their well field and recent water level trends for the area. Analyzed historic and current water use by customer class, and projected future water demand with and without conservation.

State Water Plan Development, New Mexico Interstate Stream Commission
Supported development of sections for the 2010 State Water Plan addressing statewide water supply, statewide water demand, regional water conservation strategies, climate variability and its impact on water supply, integration of planning efforts, water management strategies, and individual surface water basin summaries.

Regional Water Plan Integration, Various Locations, New Mexico
Compiled information from 16 regional water plans for their water supply inventories, water budgets, and estimated supply demand gap or surplus. Reviewed and compared methodologies used to estimate available water supply and future water demand. Compiled water rights information regarding type or category of use for surface water and groundwater.

Recharge Demonstration Project, Rio Rancho, New Mexico
Prepared project proposal and application materials for New Mexico Office of the State Engineer underground storage and recovery permit. Summarized available information on local geology, soils, and groundwater conditions and determined existing wells inside the estimated area of hydrologic effect from the demonstration project.

Brackish Water Assessment, Confidential Location
Compiled available information regarding brackish water resources including a discussion of local geology and major fresh groundwater resources. Identified potential aquifers for desalination and their connections to fresh water. Made recommendations for future study.

Eddy County 40-Year Water Plan, Eddy County, New Mexico
Compiled available information and prepared summaries of the individual water systems within the county including their infrastructure needs. Determined water columns and evaluated water conservation measures, source water and wellhead protection measures, and aquifer sustainability for the water systems.

Eagle Nest Reservoir Project, Colfax County, New Mexico
Managed operations of and releases from Eagle Nest Reservoir in compliance with New Mexico Office of the State Engineer permits and Court Decrees. Prepared accurate and complex spreadsheet models representing Eagle Nest Reservoir operations essential to provide a long-term solution based on local hydrology and help resolve the current and past litigation that has been ongoing for more than 20 years. Developed an open line of communication among the state agencies involved with Eagle Nest Reservoir and with the individual Permit 71 water users necessary to develop a long-term solution to current litigation.

Cimarron Basin Water Operations Review, Colfax County, New Mexico
Evaluated water administration in the Cimarron Basin in relation to senior direct flow rights and Eagle Nest Reservoir supply. Prepared accounting spreadsheets and assessed the long-term safe yield of the water supply. Learned the historic and current operation of the complex Eagle Nest Project where Active Water Management has been taking place for many years under the Cimarron Water Master.

Gila River Hydrologic Support, Southwest New Mexico Counties
Supported the Interstate Stream Commission Gila River Team regarding an additional 14,000 acre-feet of New Mexico water rights under the 2004 Arizona Water Settlement Act.

Regional Water Plan, Jemez y Sangre, New Mexico
Provided technical assistance in the development and revision of white papers discussing water planning alternatives.

Regional Water Plan, Socorro-Sierra Counties, New Mexico
Updated and addressed comments regarding regional water supply. Assessed quality of the surface water entering the planning region. Assisted in preparation of the regional water plan and alternative analysis.

Regional Water Plan, Southwest New Mexico Counties, New Mexico
Compiled information regarding regional water supply and demand, and assessed variability of instream flows within the planning region. Assisted in preparation of the region's water budget and the regional water plan.

Regional Water Plan, Mora-San Miguel-Guadalupe, New Mexico: Compiled information regarding regional water supply and demand. Assessed variability of instream flows within the planning region and assisted in preparation of the regional water plan and alternative analysis.

Regional Water Plan Phase II, Middle Rio Grande, New Mexico
Prepared a technical, physical, hydrological, and environmental evaluation of residential and commercial greywater use. Assisted with preparation of an assessment of regional water quality issues and impacts to the planning region's water supply.

Regional Water Plan, Colfax County, New Mexico: Updated and addressed comments regarding regional water supply and demand. Assessed variability of instream flows within the planning region. Assisted in the preparation of an agricultural water conservation plan and the final regional water plan.

Surface Water Flow Assessment, Ysleta del Sur Pueblo, Texas
Assessed variability of instream flows along the Rio Grande near El Paso, Texas. Determined locations and quantity of flow being diverted from the Rio Grande. Managed preparation of Ysleta del Sur Pueblo Archives Volume 6, Hydrologic Assessment.

40-Year Water Plan, Village of Angel Fire, New Mexico
Assisted with development of 40-year water plan. Gathered and synthesized information on groundwater supply wells, local hydrogeology, and stream flow. Assessed current and future availability of surface water and groundwater.

Main Pit Water Balance Study, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Provided technical support for a pit water balance study to determine the rate of groundwater inflow to the main pit at the Tyrone Mine. Conducted surface-water runoff computations and compared pit pumping records to evaluate the magnitude of groundwater inflow, as well as changes through time.

Assessment of Recent Organic Analyses, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Compiled and reviewed recent organic analytical results for required monitoring wells. Provided recommendation for modification of discharge plan during renewal process.

Total Maximum Daily Load Regulations, New Mexico Environment Department, Red River, New Mexico
Presented technical aspects of Total Maximum Daily Load (TMDL) development at public meetings held in Questa and Red River, New Mexico. Developed an instream flow and water balance model of the Red River watershed for spring, summer, and fall. Collected stream water samples for fluoride analysis to aid in geochemical modeling of aluminum. Determined measured loads and TMDLs for listed reaches in the watershed for metals (chronic and acute aluminum), turbidity, and stream bottom deposits.

Cost Recovery Litigation Support, Confidential Client
Performed various hydrologic and geochemical analyses to identify and delineate the different sources of contamination that have impacted groundwater.

Prediction of Impact, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Performed particle-tracking analyses to predict travel times and probable contaminant paths under current and post-mining conditions. Reviewed background and tailing pond water quality data. Developed a geochemical model to predict tailing pond seepage water quality impacts to regional aquifer.

Facility Seepage Study, Freeport McMoRan Tyrone, Inc., Tyrone, New Mexico
Determined approximate composition of stockpiles. Performed water balance for stockpiles and tailing ponds. Compiled input and output for a hydrogeochemical model used to predict seepage quality and mass loading.

Stockpile Seepage Study, Freeport McMoRan Chino, Inc., Chino Mine, Santa Rita, New Mexico
Performed water balance for stockpiles. Compiled input and output for a hydrogeochemical model used to predict seepage quality and mass loading.

Roswell Municipal Landfill, Roswell, New Mexico
Prepared annual groundwater reports on water quality submitted to the New Mexico Environment Department. Performed semiannual groundwater monitoring, including sampling for 20 NMAC 9.1 Section 1100 Table I parameters.

Plug-in Site Investigation, Superfund Site, Tucson Airport Authority, Arizona
Calculated radius of contamination and attenuation rate for various organic compounds present in soil gas. Results were used in soil gas-groundwater model.

Springer Auto and Cactus Corral Underground Storage Tank Sites, Springer, New Mexico
As site manager, performed quarterly sampling of groundwater monitor wells and prepared quarterly reports submitted to the New Mexico Environment Department.

Velarde Property Underground Storage Tank Site, Bernalillo, New Mexico
As site manager, performed quarterly sampling of groundwater monitor wells and prepared quarterly reports submitted to the New Mexico Environment Department.

Additional Professional Training

OSHA Hazardous Waste Operations and Emergency Response Supervisor Training (8-Hour), 2000

OSHA Hazardous Waste Operations and Emergency Response Training (40-Hour), 1999

OSHA Hazardous Waste Operations and Emergency Response Training Refresher (8-Hour), current

Mine Safety and Health Administration (MSHA) Annual Refresher (8-Hour), current

Reactive Transport Modeling in Geochemical Systems, 2014

Environmental Geochemistry of Ore Deposits and Mining Activities, 1999

Publications and Presentations

Earley, D., III, E.A. Salvas, and N. Blandford. 2008. Stockpile Characterization and Hydrogeochemical Seepage Modeling for Mine Closure. 2008 National Ground Water Association/U.S. Environmental Protection Agency Remediation of Abandoned Mine Lands Conference, October 2008.

Earley, D., III, D.A. Kidd, T. Shelley, I. Walder, and E.A. Salvas. 2003. Slope stability of leached copper stockpiles. Tailing and Mine Waste 2003. Presented at the Tailing and Mine Waste Conference, Vail, Colorado, October 2003.

Salvas, E.A. 2003. Technical and physical feasibility fact sheet, alternative 24: Reuse greywater. In Evaluation of Alternative Actions for Technical, Physical, Hydrological, Environmental, Economic, Social, Cultural, and Legal Feasibility and Water Quality Issues and Legal Overview. Prepared for the Mid-Region Council of Governments and the Middle Rio Grande Water Assembly, February 2003.

Earley, D., III, E.A. Salvas, M.D. Marcus, T.J. Ward, and B. Ryan. 2002. Development of an aluminum TMDL based on variable biological responses to natural and mining-related ARD impacts to Red River, New Mexico. U.S. Environmental Protection Agency Hard Rock Mining Conference, May 2002.

Parker, E.A., D. Earley, III, R.D. Marley, T.J. Ward, M.D. Marcus, and K. Calhoun. 2001. Development of a biological criterion-based TMDL for Red River, New Mexico. Presented at 53rd Annual Meeting, Rocky Mountain Section, Geological Society of America, May 1, 2001.

Earley, D., III, E.A. Parker, and K. Calhoun. 2001. GIS-facilitated, hydrogeochemical modeling for mine waste reclamations. Tailing and Mine Waste 2001. Balkema, Rotterdam, p. 273-282. Presented at the Tailing and Mine Waste Conference, Fort Collins, Colorado, January 2001.

Earley, D., III, and E.A. Parker. 1999. A hybrid probabilistic modeling approach for the assessment of seepage quality and quantity from sulfide-bearing mining wastes. Geological Society of America Abstracts with Programs, Vol. 31(7).

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NEW MEXICO ENVIRONMENT DEPARTMENT

IN THE MATTER OF:	)
AMAX RESOURCE CONSERVATION	)
COMPANY, A DIVISION OF AMAX, INC.,	)
and THE STATE OF NEW MEXICO,	)
	)
RESPONDENTS.	)

ADMINISTRATIVE ORDER ON CONSENT

ADMINISTRATIVE ORDER ON CONSENT

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ADMINISTRATIVE ORDER ON CONSENT

This Administrative Order on Consent ("Consent Order") is made and entered as of this 2nd day of December, 1992, by and between Amax Resource Conservation Company, a division of AMAX Inc., and the State of New Mexico (collectively "Respondents"); and the New Mexico Environment Department ("NMED"), an agency of the State of New Mexico.

I. **BACKGROUND/HISTORY.**

Amax Resource Conservation Company ("Amax") is a division of AMAX Inc., a New York corporation. Amax is the successor corporation to the American Metal Company Limited ("AMC"), a New York corporation.

In 1925, AMC and the Goodrich-Lockhart Company ("GLC"), formed a Delaware Corporation called the American Metal Company of New Mexico (AMCONM). AMCONM was held 51% by AMC, 48% by GLC and 1% by the Mining & Development Corporation.

From 1926 through 1939, AMCONM developed and operated a lead and zinc mine located approximately 16 miles north of the Village of Pecos at the confluence of Willow Creek and the Pecos River (the "Pecos Mine"), and a mill ("El Molino"), located about two miles northwest of the Village of Pecos which was used to mill the ore mined at the Pecos Mine .

In 1939 when the Mine and Mill were closed AMCONM transferred all its mineral rights and real property to Pecos Estates, Inc., a New Mexico corporation owned in substantially the same proportions

by the shareholders of AMCONM. Following this, AMCONM was dissolved in 1945.

On July 10, 1950 nominees of the New Mexico State Game Commission purchased all of the stock of Pecos Estates, Inc. After acquiring the stock of Pecos Estates, Inc., the nominees then transferred to the New Mexico State Game Commission all assets of Pecos Estates, Inc., including cash and real property but excluding mineral rights. Pecos Estates, Inc. was then dissolved. The New Mexico Department of Game and Fish ("NMDGF"), is the current owner of the land and of the mine and mill dumps that were transferred from Pecos Estates, Inc. prior to its dissolution.

Prior to the sale of the stock of Pecos Estates, Inc., a trust for the benefit of the then shareholders of Pecos Estates, Inc. was established naming Fred S. Norcross, Jr., Thomas G. Moore, and John Payne, Jr. as trustees and the mineral rights owned by Pecos Estates, Inc., were transferred to the trustees of the trust.

NMDGF and the New Mexico State Highway and Transportation Department ("NMSHTD"), are executive agencies of the New Mexico state government. Exclusive of the mineral rights held in trust, NMDGF is the current owner of the Pecos Mine , El Molino, and the Lisboa Springs fish hatchery located on Hwy. 63 approximately 3 miles north of the Village of Pecos.

At various times mine waste has been removed from the mine and mill areas for use as construction or maintenance material for roads, pads, campsites and the Lisboa Springs fish hatchery.

Beginning in 1985 and continuing to the present, NMED and its

predecessor agency, the Environmental Improvement Division of the former New Mexico Health and Environment Department, have been investigating the Site. NMED detected elevated metals in seeps from the mine waste, in mill tailings, in surface and ground waters, and in seeps from the waste rock pile. Further investigation needs to be conducted to determine whether these levels pose actual harm to human health or the environment. Some mine and mill wastes are high in sulfides, and pose a risk of acid rock drainage. NMED discovered that the waste rock contains lead at concentrations which may be harmful to human health and the environment. Further investigation needs to be conducted to determine whether these levels pose actual harm to human health or the environment. Respondents dispute these contentions.

II. JURISDICTION AND AUTHORITY.

NMED contends that it has jurisdiction and authority over the subject matter of this Consent Order pursuant to and including without limitation, the following statutes and regulations:

A. The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA),

B. The Federal Water Pollution Control Act a/k/a the Clean Water Act,

C. The Resource Conservation and Recovery Act,

D. The New Mexico Water Quality Act,

E. The New Mexico Water Quality Commission Regulations,

F. The New Mexico Hazardous Waste Act and regulations,

G. The New Mexico Solid Waste Act and regulations,

H. The New Mexico Department of Environment Act, and

I. The New Mexico statutory and common law of nuisance.

Respondents admit that NMED has authority to issue and enforce this Consent Order but deny NMED's authority to enforce the foregoing statutes and regulations, and further deny that these statutes and regulations have any application whatsoever against them for alleged acts or omissions, past or present, occurring or having occurred at the Pecos Mine , El Molino or the Lisboa Springs fish hatchery. By entering into this Consent Order, Respondents do not admit any liability to NMED or to each other relating to contamination on or emanating from the Site. Nothing contained in this Consent Order shall affect any right, claim, cause of action or defense of any party hereto with respect to others not parties to this agreement.

III. **PARTIES BOUND**.

A. This Consent Order applies to and is binding upon NMED and upon Respondents and their successors and assigns and the obligations hereunder shall run with the land. Any change in ownership or corporate status of Respondents including, but not limited to any transfer of assets or real or personal property, shall in no way alter Respondents' responsibilities under this Consent Order.

IV. **DEFINITIONS**.

A. Whenever terms listed below are used in this Consent Order or in the attachments incorporated herein by reference, the following definitions shall apply:

1. **Administrative Record** shall mean the compilation of documents related to this Consent Order separately kept and maintained by NMED as an official record of the obligations and performance of obligations under this Consent Order.

2. **Advisory Group** shall be composed of the Secretary or her designee, and a designee of each of the Respondents.

3. **Consent Order** shall mean this Order and all attachments , including without limitation, ATTACHMENT A (STATEMENT OF WORK), ATTACHMENT B (COST ALLOCATION AGREEMENT), ATTACHMENT C (NOTICE OF EQUITABLE SERVITUDE), and such other and further attachments as may later be incorporated by reference into this Consent Order pursuant to Section XII.E.

4. **Day** shall mean a calendar day unless expressly stated to be a working day.

5. **Mine Waste** shall include nonmineralized and low-grade mineralized waste rock removed either from above or adjacent to the ore body, wherever such material is presently found or has come to be located. The term "mine waste" includes tailings generated at the El Molino mill site wherever they are presently found or have come to be located.

6. **NMED** shall mean the New Mexico Environment Department and any successor department or agency of the State.

7. **Parties** shall mean NMED and the Respondents.

8. **Past and Future Response Costs** shall mean total costs NMED has incurred or incurs in overseeing this Consent Order, as set forth in section V. of the Cost Allocation Agreement ("CAA").

9. Project Manager(s) shall mean a qualified professional with appropriate experience to oversee the activities required by this Consent Order who is the principal person selected and retained by a Respondent to supervise and direct the implementation of the Respondent's Work under this Consent Order.

10. **Secretary** or **the Secretary** shall mean the Secretary of NMED or her successor in interest or title.

11. **Site** shall mean all of the following:

a. The mine site which shall mean:

(1) the mine and approximately 19 acres of waste rock dumps at the Pecos mine;

(2) 8 to 10 acres of wetlands at the base of the waste rock dumps;

(3) affected portions of Willow Creek located at the confluence of Willow Creek and the Pecos River.

b. The mill site which shall mean the El Molino Mill site and tailings dumps located in Los Alamitos Canyon.

c. Campgrounds which shall mean the Willow Creek, Terrero, Rio Mora, and Davis-Willow Campgrounds and the Burt Clancy Day Use Area.

d. Roads which shall mean State Highway 63 between Terrero and Cowles and any other roads for which mine waste from the Pecos Mine operation was used in construction or maintenance.

e. The Lisboa Springs Fish Hatchery which shall mean the fish hatchery located approximately two miles north of the village of Pecos, New Mexico.

f. Such other areas where mine waste or associated contaminants have been found or have come to be located.

12. **Statement of Work ("SOW")** shall mean Attachment A to this Consent Order when completed, and shall include without limitation, the statement of work for implementation of the Health and Environmental Risk Assessment, the Community Relations Plan, the Remedial Investigation, Feasibility Study (RI/FS), Remedial Design, Remedial Action (RD/RA), the Natural Resource Damage Assessment and when developed, the long-term Operation and Maintenance (O&M) Plan for the Site, and any modifications or amendments made in accordance with this Consent Order.

13. **Technical Group** shall be composed of a technical designee of the Secretary of NMED, a technical representative designated by each of the Respondents, and the Project Manager(s) or a designee of each of them.

14. **Work** shall mean all activities that Respondents are required to perform under this Consent Order, as described in the SOW.

15. **Working day** shall mean a day other than a Saturday, Sunday, or a Federal or State of New Mexico holiday.

16. **Other terms** not specifically defined herein, if defined in the Comprehensive Environmental Response, Compensation and Liability Act or regulations promulgated thereunder, shall be accorded their meaning under that Act. Terms not defined under CERCLA or in case law interpreting CERCLA, shall be accorded their usual and ordinary dictionary meaning or their common meaning in usage, applicable trade or profession.

V. PERFORMANCE OF THE WORK BY RESPONDENTS.

A. Objectives.

The objectives of the Parties in entering into this Consent Order are to protect public health, welfare and the environment by investigating and characterizing the Site and by designing and implementing appropriate response actions at the Site to be undertaken by the Respondents. The intent of this agreement is to develop a cooperative framework for the expedient resolution of a concern common to all parties. As such, the free and informal exchange of ideas, information and documents should be a governing principle.

B. Commitments by Respondents.

NMED has requested and Respondents have agreed, pursuant to the terms of this Consent Order, to the following:

1. Not later than December 18, 1992 NMED will provide the Respondents with a proposed SOW. Not later than January 15,

1993 Respondents and NMED will conclude discussions toward agreement upon a SOW for activities set forth in this Consent Order. Upon agreement, the SOW shall be attached to this Consent Order as Attachment "A", and incorporated by reference. Unless a SOW is agreed upon and incorporated herein by reference by January 20, 1993, this Consent Order shall automatically terminate and become null and void, unless extended by the Secretary in her sole discretion.

2. To the extent warranted, Respondents shall perform such work as is necessary to meet their obligations under this Consent Order, in accordance with the SOW and with the CAA, referenced in subsection 4., below, to contain and remediate contamination and restore or replace the natural resources at the Site.

3. To finance a health and environmental risk assessment (HERA), to be conducted by NMED or its designee, which will utilize those portions of prior assessments which meet EPA guidances (RAGGS) and standards for such assessments.

4. To execute a CAA for activities set forth in this Consent Order. The CAA shall be attached to this Consent Order as Attachment "B", and incorporated by reference.

5. Respondents understand and agree that unless funding for this Consent Order is subsequently authorized by the New Mexico Legislature this Consent Order shall automatically terminate and become null and void, unless extended by the Secretary in her sole discretion.

6. To reimburse NMED for past and future response costs associated with oversight of activities conducted under this Consent Order, as provided in the CAA.

C. **Project Manager(s)**. All aspects of the Work to be performed by Respondents, including Quality Assurance, Sampling and Data Analysis, pursuant to this Consent Order shall be under the direction and control of the Project Manager(s). Respondents shall provide a copy of this Consent Order to the Project Managers and shall condition all contracts entered into for the Work at the Site upon performance in conformity with the terms of this Consent Order.

1. **NMED Notification** - Within ten (10) days after execution of this Consent Order or within ten (10) days of selecting a Project Manager, whichever occurs earlier, Respondents shall notify NMED in writing of the name, title, and qualifications of the person proposed to be the Project Manager . If at any time any Respondent proposes to change a Project Manager, that Respondent shall give at least seven (7) days notice to NMED. Respondents shall identify to NMED the key supervisors for the Project Manager(s).

D. **Technical Group**.

Respondents and NMED shall establish a Technical Group to meet periodically and as necessary to review and discuss issues of a scientific and engineering nature concerning direction and implementation of the Work called for by this Consent Order, and as provided in Section IX.

E. **Advisory Group**.

Respondents and NMED shall establish an Advisory Group to meet as necessary to resolve disputes in accordance with Section IX.

F. Except with respect to Section IX. of this Consent Order, meetings of the Advisory and Technical Groups shall be considered informal working sessions, and statements made during such sessions by NMED or Respondents' personnel shall not be construed as representing official NMED or Respondents' policies unless confirmed in writing.

G. **Quality Assurance, Sampling, and Data Analysis**.

Respondents shall use quality assurance, quality control, and chain of custody procedures for all samples collected pursuant to this Consent Order. Respondents shall submit to NMED Quality Assurance Project Plans ("QAPPs") for NMED approval in accordance with the SOW. Respondents shall afford to NMED the opportunity to approve or disapprove in advance the laboratories proposed to be utilized for sampling and analysis.

1. **Samples** - Upon request, the Parties shall allow each other to take split or duplicate samples of any samples collected pursuant to this Consent Order. In order to facilitate such efforts, the Parties shall, to the maximum extent possible, provide at least seven (7) days advance notice of any sample collection dates that may differ from the dates set forth in the NMED-approved work plans that are established in accordance with the SOW. When it is not possible to provide the full 7-day notice, the Parties

agree to provide as much advance notice as possible, but in no event less than forty-eight (48) hours' oral notice prior to collection of samples, unless otherwise agreed. Samples required to be conducted immediately following rainfall or snowmelt events shall not be subject to this 48 hour provision. Respondents shall notify NMED immediately by telephone of their intention to conduct event-related sampling. When at least forty-eight hours advance notice of sampling is given, or the sampling is event-related, the party may proceed with the sampling and without being delayed by a party requesting to split samples. NMED shall have the right to request that Respondents perform, at Respondents' expense, reasonable analysis of blind, blank, spike, and/or duplicate samples to demonstrate the quality of the analytical data produced by laboratories utilized to implement the work requirements included in the SOW. NMED shall endeavor to sample in a reasonable manner and in accordance with sound scientific principles and methodologies.

H. **Additional work**. During the course of the Work NMED may determine or a Respondent may propose that sampling, analysis, reporting or other work in addition to work specifically set forth in the SOW is technically necessary and reasonable. If NMED so determines, it will advise Respondents in writing of the basis for the determination and the nature of the additional work. NMED's determination shall be subject to the dispute resolution provision of Section IX. Unless contested as provided in that section, Respondents shall undertake, perform, and complete all such

additional work in accordance with standards, specifications and schedules developed and agreed to by the Respondents and NMED, and embodied in an amendment to the SOW.

VI. **DOCUMENTS, INFORMATION AND REPORTING REQUIREMENTS.**

A. **Exchange of information.** In the spirit of this Consent Order, Respondents and NMED agree to cooperate fully in exchanging data and information. NMED and the Respondents agree to routinely exchange non-privileged technical data in their possession or developed pursuant to this Consent Order voluntarily or upon request. Respondents agree to freely and routinely communicate amongst themselves and with NMED to facilitate the orderly conduct of the Work. No such communications shall alter or waive any rights or obligations of the Respondents under this Consent Order. No guidance, suggestions or comments by NMED shall be construed as relieving Respondents of their obligation to obtain formal approval where such approval is required by this Consent Order. Respondents are encouraged to confer with NMED at any time prior to submission of any proposals, plans, studies, reports or other documents required by this Consent Order.

B. Respondents shall permit NMED, its contractors, designees and agents to inspect and copy all records, files, photographs, documents, and other writings, including all sampling and monitoring data, in any way pertaining to Work undertaken pursuant to this Consent Order, provided however, that Respondents expressly reserve their right to assert legal privilege as set

forth in section VI.C., below.

C. **Legal privileges**. Unless voluntarily waived as to a specific document or communication, the Parties expressly reserve the right to assert any and all legal privileges and nothing in this Consent Order shall be construed as a waiver by any party of any of these privileges. Respondents' work product expressly includes without limitation, all drafts of documents required to be submitted to NMED under the terms of this Consent Order.

D. **Reporting requirements**. Throughout the course of activities performed pursuant to this Consent Order, Respondents shall submit to NMED periodic written progress reports on not less than a quarterly basis. These progress reports shall include, at a minimum, the following:

1. a brief description of activities completed during the reporting period to implement the requirements of this Consent Order;

2. a brief description of activities scheduled for the following reporting period;

3. a description of personnel changes which occurred during the reporting period;

4. a description of problems encountered during the reporting period and mechanisms used or proposed for resolving the problems;

5. tables and figures summarizing all data, sampling, and test results for the period unless such information has already been submitted pursuant to the SOW.

Respondents shall furnish such progress reports to NMED as soon as possible and in no event later than the 15th day of the month following the quarter for which the report is due. The first progress report shall be due ninety (90) days after the execution

of this Consent Order.

E. **NMED Approval**. To the extent that written submissions of the Respondents require written approval or other action by NMED under this Consent Order, NMED shall reply to Respondents within the time frames specified in the SOW for reply to particular written submissions. NMED shall indicate to Respondents the specific basis for approval or disapproval, and shall suggest solutions or alternatives.

F. **Establishment of public documents repository**. NMED shall establish and maintain two public documents repositories. One shall be located at its offices in Santa Fe and a second shall be maintained at a suitable location in the Village of Pecos. The original of all documents required to be developed and submitted under this Consent Order shall be filed in Santa Fe, and a copy shall be filed in Pecos. All documents which are voluntarily submitted in connection with this Consent Order shall be filed in the same manner in both places. The repository maintained at NMED's office in Santa Fe shall constitute the Administrative record made in connection with this Consent Order. Documents maintained in both repositories shall be available for inspection and copying by the general public during usual business hours. Respondents shall provide to the person designated by NMED in Section XII.D., the original plus four (4) copies of all final documents required to be developed and submitted under this Consent Order. Draft, interim and other documents not in final form shall not be subject to the provisions of this section unless voluntarily

furnished to NMED.

VII. **COST REIMBURSEMENT**.

Cost reimbursement of NMED's past and future response costs shall be allocated and reimbursed to NMED in accordance with the CAA; attachment B to this Consent Order.

VIII. **SITE ACCESS**.

A. Respondents shall at all reasonable times afford NMED, its contractors, designees and agents, unrestricted access to the Site, with or without prior notice. Respondents shall, at all reasonable times, provide each other access to the Site and any other areas under their control upon which activities pursuant to this Consent Order occur.

B. NMED, its contractors, designees and agents shall abide by Respondents' safety requirements and procedures while at the Site.

C. In the event NMED desires that a Respondent or its designee be present during any site inspection, NMED shall request the Respondent's presence at least seventy-two (72) hours' in advance of the inspection. Upon such notice, Respondents shall provide an authorized representative to accompany NMED's employees or contractors while at the Site.

D. To the extent that access to property owned or controlled by persons other than Respondents is required to carry out the terms of this Consent Order, Respondents shall use their best

efforts to obtain from such persons access for themselves, their contractors and agents, and NMED, and its contractors, designees and agents. In the event that Respondents are unable to gain needed off-site access, and no on-site locations are suitable, NMED shall endeavor to assist Respondents, when requested to do so in writing, to gain access to such property, provided that such assistance is consistent with NMED's statutory authority. At a minimum, NMED shall encourage off-site property owners in writing to grant access to Respondents to accomplish the purposes of this Consent Order.

E. NMED shall assist Respondents in obtaining municipal, county, or other administrative approval for access when so requested in writing by Respondents, provided such assistance is consistent with NMED's statutory authority.

IX. RESOLUTION OF DISPUTES.

A. This section is intended to provide a mechanism for the expedited resolution of disputes which may from time to time arise under this Consent Order. Except where expressly referenced as an available dispute resolution mechanism in this Consent Order, this section shall not be invoked as a remedy for disputes arising from the obligations required to be performed hereunder, unless all parties agree in writing to submit the dispute to this section. When invoked, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes arising under or with respect to this Consent Order. Service of documents under

this section shall be in accordance with subsections XII.C. & D., below.

B. **Informal Resolution**. Any dispute subject to this section shall in the first instance be the subject of informal negotiations between the Parties to the dispute. The period for informal negotiations shall not exceed twenty (20) days from the time the dispute arises, unless an extension of time is requested in writing within the prescribed twenty-day time and agreed to by NMED. The dispute shall be considered to have arisen when one Party serves the other Parties with a written Notice of Dispute.

C. **Formal Dispute Resolution**.

1. **Invoking formal procedure** - In the event that the Parties cannot resolve a dispute by informal negotiations, then the disputing party may invoke the formal dispute resolution procedures of this Section by serving on the responding party and the Technical Group a written Statement of Position on the matter in dispute, including, but not limited to any factual data, analysis or opinion supporting that position and any supporting documentation relied upon by the disputing party.

2. **Responses** - Within fifteen (15) days after service of the disputing party's Statement of Position, the responding party shall serve on the disputing party and the Technical Group its Statement of Position, including but not limited to any factual data, analysis, or opinion supporting that position and all supporting documentation relied upon by the responding party.

3. **Technical Group Meeting** - Within fifteen (15) days

after service of the disputing party's and the responding party's Statements of Position, the Technical Group shall meet to resolve the dispute.

