OPERATIONS AND MAINTENANCE MANUAL
REVISION 1.1

MAYFLOWER TAILING STORAGE FACILITY AND 5 DAM

CLIMAX MINE
CLIMAX, COLORADO

Prepared for
Climax Molybdenum Company
Highway 91 – Fremont Pass
Climax, CO 80429

May 2014

URS

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This Operations and Maintenance (O&M) Manual has been prepared for the Mayflower Tailing Storage Facility (TSF) at the Climax Mine (Climax) on behalf of Climax Molybdenum Company. This manual describes normal operation of the tailing impoundment and appurtenant structures, and includes guidance for normal maintenance and inspection procedures, and for preparing and maintaining operational records.

The O&M manual does not specifically address emergency operations of the dam. Guidance during emergency operations will be provided through internal communication at Climax.

This document is a compilation of text and procedures written by URS Corporation (URS) with supporting text and methods developed by Climax operators and staff, and W.W. Wheeler and Associates, Inc. (Wheeler). Variations in the written text in this manual and procedure execution may exist. Updates will be completed occasionally and as necessary for the normal operation of the tailing dam. The tailing Superintendent will be notified if and when a work task or procedure is developed that is in conflict with this document or has been revised since incorporation in this document; the appropriate text revisions will be made as soon as possible.

This report is a living document and will be revised throughout the operation of the tailing impoundment. The original version will be identified as Revision 1.0. Subsequent revisions will be renumbered. Updates will be completed as necessary for normal operation of the tailing dam. Section 8.0 (Revision Tracking) will be used to identify updates from the previous version. This O&M manual is to be reviewed annually and updated as significant changes occur.

1.1 PURPOSE OF OPERATIONS AND MAINTENANCE MANUAL

The purpose of this O&M manual is to establish one primary control document that contains accurate and current operating instructions for the Mayflower TSF and its associated facilities and appurtenant structures. The O&M manual defines operating procedures that cover long periods of time and will encompass changes in operating personnel. The recommendations provided in the 2003 publication from the Mining Association of Canada “Developing an Operation, Maintenance and Surveillance Manual for Tailing and Water Management Facilities” were used in the preparation of the O&M manual.

All emergency responses will be communicated per internal procedures. Those procedures are not included in this O&M manual.

1.2 DOCUMENT ORGANIZATION

The O&M manual is organized in the following sections:

- Section 1 – Introduction
- Section 2 – General Personnel Information
- Section 3 – Site and Facility Information
- Section 4 – Tailing Delivery Systems and Storage Facility
- Section 5 – Water Management Systems
- Section 6 – Monitoring and Inspection
- Section 7 – Records and Reporting

- Section 8 – Revision Tracking

The report also includes supporting tables, figures and appendices.

1.3 GENERAL INFORMATION

The procedures outlined in this manual cover general O&M procedures, including recordkeeping. The manual cannot describe all possible operational events and it does not claim to present guidance for all such occurrences. If unforeseen or unanticipated conditions occur, they should be promptly brought to the attention of supervisory personnel and, as appropriate, outside consultation should be obtained from the Engineer of Record, equipment suppliers, or other appropriate company personnel.

It is important to note that the condition of a tailing dam depends on changing internal and external conditions. It is evolutionary in nature. The present condition of a tailing dam may change and may not represent the condition of the tailing dam at some point in the future. Only through periodic inspections and careful observation of monitoring data can unsafe conditions be detected so that corrective actions can be made. Likewise, continued care and maintenance are necessary to minimize possible development of unsafe conditions.

URS represents that our services are performed within the limits prescribed by the Client in a manner consistent with the level of care normally exercised by other consultants under similar circumstances. No other representation to the Client is expressed or implied and no other warranty or guarantee is included or intended.

Successful operation and maintenance of Mayflower TSF and 5 Dam (impoundment slope and tailing beach) requires a quality-oriented, well-trained staff. Presented below are guidelines and/or requirements for staff responsibilities and general information about site safety, environmental practices and regulatory agencies and oversight.

2.1 DOCUMENT DISTRIBUTION

The O&M manual is a controlled document intended for internal use only. As such, a limited number of copies are available for use. Future copies may be developed and the distribution added to the list below. The following entities will maintain a copy of the O&M manual:

- Climax Mill Engineering Office.
- Climax Tailing Operations Office.
- Climax Environmental Department Office.
- URS Office, Denver, Colorado.
- Colorado Division of Reclamation, Mining, and Safety (DRMS).
- Wheeler Office, Englewood, Colorado.