4. **Advisory Group Involvement** - If the dispute remains unresolved fifteen (15) days after such Technical Group meeting, the disputing party shall serve copies of all disputing partys' Statements of Position on the Advisory Group.

5. **Advisory Group Meeting** - Within fifteen (15) days after service of the Statements of Position from the disputing party, the Advisory Group shall meet to resolve the dispute.

6. **Final Decision** - If the dispute remains unresolved fifteen (15) days after such Advisory Group meeting, NMED shall issue a final decision, including a written statement of the reasons for its decision, and serve it on the disputing parties. This final decision shall be considered final action for purposes of this Consent Order. Final action by NMED shall be binding upon the disputing parties and unappealable unless the arbitration procedure set forth in subsection IX.D., below is timely invoked.

D. **Binding Arbitration** - A party may invoke binding arbitration from a final decision of NMED in accordance with the American Arbitration Association rules and procedures within fifteen (15) days of NMED's issuance of its final decision. The disputing parties shall share equally in the costs of such binding arbitration. The written decision of the arbitrator shall be final, unappealable, and binding upon the disputing parties.

E. **Time Frames** - Within the times for service set forth in

this section, the times may be extended by written agreement of all disputing parties and approved by NMED. Unless so extended, deadlines for service under this section shall be strictly construed.

1. Failure of a disputing or responding party to timely serve shall operate to waive any right to further dispute. The dispute in such event shall automatically be resolved against the party failing to timely serve. NMED, in its sole discretion and for good cause shown, may excuse untimely service, declare the dispute to be continuing and not automatically resolved under this subsection, and allow further process.

F. **Effect of disputes on performance obligations**. The disputing parties' performance obligation(s) under this Consent Order are not waived by invocation of this dispute resolution process. Such obligations may, in the discretion of the disputing party upon whom the obligation rests, be suspended until conclusion of the dispute resolution process. In the case of disputes amongst Respondents under this section, any increased costs resulting from such suspension shall be borne by the disputing Respondent against whom the dispute is resolved, either by final decision, or by default as set forth in subsection E.1., above. In the event that no disputing Respondent is designated as responsible for increased costs resulting from suspension, in a final decision issued pursuant to this section, then such increased costs shall be borne by the disputing Respondents in equal shares. To the fullest extent practicable, undisputed activities required under this

Consent Order shall continue as scheduled.

1. **Impairment of the Work.** If the suspension of disputed obligation(s) under this section would, in NMED's opinion, substantially impair or render expedient compliance with this Consent Order impossible, and no Respondent is willing to perform the obligation until the dispute is resolved, then NMED reserves the right to terminate this Consent Order or seek judicial enforcement pursuant to section X., below. Such election shall not be deemed a *force majeure* as defined in section XII.H., below.

X. **ENFORCEMENT.**

The Parties agree that this Consent Order shall be enforceable by the filing of a civil action solely in the District Court for Santa Fe County. In the event of such civil action, the Parties agree that such court has jurisdiction over the subject matter of this Consent Order and the Parties hereto waive their right to challenge jurisdiction or venue either in the District Court for Santa Fe County or in any other forum.

XI. **TERMINATION.**

A. Respondents shall be jointly and severally liable for satisfactory completion of the Work required to be performed under this Consent Order at the Pecos mine and El Molino Mill operable units as defined in the SOW. This Consent Order shall only terminate upon written notice from the Secretary of NMED that all of the terms of this Consent Order have been satisfactorily

completed. For purposes of this section, "satisfactory completion" shall mean at a minimum that the Site or an operable unit thereof has been, in NMED's estimation, fully remediated and stabilized in accordance with the SOW, and that NMED has approved the Respondents' plan for long-term operation and maintenance of the Site or the operable unit. Such notice shall not be unreasonably withheld by NMED.

B. Respondents may apply for termination of this Consent Order by serving the Secretary with a Notification of Completion. NMED shall evaluate the notification of completion and, within ninety (90) days after service, shall provide a written response indicating its acceptance, rejection or partial acceptance or rejection, and setting forth the reasons for the response. No notification of completion may be served by any Respondent prior to satisfactory completion as defined above, and prior to the submission of a plan for long-term operation and maintenance at the Site which is satisfactory to NMED and agreed upon by all Respondents.

C. The Secretary's determination of satisfactory completion of this Consent Order shall operate to forever bar NMED's initiation or pursuit of any claims or actions which could otherwise be asserted under state law, judicial, administrative, or otherwise against Respondents arising out of the subject matter of this Consent Order. A copy of the Secretary's notice of satisfactory completion shall be sufficient evidence to lift the equitable servitude on the property described in Attachment C to

this Consent Order, in accordance with Section XII.G. of this Consent Order.

D. In addition to specific grounds for termination set forth elsewhere in this Consent Order, the Secretary reserves the right to terminate this Consent Order at any time by serving written notice of termination upon the Respondents, if at any time she determines that the objectives of the Consent Order are not being satisfactorily met, are not being met in accordance with the terms or spirit of this Consent Order, or have been substantially impaired or impeded by the actions or inactions of Respondents or others, whether foreseeable or unforeseeable, including without limitation, actions or inactions which constitute *force majeure* under this Consent Order.

XII. GENERAL PROVISIONS.

A. Compliance With Applicable Law.

All activities required by this Consent Order shall be undertaken in compliance with the requirements of all applicable federal, state, and local laws, regulations, and ordinances. Nothing in this Consent Order shall be construed as relieving Respondents of any liability under, or obligation to comply with, applicable laws. NMED specifically retains the right to conduct other environmental studies, investigations, monitoring, or emergency activities at the Site and Site vicinity and to enforce all laws, statutes and regulations NMED is authorized to enforce.

1. **Permits** - This Consent Order is not, and shall not

be construed to be, a permit issued pursuant to any federal or state statute or regulation. Where any portion of the Work requires a federal or state permit or approval, Respondents shall submit timely and complete applications and take all other actions necessary to obtain all such permits or approvals. Respondents agree to act with due diligence and in good faith in seeking all legal permissions and permits which may from time to time be required in order to comply with this Consent Order.

2. Respondents may only seek relief under the provisions of Section XII.H. of this Consent Order for any delay in the performance of the Work resulting from a failure to obtain, or delay in obtaining, any permit required for the Work, so long as Respondents have timely complied with all applicable permitting requirements.

3. NMED shall endeavor to provide Respondents with assistance in obtaining permits, releases, or other types of permission or authorization from governmental agencies and political subdivisions. At a minimum, NMED shall provide a formal statement that the work for which a permit or other type of permission is sought, is required for compliance with the terms of this Consent Order.

B. **Good Faith Performance**.

The Parties agree that they will act reasonably and in good faith at all times to accomplish the objectives of this Consent Order. NMED and Respondents agree to perform all evaluations and actions required by this Consent Order using sound

scientific judgment. If at any time while this Consent Order is in effect NMED determines that material facts or data have been intentionally misrepresented, or that misleading or intentionally erroneous data have been submitted, then NMED may terminate this Consent Order, or pursue any other lawful remedies, or both.

C. **Computation of time**.

In computing any period of time prescribed in this Consent Order, the day of the act, event, requirement or default from which the designated period of time begins to run shall not be included. The last day of the period so computed shall be included, unless it is a Saturday, Sunday or federal or State of New Mexico holiday, in which event the period runs until the end of the next day which is not a Saturday, Sunday or holiday. Whenever this Consent Order requires that an act or proceeding be done or commenced within a prescribed period after service, and service is made by mailing as set forth in subsection XII.D., below, three (3) days shall be added to the prescribed period.

D. **Service**.

Whenever the terms of this Consent Order require service of documents, such service shall be by mail or hand-delivery to the individuals at the addresses below, unless those individuals or their successors give notice in writing to the other Parties of a change in designated recipient or address. Service required under this Consent Order shall be deemed perfected upon mailing or upon hand-delivery to a designated recipient at the designated address, or their secretary or other person in charge of their office.

For NMED:
STEVE CARY, Chief
NMED Ground Water Protection
and Remediation Bureau
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502
(505) 827-2919

and

Virginia Jackson, Records Custodian
NMED Office of General Counsel
1190 St. Francis Drive
P. O. Box 26110
Santa Fe, NM 87502
(505)827-2990

For AMAX:
KEN PAULSEN, Vice President
AMAX Resource Conservation Co.
1626 Cole Boulevard
Golden, Co. 80401-3293
(303) 234-9020

For N.M. Game and Fish Dept.:

BOB JENKS
Assistant Division Chief
HEL Division
Post Office Box 25112
Santa Fe, New Mexico 87504
827-7911

For N.M. Highway Dept:

BOB RINGER
Legal Services Engineer
Office of General Counsel
Post Office Box 1149
Santa Fe, New Mexico 87504-1149
827-5431

E. **Amendments**. This Consent Order may be amended only by mutual agreement of the Parties. Such amendments shall be in writing, signed by Respondents and the Secretary of NMED, shall become effective upon execution by all Parties, and shall be incorporated into this Consent Order by reference as additional attachments.

F. **Transfer of property**. The requirements of this Consent Order shall run with the land and shall be disclosed to any

successors in interest or title. No conveyance of title, easement or other interest in the Site shall operate to relieve Respondents of their obligations under this Consent Order. At least ninety (90) days prior to any conveyance, the conveying Respondent shall notify NMED of its intentions. Prior to any conveyance, the Respondent shall make and disclose to NMED financial and other arrangements satisfactory to assure uninterrupted work by the Project Manager under this Consent Order.

G. **Notice of equitable servitude**. Within fifteen (15) days of the effective date of this Consent Order, appropriate Respondents shall record a Notice of Equitable Servitude, in the form attached hereto as Attachment C, in the appropriate registry of deeds for San Miguel County, New Mexico, that Respondents and subsequent property owners are subject to continuing terms of this Consent Order. Respondents shall promptly provide NMED with a copy of the notice so recorded. Respondents may file a second notice signed by NMED in the appropriate registry of deeds for San Miguel County, New Mexico evidencing Respondents's satisfaction of the terms of this Consent Order upon termination pursuant to Section XI.

H. ***Force Majeure***. The Parties shall perform the requirements of this Consent Order within the time limits set forth herein, unless performance is prevented or delayed by events which constitute a *force majeure*. A *force majeure* is defined as any event arising from causes not foreseeable and beyond the control of a Respondent which could not be overcome by due diligence and which

delays or prevents performance by a date required by this Consent Order. Such events do not include unanticipated or increased costs of performance, changed economic circumstances, additional work required by NMED pursuant to section V.H. of this Consent Order, or enforcement action brought by NMED against a Respondent, whether related to this Consent Order or not.

The Respondent claiming *force majeure* shall give prompt oral notification to the other Respondents pursuant to Section XII.D. within forty-eight (48) hours after the claiming Respondent becomes aware of an event which constitutes a *force majeure*, and shall serve written notice on all parties within seven (7) days after such oral notification. The written notice shall contain an estimate of the anticipated length of delay, a description of the cause of delay, a plan for implementing measures to correct the problem and avoid such delays in the future, and an estimated schedule for implementation of these measures. The claiming Respondent shall adopt all reasonable measures to avoid and minimize the delay. Failure to comply with the notice or service provisions of this Section shall constitute a waiver of the claiming Respondent's right to assert *force majeure* as a defense to violating this Consent Order.

If the suspension of obligation(s) under this section would, in NMED's opinion, render compliance with this Consent Order impossible or impracticable, NMED reserves the right to terminate this Consent Order or to seek judicial enforcement, or both.

I. **Covenant Not to Sue**. The parties agree that as long as

Respondents remain in compliance with its terms and conditions, this Consent Order shall be the parties' exclusive remedy for contamination at the Site or for actions required to be performed under this Consent Order, for so long as this Consent Order remains in effect. The parties agree not to initiate, pursue, or participate in any other relief, civil or administrative, not expressly reserved herein which might otherwise be available under New Mexico and federal law, including without limitation the right to seek and recover damages or penalties against Respondents, their successors, assigns and employees for contamination at the Site or for actions required to be performed under this Consent Order. NMED expressly reserves the right to pursue civil or administrative relief for future violations of state or federal law by the Respondents.

J. **Severability**.

The provisions of this Order are severable. If any provision of this Consent Order is declared by a court of law to be invalid or unenforceable, all other provisions of this Order shall remain in full force and effect, unless NMED determines that the objectives of this Consent Order are substantially impaired by the court's ruling. In that event, NMED may terminate this Consent Order in accordance with the provisions of section XI.E., above.

K. **Merger**.

This Consent Order contains all the terms of the settlement agreement between the Parties, there being no oral agreements not contained herein.

L. **Effective Date.**

This Consent Order is effective on the day on which the Secretary executes this document.

M. **Authority of Signatory.**

The persons executing this Consent Order represent that they have the requisite authority to bind AMAX Incorporated, a New York Corporation, the State of New Mexico, the New Mexico Department of Game and Fish, the New Mexico Highway and Transportation Department, and the New Mexico Environment Department, to the terms of this Consent Order, and further agree that this representation shall be legally sufficient evidence of actual or apparent authority to bind this corporation, the State of New Mexico, and these agencies of the state of New Mexico, to all of the terms and conditions of this Consent Order.

FOUR DUPLICATE ORIGINALS EXECUTED this 2nd day of December, 1992.

JUDITH M. ESPINOSA, Secretary

STATE OF NEW MEXICO)
) ss.
COUNTY OF Santa Fe)

On December 2, 1992, before me, the undersigned, a Notary Public in and for said County and State, personally appeared Judith M. Espinosa, a person known to me (or proved to me on the basis of satisfactory evidence) to be the person whose name is subscribed to the within instrument, and acknowledged to me that she executed the foregoing instrument.

WITNESS my hand and official seal.

NOTARY PUBLIC

My Commission Expires:
June 19, 1995

APPROVED:

James H. Koch, New Mexico Natural Resource Damage Trustee and designee of the Honorable Bruce King, Governor

STATE OF NEW MEXICO)
) ss.
COUNTY OF Santa Fe)

On December 2, 1992, before me, the undersigned, a Notary Public in and for said County and State, personally appeared Mr. Jamie Koch, a person known to me (or proved to me on the basis of satisfactory evidence) to be the person whose name is subscribed to the within instrument, and acknowledged to me that he executed the foregoing instrument.

WITNESS my hand and official seal.

NOTARY PUBLIC

My Commission Expires:
June 19, 1995

APPROVED:

Ken Paulsen, Vice President, Amax
Resource Conservation Company,
on behalf of AMAX Inc.

STATE OF New Mexico)
) ss.
COUNTY OF Santa Fe)

On December 2, 1992, before me, the undersigned, a Notary Public in and for said County and State, personally appeared Mr. Ken Paulsen, a person known to me (or proved to me on the basis of satisfactory evidence) to be the person whose name is subscribed to the within instrument, and acknowledged to me that he executed the foregoing instrument.

WITNESS my hand and official seal.

Molly G. Chavez
NOTARY PUBLIC

My Commission Expires:
June 19, 1995

APPROVED:

Bill Montoya, Director
on behalf of the New Mexico
Department of Game and Fish

STATE OF New Mexico)
) ss.
COUNTY OF Santa Fe)

On December 2, 1992, before me, the undersigned, a Notary Public in and for said County and State, personally appeared Mr. Bill Montoya, a person known to me (or proved to me on the basis of satisfactory evidence) to be the person whose name is subscribed to the within instrument, and acknowledged to me that he executed the foregoing instrument.

WITNESS my hand and official seal.

Molly G. Chavez
NOTARY PUBLIC

My Commission Expires:
June 19, 1995

APPROVED:

Louis Medrano, Secretary
on behalf of the New Mexico
Highway and Transportation Department

STATE OF New Mexico)
) ss.
COUNTY OF Santa Fe)

On December 2, 1992, before me, the undersigned, a Notary Public in and for said County and State, personally appeared Mr. Louis Medrano, a person known to me (or proved to me on the basis of satisfactory evidence) to be the person whose name is subscribed to the within instrument, and acknowledged to me that he executed the foregoing instrument.

WITNESS my hand and official seal.

NOTARY PUBLIC

My Commission Expires:
June 19, 1995

Exhibits G – K
Appendix to petition

LONG-TERM OPERATION AND MAINTENANCE PLAN
PECOS MINE OPERABLE UNIT – TERERRO, NEW MEXICO

Report Date:
April 12, 2018

Prepared for:
Cyprus Amax Minerals Company
Phoenix, Arizona

Prepared by:
Savci Environmental Technologies, LLC
Mesa, Arizona

In Association with:
Daniel B. Stephens & Associates, Inc.
Albuquerque, New Mexico

EXHIBIT
L

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ABBREVIATIONS

3H:1V	3-feet-horizontal to 1-foot-vertical
AMC	American Metals Company
AOC	Administrative Order on Consent
BMPs	best management practices
CAMC	Cyprus Amax Minerals Corporation
CMP	Compliance Monitoring Plan
DBS&A	Daniel B. Stephens & Associates, Inc.
DD	Decision Document
EMOU	El Molino Mill Operable Unit
EMP	Environmental Monitoring Plan
EPA	Environmental Protection Agency
GCL	geocomposite clay liner
LFH	Lisboa Springs Fish Hatchery
LTOMP	Long-Term Operation and Maintenance Plan
MRWC	Main Waste Rock Cap
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environment Department
NMSHTD	New Mexico State Highway Transportation Department
NPL	National Priorities List
MOU	Memorandum of Understanding
O&M	operation and maintenance
OU	Operable Unit
PMOU	Pecos Mine Operable Unit
RA	remedial action
RACC	remedial action cleanup criteria
RACR	Remedial Action Completion Report
RD	Remedial Design Report
RI	Remedial Investigation Report
S.E.T.	Savci Environmental Technologies, LLC
SH63	State Highway 63
USD	upgradient surface drainage

1. INTRODUCTION

On behalf of Cyprus Amax Minerals Corporation (CAMC), Savci Environmental Technologies, LLC (S.E.T.), in association with Daniel B. Stephens & Associates, Inc. (DBS&A), has prepared this Long-Term Operation and Maintenance Plan (LTOMP) for the Pecos Mine Operable Unit (PMOU). This LTOMP documents the necessary procedures for inspection, maintenance and associated corrections/repairs, and monitoring for post-remedial action (RA) long-term care and maintenance at PMOU. This LTOMP was developed in accordance with the New Mexico Environment Department's (NMED's) 1998 'Final Decision Document' ([DD], NMED 1998) for the PMOU. The DD required that post-RA short-term operation and maintenance (O&M) and long-term care and maintenance be performed to ensure that the remedy performed in accordance with the DD requirements. The DD also specifies that short term O&M be performed by Respondent CAMC to cover the period required to meet all remedial action cleanup criteria (RACC) requirements, and that long-term care, maintenance, and monitoring be performed by the New Mexico Department of Game and Fish (NMDGF) or its successor (hereinafter "Operator") as property owners and co-Respondents. This LTOMP is developed to fulfill the DD's Selected Remedy Component Item 18, excerpted below:

> *"Develop a long-term operation and maintenance plan for NMED approval. The plan shall be implemented upon meeting compliance criteria; implementation shall be the responsibility of NMDGF, and shall be subject to review and possibly modification by NMED every five years."*

NMED entered into an Administrative Order on Consent (AOC) on December 2, 1992 with three Respondents: Amax Resource Conservation Company (predecessor to CAMC), NMDGF, and the New Mexico State Highway and Transportation Department (NMSHTD). The AOC required the Respondents to perform site investigations and, as necessary, remedial actions at five operable units (OUs) within the Upper Pecos Site: the PMOU, the El Molino Mill OU (EMOU), the State Recreation Use Areas OU, the State Highway 63 (SH63) OU, and the Lisboa Springs Fish Hatchery (LFH) OU. The U.S. Environmental Protection Agency (EPA) deferred listing the Upper Pecos Site on the National Priorities List (NPL), allowing the State of New Mexico to be the regulatory agency responsible for oversight of the investigations and remedial actions at each of

the OUs. EPA participated in this process through a Memorandum of Understanding (MOU) executed with NMED.

As required in the AOC, NMED issued the DD, which defined the PMOU remediation and restoration requirements. CAMC was the lead Respondent for the PMOU RA, which was performed from August 1999 through October 2003. A detailed description of the PMOU RA is outlined in the Remedial Design Report ([RD], Schafer and Associates, Inc. [Schafer] 1999) and subsequently in the 'Remedial Action Completion Report' [(RACR), EMC^2 2005a]. The as-built RA construction drawings are provided in Appendix A for reference.

Upon completion of the RA, and in accordance with the DD's Selected Remedy Component Item 16, CAMC was responsible for short-term operations, monitoring, and maintenance until the requirements of the AOC were met. CAMC developed and implemented compliance monitoring programs described below to assess the effectiveness of the remedy.

- Monthly operations and maintenance inspections, repairs, and associated corrective actions were performed post-RA beginning in 2003 through 2017 as part of the PMOU Stormwater Pollution Prevention Plan and to monitor and perform site repairs. Monthly inspections and any necessary repairs will continue in 2018.

- Environmental monitoring was conducted to assess erosion control, revegetation success, wildlife use, and visual appearance used to evaluate the effectiveness of the RA. Environmental monitoring was performed from 2004 through 2016 in accordance with the 2005 'Draft Environmental Monitoring Plan' ([EMP], EMC^2 2005b), later finalized in 2015 (WestLand Resources Inc. [WRI] and Copper Environmental Consulting [CEC] 2015). Completion of the short-term environmental monitoring has been achieved (NMED 2017).

- Water quality monitoring for groundwater and surface water was conducted to demonstrate compliance with applicable New Mexico Water Quality Control Commission standards. Water quality monitoring was performed pre-RA beginning in 1993 and post-RA from 2004 through 2017 in accordance with the 2007 'Compliance Monitoring Plan' ([CMP], DBS&A 2007) and NMED's approval of three subsequent requests to remove some sampling locations and constituents and reduce sampling frequency (NMED 2010, 2013, and 2016).

A summary of the inspections, corrective actions, monitoring and associated analytical results generated as part of the compliance monitoring programs were provided by CAMC to NMED and NMDGF annually via annual summary reports. Although CAMC was the lead Respondent for those activities, the State of New Mexico was responsible for 20 percent of the costs.

1.1 Site Background and History

The Pecos Mine, also known as the Tererro Mine, was an inactive polymetallic zinc-lead mine located approximately 15 miles north of the village of Pecos, San Miguel County, New Mexico. The first mineral discovery at the Pecos Mine dates back to 1882, and in 1883 small scale mining operations began for copper extraction. The mine was operated intermittently through 1925. The first major mining operation was started by the American Metals Company of New Mexico (AMC) in 1925, with lead and zinc as primary production metals and copper, gold, and silver as secondary recovery metals. The mined ore was transferred 12 miles by aerial tramway to the El Molino Mill near the Village of Pecos. The mine and mill operated until 1939.

In 1939, AMC transferred its mineral rights and real properties to Pecos Estates, Inc. In 1950 the New Mexico State Game Commission purchased all of the stock and assets, excluding the mineral rights, of Pecos Estates, Inc. NMDGF is the current land owner. A small portion of the land, approximately 8.174 acres along the southeastern portion adjacent to the Main Waste Rock pile, was originally owned by the U.S. Forest Service (USFS) and was transferred via a quitclaim to the NMDGF in 1994 (EMC^2 2005a [Appendix C-1]).

The primary PMOU area features included approximately 12.3 acres of exposed waste rock piles, impacted soils in areas adjacent to the waste rock piles, perennial Willow Creek and its floodplain, approximately 10 acres of wetland area at the confluence of Willow Creek and the Pecos River, and the Pecos River adjacent to and below the mine. Detailed discussion of site physical features and fate and transport of contaminants can be found in the Remedial Investigation Report ([RI], Stoller 1997).

2. MONITORING AND MAINTENANCE COMPONENTS

The LTOMP includes inspection and maintenance components and activities as follows:

- Integrity of site access control measures
- Integrity of stormwater management and erosion prevention installations
- Integrity of surface water drainage and subsurface water interception structures
- Integrity of the cover system and geotechnical stability of the Main Waste Rock Cap (MWRC) slopes
- Stability of stream restoration structures of Willow Creek and the wetland areas
- Revegetation on the MWRC, disturbed areas outside the MWRC (including borrow areas), streambanks, and the wetlands
- Groundwater monitoring

This LTOMP describes the operation of each PMOU component and activity listed above and outlines maintenance procedures and requirements of the Operator for identifying and correcting problems observed during inspections. Inspections will help reduce potential for long-term, costly maintenance requirements; example inspection forms are provided in Appendix B. The LTOMP may require periodic revisions to incorporate unanticipated events or problems, or to remove monitoring and maintenance components and activities if they are no longer needed. This LTOMP cannot describe all possible operational or maintenance events. In the event that unforeseen or unanticipated conditions occur that require further guidance, outside consultation should be obtained.

2.1 Site Access Control

The purpose of site access control is to control access to reclaimed areas of the site in order to prevent human and vehicle traffic and resulting damage. Site access control consists of three- and four-strand barbed wire fencing, smooth wire fencing, and large boulders. For a summary of all site access control locations, see Figure 1. Site access operation problems that may be encountered include damage to fencing and/or movement or removal of boulders.

Site access control shall be monitored by the Operator through inspection of existing site fencing and boulder placement areas for evidence of damaged fencing, cut wire,

damaged fence posts, damaged or moved boulders, and/or additional areas of access and damage. The Operator shall promptly repair damage observed during the inspection.

2.2 Mine Adit Closures

In November 2004, two bat gates and one cement-grouted rock backfill were installed at three adits discovered north of the Willow Creek floodplain. Mine adit closure locations are provided on Figure 1. Mine adit closure problems that may be encountered include damage to the bat gates, trash, and/or movement or removal of grouted rocks.

Mine adit closures shall be monitored through inspection of existing mine adit closure areas for evidence of damaged bat gates, damaged or removed rock backfill, and/or additional areas of access and damage. The Operator shall promptly repair damage observed during the inspection.

2.3 Surface Water Drainage and Subsurface Water Interception

The purpose of surface water drainage and subsurface water interception is to capture and divert all upgradient surface/subsurface water run-on around the MWRC area. Surface water channels help reduce long-term O&M of the soil cover system by preventing upgradient watershed surface water from flowing across the MWRC area. Gabions, reno mattresses and riprap-lined dissipater aprons are used in certain areas (Figure 1) for dissipating and transitioning concentrated surface water flow from the channels into existing natural drainages downgradient of the MWRC.

The upgradient surface drainage channel (USD Channel) and subsurface water drainage system (Underdrain) are designed to capture and convey upgradient surface/ subsurface water around the MWRC. The Underdrain extends to a maximum depth of 30 feet below the USD Channel, with eventual discharge to the Willow Creek Channel. The USD Channel is lined with an impermeable liner material and keyed to the MWRC. Midslope drainage channels are designed to capture and convey surface water flow from the MWRC to the North, Central, or South Perimeter Drainage Channels. Once diverted, surface/subsurface water is deposited into natural drainage channels (i.e., Willow Creek and the SH63 ditch), with eventual discharge into the Pecos River. All surface water channels (i.e., USD Channel, North and South Midslope/Perimeter

Channels, and Central Perimeter Channel), Underdrain, and transition dissipaters are designed to convey the 100-year, 24-hour storm event with peak flow equal to 3.8 inches (Amax 1992). Table 1 identifies the as-built parameters for each of the surface water drainage systems. For detailed surface/subsurface water drainage structure design components refer to the RACR. The as-built RA construction drawings are provided in Appendix A for reference.

Surface water drainage operation problems that may be encountered include the following:

- Sedimentation of surface water channels
- Shrub, brush, or trees in the channels
- Shifting or displacement of rock riprap
- Formation of sink holes or other depressions
- Evidence of channel overflow due to insufficient channel capacity
- Damage to gabions/reno mattresses
- Excessive sedimentation of sediment ponds/traps

Subsurface water drainage operation problems may include clogging, resulting in sink holes or ponded water or other damage to the USD Channel that may indicate possible Underdrain failure or damage.

Surface water drainage and subsurface water interception shall be monitored by the Operator through inspection of existing site surface water/subsurface water interception systems (i.e., USD Channel, midslope/perimeter drainage channels, and Underdrain) for evidence of stressed or inadequate vegetation (midslope channels), excessive erosion or siltation, and built-up sediment or miscellaneous debris and/or shrub, brush, or trees. Such built-up materials will be removed as needed, and repair of any depressions and placement of additional riprap will be performed by the Operator as needed to maintain the design flows. Lined channels shall be examined for any areas of exposed liner and for any deterioration, tears, or punctures, and will be repaired and recovered by the Operator as needed to form the original design section. In the event of a wildfire that destroys vegetation on, adjacent to, or upgradient from the PMOU, the Operator shall take preventive measures to address the potential for excessive erosion and damage to the surface water drainage systems.

2.4 Cover System and Geotechnical Stability

The purpose of the cover system and geotechnical stability is to ensure the long-term success and stability of the MWRC and surrounding areas' slopes. The MWRC consists of the following components: a 2-foot vegetative cover soil to minimize erosion and promote evapotranspiration, drainage netting in flat areas to promote lateral drainage, geocomposite clay liner (GCL) to serve as the primary infiltration barrier, and a maximum 6-inch GCL bedding soil layer to protect damage to the GCL from underlying waste rock. The purpose of the MWRC is to provide a barrier minimizing exposure to impacted materials and to support growth of vegetation to reduce infiltration into the impacted materials, thus minimizing the potential for impacts to the groundwater system. The MWRC was constructed with an overall slope of 3 feet horizontal to 1 foot vertical (3H:1V) (2H:1V along the northern toe to tie in to natural terrain); therefore, proper geotechnical stability is essential to maintain the MWRC integrity, ensure the designed function of the MWRC system, and enable long-term remedial success. For detailed geotechnical stability design components refer to the RACR. The as-built RA construction drawings are provided in Appendix A for reference.

Cover soil integrity operational problems include soil erosion and degradation such as rutting, depressions, rills, and/or gullies. Geotechnical stability operation problems that may be encountered include cover soil sloughing, lateral or radial failure of slope areas, surface cracking, slope-toe bulging, or other shifting of the MWRC and surrounding slopes that may indicate cover soil movement and instability.

Cover soil integrity and geotechnical stability shall be monitored by the Operator through visual inspection for evidence of cover soil instability including sloughing, depressions, erosion, exposure of impacted materials, cover soil slippage, and tension cracking. Geotechnical stability maintenance shall include evaluation of cover soil performance, Operator repair or restoration of any failed slope areas, and the Operator's implementation of other corrective actions as needed to maintain geotechnical integrity.

2.5 Willow Creek Restoration

The purpose of the reconstructed Willow Creek and associated floodplain is to convey surface water flow from the upstream segment of Willow Creek and the USD and North Perimeter Drainage Channels to the PMOU wetlands for ultimate discharge to the

Pecos River. The purposes of Willow Creek associated structures are to provide a controlled elevation drop for the reconstructed Willow Creek, to create a barrier to upstream fish passage, and to provide step pools and other natural stream characteristics for enhanced fish habitat within the creek.

Approximately 890 feet of Willow Creek were reconstructed to follow the natural channel alignment along the northern border of the PMOU. A gabion drop structure (i.e., fish barrier) was constructed in the upstream section of the reconstructed channel. Five additional cross-valley grade control structures, each consisting of a 2-foot-deep layer of large rock embedded in the stream bottom and extending laterally across the flood prone area, were constructed within the reconstructed creek at points of significant grade change. Two gabion/riprap drop structures were constructed along the eastern edge of the reconstructed Willow Creek to convey surface water flow from the USD Channel and North Perimeter Drainage Channel. A riprap dissipater apron was constructed at the outlet of the reconstructed creek to convey flow under SH63 via culverts into the PMOU wetlands. Wire fencing was placed along the western, eastern, and southern boundaries of the floodplain to prevent access. For detailed reconstructed Willow Creek and associated structures and floodplain design components refer the RACR. The as-built RA construction drawings are provided in Appendix A for reference.

Reconstructed Willow Creek, associated structures, and floodplain problems that may be encountered include erosion, piping or damage due to water, damage, shifting or displacement of the reconstructed fabric banks, grade control structures and rock riprap, sedimentation of drop structures and riprap that may impede water flow, and damage or vandalism to other associated Willow Creek structures.

Reconstructed Willow Creek, associated structures, and floodplain shall be monitored by the Operator through visual inspection of all reconstructed Willow Creek, associated structures, and floodplain features. Willow Creek structure maintenance may include Operator repair of any damaged or depressed structures, repair/replacement of any damaged fencing, and any other miscellaneous actions required.

2.6 Revegetation

The purpose of revegetation is to establish a self-sustaining plant community at areas throughout the site including the MWRC, waste rock and impacted soils removal areas,

the Willow Creek corridor, disturbed wetlands areas, and borrow areas. Successful revegetation aids in slope stability and the reduction of MWRC infiltration through increased evapotranspiration, and minimizes erosion. For detailed revegetation design components refer to the RACR. The as-built RA construction drawings are provided in Appendix A for reference.

Revegetation operation problems that may be encountered include barren areas or other signs of stressed or failed vegetation, weed infestations, evidence of animal or human damage, damage done as a result of weather impacts, or introduction of unwanted or adverse plant species. In addition, particular attention should be noted for deep-rooted trees or shrubs within the MWRC areas, as these could puncture the GCL and compromise the integrity of the cap system.

Revegetation shall be monitored by the Operator through inspection of all site wide revegetation areas through basic visual evaluation of revegetation growth/failure, human/animal impacts, identification of areas requiring reseeding, etc. Revegetation maintenance may include reseeding or replanting with the proper seed or plant mix as necessary to ensure revegetation success. Proper mulching, fertilization, erosion control/turf reinforcement blankets and browse protection should also be used by the Operator. If deep-rooted trees or shrubs are observed within the MWRC areas, these should be removed by the Operator as soon as practicable to avoid additional growing seasons and an increase in size, which may cause additional damage to the GCL or surrounding vegetation. If infestations of weedy or exotic/intrusive species are observed, they shall be hand pulled with the majority of the plant root removed with the plant, and shall be bagged and disposed of offsite. If evidence of human or other adverse animal impacts is discovered, proper actions shall be taken by the Operator to limit access to these areas.

The PMOU is generally free of material that could catch fire; however, in periods of drought, dried vegetation could fuel a fire. Public traffic in the area and close campground vicinity increases the possibility of fire starting through accident, negligence, or vandalism. Fire could damage or destroy site vegetation or damage site best management practices (BMPs), thus reducing erosion control and site stability. Small fires can be extinguished by using a properly rated fire extinguisher. For larger fires, 9-1-1 should be notified immediately.

2.7 Groundwater Monitor Wells

Two aquifer units have been identified at the PMOU site: (1) a local shallow alluvial/colluvial aquifer that occurs along the Pecos River and Willow Creek at depths of less than 20 feet bgs (shallow aquifer), and (2) an underlying regional aquifer that occurs in multiple bedrock units beneath the entire site (regional aquifer). The regional aquifer is called the bedrock aquifer in the RI (Stoller 1997). Both aquifers have been characterized using monitor wells (Figure 2). Over time some monitor wells have been plugged and abandoned due to site reclamation or other factors, and some monitor wells that still exist are no longer monitored because the observed water quality meets the standards as set forth in Subsections A through C of 20.6.2.3103 NMAC. Monitor wells completed in the shallow aquifer have an "S" designation (e.g., P-7S), while regional aquifer wells have no letter designation (e.g., P-7).

Post-RA quarterly compliance monitoring was conducted from 2005 through mid-2013, followed by semiannual compliance monitoring from mid-2013 through 2014, and annual monitoring during 2015 through 2017. Table 2 lists all currently maintained PMOU wells and their construction details, and Figure 2 identifies all PMOU groundwater monitor well locations. Additional details regarding the groundwater monitor wells and groundwater systems identified at the PMOU are provided within the CMP and the Petition for Alternative Abatement Standards (DBS&A 2018).

The Operator shall continue groundwater monitoring at PMOU with water levels and water quality samples collected from monitor wells P-7, P-7S, P-13, and P-13S. Groundwater sample collection shall be performed using traditional bailing sampling techniques and following applicable site-specific procedures. Appendix C provides a sample groundwater sample collection checklist and Appendix D provides standard operating procedures for collecting the groundwater samples. Purge water will be disposed of on-site in the immediate vicinity of the wells in a manner that maintains the water in the vicinity of the well casing and does not allow the purge water to run off into local waterways.

The water quality samples shall be analyzed for the following constituents:

- Field parameters: dissolved oxygen, electrical conductivity, pH, temperature, and turbidity.

- General chemistry and major ions: alkalinity, calcium, chloride, fluoride, magnesium, potassium, sodium, sulfate, and total dissolved solids.
- Metals (dissolved): barium, cadmium, cobalt, iron, manganese, and zinc.

The intent of long-term groundwater monitoring is to ensure the continued effectiveness of the RA. A proposed schedule and steps to take for a contingency plan are provided in Section 3.1.

3. MONITORING SCHEDULE

Monitoring of the PMOU components, with exception of groundwater monitoring (see Section 3.1), shall be performed monthly during March through November. Inspection components are described in Section 2; example inspection forms are provided in Appendix B.

In the event of a natural disaster such as a significant flood, extreme wind storm, fire/explosion, or earthquake, inspections shall be performed as soon as it is safe to do so. Details regarding emergency conditions are provided in Section 3.2.

If corrective action is required, items shall be repaired as soon as practicable. For areas that require corrective action, the inspection frequency of those specific areas shall be temporarily increased in consultation with NMED until the corrective action measures are observed to be operating as designed.

3.1 Groundwater Monitoring

Groundwater monitoring shall be conducted during the fall once every other year for the first six years of the LTOMP, then once every five years thereafter. The monitoring results will be provided to NMED within 4 months of the date of each monitoring event. Water levels and water quality samples will be collected from monitor wells P-7, P-7S, P-13, and P-13S, as noted in Section 2.7. The groundwater sample results shall be compared to historical analytical data for each well location (see Appendix E), along with the groundwater quality standards as set forth in Subsections A through C of 20.6.2.3103 NMAC or approved alternative abatement standards for PMOU.

If a constituent concentration exceeds the applicable standard, the laboratory will be contacted to confirm that adequate quality assurance and quality control of the sample was conducted, and the monitor well shall be resampled within 6 months. In the event of a confirmed exceedance (i.e., there are two valid groundwater samples collected within 6 months of one another that exceed the applicable standard), the following actions will be taken:

1. The frequency of groundwater monitoring will be increased to quarterly for the well that exceeds the applicable standard(s) to better determine trends in the constituent concentration(s), and

2. An updated site review will be conducted to evaluate current site conditions and identify potential contributing factors to the change in water quality.

The results of these actions will be provided to NMED and further actions, if any, will be determined in conjunction with NMED. If subsequent samples meet the applicable standard for 8 consecutive quarters, the routine monitoring schedule will be resumed.

3.2 Exceptional Events Threatening the Integrity of the Remedy

This LTOMP is designed and intended to ensure that appropriate inspections and O&M practices are undertaken to preserve the integrity of the remedy and its intended function as described in Section 2. Certain exceptional events may occur that could affect the integrity of the remedy and that could require repairs beyond the actions contemplated in Section 2. Examples are rainfall events that exceed the design capacities of the remedy, excessive wind storms, wildfire, or earthquakes. If these exceptional events occur, additional inspections and normal repair and maintenance activities shall be undertaken by the Operator as described below. If the inspections identify conditions that threaten the integrity of the remedy and that will require repairs in addition to the maintenance and repair activities described in Section 2 of this LTOMP, then the Operator shall notify CAMC in writing within 30 days of the occurrence and provide a description of the event and photographs of other evidence of any visible damage. The Operator shall grant CAMC access to the site to inspect for damage and to assess the extent to which repairs are needed to preserve or restore the integrity of the remedy. CAMC shall conduct its assessment as soon as reasonably practicable, with a goal of completing the assessment within 90 days of the occurrence of the exceptional event. Provided that the damage was not a result of the Operator's failure to conduct maintenance as required in Section 2, CAMC shall negotiate with the Operator in good faith to provide funding or work covering 80 percent of the costs to repair damage caused by the exceptional event.

3.2.1 Exceptional Rainfall Event

The PMOU surface water interceptor and drainage system was designed to accommodate peak runoff flows from a 100-year, 24-hour storm event. If a storm of greater magnitude has occurred, damage may have occurred to the surface water channels, MWRC, stormwater management systems, or other areas of the PMOU.

Following a flood or large storm event, the MWRC, surface water channels, Willow Creek, floodplain, channel structure, and all other areas of the PMOU shall be inspected, and maintenance and repair activities shall be conducted by the Operator as described in Section 2. If the Operator observes damage that cannot be repaired by the maintenance and repair activities described in Section 2, the Operator shall notify CAMC as described in Section 3.2.

3.2.2 *Exceptional Wind Storms*

Excessive wind storms have the capability to damage surface water channels, BMPs, and the MWRC system. The MWRC soil cover may be eroded by winds where sufficient vegetation is not present to anchor it. Silt fencing, hay bales, and other BMPs may be damaged or blown away. Following a windstorm, inspection and maintenance should be performed by the Operator as described in Section 2. If the Operator observes damage that cannot be repaired by the maintenance and repair activities described in Section 2, the Operator shall notify CAMC as described in Section 3.2.

3.2.3 *Wildfires*

Following a fire, any area damaged or affected should be inspected, and maintenance should be performed by the Operator as described in Section 2. If the Operator observes damage that cannot be repaired by the maintenance and repair activities described in Section 2, the Operator shall notify CAMC as described in Section 3.2.

3.2.4 *Earthquake*

The MWRC system was designed to withstand a 250-year earthquake event based on the PMOU area's history of seismic activity. An earthquake in excess of the design loading could compromise the geotechnical stability of the MWRC system. Following a large seismic event, a thorough inspection of the MWRC should be performed for any sign of distress, such as toe bulging, lateral slippage, cracks, and bulges. Surface water channels and drop structures should also be inspected for any signs of depressions, displaced riprap, shifting, and underlying liner damage. Any damaged area should be inspected, and maintenance should be performed by the Operator as described in Section 2. If the Operator observes damage that cannot be repaired by the maintenance and repair activities described in Section 2, the Operator shall notify CAMC as described in Section 3.2.

4. REFERENCES

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TABLES

LONG-TERM OPERATION AND MAINTENANCE PLAN
PECOS MINE OPERABLE UNIT – TERERRO, NEW MEXICO

lorth Perimeter Reach 1 (2)	NA	NA	NA	NA	NA	NA	NA	NA	NA
lorth Perimeter Reach 2	134	1.9	11.4	0.052	9.4	5.79	0.74	1.16	1-foot-thick rock-filled reno mattress lining over 8-oz. non-woven geotextile and GCL.
lorth Perimeter Reach 3	81	1.9	11.4	0.260	10.1	10.78	0.56	1.34	1-foot-thick rock-filled reno mattress lining over 8-oz. non-woven geotextile and GCL.
lorth Mid-Slope	888	1.5	12	0.020	9.1	3.06	0.74	0.76	2- to 3-foot revegetated, turf reinforcement blanketec topsoil over GCL.
entral Perimeter	180	1.9	11.4	0.256	1.7	6.87	0.29	1.61	1-foot-thick rock-filled reno mattress lining over 8-oz. non-woven geotextile and GCL.
outh Mid-Slope	774	1.5	12	0.021	2.5	2.25	0.45	1.05	2- to 3-foot revegetated, turf reinforcement blanketec topsoil over GCL.
outh Mid-Slope Tie-In	132	1.5	11.4	0.136	2.5	5.96	0.37	1.13	1-foot-thick rock-filled reno mattress lining over 8-oz. non-woven geotextile and GCL.
outh Perimeter Reach 1 (2)	NA	NA	NA	NA	NA	NA	NA	NA	NA
outh Perimeter Reach 2	132	1.9	11.4	0.106	1.7	4.93	0.34	1.56	1-foot-thick rock-filled reno mattress lining over 8-oz. non-woven geotextile and GCL.
outh Perimeter Reach 3	114	1.9	11.4	0.149	2.7	6.29	0.38	1.52	1-foot-thick rock-filled reno mattress lining over 8-oz. non-woven geotextile and GCL.
SD Channel Reach 1	865	1.26	12	0.023	11.8	4.17	0.51	0.75	1-foot-thick rock-filled reno mattress lining over 8-oz. non-woven geotextile, 20-mil HDPE, and a second layer of 8-oz. non-woven geotextile.
SD Channel Reach 2	465	1.58	18	0.023	48.4	5.78	0.80	0.78	1-foot-thick rock-filled reno mattress lining over 8-oz. non-woven geotextile, 20-mil HDPE, and a second layer of 8-oz. non-woven geotextile.
SD Channel Reach 3	775	1.9	24	0.023	68.7	5.99	0.8	1.10	1-foot-thick rock-filled reno mattress lining over 8-oz. non-woven geotextile, 20-mil HDPE, and a second layer of 8-oz. non-woven geotextile.
SD Channel North Drainage Confluence	100	3	18	0.023	20.7	4.92	0.69	2.31	1-foot-thick rock-filled reno mattress lining over 8-oz. non-woven geotextile, 20-mil HDPE, and a second layer of 8-oz. non-woven geotextile.
SD Channel South Drainage Confluence	60	3	18	0.023	39.4	5.91	0.97	2.03	1-foot-thick rock-filled reno mattress lining over 8-oz. non-woven geotextile, 20-mil HDPE, and a second layer of 8-oz. non-woven geotextile.
econstructed Willow Creek (3)	915	1.7	9.2	0.060	22 to 55	NA	NA	NA	Graded cobbles, boulders, and gravel/fines over a 6- to 12-in. compacted clay layer. Reconstructed banks composed of topsoil/small rocks wrapped non-woven coir fabric inside a layer of woven coir fabric.

s = Cubic Feet per Second; ft = feet; ft/s = feet per second; NA = not applicable; GCL = geosynthetic clay liner; HDPE = high density polyethylene.

tes:

North, Central and South Perimeter Channels, North and South Midslope Channels and South Midslope Tie-in parameters as developed from EMC²'s CB R.8.35, 'Midslope & Central Perimeter Channels Hydrology and Hydraulics Design' and reported in EMC2's CB R.8.102, 'As-Built CAP Channel Hydrology/Hydraulic Checks'. USD Channel Reach 1, 2, 3, North and South Confluence length, depth, width and slope as reported in EMC²'s 'Remedial Action Completion Report'. Qpeak, Velocity, Flow Depth and Free-Board based on design calculations performed in EMC2's CB R.8.23, 'USD Channel Redesign Hydraulics Calculations'.

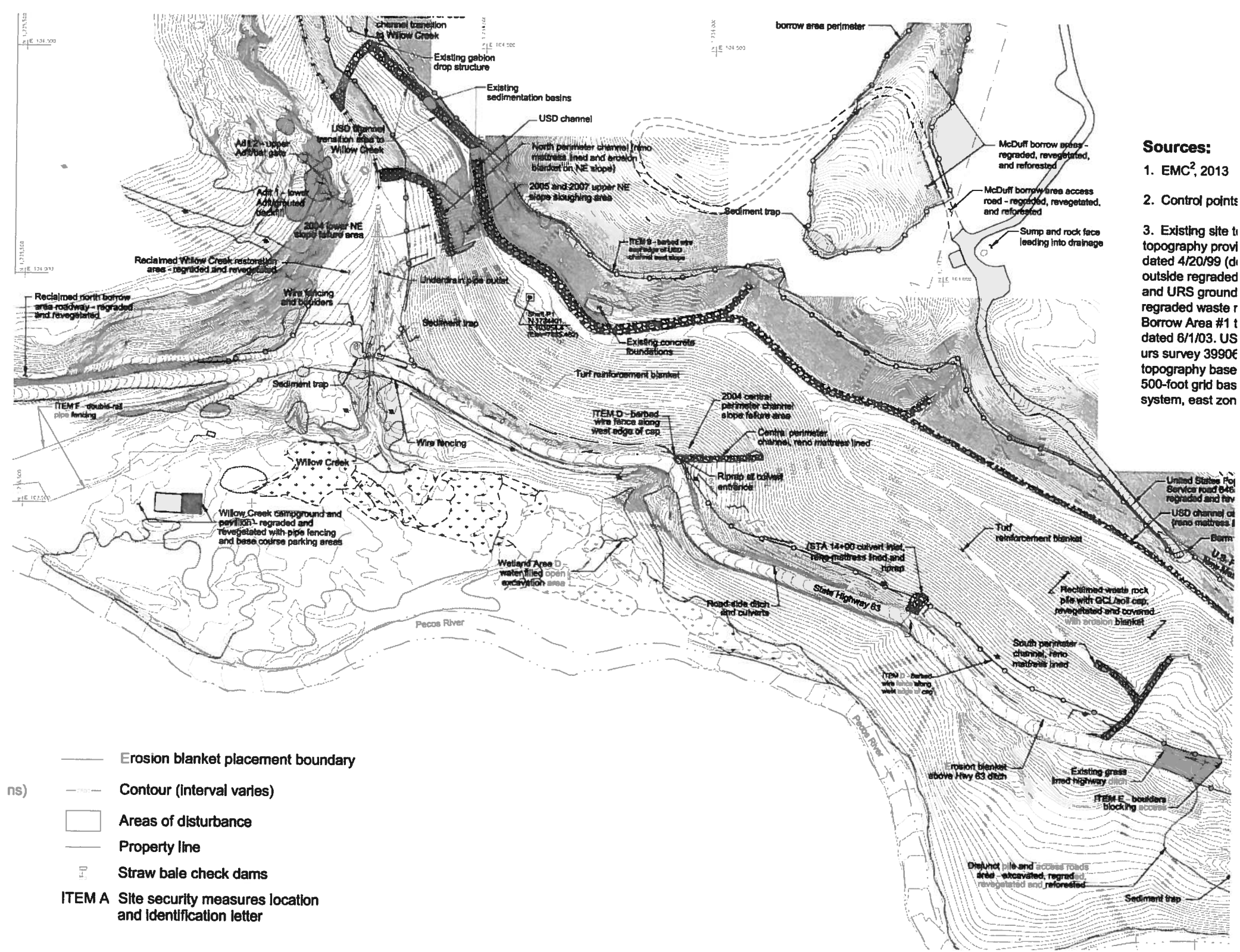
TABLE 2
WELL CONSTRUCTION SUMMARY

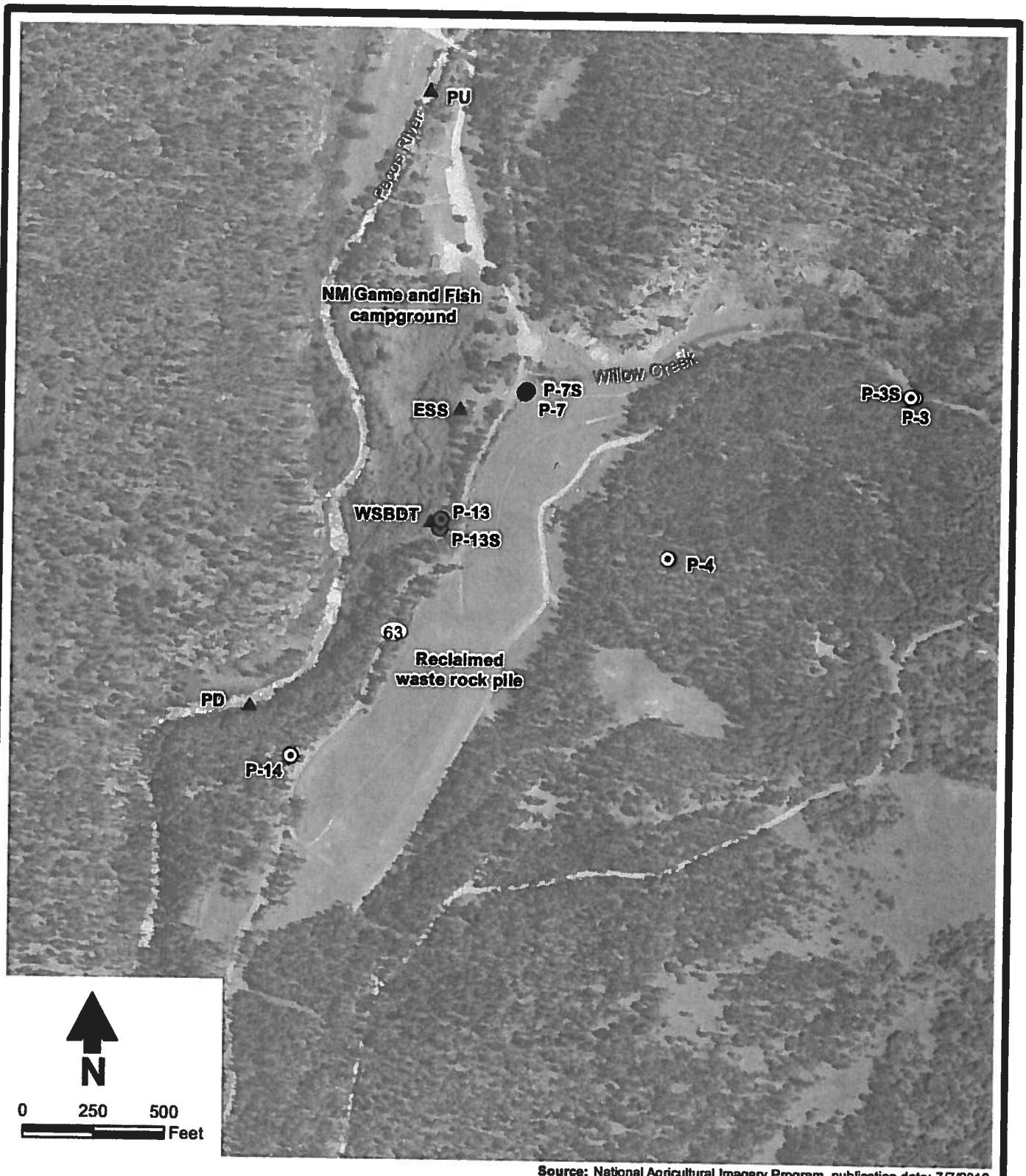
Well Name	Top of Casing Elevation (feet msl)	Total Depth (feet bgs)	Elevation of Screened Interval (feet msl)		Geological Unit of Completion
			Bottom	Top	
Wells Recommended Not Monitored					
P-3	7,881.45	125	7,759.45	7,799.45	Bedrock
P-3S	7,882.60	10.6	7,872.60	7,877.60	Alluvium
P-4	7,995.21	305	7,695.21	7,745.21	Bedrock
P-14	7,852.00	101.4	7,747.60	7,767.60	Bedrock
Wells Recommended to be Monitored for Water Level Measurements and Water Quality					
P-7	7,798.78	94	7,703.78	7,753.78	Bedrock
P-7S	7,799.08	15	7,783.08	7,793.08	Alluvium
P-13	7,781.00	30	7,748.00	7,758.00	Bedrock
P-13S	7,781.50	10	7,768.50	7,773.50	Alluvium

msl = mean sea level, bgs = below ground surface

FIGURES

LONG-TERM OPERATION AND MAINTENANCE PLAN
PECOS MINE OPERABLE UNIT – TERERRO, NEW MEXICO


channel transition to Willow Creek
Existing gabion drop structure
Existing sedimentation basins
USD channel
USD channel transition area to Willow Creek
Adit 2 - upper Adit/bat gate
Adit 1 - lower Adit/protected (locked)
2004 lower NE slope failure area
Reclaimed Willow Creek restoration area - regraded and revegetated
Reclaimed north borrow area roadway - regraded and revegetated
Wire fencing and boulders
Underdrain pipe outlet
Sediment trap
Shaft P1
N 1734401
E 1005014
(Elev=7615.46)
Existing concrete foundations
Turf reinforcement blanket
Sediment trap
ITEM F - double-rail pipe fencing
ITEM D - barbed wire fence along west edge of cap
2004 central perimeter channel slope failure area
Central perimeter channel, reno mattress lined
Wire fencing
Willow Creek
Riprap at culvert entrance
Willow Creek campground and pavilion - regraded and revegetated with pipe fencing and base course parking areas
Wetland Area D - water filled open excavation area
Road-side ditch and culverts
Pecos River
STA 14+00 culvert inlet, reno mattress lined and riprap
State Highway 63
Turf reinforcement blanket
Reclaimed waste rock pile with GCL/soil cap, revegetated and covered with erosion blanket
South perimeter channel, reno mattress lined
ITEM D - barbed wire fence along west edge of cap
Pecos River
Erosion blanket above Hwy 63 ditch
Existing grass lined highway ditch
ITEM E - boulders blocking access
Disjunct pile and access roads area - excavated, regraded, revegetated and reforested
Sediment trap
borrow area perimeter
McDuff borrow areas - regraded, revegetated, and reforested
McDuff borrow area access road - regraded, revegetated, and reforested
Sump and rock face leading into drainage
North perimeter channel (reno mattress lined and erosion blanket on NE slope)
2005 and 2007 upper NE slope sloughing area
Sediment trap
ITEM B - barbed wire fence along upper edge of cap
United States Po
Service road 845
regraded and rev
USD channel ou
(reno mattress l
Berm
U.S. F
Wildlife
Sources:
1. EMC², 2013
2. Control points
3. Existing site t
topography provi
dated 4/20/99 (d
outside regraded
and URS ground
regraded waste r
Borrow Area #1 t
dated 6/1/03. US
urs survey 39906
topography base
500-foot grid bas
system, east zon
Erosion blanket placement boundary
Contour (interval varies)
Areas of disturbance
Property line
Straw bale check dams
ITEM A Site security measures location and identification letter



Source: National Agricultural Imagery Program, publication date: 7/7/2016

Explanation

- ● Monitor well and recommended long-term sample location
- ⊙ Monitor well
- ▲ Surface water or seep sample location

S:\Projects\ES06.0038_PMOU\GIS\WX\Dst\Report\AAS\Longterm_Monitoring_Plan\Fig02_Groundwater_and_Surface_Water_Monitoring_Locations.mxd