Updates and revisions to the O&M manual will be coordinated through the Climax Mill Engineering Office so that all copies reflect the changes and they remain identical.

2.2 ROLES AND RESPONSIBILITIES

It is the responsibility of every Climax employee to perform his or her assignment in a manner that promotes safety, protects the environment, and is consistent with established responsibilities. The following personnel are responsible for managing, operating, and maintaining the Climax tailing dams and appurtenances.

Tailing Operations
Tailing Supervisor – Rodney Cordova (719) 231 -1248
Services Superintendent – Gordon Stinnett (719) 486-7616
Mill Manager – Mark Mansuetti (719) 486-7588
Tailing & Water (Area 500) Engineering
Tailing Engineer – Mike Waldron (719) 486-7545
Senior Engineer – Tom Brown (719) 486-7635
Chief Engineer – Ron Valentine (719) 486-7565

Day-to-day operation of Mayflower TSF is the responsibility of the tailing operators. Currently the operation of the dam is to be performed by four operators under supervision by the Services Superintendent. The quantity of designated staff will vary with operational requirements. Climax will continually evaluate staffing needs for tailing deposition and dam operation.

Tailing Operator Responsibilities

Identified responsibilities for tailing operators include, but are not limited to the following:

- Understand the proper operating procedures for the tailing dams, decant ponds, surface water conveyance channels, and appurtenant structures
- Maintain operation of the dams, decant ponds, surface water conveyance channels, and all appurtenant structures
- Communicate regularly with the mill operator, stay informed on the slurry pulp density and flow being sent through the tailing delivery lines (TDL)
- Perform scheduled inspections
- Perform maintenance tasks as needed
- Maintain neat and informative records
- Immediately inform management about operational problems and maintenance issues
- Be aware of safety hazards and precautions
- Report all unusual circumstances, no matter how minor they might appear, to your Supervisor and the next shift
- Do not leave the tailing dam(s) without proper relief

2.3 COMMUNICATION

Site communications between operators, the Supervisor and other Climax personnel generally occurs over via two-way radio. Climax channel 2 is used for most site activities.

Emergencies and other site-wide communications are generally issued from the personnel at the security gate over the radio. Climax channel 1 is used for emergency communications.

Use of additional channels will be discussed prior to project/task implementation.

Telephone service is generally unavailable in industrial areas at the site. Cell phone carrier T-Mobile is the most reliable service provider.

2.4 SAFETY

The safety of all personnel at Climax is of utmost priority of Climax Molybdenum Company.

For a complete description of the safety rules and regulations, refer to applicable MSHA documentation and Climax Safety Procedures maintained by the Climax Health and Safety Department.

2.5 ENVIRONMENTAL

Climax Molybdenum Company is committed to the stewardship of the environment and to maintaining a compliant facility with all activities conducted on-site. Anyone working at Climax is required to exercise care over the management of materials, disposal of wastes, control of emissions, and the minimization of disturbances. Due to the detailed nature of the regulatory framework upon which Climax operates, special circumstances may apply to the individual activities that warrant interface with the Environmental Department. Employees and contractors will discuss project requirements with the Environmental Department prior to starting new work.

2.6 REGULATORY OVERSIGHT

There are several regulatory agencies that have jurisdiction over all or portions of the Climax facilities, including but not limited to, the following:

A. Mine Safety and Health Administration (MSHA)
   a. Worker Safety
B. Colorado Division of Reclamation, Mining, and Safety (DRMS)
   a. Environmental Protection
   b. Reclamation
   c. Flood Management
   d. Tailing Dam Safety
C. Colorado Office of the State Engineer (SEO)
   a. Water Storage Dam Safety
   b. Water Rights Administration
D. Colorado Department of Public Health and Environment (CDPHE)
   a. Water Quality
   b. Discharge Permits
   c. Stormwater Management
   d. Air Emissions
   e. Mill Drinking Water Regulations
E. Summit, Lake and Eagle Counties
   a. Grading and Building Permits
   b. Planning and Land Use Regulations
F. US Army Corps of Engineers (USACE)
   a. Wetlands
   b. Waters of the US
G. Colorado Department of Transportation (CDOT)
   a. State Highway 91

Tailing produced from the milling process was historically stored in four tailing impoundments in the Tenmile Valley. 1 Dam and 2 Dam form the Robinson TSF, which is located in the Tenmile Creek basin. 3 Dam forms the Tenmile TSF and 5 Dam forms the Mayflower TSF, both of which are also located in the Tenmile Creek basin; and 4 Dam formed a former oxide tailing facility and is located in the Eagle Valley drainage. 2 Dam has been partially inundated by the Tenmile TSF, and 4 Dam has been converted to a water retention dam. Tailing contained in 4 Dam was removed and the impoundment was reclaimed and converted to a fresh water reservoir in 1997. A plan view of the tailing dams is presented on Figure 3-1. Further description of Mayflower TSF, the subject of this O&M manual, is presented below.