Daniel B. Stephens & Associates, Inc.
4/11/2018
JN ES06.0038

PECOS MINE OPERABLE UNIT
Groundwater Monitoring Locations

Figure 2

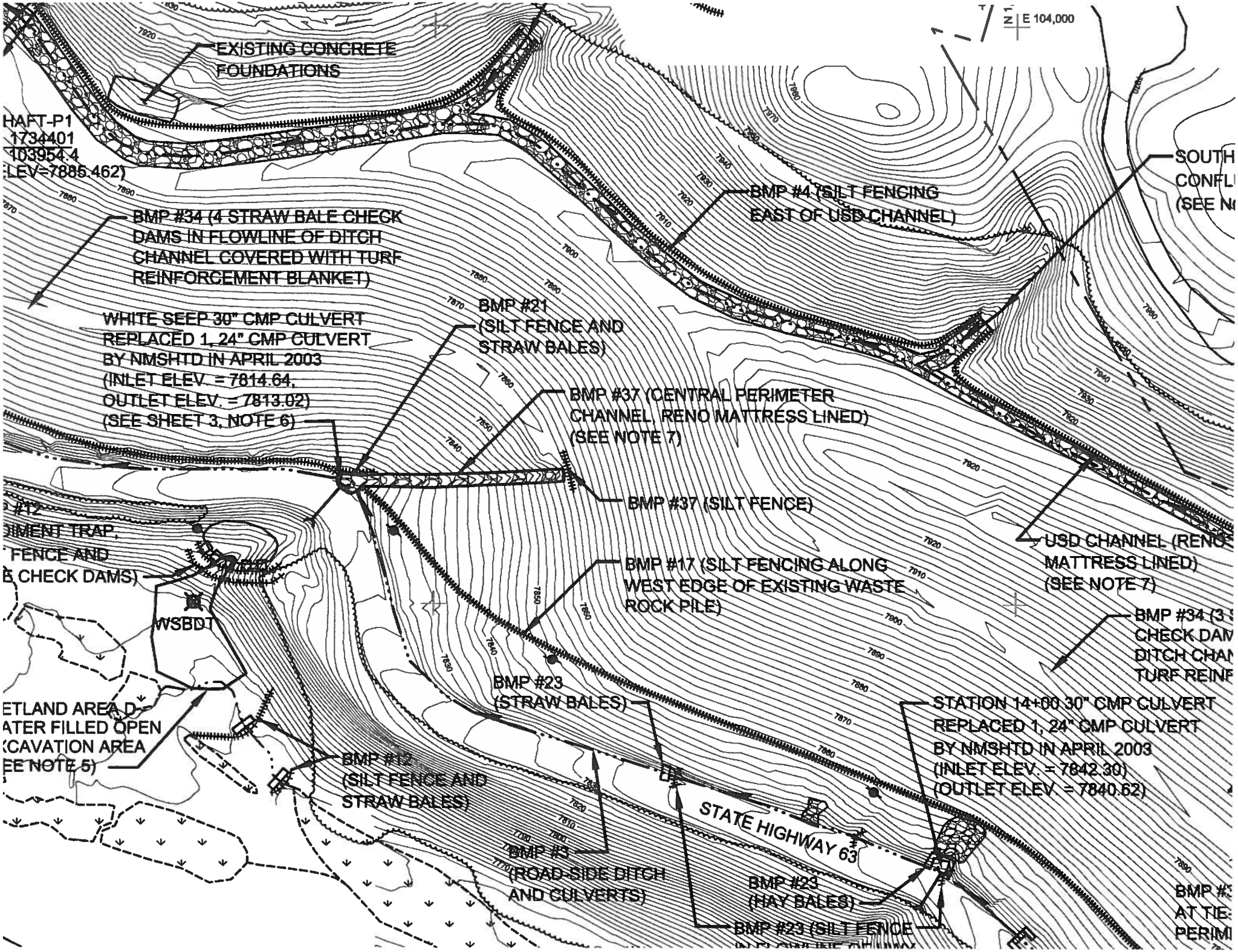
APPENDIX A
REMEDIAL ACTION AS-BUILT CONSTRUCTION DRAWINGS

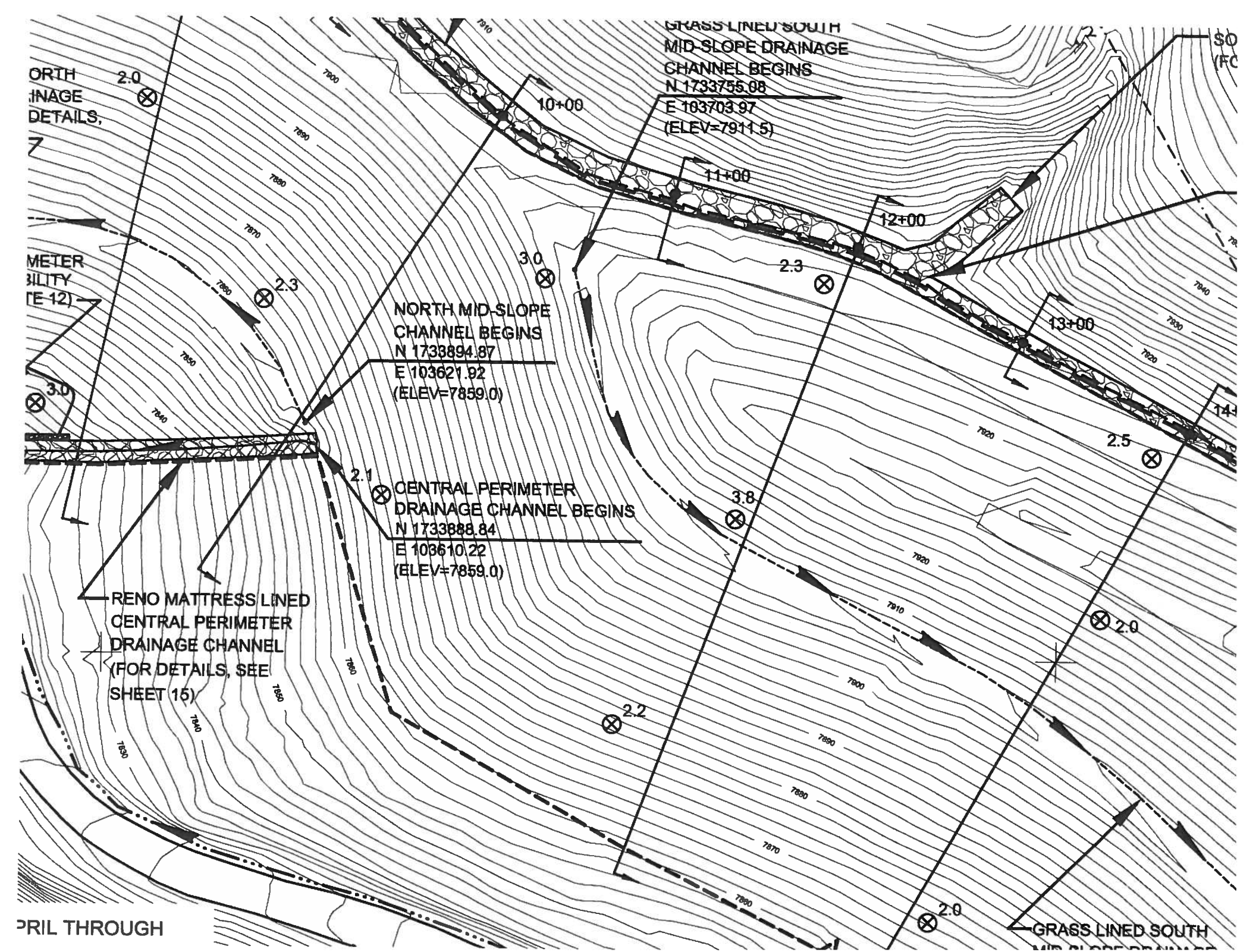
LONG-TERM OPERATION AND MAINTENANCE PLAN
PECOS MINE OPERABLE UNIT – TERERRO, NEW MEXICO

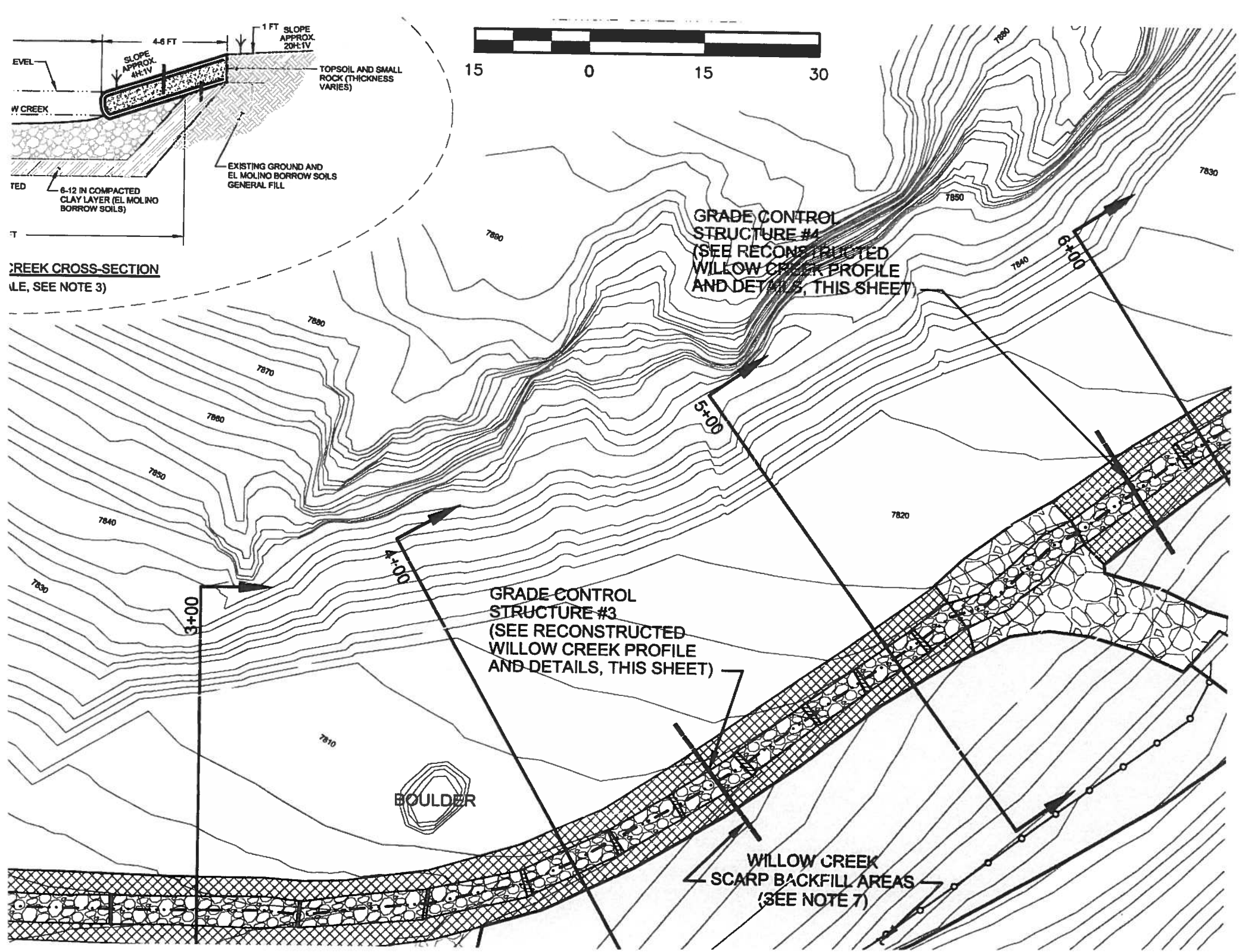
13	1018-E88	AS-BUILT DRAINAGE CHANNEL PROFILES
14	1018-E89	AS-BUILT DETAILS AND CROSS-SECTIONS
15	1018-E90	AS-BUILT DETAILS AND CROSS-SECTIONS
16	1018-E82	MINE SITE AS-BUILT REVEGETATION PLAN
17	1018-E177	BORROW AREAS AS-BUILT CONDITIONS AND REVEGETATION PLANS
18	1018-E176	BORROW AREAS AS-BUILT CONDITIONS AND REVEGETATION PLANS

AS-BUILT

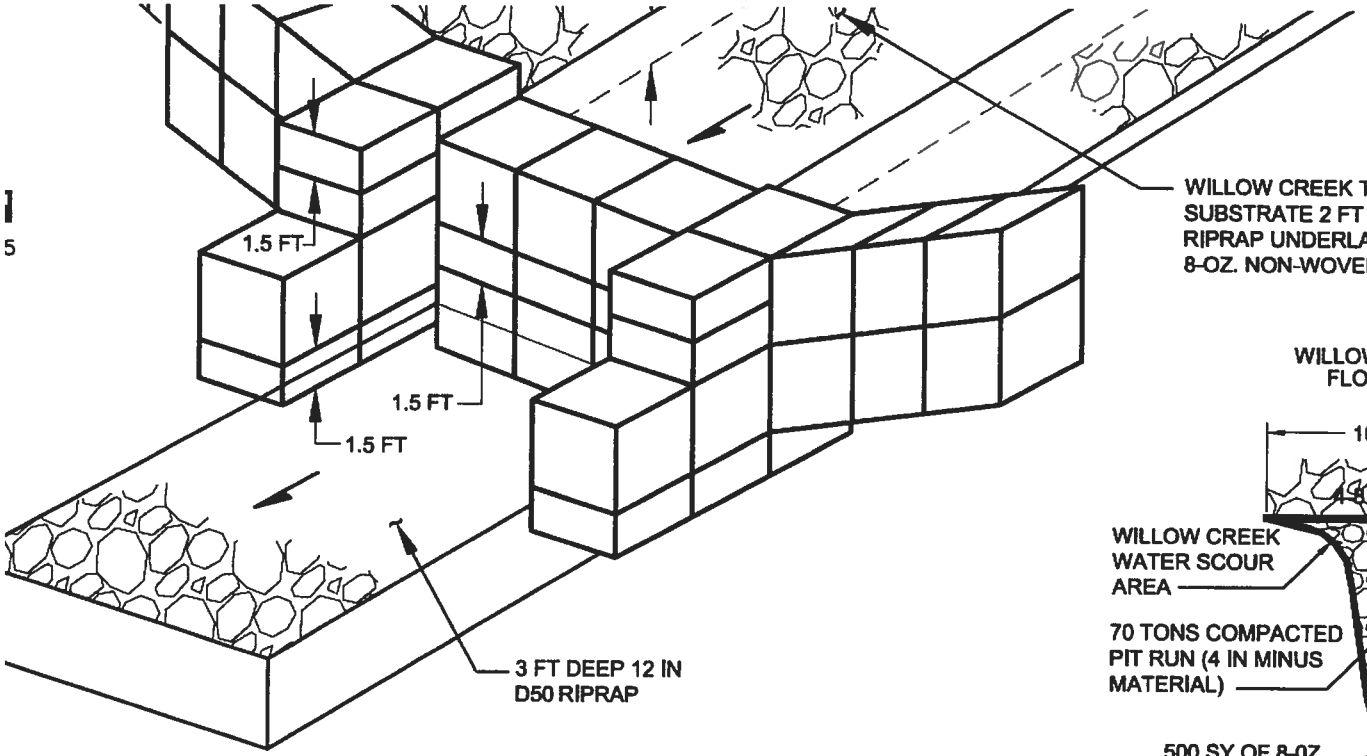
'RUCTION DRAWINGS


E 104,000
EXISTING CONCRETE FOUNDATIONS
HAFT-P1
1734401
103954.4
LEV=7885.462)
BMP #34 (4 STRAW BALE CHECK DAMS IN FLOWLINE OF DITCH CHANNEL COVERED WITH TURF REINFORCEMENT BLANKET)
WHITE SEEP 30" CMP CULVERT REPLACED 1, 24" CMP CULVERT BY NMSHTD IN APRIL 2003 (INLET ELEV. = 7814.64, OUTLET ELEV. = 7813.02) (SEE SHEET 3, NOTE 6)
BMP #4 (SILT FENCING EAST OF USD CHANNEL)
BMP #21 (SILT FENCE AND STRAW BALES)
BMP #37 (CENTRAL PERIMETER CHANNEL, RENO MATTRESS LINED) (SEE NOTE 7)
BMP #37 (SILT FENCE)
SOUTH
CONFL
(SEE N
USD CHANNEL (RENO
MATTRESS LINED)
(SEE NOTE 7)
#12
IMENT TRAP,
FENCE AND
CHECK DAMS)
WSBDT
BMP #17 (SILT FENCING ALONG WEST EDGE OF EXISTING WASTE ROCK PILE)
BMP #34 (3
CHECK DAM
DITCH CHAN
TURF REINF
BMP #23 (STRAW BALES)
STATION 14+00 30" CMP CULVERT REPLACED 1, 24" CMP CULVERT BY NMSHTD IN APRIL 2003 (INLET ELEV. = 7842.30) (OUTLET ELEV. = 7840.62)
ETLAND AREA D
ATER FILLED OPEN
CAVATION AREA
EE NOTE 5)
BMP #12 (SILT FENCE AND STRAW BALES)
STATE HIGHWAY 63
BMP #3 (ROAD-SIDE DITCH AND CULVERTS)
BMP #23 (HAY BALES)
BMP #23 (SILT FENCE
BMP #
AT TIE-
PERIM


GRASS LINED SOUTH
MID-SLOPE DRAINAGE
CHANNEL BEGINS
N 1733755.08
E 103703.97
(ELEV=7911.5)
10+00
11+00
12+00
13+00
NORTH MID-SLOPE
CHANNEL BEGINS
N 1733894.87
E 103621.92
(ELEV=7859.0)
CENTRAL PERIMETER
DRAINAGE CHANNEL BEGINS
N 1733888.84
E 103610.22
(ELEV=7859.0)
RENO MATTRESS LINED
CENTRAL PERIMETER
DRAINAGE CHANNEL
(FOR DETAILS, SEE
SHEET 15)
2.0
2.3
3.0
2.1
3.8
2.2
2.5
2.0
2.0
3.0
GRASS LINED SOUTH

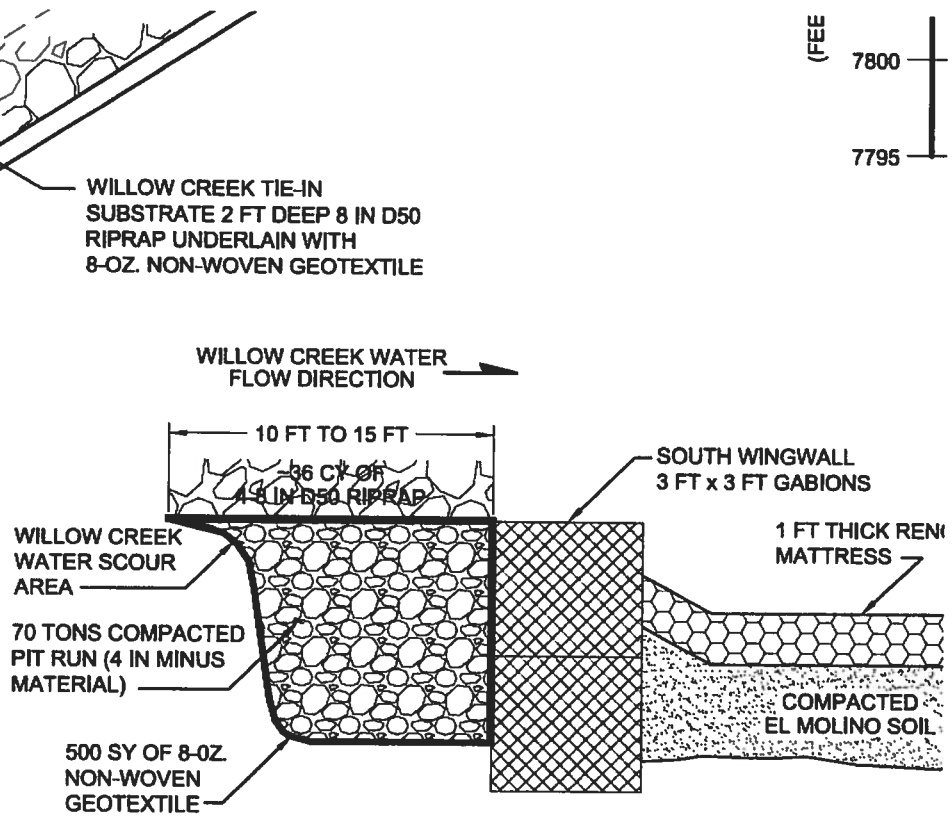


CREEK CROSS-SECTION
ALE, SEE NOTE 3)



UPSTREAM DROP STRUCTURE/FISH BARRIER ORTHOGONAL VIEW

(NOT TO SCALE)



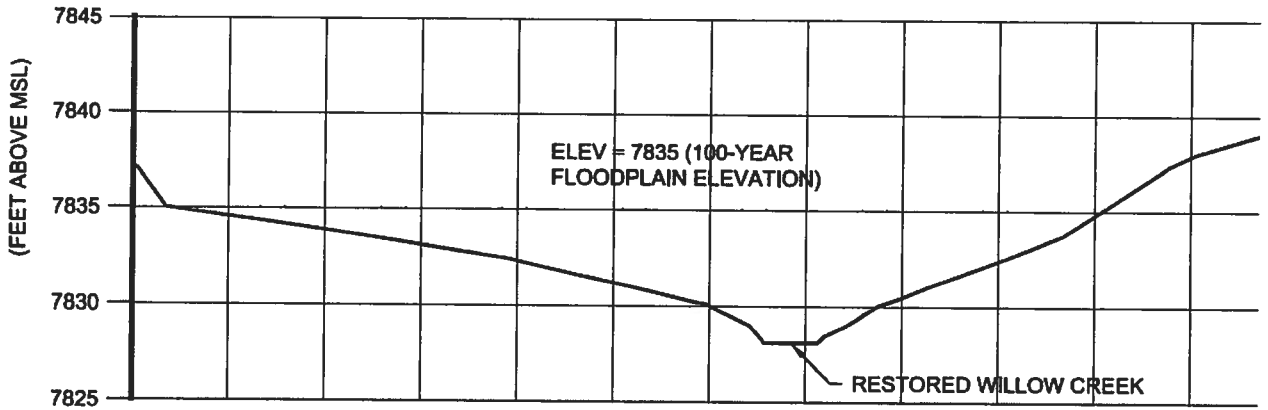
DROP STRUCTURE/FISH BARRIER SCOU PLUG/PROTECTION DETAIL

(NOT TO SCALE)
(LOOKING SOUTH)

:FERENCES:

E FOLLOWING SURFACE AND DATA SURVEY INFORMATION
OWN ON THIS DRAWING WAS PROVIDED BY URS
RPORATION (URS). THE SURVEY COVERAGE AREAS,
ENAMES, AND DATES ARE AS FOLLOWS:

ISTING SITE TOPOGRAPHY BASED ON:
REAS NORTH OF RECLAIMED WILLOW CREEK FLOODPLAIN,
TLAND AREAS, ALL AREAS WEST OF AND INCLUDING
HWAY 63 AND PORTIONS OF AREAS SOUTH OF THE
CLAIMED WASTE ROCK PILE, APRIL 20, 1999 AERIAL SURVEY,
ENAME PECOS12.DWG, DATED 4/20/99.
-BUILT NORTHEAST SLOPE TOPOGRAPHY, RECLAIMED
LOW CREEK AND FLOODPLAIN AREA, APRIL 2000 SURVEY,
ENAMES: MAIN_1_CNTRS.DWG, MAIN_1_PNTS.TXT, DATED
8/2000 (NORTHEAST SLOPE SECTION AREA ONLY).
-BUILT USD CHANNEL AND USD CHANNEL EAST SLOPE



HORIZONTAL SCALE IN FEET

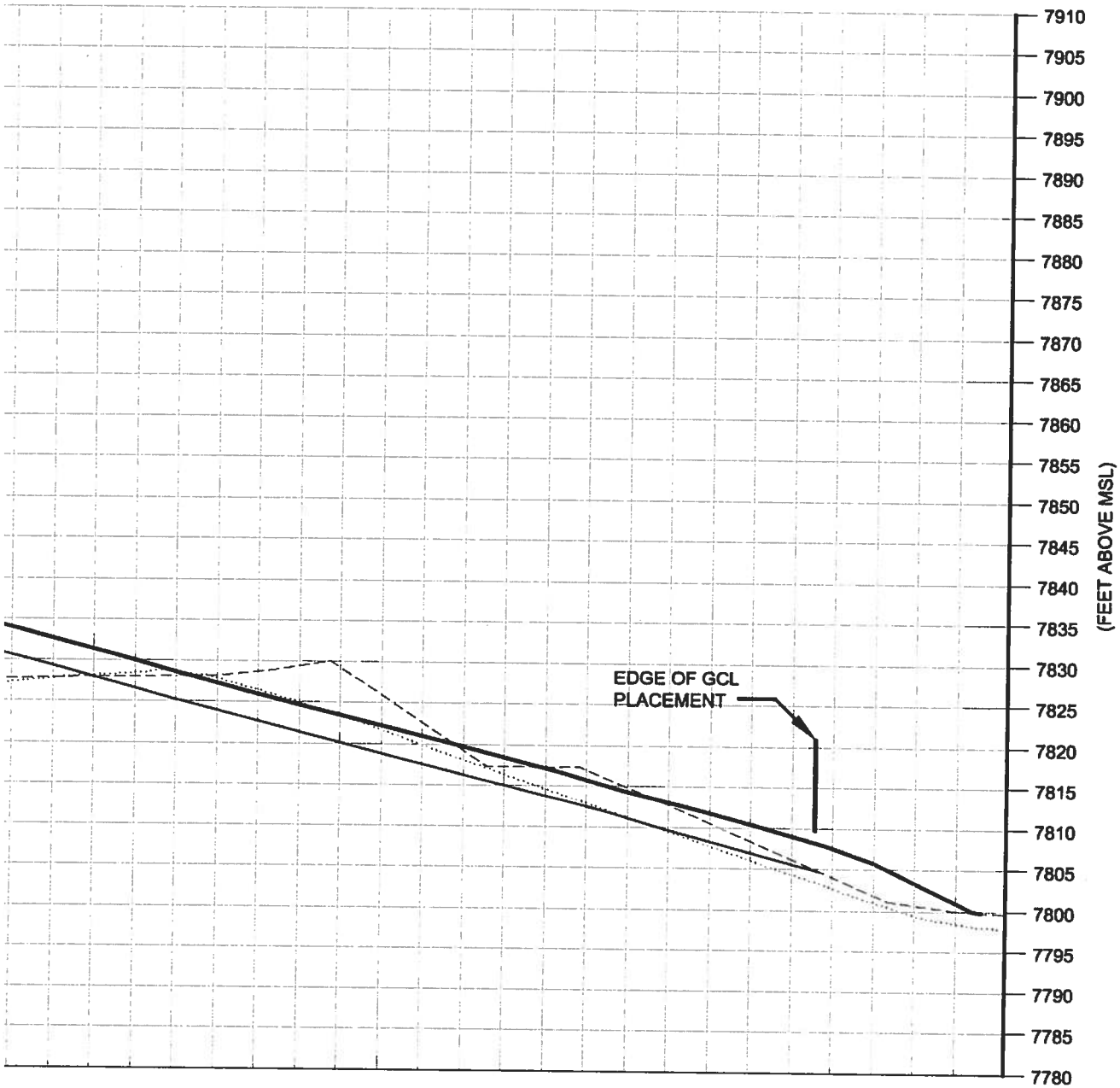
CROSS-SECTION 7+00

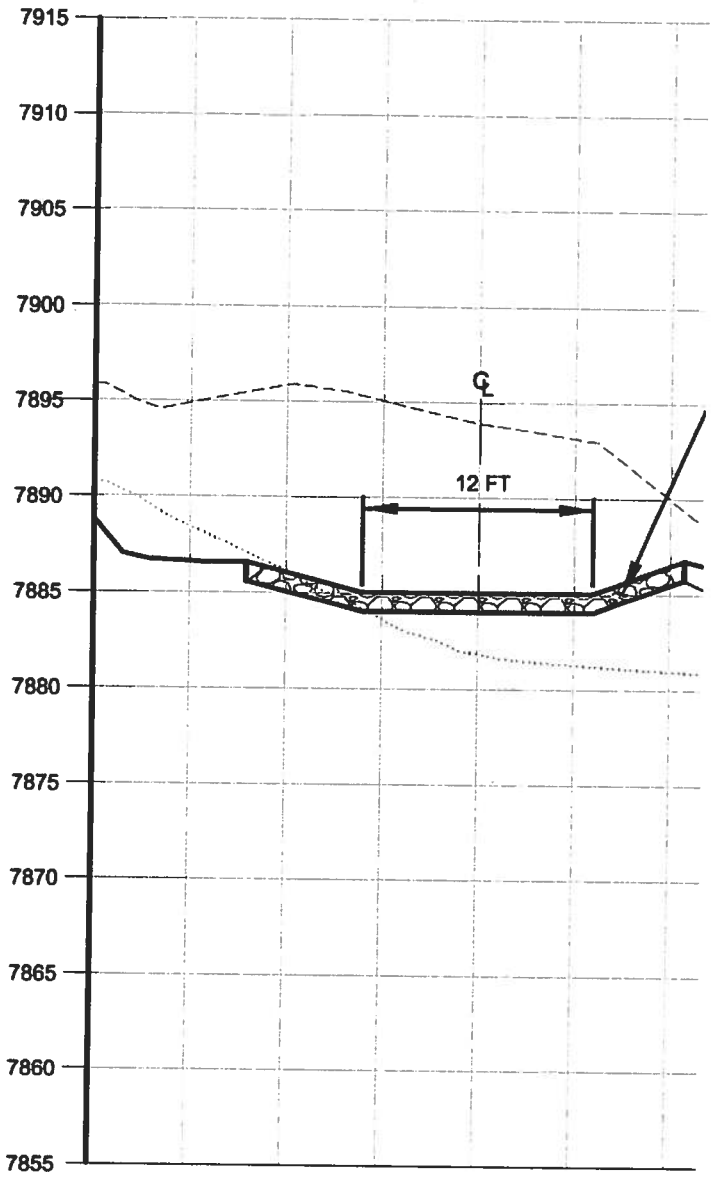
VERTICAL SCALE IN


12
13
14
15
16
17
18
19
20
7880
7870
7860
7850
7840
7830
7820
7810
7800
7790
7780
7940
7930
7920
7910
7900
7890
7880
7870
STATE HIGHWAY 63

CROSS SE

LOOKI

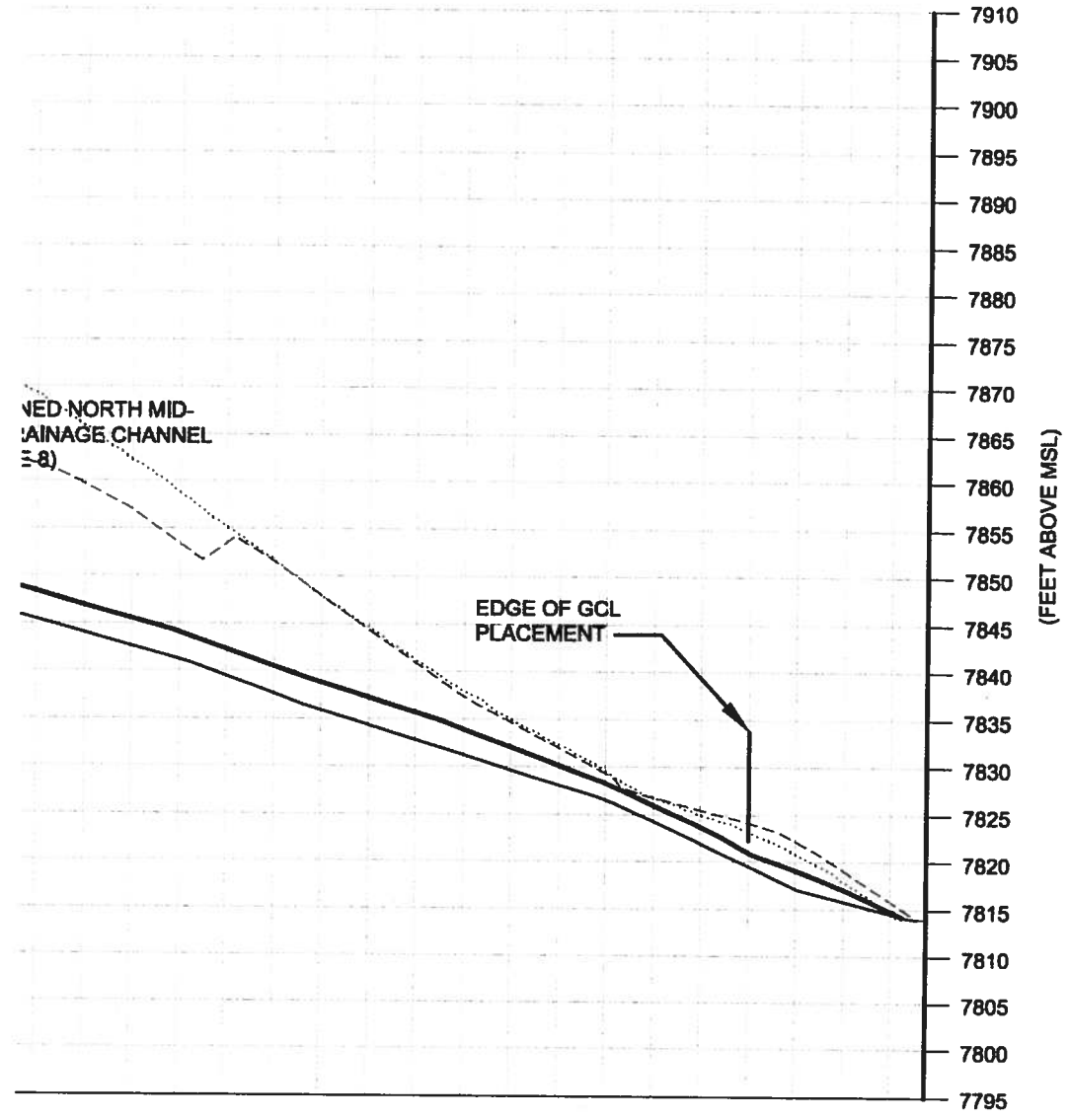


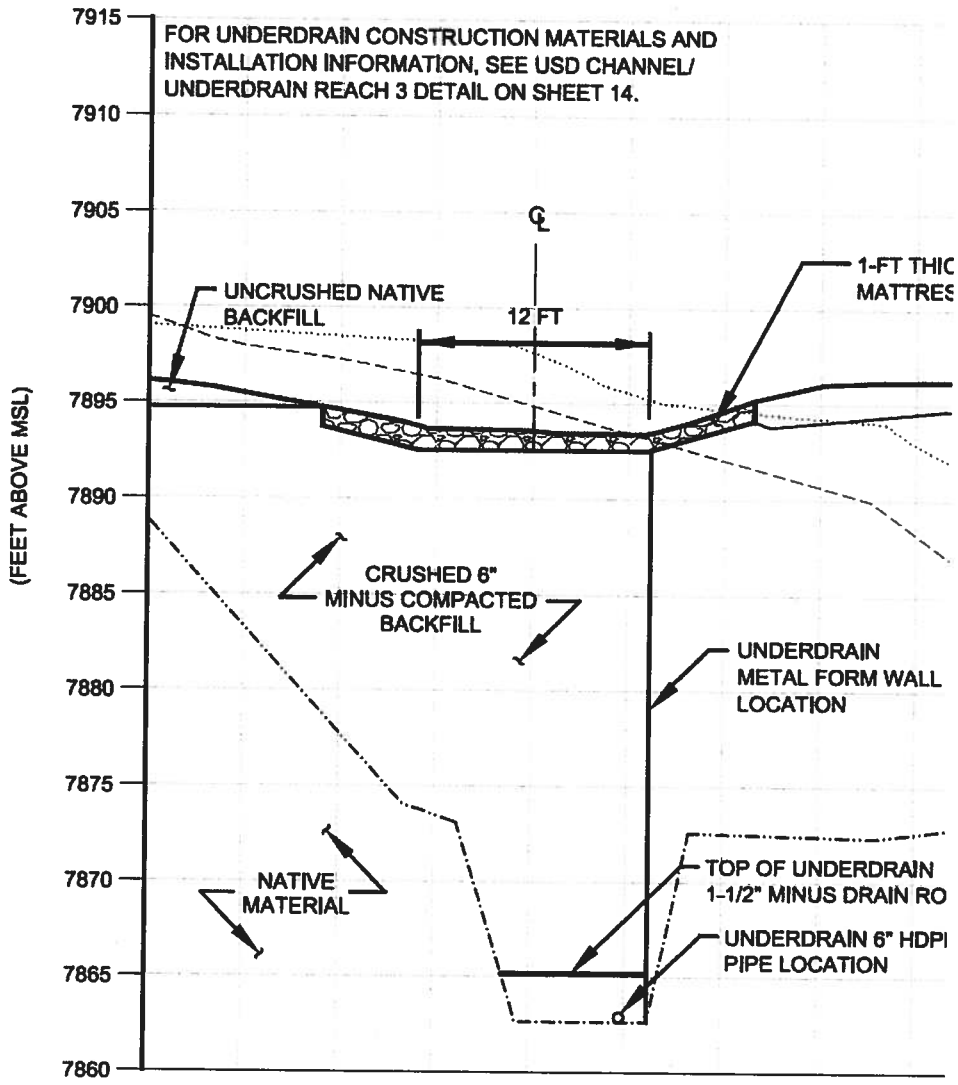


T

USD (

CROSS S





USD CHANNEL/UNDERDRAIN CROSS SECTION 6+00

LOOKING SOUTHEAST

20

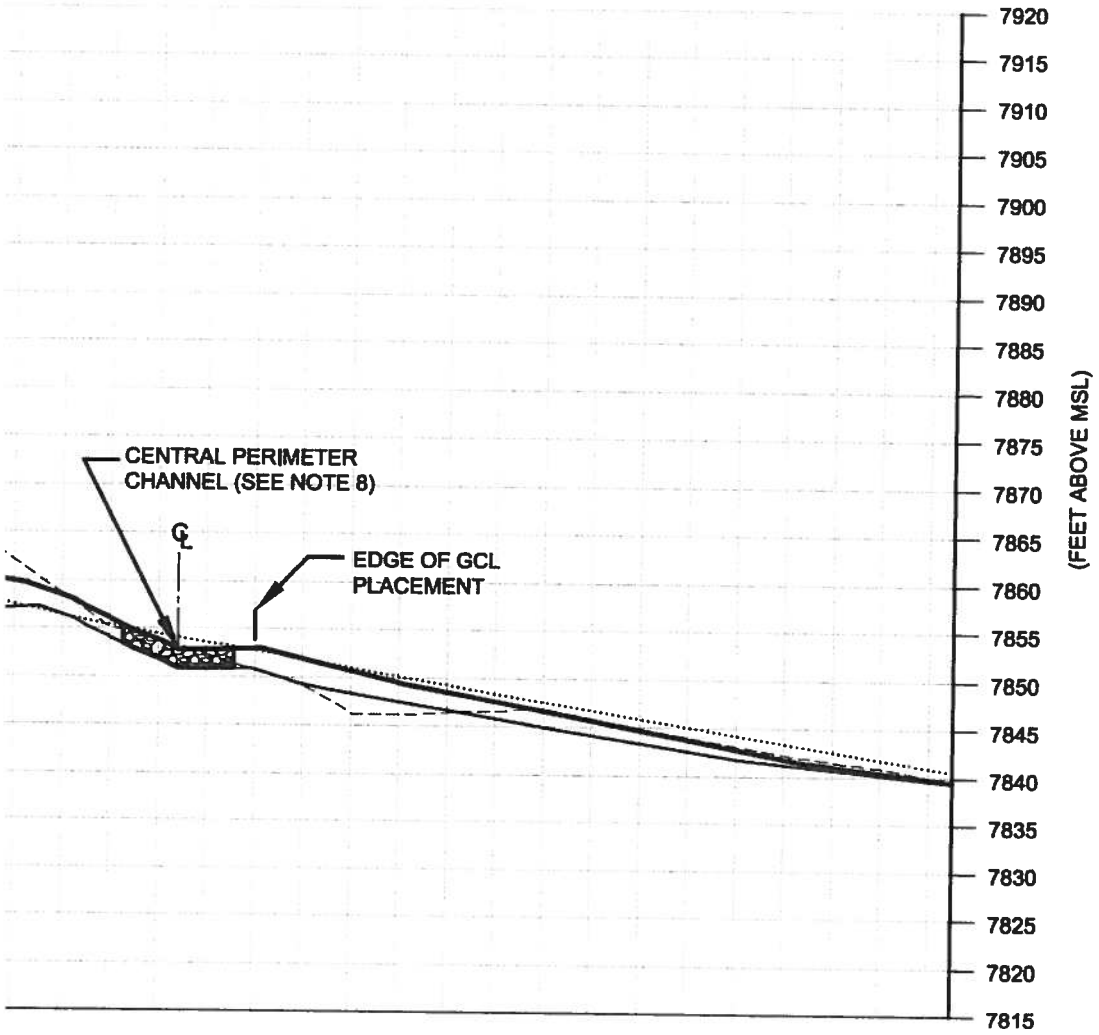
DONALD G. BOOTH NEW MEXICO 13935 REGISTERED PROFESSIONAL ENGINEER

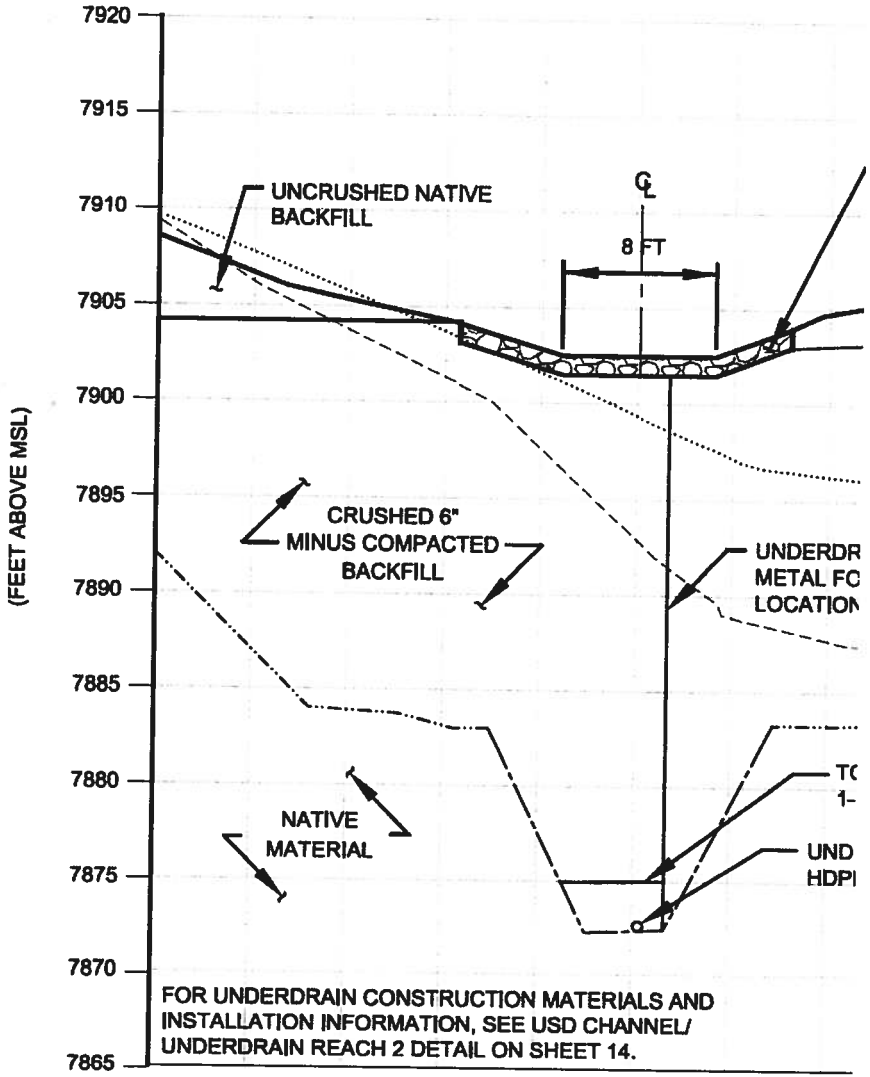
COPY

01/03/05

EXISTING CONDITIONS TOPOGRAPHY

3. INTERMEDIATE BENCHING TOPOGRAPHY AS SURVEY





USD CHANNEL/UNDERD
CROSS SECTION 10+

LOOKING SOUTHWEST

SCALE IN FEET

10 0

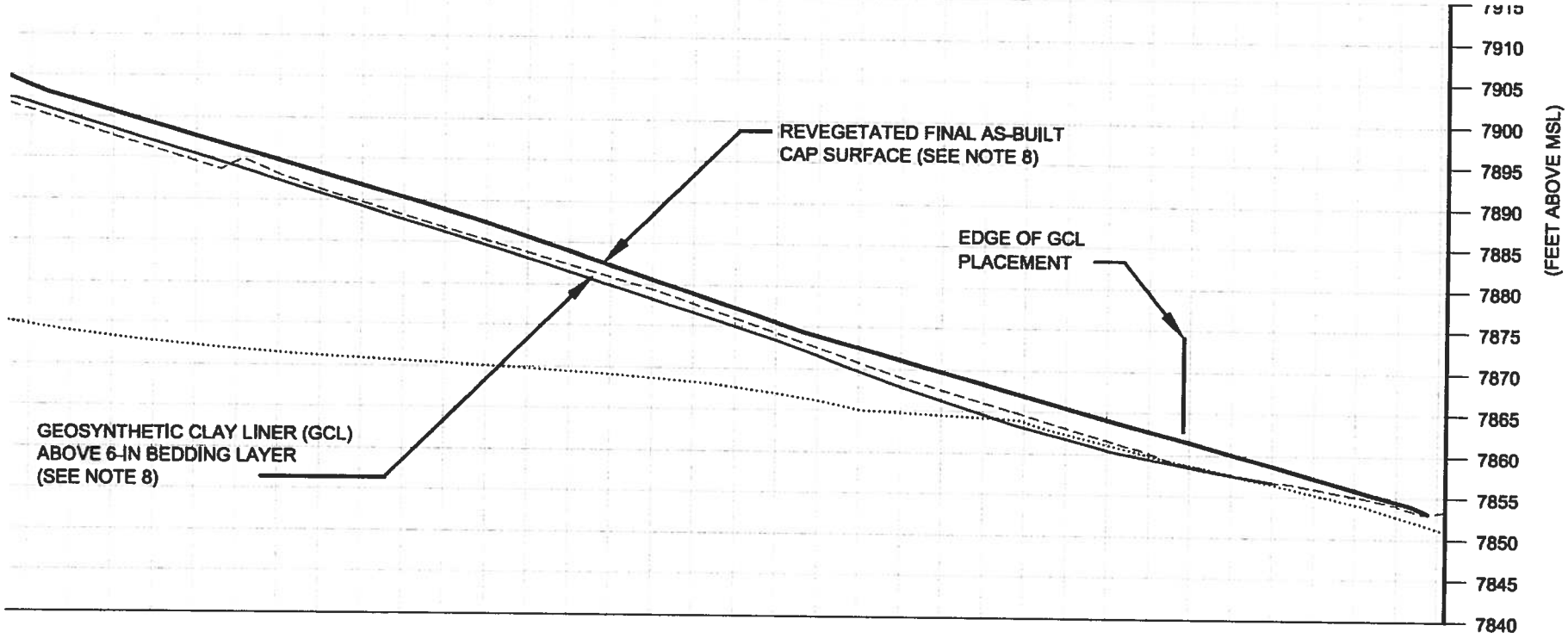
DONALD G. BOOTH NEW MEXICO 13939 REGISTERED PROFESSIONAL ENGINEER

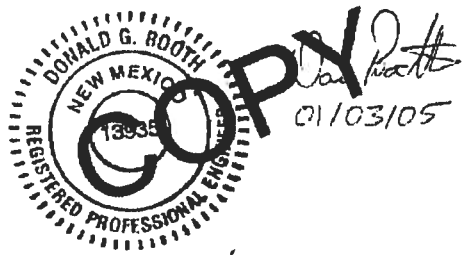
COPY

01/03/05

CONDITIONS TOPOGRAPHY

3. INTERMEDIATE BENCHING TOPOGRAPHY AS SURVEY



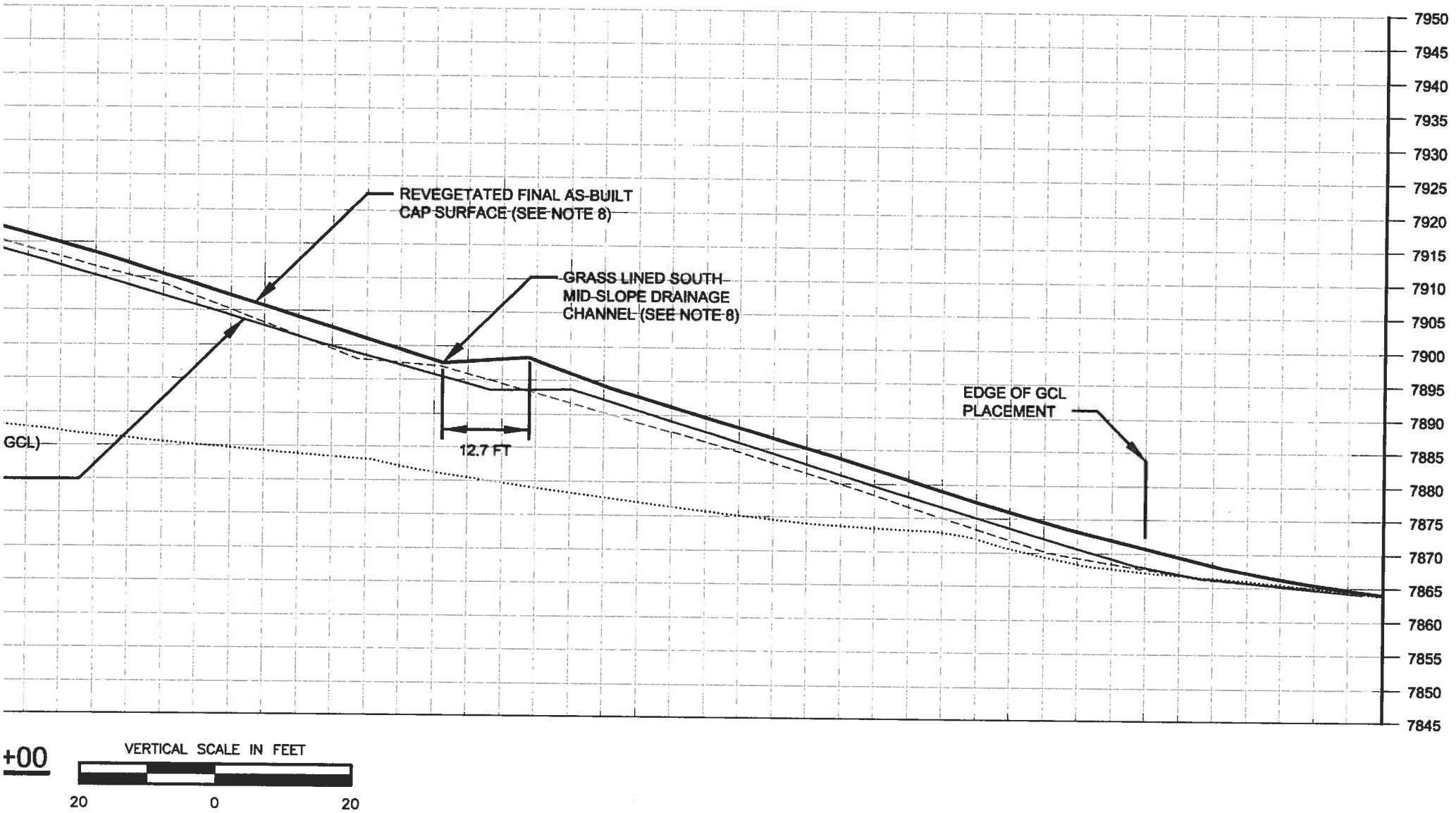


I CONDITIONS TOPOGRAPHY

I CONDITIONS TOPOGRAPHY
EE NOTE 2)

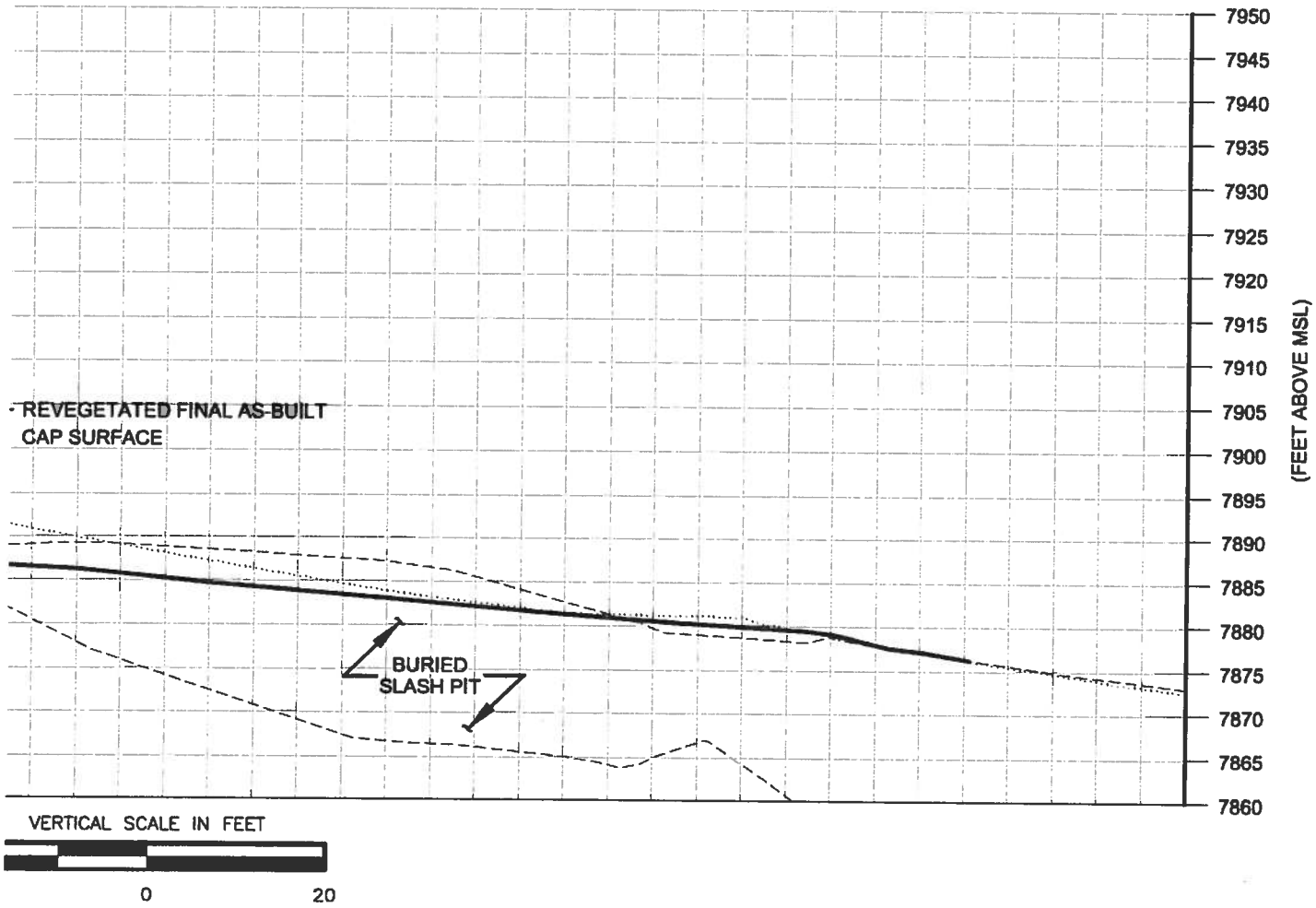
E BENCHING TOPOGRAPHY (SEE NOTE 3)

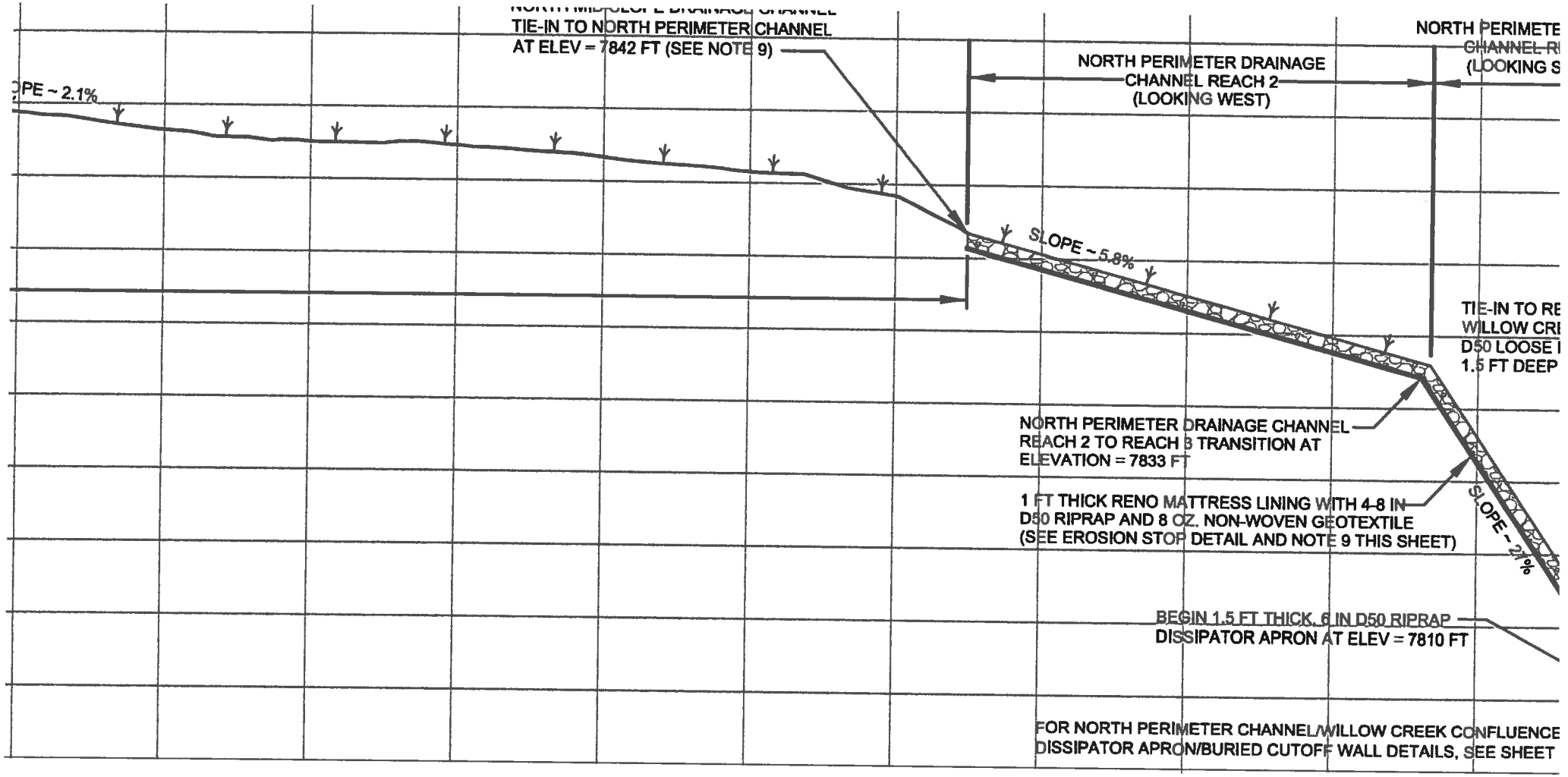
3. INTERMEDIATE BENCHING TOPOGRAPHY AS SURVEYEL
STATIONS 2+20 THROUGH 5+00 WHERE DATA WAS ESTI
ON SURVEY DATA FOR STATION 6+00 AND FIELD MEASU
DURING CONSTRUCTION WHERE CONDITIONS CHANGE
PRE-EXISTING CONDITIONS AND AS-BUILT TOPOGRAPH
SEE REFERENCES SECTION THIS SHEET FOR SURVEY D



ITIONS TOPOGRAPHY

3. INTERMEDIATE BENCHING TOPOGRAPHY AS SURVEYED, EX STATIONS 2+20 THROUGH 5+00 WHERE DATA WAS ESTIMAT ON SURVEY DATA FOR STATION 6+00 AND FIELD MEASUREM


7950
7945
7940
7935
7930
7925
7920
7915
7910
7905
7900
7895
7890
7885
7880
7875
7870
7865
7860
(FEET ABOVE MSL)
REVEGETATED FINAL AS-BUILT CAP SURFACE
BURIED SLASH PIT
VERTICAL SCALE IN FEET
0
20