3.1 FACILITY OVERVIEW

Operations at Mayflower TSF began in the 1970s. 5 Dam was constructed using the upstream deposition method to raise the dam. The most recent deposition campaign ended in 1985. The dam currently has a crest elevation of 10,612 feet, a downstream slope of approximately 3.8H:1V (horizontal to vertical), a maximum height of approximately 190 feet, a crest length of approximately 2,100 feet, and a stepped-back deposition berm (crest elevation 10,630) that was constructed in 2012. It is estimated the crest will continue to be raised, using the upstream construction method, at an overall 4H:1V slope throughout deposition activities at the impoundment. The current Life of Mine (LOM) crest elevation is 10,820 feet. The original facility design identified an ultimate design elevation of 10,960 feet.

History of Construction, Modifications, and Performance

The impoundment and starter dam are founded on glacial till. Deposition was initiated behind the starter dam that is composed of compacted glacial till. Initial tailing deposition utilized selected placement of cyclone-separated tailing. The coarse tailing fraction (underflow) was placed in the valley bottom, on the side slopes, and against the starter dam to provide bottom drainage. After a well-drained foundation was established, tailing deposition continued with header-and-spigot placement in the summer months and single point (lead-off) deposition during the winter months.

5 Dam has a series of foundation drains (subdrains) and drain trenches that, in conjunction with the foundation drain blanket of cycloned tailing, provide impoundment bottom drainage. This drain system is composed of 8- and 12-inch diameter perforated Hel-Cor corrugated steel pipe placed in trenches excavated into the valley floor and surrounded by gravel and sand. Climax upgraded the subdrain system in 2013, which included replacing the historic 24-inch corrugated steel collector pipeline with a new corrugated HDPE pipeline with added manholes at the subdrain tie-ins. The main subdrain lines are about 1,600 feet in length. The subdrain system will be extended as the dam is raised. System extension will generally require excavation of new drainage trenches into native ground along the abutment of the future footprint, extending into the impoundment. The trenches are to be backfilled with slotted drainage piping and sand/gravel bedding, and will tie into a main collection line that runs along the dam toe footprint. A design of the subdrain system will be prepared when extension activities are required.

The historic decant system in the dam consists of 2 separate, adjacent pipelines. These pipelines are used to dewater the decant pool and as an emergency/flood spillway. Each pipeline consists of a 42-inch diameter steel pipe encased in blocks of reinforced concrete, founded on prepared subgrade. Climax is currently constructing a new dewatering system that will consist of a barge and tunnel. The barge will be used to dewater the decant pool and the tunnel will be used as a flood spillway. The historic decant system will be closed with grout in the future, currently anticipated in 2014. The barge and tunnel facilities will have their own O&M manuals, each prepared under separate cover.

Reclamation

5 Dam was partially reclaimed in the mid-1990s. The downstream face was regraded to a uniform slope and covered with a glacial till soil approximately 2 feet deep. A soil cover was also placed on the impoundment top surface up to the edge of the decant pool.

Recent Modifications for Startup

A new deposition berm with 3 leadoffs was constructed in 2012 in anticipation of deposition activities scheduled to start in August 2014. Climax removed the reclamation cover in the berm footprint in 2012, and then ripped and disced the underlying tailing to improve drainage for start-up. The remaining soil cover between the beach and decant pond will be removed in 2014; the beach will be ripped and disced prior to start-up.

A plan view of 5 Dam is presented on Figure 3-2.

3.2 SITE CLIMATE SETTING

The Climax Mine is located at the top of Fremont Pass in the Rocky Mountains of Colorado. Site elevations range from about 10,300 feet to over 13,000 feet. Presented below is a general overview of the climate and weather experienced at Climax.