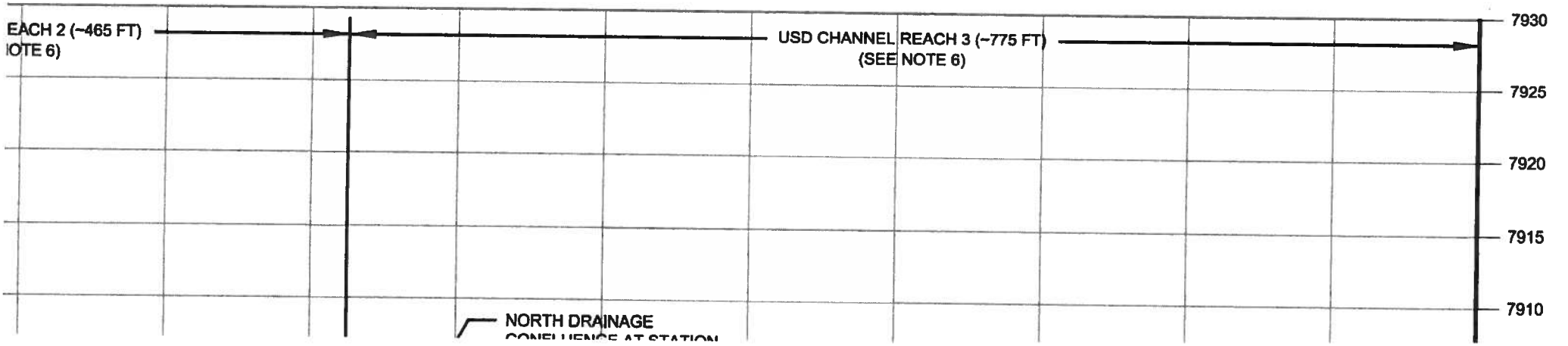


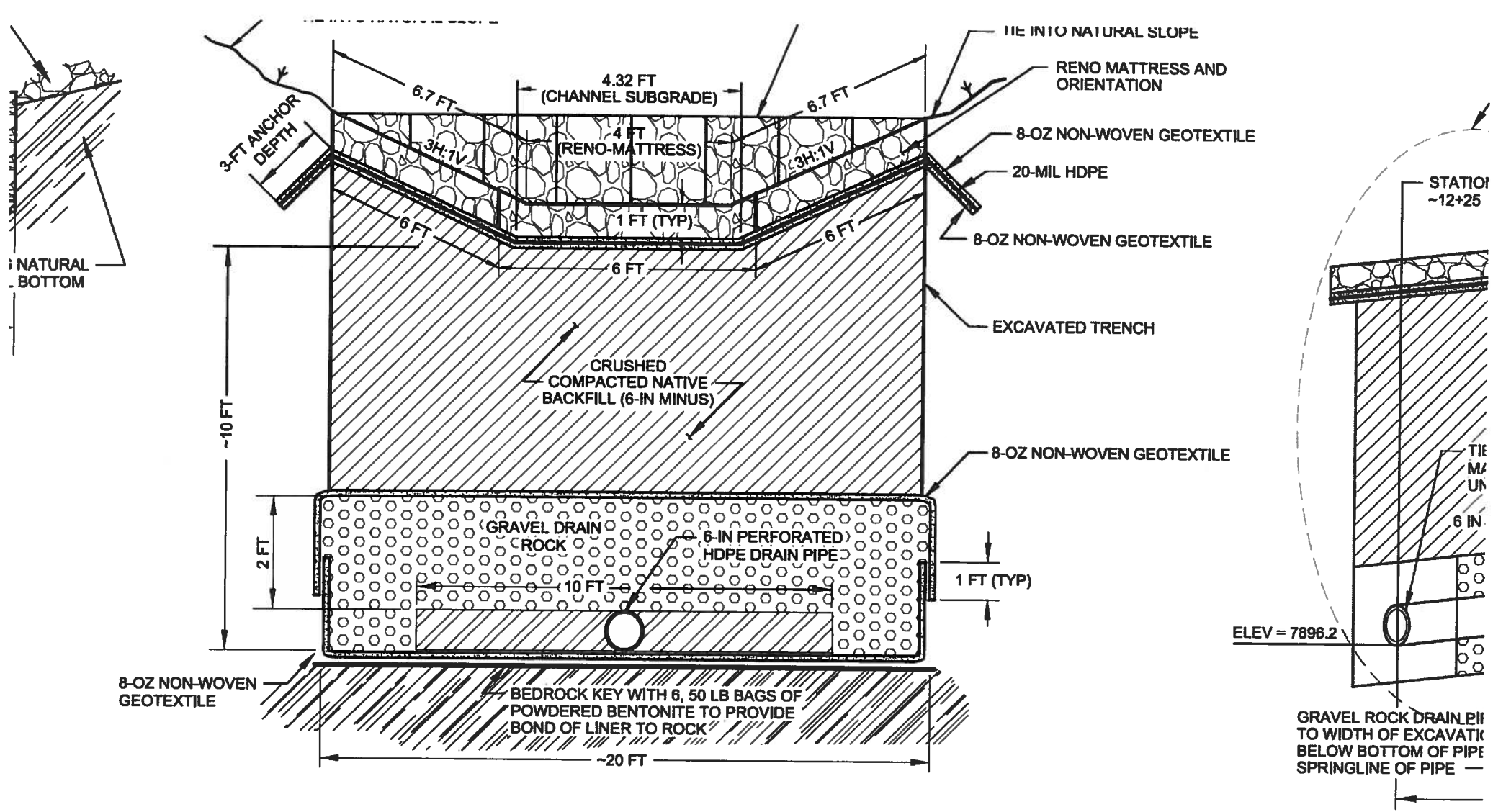
ER DRAINAGE CHANNEL PROFILES

TH AS NOTED

VERTICAL SCALE IN FEET

10 0 10





NORTH AND SOUTH CONFLUENCE/ INTERCEPTOR CROSS SECTION DETAIL

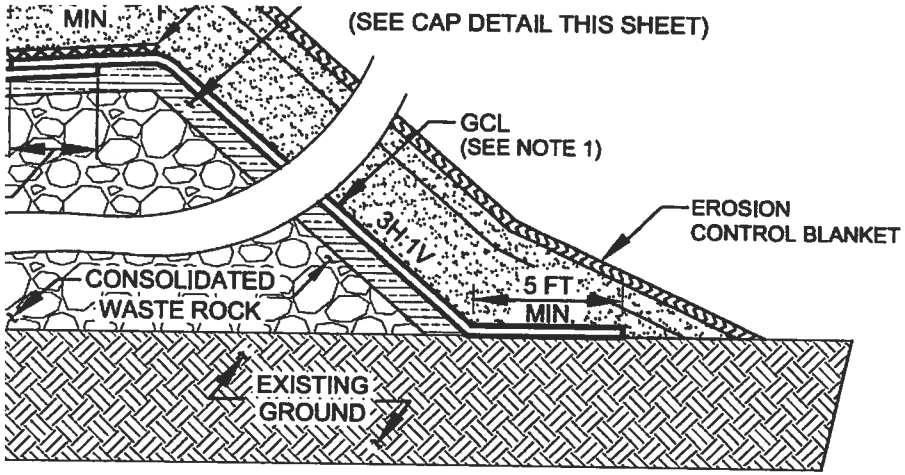
(NOT TO SCALE)

(TYPICAL)

20-MIL HDPE

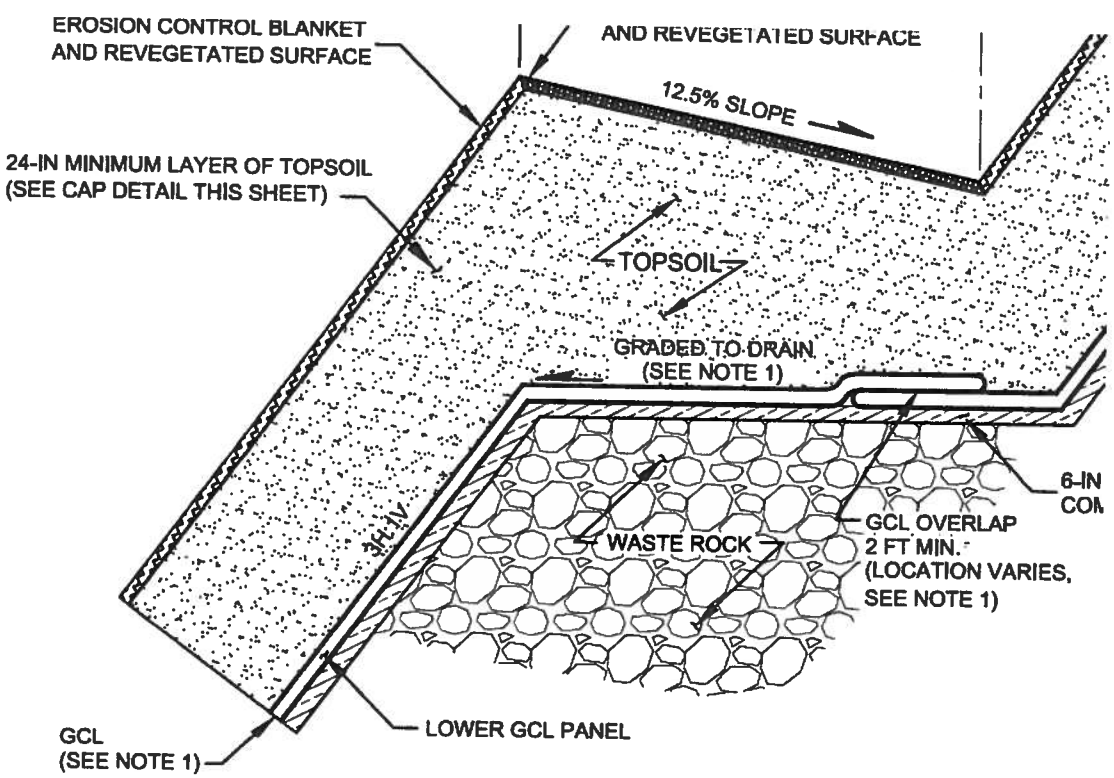
1, 2.25-IN x 2.25-IN x 3/8-IN ANGLE IRON ON TOPS OF SHEET METAL INSTALLED TO STABILIZE FORM

DONALD G. BOOTH
NEW MEXICO
13935
REGISTERED PROFESSIONAL ENGINEER



STE ROCK PILE TOE OF SLOPE AND SLOPE GCL RUN-OUT/OVERLAP DETAIL

(TYPICAL)
(NOT TO SCALE)



NORTH AND SOUTH MID-SLOPE DRAI CHANNEL CROSS SECTION AND GCL OVER

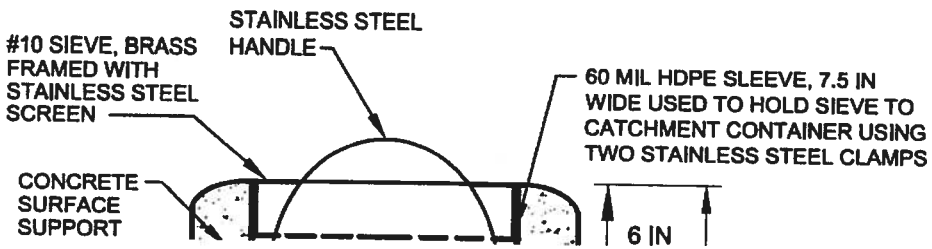
(TYPICAL)
(NOT TO SCALE)

ESSURE
NSITIVE
PE

AM

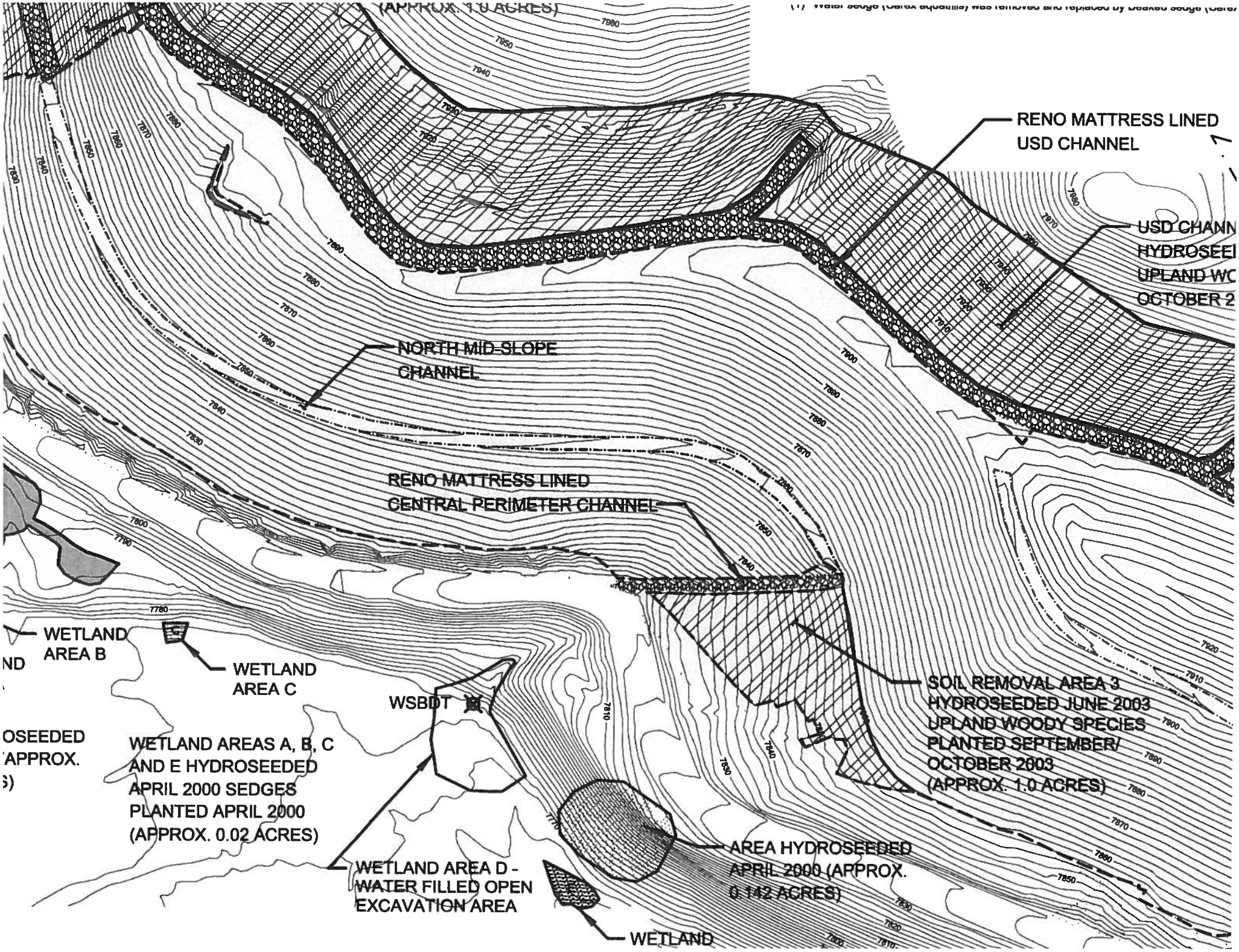
INING

ON



NOTES:

1. THE NORTH AND SOUTH MID-SL GEOSYNTHETIC CLAY LINER (GC WERE PERFORMED OUTSIDE OF


(APPROX. 1.0 ACRES)
RENO MATTRESS LINED
USD CHANNEL
USD CHANN
HYDROSEEI
UPLAND WC
OCTOBER 2
NORTH MID-SLOPE
CHANNEL
RENO MATTRESS LINED
CENTRAL PERIMETER CHANNEL
WETLAND
AREA B
WETLAND
AREA C
WSBDT
WETLAND AREAS A, B, C
AND E HYDROSEEDED
APRIL 2000 SEDGES
PLANTED APRIL 2000
(APPROX. 0.02 ACRES)
WETLAND AREA D -
WATER FILLED OPEN
EXCAVATION AREA
SOIL REMOVAL AREA 3
HYDROSEEDED JUNE 2003
UPLAND WOODY SPECIES
PLANTED SEPTEMBER/
OCTOBER 2003
(APPROX. 1.0 ACRES)
AREA HYDROSEEDED
APRIL 2000 (APPROX.
0.142 ACRES)
WETLAND

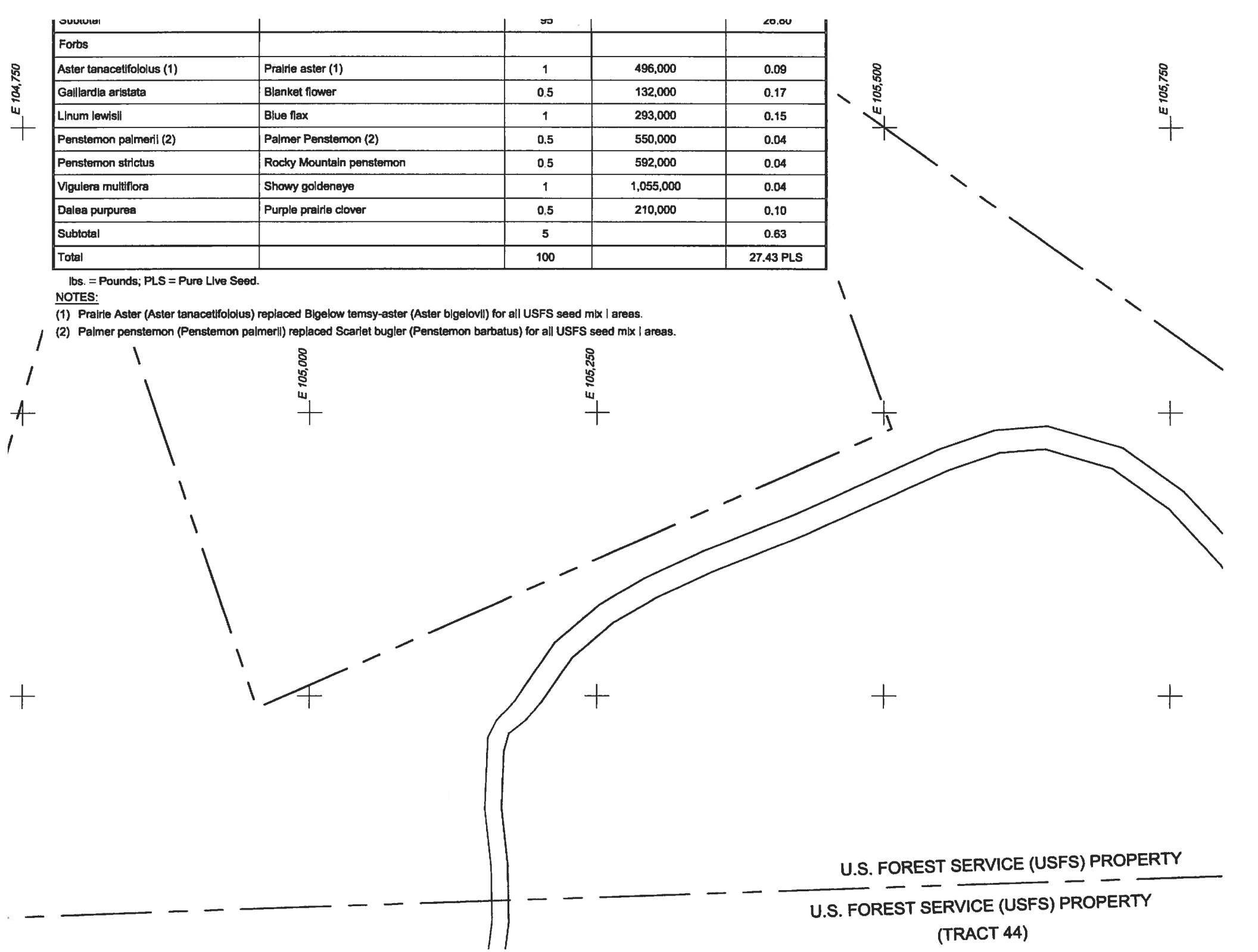
Subtotal		95		26.80
Forbs				
Aster tanacetifololius (1)	Prairie aster (1)	1	496,000	0.09
Gaillardia aristata	Blanket flower	0.5	132,000	0.17
Linum lewisii	Blue flax	1	293,000	0.15
Penstemon palmerii (2)	Palmer Penstemon (2)	0.5	550,000	0.04
Penstemon strictus	Rocky Mountain penstemon	0.5	592,000	0.04
Viguiera multiflora	Showy goldeneye	1	1,055,000	0.04
Dalea purpurea	Purple prairie clover	0.5	210,000	0.10
Subtotal		5		0.63
Total		100		27.43 PLS

lbs. = Pounds; PLS = Pure Live Seed.

NOTES:

(1) Prairie Aster (Aster tanacetifololius) replaced Bigelow temsy-aster (Aster bigelovii) for all USFS seed mix I areas.

(2) Palmer penstemon (Penstemon palmerii) replaced Scarlet bugler (Penstemon barbatus) for all USFS seed mix I areas.



USFS RO
(DAVIS WILLOW R

REA VICINITY MAP

SCALE)

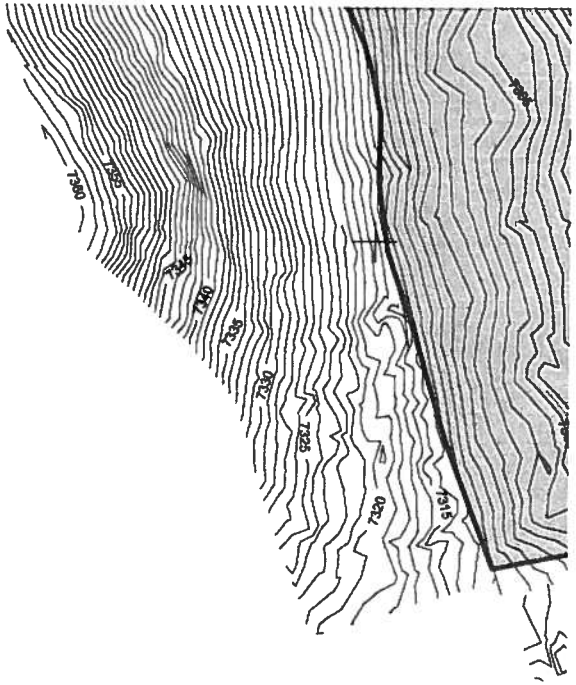
LAND AREAS

	Percent	Seeds/pound	lbs/acre
	15	191,000	3.42
	10	90,000	4.84
	15	159,000	4.11
	15	550,000	1.19
	15	110,000	5.94
	15	2,500,000	0.26
	10	925,000	0.47
	95		20.23
	1	1,550,000	0.03
	0.5	132,000	0.17
	1	293,000	0.15
	0.5	550,000	0.04
	0.5	592,000	0.04
	1	1,055,000	0.04
	0.5	210,000	0.10
	5		0.57
	100		20.80 PLS

mbia) for all seed mix I planting areas.

Plant Species
er Disturbed Areas

	Planting Density (stems per acre)



EL MOLINO BORROW AREA SEED MIX

Species	Common Name	Percent	Seeds/pound
Grasses			
Bouteloua gracilis	Blue grama "Lovington"	11	825,000
Bouteloua curtipendula	Side-oats grama "Vaughn"	22	191,000
Agropon smithii	Western wheatgrass "Arriba"	13	110,000
Bromus marginatus	Mountain brome "Bromar"	16	90,000
Festuca arizonica	Arizona fescue "Redondo"	5	550,000
Sporobolus cryptandrus	Sand dropseed	14	5,298,000
Subtotal		81	
Forbs			
Penstemon strictus	Rocky Mountain penstemon	4	592,000
Linum lewisii	Blue flax	2	293,000
Asteraceae family	Native coneflower	2	345,000
Malvaceae family	Native globemallow	3	500,000
Subtotal		11	
Legume			
Melilotus officinalis	Yellow blossom "Sweet Clover"	8	260,000
Subtotal		8	
Total		100	

lbs. = Pounds; PLS = Pure Live Seed.

APPENDIX B
EXAMPLE INSPECTION FORMS

LONG-TERM OPERATION AND MAINTENANCE PLAN
PECOS MINE OPERABLE UNIT – TERERRO, NEW MEXICO

Surface Water Drainage and Subsurface Water Interception Inspection Form
Pecos Mine Operable Unit - Tererro, New Mexico

Inspected By: _____

Company Name: _____

Date of Inspection: _____

Inspection Item	Successful Operation?		Need of Maintenance?		Location	Comments	Corrective Action Performed
Surface water channel dissipater aprons are free of erosion, siltation, buildup of miscellaneous debris, depressions, riprap failure or transport etc.	Yes	No	Yes	No	North, South, Central Perimeter Drainage Channels and Willow Creek/Hwy. 63 Culvert Transition		
Surface water channels appear to be functioning properly and are free of depressions, siltation, miscellaneous debris, etc.	Yes	No	Yes	No	North Perimeter Drainage Channel		
Surface water channels appear to be functioning properly and are free of depressions, siltation, miscellaneous debris, etc.	Yes	No	Yes	No	South Perimeter Drainage Channel		
Surface water channels appear to be functioning properly and are free of depressions, siltation, miscellaneous debris, etc.	Yes	No	Yes	No	Central Perimeter Drainage Channel		
Surface water channels appear to be functioning properly, have adequate vegetation and are free of depressions, siltation, miscellaneous debris, etc.	Yes	No	Yes	No	North Mid-slope Drainage Channel		
Surface water channels appear to be functioning properly, have adequate vegetation and are free of depressions, siltation, miscellaneous debris, etc.	Yes	No	Yes	No	South Mid-slope Drainage Channel		
Surface water channels appear to be functioning properly and are free of depressions, siltation, miscellaneous debris, etc.	Yes	No	Yes	No	USD Channel		

Surface Water Drainage and Subsurface Water Interception Inspection Form
Pecos Mine Operable Unit - Tererro, New Mexico

Inspection Item	Successful Operation?		Need of Maintenance?		Location	Comments	Corrective Action Performed
Surface water channels appear to be operating within capacity and show no signs of overflow or under-design.	Yes	No	Yes	No	North, South, Central Perimeter Drainage Channels and Willow Creek/Hwy. 63 Culvert Transition		
Surface water channels have sufficient armoring where needed and show no signs of erosion/damage.	Yes	No	Yes	No	North, South, Central Perimeter Drainage Channels and Willow Creek/Hwy. 63 Culvert Transition		
Culverts are free of debris, silt or other impeding materials and appear to be functioning properly.	Yes	No	Yes	No	Willow Creek Culverts, White Seep Culvert, STA 14+00 Culvert and Southern Culvert		
USD Channel north and south drainage tie-ins appear to be functioning properly and are free of depressions, siltation, miscellaneous debris, or other damage.	Yes	No	Yes	No	North and South USD Channel Tie-In		
Gabion Drop Structure from USD Channel to Willow Creek appears to be functioning properly and is free of depressions, siltation, miscellaneous debris, or other damage.	Yes	No	Yes	No	USD Channel/Willow Creek Gabion Drop Structure		
Highway 63 ditch appears to be functioning properly and is free of siltation, miscellaneous debris or other damage.	Yes	No	Yes	No	Highway 63 Ditch		

Surface Water Drainage and Subsurface Water Interception Inspection Form
Pecos Mine Operable Unit - Tererro, New Mexico

Inspection Item	Successful Operation?	Need of Maintenance?	Location	Comments	Corrective Action Performed
Additional Inspection Items and Corrective Actions (Please List Below)					
	Yes No	Yes No			
	Yes No	Yes No			
	Yes No	Yes No			
	Yes No	Yes No			

Geotechnical Stability Inspection Form
Pecos Mine Operable Unit - Tererro, New Mexico

Inspected By:

Company Name:

Date of Inspection:

Inspection Item	Successful Operation?		Need of Maintenance?		Location	Comments	Corrective Action Performed
Is GCL and/or drainage net exposed?	Yes	No	Yes	No	Main Waste Rock Pile Cap		
Are there signs of cover soil sloughing?	Yes	No	Yes	No	Main Waste Rock Pile Cap		
Are there signs of tension cracking at the crest or along the sideslopes of the cap?	Yes	No	Yes	No	Main Waste Rock Pile Cap		
Does the cover soil show signs of lateral slippage, sliding or bulging at the toe of the slope?	Yes	No	Yes	No	Main Waste Rock Pile Cap		
What is the condition of the cover soil at the time of inspection? (i.e., saturated, dry, wet?)	Yes	No	Yes	No	Main Waste Rock Pile Cap		
Does the main shaft cover show signs of wall movement, concrete movement, erosion along interface, etc.?	Yes	No	Yes	No	Main Waste Rock Pile Cap		
Does the main shaft cover retaining wall show signs of wall movement, concrete movement, erosion along interface, etc.?	Yes	No	Yes	No	Main Waste Rock Pile Cap		

Geotechnical Stability Inspection Form
Pecos Mine Operable Unit - Tererro, New Mexico

Inspection Item	Successful Operation?	Need of Maintenance?	Location	Comments	Corrective Action Performed
Is there sloughing/debris in the Highway 63 ditch or on the highway itself?	Yes No	Yes No	Main Waste Rock Pile Cap		
Additional Inspection Items and Corrective Actions (Please List Below)					
	Yes No	Yes No			
	Yes No	Yes No			
	Yes No	Yes No			
	Yes No	Yes No			

Willow Creek and Wetland Structure Stability Inspection Form
Pecos Mine Operable Unit - Tererro, New Mexico

Inspected By: _____

Company Name: _____

Date of Inspection: _____

Inspection Item	Successful Operation?		Need of Maintenance?		Location	Comments	Corrective Action Performed
Willow Creek fish barrier drop structure appears structurally sound and shows no signs of depressions, settling, damage, or other need of repair.	Yes	No	Yes	No			
Willow Creek fish barrier drop structure is functioning properly. Willow Creek is properly flowing over the structure as designed.	Yes	No	Yes	No			
Where applicable (i.e., Willow Creek has not meandered from original alignment) step pools are functioning properly.	Yes	No	Yes	No			
Willow Creek turnout parking area near Highway 63 shows no signs of erosion or other miscellaneous damage.	Yes	No	Yes	No			
USD Channel drop structure/Willow Creek confluence shows no signs of depressions, settling, damage, or other need of repair.	Yes	No	Yes	No			
Willow Creek tie-in to fish barrier drop structure shows no signs of damage or need of repair.	Yes	No	Yes	No			
Willow Creek fencing maintains site access limitation function and shows no signs damage or need of repair.	Yes	No	Yes	No			

Willow Creek and Wetland Structure Stability Inspection Form
Pecos Mine Operable Unit - Tererro, New Mexico

Inspection Item	Successful Operation?	Need of Maintenance?	Location	Comments	Corrective Action Performed
Willow Creek banks and floodplain revegetation (see 'Revegetation Success Inspection Form')	Yes No	Yes No			
Additional Inspection Items and Corrective Actions (Please List Below)					
	Yes No	Yes No			
	Yes No	Yes No			
	Yes No	Yes No			
	Yes No	Yes No			
	Yes No	Yes No			

Revegetation Success Inspection Form
Pecos Mine Operable Unit - Tererro, New Mexico

Inspected By: _____

Company Name: _____

Date of Inspection: _____

Inspection Item	Successful Operation?		Need of Maintenance?		Location	Comments	Corrective Action Performed
Revegetated cover has germinated and is growing successfully with no signs of stressed, inadequate vegetation, noxious weeds or signs of human/animal damage or interference (i.e., grazing, recreational vehicle damage, etc.).	Yes	No	Yes	No	NE Slope of Main Waste Rock Pile		
	Yes	No	Yes	No	Willow Creek Reconstructed Banks		
	Yes	No	Yes	No	Willow Creek Floodplain		
	Yes	No	Yes	No	North Borrow Area and Access Road		
	Yes	No	Yes	No	Disjunct Pile and Access Roads		
	Yes	No	Yes	No	Wetland Areas A, B, C, E and Surrounding Wetlands		
	Yes	No	Yes	No	East Slope of USD Channel		
	Yes	No	Yes	No	El Molino Borrow Area and Access Road		
	Yes	No	Yes	No	USFS Borrow Area Haul Road		

Revegetation Success Inspection Form
Pecos Mine Operable Unit - Tererro, New Mexico

Inspection Item	Successful Operation?		Need of Maintenance?		Location	Comments	Corrective Action Performed
Revegetated cover has germinated and is growing successfully with no signs of stressed, inadequate vegetation, noxious weeds or signs of human/animal damage or interference (i.e., grazing, recreational vehicle damage, etc.).	Yes	No	Yes	No	McDuff Borrow Area/Roads		
	Yes	No	Yes	No	Willow Creek Campground (Flat & Slope Areas)		
	Yes	No	Yes	No	Area South of Main Waste Rock Pile		
	Yes	No	Yes	No	Main Waste Rock Pile Cap		
Containerized plants appear to be growing successfully with no sign stressed, inadequate vegetation, noxious weeds or signs of human/animal damage or interference.	Yes	No	Yes	No	Willow Creek Corridor - Reconstructed Bank		
	Yes	No	Yes	No	Willow Creek corridor - Subirrigated Floodplain		
	Yes	No	Yes	No	North Borrow Area and Access Roads		
	Yes	No	Yes	No	Area South of Main Waste Rock Pile		
	Yes	No	Yes	No	McDuff Borrow Area		
	Yes	No	Yes	No	Disjunct Pile		
	Yes	No	Yes	No	NE-Slope Area		
	Yes	No	Yes	No	Willow Creek Floodplain		

Revegetation Success Inspection Form
Pecos Mine Operable Unit - Tererro, New Mexico

Inspection Item	Successful Operation?	Need of Maintenance?	Location	Comments	Corrective Action Performed
Containerized plants appear to be growing successfully with no sign stressed or inadequate vegetation, noxious weeds or signs of human/animal damage or interference.	Yes No	Yes No	USD Channel East Slope		
	Yes No	Yes No	Soil Removal Area 3		
	Yes No	Yes No	East Slope Near Hwy. 63		
	Yes No	Yes No	Wetland Areas A, B, C and E (Sedges)		
Willow Creek cuttings appear to be growing successfully with no sign of stressed or inadequate vegetation, noxious weeds or signs of human/animal damage or interference.	Yes No	Yes No	Willow Creek Reconstructed Banks		
Additional Inspection Items and Corrective Actions (Please List Below)					
	Yes No	Yes No			
	Yes No	Yes No			
	Yes No	Yes No			
	Yes No	Yes No			
	Yes No	Yes No			

APPENDIX C
EXAMPLE GROUNDWATER SAMPLE COLLECTION CHECKLIST

LONG-TERM OPERATION AND MAINTENANCE PLAN
PECOS MINE OPERABLE UNIT – TERERRO, NEW MEXICO

PMOU Groundwater Sampling Checklist

Samplers

_____ Month _____ Year _____

Sampling Location	Sample ID	Field Data				Lab Analysis			Sample Information			
		DTW	pH/EC/Temp	DO	Turbidity	General chemistry	Dissolved Metals	Dissolved Anions	Date	Time	Sampler	Comments
P-7												
P-7S												
P-13												
P-13S												
QC Samples												
Duplicate	DU1-											Duplicate of
Field Blank	FB1-											

APPENDIX D

GROUNDWATER SAMPLING STANDARD OPERATING PROCEDURES

LONG-TERM OPERATION AND MAINTENANCE PLAN PECOS MINE OPERABLE UNIT – TERERRO, NEW MEXICO

Table of Contents

Groundwater Sampling Standard Operating Procedure
Long-Term Monitoring Plan, Pecos Mine Operable Unit

1. Introduction

This groundwater sampling standard operating procedure (SOP) has been prepared for long-term groundwater monitoring at the Pecos Mine Operable Unit (PMOU) near Pecos, New Mexico. Groundwater monitoring shall be conducted during the fall once every two years for the first six years, followed by once every five years. The monitoring results will be provided to the New Mexico Environment Department (NMED) within four months of the date of each monitoring event. The intent of long-term groundwater monitoring is to ensure the continued effectiveness of the remedial action. Groundwater monitoring will continue with water levels and water quality samples collected from PMOU monitor wells P-7, P-7S, P-13, and P-13S.