Climax Weather Station

The Climax Weather Station is located to the west of State Highway 91 near the top of Fremont Pass at latitude 39.37°, longitude 106.18°, and elevation 11,294 feet. Temperature and precipitation are recorded daily by Climax personnel and reported to the National Oceanic and Atmospheric Administration (NOAA) for publication through the National Climatic Data Center (NCDC). Those data are available through NCDC monthly Climatologic Data publications and website. Daily data and monthly summaries are available from 1952 through the present.

Temperature

The average annual temperature is 30.9 degrees Fahrenheit (°F). The average temperature during the summer months is typically about 45 to 50°F with lows from about 35 to 40°F and highs from about 60 to 65°F. Freezing can occur during any month of the year and the temperature rarely exceeds 70°F. During the winter, the average temperature is typically about 10 to 15°F with lows from about zero to 5°F and highs from about 25 to 30°F. The average temperature during July, the warmest month, is 51.9°F. Based on these temperature statistics, the climate at Climax can nearly be classified as tundra, which is defined as having the average temperature of the warmest month less than 50°F. The average monthly temperatures as recorded by the Climax Weather Station are summarized below.

Table 3-1
Summary of Average Monthly Temperatures

Month	Temperature (°F)	Month	Temperature (°F)
January	13.4	July	51.9
February	15.0	August	50.1
March	19.5	September	43.5
April	26.2	October	33.5
May	35.9	November	21.5
June	45.8	December	14.6

Precipitation

The average annual precipitation recorded at the Climax Weather Station is 23.09 inches and generally does not vary greatly from month to month. Precipitation that falls from November through April typically occurs as snow while precipitation that falls from June through September typically occurs as rain. Although rare during the summer months, snow could occur any time throughout the year. April and August are typically the wettest months with 2.40 inches and 2.38 inches on average, respectively. The average monthly precipitation as recorded at the Climax Weather Station is summarized below.

Table 3-2
Summary of Average Monthly Precipitation

Month	Precipitation (inches)	Month	Precipitation (inches)
January	2.06	July	2.25
February	1.81	August	2.38
March	2.22	September	1.59
April	2.40	October	1.44
May	1.89	November	1.83
June	1.29	December	1.61
		Annual	23.09

Evaporation

Evaporation has not been routinely recorded at Climax. However, evaporation from the water pools and wetted tailing beach areas can be estimated using the approach outlined in the 1994 Wheeler publication titled "Change of Water Rights at the Climax Mine and Mill, Case No. 92CW233 and 92CW336". That analysis established monthly site-specific coefficients of pan evaporation, which were calibrated to the historic pan evaporation data from the Climax Weather Station (1958 to 1971) for use in the Blaney-Criddle method to calculate monthly pan evaporation based on the average monthly temperature and percentage of annual daylight hours. It is necessary to convert the calculated pan evaporation rates to evaporation rates from the tailing dam water pools and wetted tailing beaches separately. Coefficients of 0.76 and 1.00 were used in this analysis to estimate the evaporation rates from water pools and wetted tailing beaches, respectively. The monthly evaporation rates from the water pools and wetted tailing beach areas, based on the average monthly temperatures, are summarized below.

Table 3-3
Summary of Average Monthly Evaporation Rates

Month	Average Pond Evaporation (inches)	Average Beach Evaporation (inches)
January – April	0.00	0.00
May	2.62	3.45
June	3.36	4.42
July	4.61	6.07
August	3.69	4.85
September	3.16	4.16
October	2.12	2.79
November – December	0.00	0.00
Annual	19.56	25.74

Snow Pack

The Climax Mine receives, on average, 21.0 inches of snow water equivalent (SWE) each year at the Fremont Pass SNOTEL site. That station began measuring snowfall, snow pack, and SWE as part of the National Resources Conservation Services (NRCS) snow telemetry program in 1981. Measurements are taken daily via a pressure sensing snow pillow. The Fremont Pass SNOTEL station is located on the north slope of Chalk Mountain, at latitude 39.38°, longitude 106.20°, and elevation 11,400 feet.

The lowest SWE recorded was 12.2 inches in 2002 and the greatest was 29.1 inches in 1984. The snow pack typically melts over a 45-day period from about mid-May through the end of June. Since 1939, monthly snow pack readings have also been recorded for the Fremont Pass Snow Course site, which is located near the current SNOTEL site. The overlapping period of record for the two sites was used to develop a correlation to assimilate monthly snow pack values for the SNOTEL site back to 1939; thus creating a longer period of record. The assimilated data, however, does not necessarily indicate the actual peak snowfall for each year unless the peak happened to occur the same day as the original Snow Course reading.