The purpose of this SOP is to present guidelines and procedures for collection, preservation, and shipment of groundwater samples for laboratory chemical analysis. This SOP also outlines procedures for measurement of field water quality parameters during sample collection activities, and documentation and reporting of the water quality results.

2. Groundwater Sampling Preparation and Documentation

Prior to any water sampling event, it is recommended that the water sampler requisition all necessary equipment and supplies. All equipment to be used, with the exception of rental equipment, should be calibrated and tested prior to being sent to the field. Meter calibration shall be conducted in accordance with standard manufacturer-recommended procedures using clean, fresh reagents.

Prior to a water sampling event, the number and type of samples to be collected (field and quality assurance samples) shall be determined. The project manager for the analytical laboratory should be contacted to order appropriate sample containers and inform the analytical laboratory of the expected arrival date of the samples, the analytes to be determined for each

sample, and the required turnaround time. It is the water sampler's responsibility to confirm that all sample bottles have been received and are loaded for sampling.

Each sample will be traceable from the point of collection through analysis and final disposition to ensure sample integrity. Maintaining sample integrity helps to ensure the defensibility and reliability of the analytical data. Documentation used to account for sample custody includes the following:

- Sample identification numbers
- Sample tags or labels
- Custody seals for sample coolers
- Chain of custody records
- Field logbooks

2.1 Sample Identification Numbers

All samples shall have unique identification (ID) numbers that trace the samples to the sample locations, media, and sampling parties. Historically, the sample ID number contains the information listed in Table 1 as part of the character code.

Table 1. Sample Identification Numbers

Number of Characters	Description	Example Code
2 to 4	Sample location	P7 = PMOU well P-7
2 to 4	Sample medium	MW = Groundwater monitor well
3	Sample quarter and year	416 = 4th quarter, 2016
2 to 3	Sampling party ID	DS = DBS&A

For example, in the sample ID number P7MW416DS, the sample location is PMOU well P-7, the sample medium is groundwater, the sample was collected in the fourth quarter of 2016, and the sampling party was Daniel B. Stephens & Associates, Inc. (DBS&A).

2.2 *Sample Labels*

Each sample container will be clearly labeled with sample information using adhesive-backed labels and waterproof ink at the time of collection. At a minimum, the information on the labels will include the following information:

- Sample ID number
- Date of sample collection
- Sample location
- Time of sample collection
- Initials of the sample collector
- Sample medium
- Analysis required
- Preservation
- Filtered/unfiltered

2.3 *Chain of Custody Records*

The custody of samples must be maintained and documented from the time the sample is collected to the time that valid analytical results are received from the laboratory. The sampling team is responsible for completing a chain of custody form and checking all sample labels to ensure that all samples are accounted for and in good condition and that no errors were made in labeling and/or completing the chain of custody form.

The chain of custody form consists of an original form with a carbonless copy or an electronic form with a scanned copy. The original form is included with the samples to be shipped by enclosing the form in a plastic bag and taping it to the inside lid of the cooler. The second copy or scanned copy of the chain of custody will be retained by the sampling team. The laboratory will sign for receipt of the samples, keep the original copy, and return a scanned copy to the sampling party via email confirming receipt of the samples and requested analyses. It is recommended that the water sampler or project manager match and file scanned copies to

complete the chain of custody procedure. The laboratory's scanned copy of the chain of custody is attached to their final analysis report.

2.4 Field Logbooks

Field logbooks should be kept to record all sampling activities and observations. The logbooks contain the on-site measurement data and documentation so that reconstruction of the sampling event may be conducted at a later time if necessary. All daily entries will be made in waterproof ink, dated, and signed. Logbooks will be bound, waterproof, and contain numbered pages. All corrections in the logbooks will be initialed and dated. The following information can be recorded in the field logbook:

- Name and affiliation of all on-site personnel or visitors
- Weather conditions during the field activity
- Summary of daily activities and significant events
- Sampling data (detailed list of notable items included below)
- Notes of conversations with coordinating officials
- References to other field logbooks or forms that contain specific information
- Discussions of problems encountered and their resolution
- Discussions of deviations from the SOP or other governing documents
- Description of all photographs taken

Field personnel will prepare all sample documentation prior to shipping the samples to the appropriate laboratory for analysis. Groundwater samples submitted to an off-site laboratory for analysis will be shipped using next-day delivery.

3. Collection of Groundwater Samples

Groundwater sample collection shall be performed using traditional bailing sampling techniques, as described in the following subsections. The water quality samples collected will be analyzed for the following constituents.

- Field parameters: dissolved oxygen (DO), electrical conductivity (EC), pH, temperature, and turbidity.
- General chemistry and major ions: alkalinity, calcium, chloride, fluoride, magnesium, potassium, sodium, sulfate, and total dissolved solids (TDS).
- Metals (dissolved): barium, cadmium, cobalt, iron, manganese, and zinc.

3.1 Wellhead Preparation

Prior to groundwater sample collection, the following wellhead protection activities are recommended to be conducted:

- Inspect the area around the well for wellhead integrity, cleanliness, and signs of possible tampering or contamination.
- Remove the cap on the wellhead. Note any obvious odors within the wellbore in the field logbook.

3.2 Groundwater Level Measurement

Each monitor well will be gauged prior to purging to document the depth to water (DTW) from top of casing (TOC) by an electrical sounder. Electrical sounders operate by completing an electrical circuit when the probe contacts the water, thus providing a measure of the depth to water. When the circuit is completed, a light, buzzer, or ammeter needle indicates that the probe is in contact with the water surface. The probe is connected to a graduated tape, usually made from plastic and fiberglass. Batteries supply the necessary current through electrical wires contained in the graduated tape. Electrical sounders measure depths to within 0.02 foot.

Field personnel should position themselves near the measuring point so that the DTW can be read at eye level. A second confirmatory reading should be performed before the electrical tape is withdrawn from the well. The following information shall be recorded: the person making the measurement, the measuring device, the surveyed point from which the measurement is made,

the time of day (military time), the date, the wellhead condition, and any measuring point changes.

3.3 Monitor Well Purging

The purpose of purging the well prior to sampling is to remove stagnant water from the well bore so that a representative groundwater sample can be collected. The method of purging can have a pronounced effect on the quality of the groundwater sample. For example, rapid purging may increase sample turbidity, and is therefore not recommended.

The following purging procedure can be used as a general guideline:

1. Calculate the volume of water standing in the casing (cubic feet) by using the formula:

$$V = \pi r^2 L$$

where r = the radius of the casing (remember to convert inches to feet)
L = the length of the water column (total depth of well – the static water level) (ft)
Note: 1 cubic foot holds 7.48 gallons of water.

2. Purge the well using traditional bailing techniques.

3. Measure applicable field parameters after approximately each 0.5 casing volume has been removed from the well. Purging is generally considered complete after a minimum of three casing volumes, at which time the field parameters (i.e., pH, EC, and temperature) are generally stable over the final casing volume.

4. In low-permeability formations, it may not be possible to purge three casing volumes before the well goes dry. When the formation permeability is too low to allow for continuous purging, remove all of the standing water in the well by bailing. As soon as the well has recharged sufficiently, collect a sample. Wells that go dry typically require 12 to 24 hours for sufficient recovery. Results of previous water sampling events will be consulted when available.

5. Take careful notes in order to document all purging procedures. The notes shall include date, time, name(s) of sampler(s), weather, purge rate, purge method, field parameter measurements (at each time measured, with corresponding purge volume), visual observations, odor, and any other relevant information.

Purge water will be disposed of on-site in the immediate vicinity of the wells in a manner that maintains the water in the vicinity of the well and does not allow the purge water to run off into local waterways.

3.4 Measurement of Field Parameters

For PMOU wells, field water quality parameter measurements (pH, EC, and temperature) should be collected throughout purging and logged for all wells in the field logbooks. Measure DO from the initial purge water sample, and turbidity from the final purge water sample.

3.4.1 Electrical Conductivity and Temperature

EC is a measure of the ease of flow of electric current, and is the inverse (reciprocal) of resistivity. The term electrical conductivity, sometimes referred to simply as "conductivity," is defined as the electrical conductance that would occur through the water between the faces of a 1-centimeter cube of the water. EC is usually reported in units of micromhos per centimeter (µmhos/cm), which has been renamed microsiemens per centimeter (µS/cm). By measuring the EC of a water sample in the field, one can estimate the TDS concentration of the water using the approximate conversion TDS = 0.6 x EC. Because the EC of a water sample allows rapid determination of TDS (salinity), EC is probably the single most useful water quality parameter.

The EC of water containing dissolved ions increases with increasing temperature of the water. The temperature dependence varies for different waters and is dependent on the type and concentrations of dissolved ions, but an approximate rule of thumb is that EC increases 2 percent per °C temperature increase. For quantitative comparison of EC values measured on different water samples at different field temperatures, it is necessary to correct all values to the EC at 25°C. For most qualitative work, however, this is unnecessary. Whether or not

temperature corrections are to be applied, the EC value as measured at field temperature should always be recorded in the field logbook, along with the temperature of the water sample at the time the measurement was made.

EC will be measured at the wellhead using a YSI-556 or other appropriate EC meter. Most pH and EC meters also include a water temperature sensor with a precision of ±0.1°C. Groundwater temperature may be determined using a standard pH or EC meter equipped with a temperature sensor. Determine and record the groundwater temperature at the same time and using the same technique as for determining groundwater pH and EC.

Temperature sensors generally do not require calibration. However, to ensure that the temperature sensor is functioning properly, check it against a high-quality mercury thermometer at least once a year. If not in agreement within ±0.2°C, have the temperature probe serviced by the manufacturer.

3.4.2 pH

A standard pH meter can be used to measure the pH of the groundwater at the wellhead periodically during well purging. Calibrate the pH meter at the start of each day following the manufacturer's instructions and using two standard pH buffers that straddle the expected groundwater pH range. Check that the meter remains in calibration several times during the day by immersing the probe in the buffer solutions. Recalibrate as necessary.

Groundwater pH should be measured immediately upon withdrawal from the well, as pH can change as a result of temperature change and exposure to air. Place the pH probe in a cup or other suitable container into which the groundwater can be directed during purging. Measure and record the groundwater pH at the start of purging, then several more times during purging. The pH and other field parameters should be relatively stable. Prior to sampling, record the final pH in the field logbook.

3.4.3 Dissolved Oxygen

DO provides a measure of the concentration of oxygen (O_2) dissolved in the water. Groundwater DO concentrations should be measured immediately in the field, as subsequent

DO changes can occur as a result of exposure to air. Place the DO probe in a bucket or other suitable container into which the groundwater can be directed during purging. Try to minimize aeration of the water due to splashing. Measure the groundwater DO concentration at the start of purging at the wellhead. Record this initial DO value in the field logbook.

3.4.4 Turbidity

Turbidity provides an estimate of the clarity of the water sample by measuring the scattering effect on light caused by suspended particles present. Turbidity is reported in nephelometric turbidity units (NTU). Turbidity will be measured with a Hach Turbidimeter or other appropriate portable turbidity meter. Follow the manufacturer instructions to analyze the water sample. Measure the groundwater turbidity concentration at the end of purging and record the turbidity value in the field logbook.

3.5 Groundwater Sample Collection

The following procedure shall be used to collect groundwater samples:

1. PMOU wells are not equipped with a sampling pump; use dedicated or disposable polyethylene bailers for sampling.

2. Measure field parameters as described in Section 3.4. Temperature, EC, and pH will be measured throughout well purging.

3. After the well has been purged, collect water samples as soon as possible.

4. Use the filtering procedure described in Section 3.7 for water samples requiring filtration.

5. Use pre-preserved containers supplied by the analytical laboratory rather than adding preservatives in the field.

6. Record all pertinent information in the field notebook. Data to be recorded include the date and time of sample collection, climatic conditions at the time of sampling, well sampling sequence, types of sample containers used, sample identification numbers, field parameter data, name(s) of collector(s), deviations from established sampling

protocol (e.g., equipment malfunctions), purpose of sampling (e.g., routine, contingency), and collection of quality control samples.

3.6 Quality Control Samples

Field quality control (QC) sampling and measurements will be used to verify the analytical data and assess the influence of sampling activities and measurements on data quality. The QC samples will include a field duplicate and a field blank. Field duplicates are independent samples that are collected as close as possible, in space and time, to the original investigative samples. Field duplicates can measure the influence of sampling and field procedures on the precision of an environmental measurement. They can also provide information on the heterogeneity of a sampling location. Immediately following collection of the original sample, the field duplicate will be collected using the same collection method. One field duplicate will be collected at PMOU and analyzed for the same analytes as the original sample.

Field blanks are collected to evaluate whether ambient site conditions may be influencing water quality results. A prime example is airborne dust. Field blanks are collected by filling sample containers with analyte-free water at a sample location. One field blank will be collected at PMOU and analyzed for the same analytes as the primary samples.

3.7 Sample Filtration

The following SOP defines activities to be completed to properly filter water samples in preparation for analysis by an analytical laboratory. Filtration is required for any dissolved analysis and the samples should be completed in the field if possible. If field filtering is not possible, preserve the sample by chilling to 4°C (i.e., do not add acid), and immediately ship the sample via overnight delivery to the laboratory. Indicate on the chain of custody that laboratory filtration and preservation are required.

The following procedure shall be followed to filter samples in the field with a peristaltic pump (e.g., GeoPump):

1. Connect the GeoPump to a 12V automobile power source port or to an outlet if electricity is available.

2. Replace the tubing for the GeoPump at the beginning of each sampling round. If the samples are collected in any order other than most contaminated to least contaminated, or if very high levels of contamination are suspected or observed, then replace the tubing between each sample or as necessary.

3. If the tubing is not replaced between each sample, flush the lines with Liquinox followed by at least three flushes with distilled water.

4. Collect an unfiltered water sample as discussed in Sections 3.5 or 3.6.

5. Place the intake line in the unfiltered sample.

6. Pump at least a few hundred milliliters of the sample through the GeoPump prior to sample collection in order to flush the line. Set the GeoPump at the lowest rate possible in order to minimize aeration. Dispose of this water appropriately.

7. Place a new disposable 0.45-micron filter on the output line. Pump a few milliliters of the sample through the GeoPump prior to sample collection in order to wet and flush the filter. Direct the output stream from the filter into the pre-acidified sample container.

4. Data Evaluation and Reporting

Groundwater monitoring shall be conducted during the fall once every other year for the first six years, then once every five years. The monitoring results will be provided to NMED within four months of the date of each monitoring event. Water levels and water quality samples will be collected from monitor wells P-7, P-7S, P-13, and P-13S. A field duplicate at one random well location and a field blank will also be collected for QC purposes. The groundwater sample results shall be compared to historical analytical data for each well location (see Appendix E), along with the groundwater quality standards as set forth in Subsections A through C of 20.6.2.3103 NMAC or approved alternative abatement standards for PMOU.

If a constituent concentration exceeds the applicable standard, the laboratory will be contacted to confirm that adequate quality assurance and quality control of the sample was conducted, and the monitor well shall be resampled within six months. In the event of a confirmed exceedance (i.e., there are two valid groundwater samples collected within six months of one another that exceed the applicable standard), the following actions will be taken:

1. The frequency of groundwater monitoring will be increased to quarterly for the well that exceeds the applicable standard(s) to better determine trends in the constituent concentration(s).

2. An updated site review will be conducted to evaluate current site conditions and identify potential contributing factors to the change in water quality.

The results of these actions will be provided to NMED and further actions, if any, will be determined in conjunction with NMED. If subsequent samples meet the applicable standard for eight consecutive quarters, the routine monitoring schedule will be resumed.

APPENDIX E

GROUNDWATER HISTORICAL ANALYTICAL RESULTS

LONG-TERM OPERATION AND MAINTENANCE PLAN
PECOS MINE OPERABLE UNIT – TERERRO, NEW MEXICO

0.03	171	0.0008	0.040	0.03	<0.1	82.2	0.0018	1	<0.01	<0.01	<0.01	1.5	0.18	<0.0002	1.1		0.014	<0.01	7.1	<0.01	0.38		
.08	204	0.0007	0.041	0.01	<0.1	80.8	0.0001	2	<0.01	<0.01	<0.01	1.4	0.24		1.0		0.013	<0.01	7.1	<0.01	<0.02		
0.03	198	0.0008	0.044	0.02	<0.1	85.3	<0.0001	2	<0.01	<0.01	<0.01	1.4	0.20	<0.0002	1.1		0.011	<0.01	7.5	<0.01	<0.02		
0.03	198	<0.0005	0.042	0.01	<0.1	83.7	<0.0001	1	<0.01	<0.01	<0.01	1.4	0.04	<0.0002	1.2		0.014	<0.01	7.1	<0.01	<0.02	<0.01	
0.03	214	<0.0005	0.043	0.02	<0.1	84.8	0.0008	2	<0.01	<0.01	<0.01	1.4	0.11	<0.0002	1.1		0.015	<0.01	7.2	<0.01	<0.02	<0.01	<0
0.03	194	0.0008	0.048	0.02	<0.1	86.2	<0.0001	1	<0.01	<0.01	<0.01	1.4	0.07	<0.0002	1.1		0.015	0.02	7.6	<0.01	0.03	0.01	
0.03	196	0.0007	0.046	0.02	<0.1	87.3	<0.0001	1	<0.01	<0.01	<0.01	1.2	0.22	<0.0002	1.3		0.013	<0.01	7.2	<0.01	<0.02	<0.01	<0
0.03	201	0.0008	0.041	0.02	<0.1	84.3	<0.0001	1	<0.01	<0.01	<0.0005	1.3	0.20	0.0004	0.9	16.8	0.008	<0.01	7.3	<0.01	0.09	0.02	<0
0.03	199	0.0007	0.041	0.02	<0.1	83.4	<0.0001	<1	<0.01	<0.01	0.0007	1.4	0.21	<0.0002	1.2	16.5	0.012	<0.01	7.2	<0.01	<0.02	<0.01	<0
0.03	197	0.0008	0.051	0.02	<0.1	85.9	<0.0001	2	<0.01	<0.01	0.0005	1.4	0.16	<0.0002	1.0	17.1	0.013	<0.01	7.4	<0.01	<0.02	<0.01	<0
0.03	192	0.0010	0.041	0.01	<0.2	87.0	<0.0001	1	<0.01	<0.01	<0.0005	1.3	0.08	<0.0002	0.8	17.3	<0.005	<0.01	7.1	<0.01	<0.02	<0.01	
0.03	193	0.0006	0.045	0.02	<0.1	85.4	<0.0001	2	<0.01	<0.01	<0.0005	1.4	0.09	<0.0002	1.1	17.0	0.015	<0.01	7.3	<0.01	0.04	0.01	<0
0.03	190	0.0006	0.045	0.02	<0.1	86.2	<0.0001	1	<0.01	<0.01	<0.0005	1.4	0.23	<0.0002	1.1	17.0	0.015	0.01	7.4	<0.01	<0.02	<0.01	<0
0.03	192	0.0006	0.043	0.02	<0.1	84.8	<0.0001	2	<0.01	<0.01	<0.0005	1.9	0.17	<0.0002	1.1	16.9	0.014	<0.01	7.3	0.01	<0.02	<0.01	
0.03	191	0.0008	0.043	0.02	<0.01	83.5	<0.0001	1	<0.01	<0.01	<0.0005	1.2	0.15	<0.0002	1.1	15.9	<0.005	<0.01	7.3	<0.01	<0.02	0.02	<0
0.03	200	0.0008	0.041	0.02	<0.01	85.5	<0.0001	<1	<0.01	<0.01	0.0013	1.2	0.18	<0.0002	1.0	17.0	0.013	<0.01	7.2	<0.01	<0.02	<0.01	<0
0.03	194	0.0008	0.038	0.01	<0.01	83.4	<0.0001	1	<0.01	<0.01	<0.0005	1.3	0.20	<0.0002	0.8	16.4	0.009	<0.01	6.9	<0.01	<0.02	<0.01	<0
0.06	199	<0.0005	0.041	<0.02	<0.01	86.7	<0.0001	<1	<0.01	<0.01	0.0005	1.2	0.23	<0.0002	1.1	17.4	0.010	<0.01	6.9	<0.01	<0.02	<0.01	
0.03	200	<0.0005	0.040	0.02	<0.01	83.9	<0.0001	1	<0.01	<0.01	<0.0005	1.3	0.18	<0.0002	1.2	16.4	0.010	<0.01	7.1	0.02	<0.02	0.01	
0.03	196	0.0009	0.045	<0.01	<0.01	84.1	<0.0001	<1	<0.01	<0.01	<0.0005	1.3	0.14	<0.0002	0.7	16.3	0.006	<0.01	7.2	<0.01	0.42	<0.01	<0
0.03	193	0.0005	0.039	0.01	<0.01	85.7	<0.0001	<1	<0.01	<0.01	<0.0005	1.3	0.20	<0.0002	1.0	16.5	0.014	<0.01	7.0	<0.01	<0.02	<0.01	
0.03	186	0.0005	0.040	0.01	<0.01	87.1	<0.0001	1	<0.01	<0.01	<0.0005	1.3	0.19	<0.0002	1.4	17.0	0.012	<0.01	7.8	<0.01	<0.02	<0.01	<0
	164	<0.0005	0.055		<0.1	105	0.0040		<0.01	<0.01	0.0009	<0.1	<0.01	<0.0002	1.0		<0.005		2.1	<0.01			<0
	175	<0.0005	0.043		<0.1	78.6	0.0018		<0.01	<0.01	0.0009	0.1	<0.01		0.9		<0.005		2.0	<0.01			
	188	<0.0005	0.044		<0.1	73.3	0.0004		<0.01	<0.01	0.0008	0.1	<0.02	<0.0002	1.0		<0.005		1.7	<0.01			
0.03	188	<0.0001	0.042	0.01	<0.1	77.4	0.0004	1	<0.01	<0.01	<0.01	<0.1	<0.02	<0.0002	1.1		0.007	<0.01	1.5	<0.01	0.13		<0
0.03	171	<0.0005	0.034	<0.01	<0.1	66.0	0.0001	2	<0.01	<0.01	<0.01	<0.1	<0.02		0.7		<0.005	<0.01	1.4	<0.01	<0.02		<0
0.05	164	<0.0005	0.039	<0.01	<0.1	72.1	0.0001	2	<0.01	<0.01	<0.01	<0.1	0.03	<0.0002	1.0		<0.005	<0.01	1.6	<0.01	<0.02		
0.03	206	<0.0005	0.054	0.01	<0.1	89.5	0.0017	1	<0.01	<0.01	<0.01	0.2	<0.02	<0.0002	1.4		0.006	<0.01	2.0	<0.01	<0.02	0.45	
0.06	201	<0.0005	0.047	0.01	<0.1	81.6	0.0002	2	<0.01	<0.01	<0.01	<0.1	0.05	<0.0002	1.0		0.008	<0.01	1.8	<0.01	0.04	0.69	
0.03	166	<0.0005	0.039	0.01	<0.1	71.6	0.0002	1	<0.01	<0.01	<0.01	0.1	<0.02	<0.0002	0.8		0.010	<0.01	1.6	<0.01	0.05	0.21	
0.04	174	<0.0005	0.047	<0.01	<0.1	88.1	0.0003	1	<0.01	<0.01	<0.01	<0.1	<0.02	0.0002	1.4		<0.005	<0.01	1.9	<0.01	<0.02	0.14	<0
0.06	190	<0.0005	0.043	0.01	<0.1	76.1	0.0003	<1	<0.01	<0.01	0.0009	0.1	<0.02	<0.0002	1.2	4.4	0.013	<0.01	1.6	<0.01	0.12	0.1	<0
0.05	163	<0.0005	0.045	0.01	<0.1	72.6	0.0002	2	<0.01	<0.01	<0.0005	<0.1	<0.02	<0.0002	0.8	4.3	0.006	<0.01	1.3	<0.01	0.04	0.16	<0
0.07	170	<0.0005	0.042	<0.01	<0.1	87.6	0.0002	1	<0.01	<0.01	0.0010	<0.1	<0.02	<0.0002	0.8	5.1	<0.005	<0.01	1.9	<0.01	0.12	0.22	
0.03	181	<0.0005	0.045	0.01	<0.1	77.3	0.0002	2	<0.01	<0.01	0.0006	0.1	<0.02	<0.0002	0.9	4.4	0.008	<0.01	1.6	<0.01	0.02	0.22	<0
0.05	173	<0.0005	0.044	<0.01	<0.1	80.0	0.0003	1	<0.01	<0.01	0.0006	0.2	<0.02	0.0003	1.0	4.6	0.009	<0.01	1.6	<0.01	<0.02	0.10	<0
0.04	168	<0.0005	0.036	<0.01	<0.1	72.5	0.0002	2	<0.01	<0.01	0.0013	0.1	0.04	<0.0002	0.7	4.3	0.006	<0.01	1.3	<0.01	0.06	0.14	
0.07	198	<0.0005	0.048	<0.01	<0.01	88.0	0.0005	1	<0.01	<0.01	0.0012	0.1	0.10	<0.0002	0.9	5.1	<0.005	<0.01	1.8	<0.01	0.03	0.26	
0.03	185	<0.0005	0.042	0.01	<0.01	77.5	0.0002	<1	<0.01	<0.01	0.0011	0.1	<0.02	<0.0002	1.3	4.5	<0.005	<0.01	1.9	<0.01	0.03	0.20	<0
0.07	178	<0.0005	0.038	<0.01	<0.01	80.6	0.0004	1	<0.01	<0.01	0.0014	0.1	0.10	<0.0002	0.7	4.6	0.005	<0.01	1.5	<0.01	<0.02	0.33	
0.08	188	<0.0005	0.034	<0.01	<0.01	73.6	0.0004	1	<0.01	<0.01	0.0011	0.1	0.07	<0.0002	1.0	4.2	<0.005	<0.01	1.4	<0.01	0.05	0.23	
0.03	180	<0.0005	0.044	0.01	<0.01	93.6	0.0007	1	<0.01	<0.01	0.0047	<0.1	0.06	<0.0002	1.1	5.5	<0.005	<0.01	2.7	0.01	0.08	0.09	
0.03	190	<0.0005	0.051	<0.01	<0.01	82.5	0.0009	<1	<0.01	<0.01	<0.0005	0.2	<0.02	<0.0002	0.8	4.6	<0.005	<0.01	1.8	<0.01	<0.02	0.16	
0.03	175	<0.0005	0.037	0.01	<0.01	72.7	0.0011	<1	<0.01	<0.01	0.0005	<0.1	<0.02	<0.0002	0.9	3.9	0.007	<0.01	1.4	<0.01	0.02	0.12	
0.9	155	<0.0005	0.036	<0.01	<0.01	88.4	0.0003	1	<0.01	<0.01	0.0009	0.1	0.09	<0.0002	1.0	4.0	0.126	<0.01	1.8	0.02	0.05	0.19	