Prevailing Wind

Climax began recording average wind speed and direction at the site in about October 2008. The most common prevailing wind direction is from the north-northwest with average wind speeds between five and ten miles per hour. Data on wind gusts are not available. The nearest known wind station with a relatively long period of recorded wind data is at the Leadville Airport, which lies about 10 miles south and west of the Climax site. At Leadville, the prevailing winds typically blow from the north or northwest and range in average speed of six to nine miles per hour. However, because wind patterns in the mountains of Colorado are predominantly controlled by topography, the Leadville wind data may not be representative of conditions at Climax.

Table 3-4
Summary of Average Monthly Wind Speeds

Month	Average Wind Speed (mph)
Oct-08	6.77
Nov-08	8.53
Dec-08	6.63
Jan-09	7.54
Feb-09	6.99
Mar-09	7.42
Apr-09	8.29
May-09	5.88
Jun-09	5.33
Jul-09	5.78
Aug-09	5.60
Sep-09	6.10
Average	6.74

3.3 SITE GEOLOGIC SETTING

The Mayflower TSF is located in a deep U-shaped glacial valley in a structurally complex area of the Southern Rocky Mountain Physiographic province, near the center of the Colorado Mineral Belt. Bedrock in the region ranges from Precambrian to Tertiary in age, with older crystalline rocks to the east and younger sedimentary and meta-sedimentary rocks to the west (Widman, et al., 2004). Surface deposits consist mostly of Quaternary sediments from Pleistocene glaciation (Woodward-Clevenger & Associates, Inc., 1973; Woodward-Clyde Consultants, Inc., 1978; Widman, et al., 2004) and some Holocene stream, slopewash, and talus deposits. Tertiary-age calc-alkali igneous rocks associated with mountain-building activity dominate local geology. The intrusive igneous rocks consist mostly of quartz monzonite and are also responsible for slightly to highly metamorphosed older sedimentary rocks consisting mostly of quartzite and gneiss derived from the Minturn and Maroon formations.

Faulting is present in the area including the major mapped faults; Mosquito, Kokomo, Tenmile, and Mayflower faults. Offsets along numerous closely spaced block faults are evident in the intrusive bedrock and sediments. Two general sets of faults at the site are nearly vertical and roughly perpendicular to each other are thought to bound blocks of rock that form a "block faulted" structure. This block faulted structure is thought to be related to regional tension stresses which may be structurally related to the Mosquito fault, a large structure located near the northern end of the Rio Grande Rift Zone. Both the major and minor fault systems are considered inactive and are not indicative of present, more stable conditions. No evidence exists to suggest the faulting has disrupted recent, unconsolidated deposits. Past field investigations indicate that the fault zones are generally composed of clayey fault gouge.

The physiography of the area has also been impacted by Pleistocene glacial erosion and deposition. The valley and its principal tributaries typically are U-shaped with broad, relatively flat valley floors and steep side slopes. Glacially deposited rock debris is widespread and locally more than 150 feet thick in the valley bottom. Although glacially derived soils are the most prominent in aerial extent and thickness, surficial deposits also include alluvium, talus, slope wash, residual soils, and minor landslide debris.

3.4 INTERCEPTOR SYSTEM

An extensive system of interception and bypass facilities has been developed at Climax. The purpose of these facilities is to limit the inflow of fresh water into the process water system where the flows would become impacted and require treatment prior to release to Tenmile Creek. The facilities generally consist of canals, culverts, and pipelines that traverse along the perimeter of the impacted areas and discharge below the Mayflower TSF. Additional information about the interceptor system is included in Section 5.1.

3.5 FACILITY HYDROLOGY OVERVIEW

This section provides a general discussion of the contributing watershed and design storms used for water management on 5 Dam as provided by Wheeler who currently provides hydrology consulting services to Climax. Several design storms have been estimated for evaluating conditions on 5 Dam. These include the Probable Maximum Precipitation (PMP) and lower frequency storm events. Appendices A and B include general information on pond capacity, historic levels, layout and hydrology.

3.5.1 Watershed

Mayflower TSF is located in the Tenmile Creek valley, immediately north and downstream of Tenmile TSF. The areas contributing inflow to the Mayflower TSF are somewhat different under normal and flood conditions. Under normal operating conditions, the 5 Dam seepwater pump station pumps collected seepwater to the 3 Dam pump station or Mayflower decant pond and the interceptor system diverts fresh water runoff from the upper reaches of the tributary areas. However, under probable maximum flood (PMF) conditions, it is assumed that the interceptor system would fail so that the entire tributary area would contribute runoff. Also, under flood conditions, the pump station may not be operable and, if it is, the amount of pumped inflow would be insignificant compared to the magnitude of the natural runoff.

The total basin area naturally tributary to Mayflower TSF is approximately 19.78 square miles, which is about 12,660 acres. This includes the areas from which runoff would be collected by the interceptor system during normal operating conditions. The basin area that lies below the interceptor system and naturally tributary to Mayflower TSF is approximately 6.4 square miles, or 4,100 acres. Note some interceptor leakage migrates into Mayflower TSF.

Robinson TSF and Tenmile TSF lie just upstream of Mayflower TSF and intercept runoff from about 6.8 square miles, or about 4,400 acres, of the Mayflower TSF drainage area. This includes areas above the interceptor system. After being routed through Robinson Pond, water is released to the Tenmile TSF decant pond through the 2 Dam Spillway, and then to the Mayflower TSF decant pond through the Tenmile Decant and Tenmile Tunnel. If necessary, the control structure for the 2 Dam spillway and the Tenmile Decant can be used to regulate inflow to Mayflower TSF by detaining water in Robinson Pond and Tenmile TSF.

3.5.2 Precipitation

A site-specific PMP evaluation was completed by Applied Weather Associates resulting in a 6-hour local storm PMP depth of 4.41-inches. The lower frequency storms rainfall depth-duration data were estimated using the Log Pearson Type III statistical analyses of the historical daily precipitation data and empirically using NOAA Atlas 2. The Log Pearson Type III values have been adopted as the appropriate design storm depths. The 24-hour rainfall depths from both design rainfall analyses are provided in the Table 3-5.

Table 3-5
Summary of 24-Hour Rainfall Depths

Return Period	Log Pearson III (inches)	NOAA Atlas 2 (inches)
2-year	0.94	1.39
5-year	1.22	1.90
10-year	1.40	2.20
25-year	1.64	2.80
50-year	1.81	3.10
100-year	1.99	3.51
200-year	2.16	3.88

3.5.3 Snowmelt Runoff Rates

Snowmelt at Climax plays a significant role in water management. The highest snowmelt runoff typically occurs in June, and, in some years, extends into the first few weeks of July. Wheeler completed a snowmelt runoff analysis of the Black Gore Creek basin and transposed that analysis to the Climax basins. The result of that analysis suggests a one-day 100-year snowmelt runoff rate of 21.78 cfs per square mile.

3.6 FLOOD ROUTING REQUIREMENTS

Tailing dams in Colorado are under the jurisdiction of DRMS. DRMS does not provide specific flood routing criteria for tailing dams. However, Climax recognizes the importance of dam safety and has historically strived to meet the dam safety and flood routing criteria established by the Dam Safety Branch of the Colorado Division of Water Resources (DWR).

3.6.1 Hazard and Size Classification

According to the DWR Rules and Regulations for Dam Safety and Dam Construction, 5 Dam would be classified as a large-size, high-hazard dam and would therefore be required to safely pass 100 percent of the site-specific PMP event with one foot of residual freeboard above the maximum water level during the inflow design flood.

3.6.2 Design Storm, Storage and Operational Considerations

Due to the variability in the timing of snowmelt runoff and the occurrence of the PMP, Climax has historically operated the water pools on the tailing dams to have adequate capacity to pass the PMP event simultaneously with the peak of the 100-year snowmelt runoff. The following key assumptions are critical for establishing the inflow design flood for Mayflower TSF:

- The spillway must pass 100 percent of the site-specific PMP with one foot of residual freeboard above the maximum flood water level.
- The design storm includes the simultaneous occurrence of the PMP and the peak one-day 100-year snowmelt runoff.
- The initial water level in the Mayflower TSF decant pond at the onset of the PMP is at the level of the spillway crest. It will be necessary to operate the water pool on the pond to ensure that the water level does not exceed the prerequisite spillway crest.
- The interceptor system would fail at the onset of the PMP.