0.03	392	<0.0005	3.420	0.02	<0.1	113	<0.0001	3	<0.01	<0.01	<0.01	1.6	3.29	<0.0002	2.0		0.864	<0.01	9.7	<0.01	<0.02		
0.03	371	<0.0005	3.260	0.02	<0.1	115	<0.0001	4	<0.01	<0.01	<0.01	1.6	3.43	<0.0002	2.1		0.916	<0.01	9.9	<0.01	0.02	<0.01	
0.03	385	<0.0005	3.190	0.03	<0.1	114	<0.0001	3	<0.01	<0.01	<0.01	1.7	3.07	<0.0002	2.0		0.897	<0.01	9.7	<0.01	<0.02	0.02	
0.03	367	<0.0005	3.270	0.03	<0.1	116	<0.0001	3	<0.01	<0.01	<0.01	1.7	2.89	0.0002	2.1		0.945	<0.01	10.2	<0.01	0.03	0.02	<0.01
0.03	368	<0.0005	3.600	0.02	<0.1	122	<0.0001	3	<0.01	<0.01	<0.01	1.5	3.27	<0.0002	2.3		0.970	<0.01	9.9	<0.01	<0.02	0.02	<0.01
0.03	380	<0.0005	3.240	0.03	<0.1	113	<0.0001	3	<0.01	<0.01	<0.0005	1.7	3.27	0.0003	2.1	18.4	0.924	<0.01	9.9	<0.01	0.03	0.03	<0.01
0.03	382	<0.0005	3.37	0.03	<0.1	113	<0.0001	3	<0.01	<0.01	0.0011	1.7	3.42	<0.0002	2	18.9	0.901	<0.01	10.2	<0.01	<0.02	<0.01	<0.01
0.03	369	0.0005	3.580	0.03	<0.1	124	<0.0001	3	<0.01	<0.01	0.0010	1.7	3.77	<0.0002	2.2	20.3	0.981	<0.01	10.9	<0.01	<0.02	0.01	
0.04	362	0.0009	3.340	<0.01	<0.2	115	<0.0001	3	<0.01	<0.01	0.0009	1.6	3.21	<0.0002	1.7	18.8	0.900	<0.01	9.8	<0.01	<0.02	<0.01	
0.03	403	0.0006	3.430	0.02	<0.1	116	<0.0001	4	<0.01	<0.01	0.0006	1.4	2.99	<0.0002	2.1	19.2	0.932	<0.01	21.7	<0.01	<0.02	1.16	
0.03	361	<0.0005	3.470	0.02	<0.5	115	<0.0001	3	<0.01	<0.01	0.0006	1.5	3.54	<0.0002	2.1	18.9	0.942	0.01	10.3	<0.01	<0.02	0.02	
0.03	357	<0.0005	3.240	0.02	<0.1	112	<0.0001	4	<0.01	<0.01	0.0006	0.2	3.44	<0.0002	2.0	18.5	0.924	<0.01	10.1	<0.01	0.04	0.02	
0.03	373	0.0006	3.370	0.02	<0.05	115	<0.0001	3	<0.01	<0.01	0.0013	1.5	3.36	<0.0002	2.0	18.3	0.942	<0.01	10.3	<0.01	0.03	0.05	
0.03	383	0.0006	3.230	0.02	<0.01	116	<0.0001	3	<0.01	<0.01	<0.0005	1.6	3.61	<0.0002	2.2	18.6	0.916	<0.01	10.3	<0.01	<0.02	0.02	
0.03	375	0.0007	3.240	0.02	<0.1	112	<0.0001	3	<0.01	<0.01	0.0008	1.6	3.48	<0.0002	1.5	18.5	0.922	<0.01	9.8	<0.01	<0.02	<0.01	
0.03	384	0.0007	2.960	<0.01	<0.05	121	<0.0001	3	<0.01	<0.01	0.0010	1.5	3.88	<0.0002	2.3	20.1	0.916	<0.01	9.9	<0.01	<0.02	<0.01	
0.03	385	<0.0005	3.310	0.01	<0.05	120	<0.0001	3	<0.01	<0.01	0.0011	1.6	3.77	<0.0002	2.0	19.4	0.938	<0.01	10.0	0.02	<0.02	0.01	
0.03	379	0.0009	3.820	0.02	<0.05	115	<0.0001	3	<0.01	<0.01	<0.0005	1.6	2.96	<0.0002	1.7	18.9	0.925	<0.01	10.6	<0.01	<0.02	0.02	
0.03	376	0.0006	3.450	0.02	0.04	121	<0.0001	3	<0.01	<0.01	0.0006	1.6	3.72	<0.0002	2.1	19.4	0.935	<0.01	10.5	<0.01	0.06	0.03	
0.03	367	<0.0005	3.270	<0.01	<0.1	122	<0.0001	3	<0.01	<0.01	0.0005	1.7	4.13	<0.0002	2.3	19.6	1.030	<0.01	10.9	<0.01	<0.02	0.01	
	367	<0.0005	3.210		<0.02	113	<0.0001	<5	0.01			1.6	3.93		1.9	18.4	1.000		10.5			0.01	
	368	0.0005	3.460		<0.05	118	<0.0001	3	<0.01			1.7	3.83		2.2	19.6	1.000		10.4			0.02	
	372	0.0007	3.280		<0.02	117	0.0002	3	<0.01			1.6	3.66		2.0	18.9	0.919		10.6			0.08	
	386	<0.0005	3.400		<0.05	113	<0.0001	3	<0.01			1.7	3.74		2.1	18.3	0.966		10.2			0.01	
	384	0.0006	3.490		<0.02	114	<0.0001	3	<0.01			1.7	3.79		2.2	18.6	0.976		10.4			<0.01	
	367	0.0005	3.530		<0.1	115	<0.0001	3	<0.01			1.6	3.61		2.2	18.6	0.961		10.3			<0.01	
	372	0.0006	3.460		<0.05	116	<0.0001	3	<0.01			1.7	3.79		2.1	18.5	0.948		10.3			0.02	
	374	0.0008	3.450		<0.1	116	<0.0001	3	<0.01			1.7	3.84		2.1	18.9	0.978		10.6			0.01	
	392	0.0006	3.410		<0.1	116	<0.0001	2	<0.01			1.6	4.02		2.1	18.4	1.000		10.2			0.02	
	395		3.990		<0.05	117	<0.0001		<0.01			1.65	3.79		2	18.4	0.931		10.5				
	420		3.750		<0.1	119	<0.0001		<0.01			1.61	3.91		2.2	18.2	0.955		10.6				
	424		3.950		<0.05	120	<0.0001		<0.01			1.66	4.03		2.1	18.5	0.973		10.3				
	406		3.410		<0.05	120	<0.0001		<0.01			1.56	4.07		2.1	18.5	0.989		10.4				
			3.400									0.31	4.18				1.00						
			3.36									1.77	4.12				0.984						

	378	0.0021				118	<0.0001	3			<0.0005		7.29		2.1	17.8	2.050		10.1				
	397	0.0063				121	<0.0001	4			0.0007		5.94		2.0	18.1	2.140		10.1				
	379	<0.005				129	<0.001	11			<0.0005		11.50		2.0	18.4	2.180		11.1				
	325	0.0104	0.315		0.2	163	<0.0001		<0.01	<0.01	<0.0005	1.2	8.76	<0.0002	2.5		2.530		17.7	<0.01			
	358	0.0026	0.473		<0.1	113	0.0003		<0.01	<0.01	0.0010	1.8	14.00		2.1		2.280		10.0	<0.01			
	383	0.0042	0.700		0.3	115	<0.0001		<0.01	<0.01	<0.0005	1.5	12.40		2.0		1.990		10.4	<0.01			
03	434	0.0015	0.717	0.02	<0.1	125	<0.0001	5	<0.01	<0.01	<0.01	1.6	11.30	0.0003	2.2		2.090	<0.01	13.1	<0.01	<0.02		
03	399	0.0026	0.743	0.02	<0.1	114	<0.0001	5	<0.01	<0.01	<0.01	1.5	12.80		1.6		2.070	<0.01	9.4	<0.01	0.02		
03	385	0.0038	0.757	0.02	<1	119	<0.0001	3	<0.01	<0.01	<0.01	1.5	14.70	<0.0002	1.9		2.030	<0.01	10.0	<0.01	<0.02		
03	383	0.0106	0.526	0.03	<1	142	<0.0001	9	<0.01	<0.01	<0.01	1.6	16.80	<0.0002	2.5		2.460	<0.01	19.4	<0.01	0.03	0.28	
03	373	0.0098	0.616	0.03	<0.1	118	<0.0001	5	<0.01	<0.01	<0.01	1.6	11.70	<0.0002	2.0		1.970	<0.01	12.7	<0.01	<0.02	0.26	
03	377	0.0042	0.728	0.02	<2	121	<0.0001	4	<0.01	<0.01	<0.01	1.5	13.60	<0.0002	1.9		2.150	<0.01	10.6	<0.01	0.03	0.08	
03	378	0.0028	0.741	0.02	<0.5	123	<0.0001	4	<0.01	<0.01	<0.01	1.3	15.90	<0.0002	2.3		2.100	<0.01	10.5	<0.01	<0.02	0.04	

0.03	378	0.0036	0.709	0.02	<0.05	124	<0.0001	5	<0.01	<0.01	0.0008	1.3	9.68	<0.0002	1.9	18.1	2.020	<0.01	13.4	<0.01	0.08	0.05	<
0.03	400	0.0029	0.717	0.02	<0.2	123	<0.0001	<5	<0.01	<0.01	<0.0005	1.4	14.50	<0.0002	2.2	18.3	2.130	<0.01	12.4	<0.01	0.02	0.09	<
0.03	394	0.0020	0.752	0.02	<0.2	121	<0.0001	6	<0.01	<0.01	<0.0005	1.4	13.90	<0.0002	1.7	18.5	2.230	<0.01	11.3	<0.01	<0.02	0.14	<
0.03	397	0.0049	0.759	<0.01	<0.05	119	<0.0001	3	<0.01	<0.01	0.0009	1.3	13.10	<0.0002	2.2	17.9	2.200	<0.01	10.9	<0.01	<0.02	0.06	(
0.03	387	0.0024	0.467	0.02	<0.1	124	<0.0001	5	<0.01	<0.01	0.0007	1.4	14.70	<0.0002	2.0	18.8	2.400	<0.01	11.0	0.03	<0.02	0.03	<
0.05	399	0.0041	0.788	0.02	<0.1	123	0.0001	<5	<0.01	<0.01	<0.0005	1.5	12.40	<0.0002	1.9	18.6	2.220	<0.01	12.8	<0.01	<0.02	0.11	(
0.03	396	0.0033	0.720	0.02	<0.1	124	<0.0001	<10	<0.01	<0.01	<0.0005	1.5	14.00	<0.0002	1.9	18.4	2.030	<0.01	11.4	<0.01	<0.02	0.07	(
0.03	371	0.0022	0.750	0.01	<0.1	128	0.0001	4	<0.01	<0.01	<0.0005	1.4	13.50	<0.0002	2.3	19.4	2.250	<0.01	11.8	<0.01	<0.02	0.07	(
	387	0.0011	0.778		<0.1	120	<0.0001	<5	<0.01			1.4	12.70		1.7	18.6	2.210		12.7			0.08	
	383	0.0036	0.782		<0.1	127	0.0001	5	<0.01			1.5	12.90		2.2	19.6	2.240		12.3			0.19	
	388	0.0077	0.766		<0.1	121	0.0004	<5	<0.01			1.5	12.80		2.0	18.4	2.100		10.9			0.40	
	399	0.0075	0.729		<0.1	113	<0.0001	<5	<0.01			1.4	11.30		1.9	17.2	2.030		12.2			0.39	
	397	0.0054	0.851		<0.1	125	0.0002	5	<0.01			1.4	11.50		2.2	18.8	2.230		12.8			0.41	
	391	0.0036	0.790		<0.5	125	<0.0001	5	<0.01			1.5	12.90		2.3	18.6	2.200		13.1			0.14	
	396	0.0083	0.833		<0.05	125	<0.0001	4	<0.01			1.5	11.10		2.1	18.6	2.220		11.8			0.14	
	382	0.0054	0.810		<0.5	123	0.0002	4	<0.01			1.4	13.40		1.9	19.0	2.230		11.1			0.21	
	389	0.0201	0.880		<0.05	124	<0.0001	3	<0.01			1.4	13.10		2.2	18.8	2.270		11.8			0.79	
	409		0.748		<0.05	125	<0.0001		<0.01			1.20	4.74		2.1	17.5	1.700		10.7				
	424		0.808		<0.1	129	0.0003		<0.01			1.19	8.25		2.2	18	1.970		11.9				
	422		0.816		0.092	127	0.0006		<0.01			1.32	10.40		2.2	18.1	2.110		11.3				
	424		0.867		<0.05	129	<0.0001		<0.01			1.28	13.40		2.1	18.3	2.200		10.9				
			0.858										14.60				2.200						
			0.880										14.4				2.26						

	383	0.0147	0.359		0.3	97.4	<0.0001		<0.01	<0.01	0.0020	1.5	12.70		1.7		1.780		10.8	<0.01			(
03	376	0.0194	0.400	0.03	<0.1	109	0.0003	2	<0.01	<0.01	<0.01	1.6	25.70	<0.0002	1.9		1.820	<0.01	9.6	<0.01	<0.02		<
03	378	0.0162	0.312	0.02	<0.1	112	<0.0001	3	0.01	<0.01	<0.01	1.4	17.40		1.8		1.800	<0.01	10.0	<0.01	0.11		<
03	382	0.0193	0.428	<0.01	<1	105	<0.0001	4	<0.01	<0.01	<0.01	1.5	26.50	<0.0002	1.6		1.700	<0.01	9.7	<0.01	0.03		(
03	384	0.0139	0.448	0.02	<1	108	0.0001	4	<0.01	<0.01	<0.01	1.6	23.20	<0.0002	1.8		1.650	<0.01	10.0	<0.01	0.03	0.50	(
03	385	0.0171	0.461	0.03	<0.1	111	<0.0001	5	<0.01	<0.01	<0.01	1.7	28.20	<0.0002	1.8		1.730	<0.01	10.1	<0.01	<0.02	0.06	(
03	353	0.0108	0.411	0.03	<0.2	105	<0.0001	6	<0.01	<0.01	<0.01	1.6	21.10	<0.0002	1.6		1.630	<0.01	9.7	<0.01	<0.02	0.07	<
03	357	0.0176	0.478	0.02	<0.5	113	0.0001	4	<0.01	<0.01	<0.01	1.4	29.80	<0.0002	2.0		1.750	<0.01	11.2	<0.01	<0.02	0.03	<
03	385	0.0185	0.430	0.02	<0.1	108	0.0002	5	0.01	<0.01	<0.0005	1.5	22.20	0.0003	1.8	18.1	1.450	<0.01	10.0	<0.01	0.02	0.08	<
03	389	0.0163	0.486	0.03	<2	112	<0.0001	4	<0.01	<0.01	<0.0005	1.6	30.3	<0.0002	1.8	19.1	1.73	<0.01	10.4	<0.01	<0.02	0.07	<
03	360	0.0184	0.528	0.02	<10	111	<0.0001	10	0.01	<0.01	<0.0005	1.5	32.20	<0.0002	1.9	18.8	1.840	<0.01	10.6	<0.01	<0.02	0.15	(
05	349	0.0186	0.470	0.02	1	114	<0.0001	4	<0.01	<0.01	<0.0005	1.3	29.20	<0.0002	1.6	18.9	1.670	<0.01	10.2	<0.01	<0.02	0.03	(
03	351	0.0174	0.503	0.02	<2	112	<0.0001	3	<0.01	<0.01	<0.0005	1.4	31.00	<0.0002	1.7	19.2	1.750	<0.01	10.5	<0.01	<0.02	0.04	<
03	353	0.0145	0.509	0.03	<1	114	0.0001	6	<0.01	<0.01	<0.0005	1.6	29.60	<0.0002	1.8	19.2	1.800	0.02	10.6	<0.01	0.02	0.07	<
03	344	0.0153	0.488	0.02	<1	112	<0.0001	10	0.01	<0.01	0.0005	<0.1	31.50	<0.0002	1.7	19.0	1.710	<0.01	10.6	<0.01	<0.02	0.07	<
03	347	0.0169	0.476	0.02	<0.1	106	<0.0001	6	<0.01	<0.01	0.0006	1.5	30.60	<0.0002	1.5	17.9	1.690	0.01	10.6	<0.01	0.04	0.03	<
03	366	0.0160	0.478	0.02	<0.2	114	<0.0001	6	<0.01	<0.01	<0.0005	1.5	31.50	<0.0002	1.7	19.0	1.680	<0.01	10.5	<0.01	<0.02	0.04	<
03	359	0.0147	0.463	0.02	<0.1	110	<0.0001	7	<0.01	<0.01	0.0006	1.6	30.90	<0.0002	1.1	19.1	1.660	0.02	10.4	<0.01	<0.02	0.04	(
03	367	0.0164	0.439	<0.01	<0.2	110	<0.0001	4	<0.01	<0.01	0.0007	1.4	29.90	<0.0002	2.1	18.4	1.560	<0.01	10.5	<0.01	0.07	0.03	(
03	370	0.0194	0.463	0.03	<0.2	113	<0.0001	6	<0.01	<0.01	0.0006	1.5	31.40	<0.0002	1.7	19.1	1.620	<0.01	10.2	0.02	0.23	0.03	<
5	364	0.0149	0.502	0.01	<0.2	109	<0.0001	<10	<0.01	<0.01	0.0007	1.5	29.40	<0.0002	1.6	18.4	1.670	<0.01	10.9	<0.01	<0.02	0.11	(
03	365	0.0140	0.461	0.02	<0.1	116	<0.0001	<10	0.01	<0.01	<0.0005	1.5	29.20	<0.0002	1.9	19.3	1.680	<0.01	10.7	<0.01	0.06	0.04	(
03	350	0.0184	0.485	0.02	<0.2	116	<0.0001	<10	0.01	<0.01	<0.0005	1.6	32.30	<0.0002	1.8	19.4	1.710	<0.01	11.3	<0.01	<0.02	0.03	(
	352	0.0192	0.485		<0.2	109	<0.0001	<10	<0.01			1.5	31.00		1.6	18.4	1.670		10.9			0.03	
	352	0.0170	0.485		<0.2	115	<0.0001	5	<0.01			1.8	31.10		1.8	20.0	1.870		10.5			0.03	

	389	0.0247	0.511		<0.05	111	<0.0001		<0.01			1.57	32.10		1.8	18	1.410		10.9				
	385	0.0243	0.457		<0.1	112	<0.0001		<0.01			1.48	29.50		1.9	17.6	1.420		10.8				
	397	0.0212	0.520		<0.05	111	0.0003		<0.01			1.58	32.90		1.9	18.1	1.420		10.6				
	382	0.0235	0.504		<0.05	115	<0.0001		0.02			1.39	32.50		1.8	18.4	1.720		10.6				
													31.80				1.680						
													33.3				1.67						

	285	0.0038	0.145		<0.1	263	0.1990		0.10	<0.01	0.0043	2.2	6.45		2.4		7.660		17.5	0.03			
12	289	0.0029	0.088	0.03	<0.1	264	0.3800	2	0.18	<0.01	<0.05	2.6	5.93	0.0003	2.3		10.300	<0.05	22.3	0.07	<0.02		
05	300	0.0030	0.171	0.02	<0.5	170	0.1220	7	0.07	<0.01	<0.01	2.2	12.60		1.6		6.310	<0.01	12.4	0.02	0.02		
03	350	0.0027	0.440	<0.01	<0.2	130	0.0673	5	0.03	<0.01	<0.01	2.1	7.07	<0.0002	1.7		3.710	<0.01	10.7	<0.01	<0.02		
35	316	0.0031	0.116	0.03	<1	237	0.1490	21	0.07	<0.01	0.01	2.3	5.61	0.0004	2.5		6.210	0.01	22.1	0.02	0.02	1.06	
03	327	0.0027	0.137	0.02	<0.5	184	0.0717	8	0.05	<0.01	<0.01	2.3	6.54	0.0003	1.9		4.840	0.01	13.1	0.01	<0.02	1.48	
11	273	0.0012	0.061	0.02	<1	239	0.1910	8	0.09	<0.01	0.06	2.1	1.49	<0.0002	1.5		6.420	<0.01	14.7	0.03	0.03	0.23	
08	298	0.0022	0.107	0.03	<0.5	226	0.1620	20	0.11	<0.01	0.03	2.0	5.58	0.0002	2.1		6.950	<0.01	21.9	0.04	<0.02	0.42	
03	320	0.0034	0.227	0.03	<0.1	222	0.0991	13	0.07	<0.01	0.0032	2.2	9.05	0.0003	2.3	57.8	6.060	<0.01	16.8	0.01	<0.02	0.42	
08	320	0.0027	0.099	0.03	<0.1	210	0.0839	9	0.06	<0.01	0.0122	2.1	5.37	0.0003	1.9	45.7	4.86	<0.01	14.1	0.01	<0.02	0.27	
08	289	0.0024	0.146	0.02	<0.5	242	0.1400	35	0.09	<0.01	0.0144	1.8	6.44	0.0007	1.8	65.3	6.380	0.01	22.0	0.02	0.03	2.17	
29	279	0.0027	0.086	0.02	<0.2	230	0.1680	36	0.10	<0.01	0.0857	2.0	5.88	0.0005	1.7	75.1	6.200	<0.01	29.9	0.02	<0.02	1.02	
05	321	0.0027	0.129	0.03	<0.5	212	0.0816	19	0.05	<0.01	0.0127	2.0	5.83	0.0003	2.0	43.3	4.500	<0.01	16.8	0.01	0.02	1.15	
24	299	0.0023	0.092	0.02	<0.5	249	0.0660	27	0.06	<0.01	0.0234	2.0	4.31	0.0002	1.9	54.6	5.110	<0.01	20.7	0.01	<0.02	1.5	
28	238	0.0014	0.054	0.02	<1	271	0.1210	68	0.11	<0.01	0.0697	1.6	3.03	<0.0002	1.7	75.6	6.520	<0.01	38.2	0.03	0.73	0.97	
03	272	0.0016	0.034	0.02	<0.05	317	0.1570	68	0.13	<0.01	0.0838	1.8	2.49	0.0003	2.1	95.9	7.790	<0.01	49.1	0.03	0.03	0.39	
04	328	0.0020	0.067	0.03	<0.1	255	0.0719	35	0.07	<0.01	0.0490	2.0	4.60	<0.0002	2.1	61.4	5.020	<0.01	27.8	0.02	<0.02	0.67	
03	305	0.0025	0.074	0.02	<0.1	284	0.0955	43	0.10	<0.01	0.0484	1.9	6.36	<0.0002	1.7	89.7	7.650	<0.01	33.5	0.01	<0.02	0.44	
05	328	0.0022	0.074	<0.01	<0.05	199	0.0524	16	0.07	<0.01	0.1200	1.6	5.09	<0.0002	1.5	49.6	4.860	<0.01	17.0	0.02	<0.02	0.23	
03	296	0.0014	0.052	0.03	<0.1	243	0.0728	56	0.08	<0.01	0.0202	1.7	6.43	<0.0002	2.1	63.8	6.180	<0.01	36.0	0.02	0.54	0.14	
19	312	0.0020	0.072	0.03	<0.05	260	0.0587	47	0.06	<0.01	0.0611	1.9	4.51	<0.0002	2.6	64.1	5.230	<0.01	34.0	0.01	<0.02	0.09	
6	326	0.0019	0.074	0.03	0.22	188	0.0374	13	0.05	<0.01	0.0280	1.8	4.45	<0.0002	1.9	38.3	3.870	<0.01	16.8	<0.01	<0.02	0.19	
03	273	0.0005	0.033	<0.01	<0.1	243	0.0468	50	0.08	<0.01	0.0130	1.6	3.08	0.0003	2.6	57.1	5.870	<0.01	30.2	0.01	<0.02	0.32	
	331	0.0009	0.038		<0.05	183	0.0436	22	0.05			1.7	3.45		1.6	43.2	4.930		21.2			0.32	
	272	0.0009	0.052		<0.05	295	0.0865	51	0.06			1.8	1.35		2.7	71.2	6.720		37.7			0.25	
	295	0.0008	0.033		<0.1	222	0.0527	34	0.06			1.5	3.73		1.9	58.2	5.680		26.2			0.20	
	289	0.0109	0.031		<0.05	230	0.0596	63	0.08			1.5	5.00		1.9	66.7	6.290		34.8			0.56	
	317	<0.0005	0.029		<0.05	220	0.0545	36	0.07			1.7	2.30		2.4	57.8	5.410		28.8			0.03	
	307	0.0007	0.041		<0.25	219	0.0495	45	0.05			1.7	1.72		2.6	54.4	4.930		30.0			0.13	
	310	0.0011	0.032		<0.25	179	0.0311	34	0.05			1.6	5.56		1.7	44.8	4.970		21.8			0.45	
	298	0.0006	0.025		<0.25	193	0.0353	69	0.06			1.5	5.53		1.6	49.7	5.300		31.3			0.18	
	325	0.0008	0.037		<0.25	180	0.0260	32	0.06			1.7	6.26		2.3	41.8	4.700		24.6			0.13	
	271		0.025		<0.5	297	0.0511		0.09			1.12	6.18		2.3	80.3	6.010		88				
	347		0.034		<0.25	208	0.0325		0.05			1.59	6.99		2.2	48.2	4.450		42.4				
	351		0.026		<0.25	187	0.0134		0.04			1.45	8.84		1.7	44	3.890		32.1				
	322		0.053		<0.25	220	0.0160		0.05			1.26	10.70		2.1	47.7	4.310		39.6				
							0.0148		0.05			1.63	11.60				4.540						
							0.025		0.07			1.50	11.9				6.12						

	130	<0.0005	0.061		8.6	207	<0.0001		<0.01	<0.01	<0.0005	0.2	<0.02		2.0		<0.005		8.9	<0.01			
3	121	<0.0001	0.068	0.05	0.1	178	<0.0001	10	<0.01	<0.01	<0.01	<0.1	<0.02	0.0003	2.0		<0.005	<0.01	7.4	<0.01	2.78		
3	137	<0.0005	0.037	0.02	<0.5	200	<0.0001	11	<0.01	<0.01	<0.01	0.1	0.08		1.8		<0.005	<0.01	8.0	<0.01	1.94		

.06	139	<0.0005	0.043	0.01	<0.1	209	<0.0001	12	<0.01	<0.01	0.0015	0.2	<0.02	<0.0002	2.0	35.1	<0.005	<0.01	8.3	<0.01	1.83	0.15
.17	134	0.0009	0.048	0.01	0.1	229	<0.0001	14	<0.01	<0.01	0.0014	0.3	0.03	<0.0002	2.0	38.7	0.013	<0.01	8.8	<0.01	1.72	0.18
.03	129	<0.0005	0.045	0.02	0.2	242	<0.0001	16	<0.01	<0.01	0.0012	0.2	<0.02	<0.0002	2.1	40.8	<0.005	<0.01	9.1	<0.01	2.21	0.10
.07	128	0.0005	0.034	0.01	0.2	239	<0.0001	16	<0.01	<0.01	0.0015	0.2	0.02	<0.0002	2.1	39.6	<0.005	0.01	9.2	<0.01	1.96	0.23
.03	132	<0.0005	0.031	0.02	0.1	191	<0.0001	15	<0.01	<0.01	0.0011	0.2	<0.02	<0.0002	1.9	31.8	<0.005	<0.01	8.0	0.01	1.72	0.12
.03	142	0.0006	0.031	0.02	0.07	188	<0.0001	13	<0.01	<0.01	0.0016	0.2	0.03	<0.0002	1.7	32.0	0.008	<0.01	8.2	<0.01	1.61	0.07
.03	150	0.0011	0.028	0.02	<0.1	184	<0.0001	12	<0.01	<0.01	0.0019	0.2	<0.02	<0.0002	1.9	30.4	0.008	<0.01	7.9	<0.01	1.47	0.13
.19	151	0.0006	0.039	0.02	<0.05	171	<0.0001	12	<0.01	<0.01	0.0019	0.1	0.19	<0.0002	1.3	29.7	0.070	<0.01	7.4	<0.01	1.33	0.24
.24	154	0.0005	0.043	<0.01	0.08	180	<0.0001	12	<0.01	<0.01	0.0022	0.2	0.25	<0.0002	2.1	30.4	0.133	<0.01	7.1	<0.01	1.36	0.25
.05	156	<0.0005	0.029	0.02	0.7	179	<0.0001	10	<0.01	<0.01	0.0010	0.2	<0.02	<0.0002	1.9	29.8	<0.005	<0.01	7.6	<0.01	1.48	0.21
.31	146	0.0007	0.054	<0.01	0.10	189	<0.0001	14	<0.01	<0.01	0.0013	0.2	0.23	<0.0002	2.0	32.3	0.108	<0.01	8.5	<0.01	1.61	0.10
.03	143	0.0009	0.029	0.01	0.5	204	<0.0001	13	<0.01	<0.01	0.0008	0.2	<0.02	<0.0002	2.0	33.8	<0.005	<0.01	8.1	<0.01	1.53	0.09
.09	141	<0.0005	0.038	0.01	<0.1	198	<0.0001	14	<0.01	<0.01	0.0013	0.2	0.13	<0.0002	2.4	33.1	0.053	<0.01	9.4	<0.01	1.43	0.05
	144	<0.0005	0.028		<0.05	177	<0.0001	12	<0.01			<0.1	<0.02		1.9	29.9	<0.005		8.3			0.09
	149	<0.0005	0.030		0.14	182	<0.0001	13	<0.01			0.2	<0.02		1.9	30.9	<0.005		7.8			0.08
	161	<0.0005	0.036		<0.05	171	<0.0001	13	<0.01			0.2	0.19		1.8	28.9	0.066		7.5			0.04
	185	<0.0005	0.027		<0.05	151	<0.0001	11	<0.01			0.3	<0.02		1.8	25.6	<0.005		8.2			0.05
	181	<0.0005	0.030		<0.05	175	<0.0001	13	<0.01			0.2	<0.02		2.0	29.5	<0.005		9.1			0.04
	178	<0.0002	0.029		0.171	161	<0.0001	11	<0.01			0.2	0.03		2.0	27.3	0.005		9.5			0.04
	199	<0.0002	0.032		<0.25	155	<0.0001	10	<0.01			0.2	0.07		1.8	26.3	0.010		9.9			0.04
	205	0.0002	0.032		<0.25	159	<0.0001	10	<0.01			0.3	0.07		1.9	27.5	0.015		10.5			0.06
	202	<0.0002	0.043		<0.25	149	<0.0001	8	0.02			0.3	0.22		1.9	25.7	0.071		10.3			0.07
	197				<0.5	145	<0.0001		<0.01			0.23	0.08		1.8	24.6	0.031		9.4			
	129				<0.25	139	<0.0001		<0.01			<0.25	<0.02		1.8	22.3	<0.005		6.9			
	171				<0.25	160	<0.0001		<0.01			<0.25	<0.02		1.9	26	<0.005		7.4			
	145				<0.25	211	<0.0001		<0.01			<0.25	0.08		2	34.1	0.027		8.3			