3.7 FACILITY WATER TREATMENT OVERVIEW

Under current conditions, the decant ponds at the Tenmile and Mayflower TSFs provide first-stage and second-stage water treatment, respectively. In 2014, Climax will commission the Property Discharge Water Treatment Plant (PDWTP) to provide second-stage water treatment prior to releasing water into Tenmile Creek. The PDWTP will replace the water treatment function of the Mayflower TSF decant pond after deposition onto 5 Dam begins. The maximum capacity of the PDWTP is 14,000 gpm; therefore the Mayflower TSF decant pond must be managed to sufficiently attenuate snowmelt runoff and rainfall floods considering the capacity of the PDWTP.

The impacted waters from the underground mine workings at Climax are collected and delivered to the Sludge Densification Plant (SDP) through the East Tailing Delivery Line (ETDL). Seepage from 1 Dam and 3 Dam is collected and conveyed to the SDP through the Warren's Pump System and the 3 Dam Seepwater Pump System. Less impacted waters tributary to Tenmile TSF will bypass the SDP and flow directly into the Tenmile TSF decant pond. All of these water sources will receive first-stage treatment in either the SDP or the Tenmile TSF decant pond, or both. The maximum capacity of the SDP is 6,900 gallons per minute (gpm). All of the first-stage effluent from Tenmile TSF is decanted into the Tenmile Tunnel and routed to either Robinson Lake or Mayflower TSF.

The ETDL collects surface runoff and shallow subsurface water from camp, low-grade ore dumps, and McNulty overburden storage facility (OSF). Surface runoff and shallow subsurface water are also pumped from the Storke area by the Storke Wastewater Pump System. Lastly, water is pumped from the open pit and underground mine workings through the 5-Shaft Pump System. The 5-Shaft system has a small amount of storage capacity so that the timing and magnitude of the pumped flows can be managed somewhat to facilitate operation of the SDP. The maximum two-pump capacities of the Storke and 5-Shaft pumping systems are 2,000 and 3,800 gpm, respectively. The flow rate through the ETDL can be on the order of 15,000 gpm during periods of high runoff.

Warren’s Pump Station delivers 1 Dam runoff and seepwater to the SDP via the 2 Dam Pipeline. Under the current configuration, surface runoff and seepage from Robinson Dam and 4 Dam are pumped by their respective systems directly into Robinson Lake. The maximum two-pump capacity of the Warren pump system is about 4,000 gpm.

The 3 Dam Pump Station delivers surface runoff and seepwater from 3 Dam to the SDP. 3 Dam Pump Station can be shut off during upset conditions. The maximum two-pump capacity of the 3 Dam pump system is about 4,500 gpm.

The 5 Dam Pump Station delivers collected surface runoff and seepwater to the 3 Dam Pump Station. The maximum three-pump capacity of the 5 Dam pump system is about 3,100 gpm.

Beginning in 2014, tailing will be discharged directly into the Mayflower TSF. At that time the 5 Dam Pump Station will deliver runoff and seepwater directly into the 5 Dam decant pond.

After about 54 million tons of tailing have been deposited into 5 Dam, the 3 Dam Pump Station will become inundated. At that time, the surface runoff and seepage from 3 Dam will naturally flow directly into the Mayflower TSF decant pond.

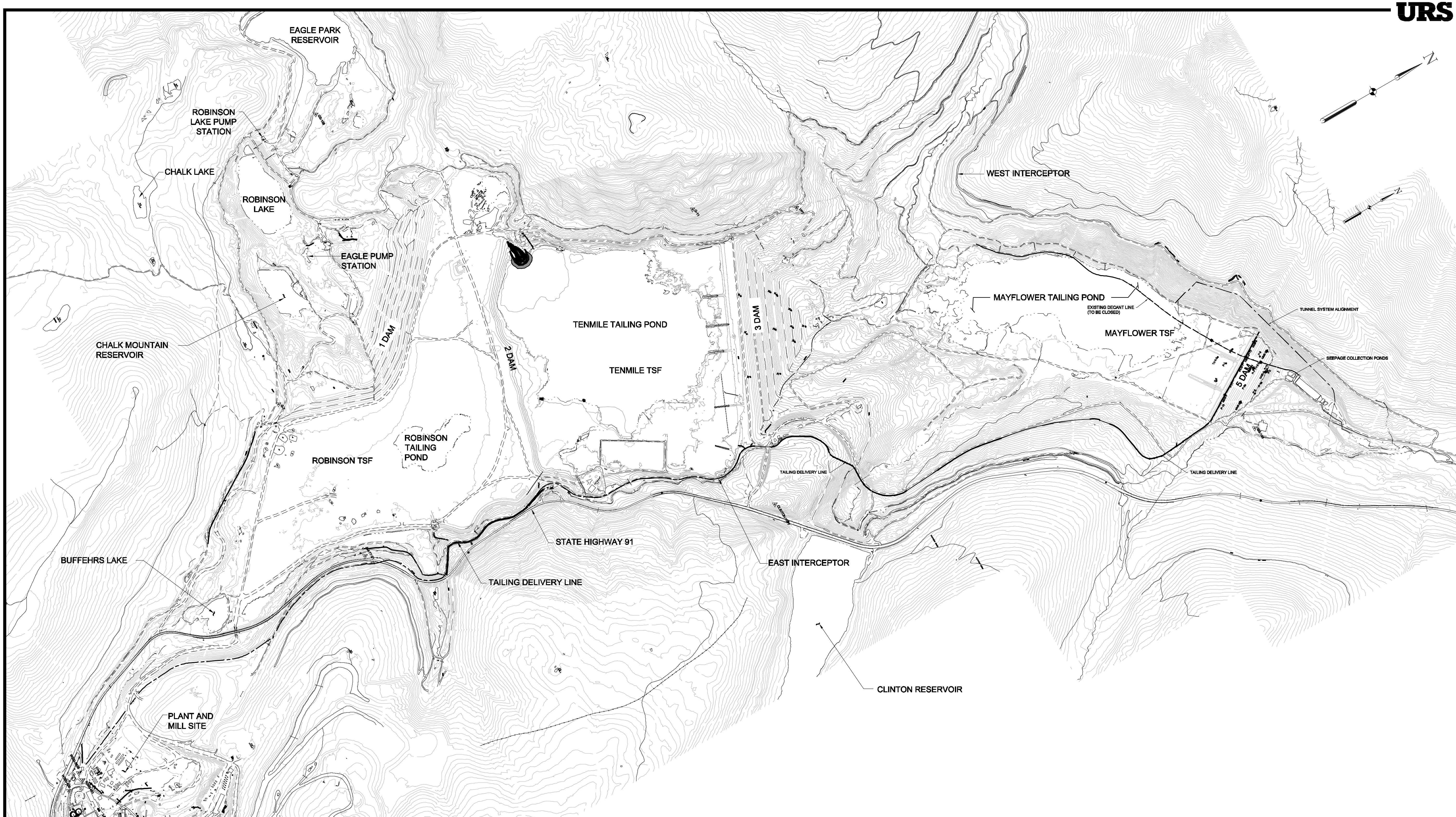
3.8 FACILITY GEOTECHNICAL OVERVIEW

URS completed stability analyses for existing and estimated future operating and post-closure conditions at the current life of mine crest elevation of 10,820 feet. Resulting factors-of-safety (FS) for the analyses are summarized in the following table.

Table 3-6
Summary of Stability Analyses

Loading Condition	Design Section	Failure Surface	Calculated Minimum FS (Global Failure)	Minimum Recommended FS
Steady-State (Static Drained)	Existing Conditions (Elevation 10,612)	Circular	2.6	1.5
		Noncircular	3.0	
	Future Design Elevation (Elevation 10,820)	Circular	2.7	
		Noncircular	2.7	
Undrained/ Post-Earthquake (OBE Event)	Existing Conditions (Elevation 10,612)	Circular	2.5	1.2/1.0
		Noncircular	2.4	
	Future Design Elevation (Elevation 10,820)	Circular	2.1	
		Noncircular	2.0	
Post-Earthquake (MDE Event)	Future Design Elevation (Elevation 10,820)	Circular	2.8	1.0
		Noncircular	2.2	

The results of the slope stability analyses show 5 Dam exceeds recommended minimum FS criteria. The analyses are further discussed in the URS reports "Final Report, Mayflower Tailing Storage Facility, 5 Dam Seepage and Stability Analyses, Climax Mine, Climax, Colorado," dated September 2013 and "Mayflower Tailings Storage Facility (5 Dam) Post-Closure Condition Seepage and Stability Analyses, Climax Mine, Climax, Colorado; Prepared as Addendum to *"Final Report, Mayflower Tailing Storage Facility, 5 Dam Seepage and Stability Analyses, Climax Mine, Climax, Colorado," Report dated September 2013*".



N:\Projects\22243088_Mayflower_Eval_Des\Sub_0019.0_Constr_Design\Plan_Sheets\CLIMAX SITE PLAN-MAYFLOWER 3-1AND2.dwg

NOTE:

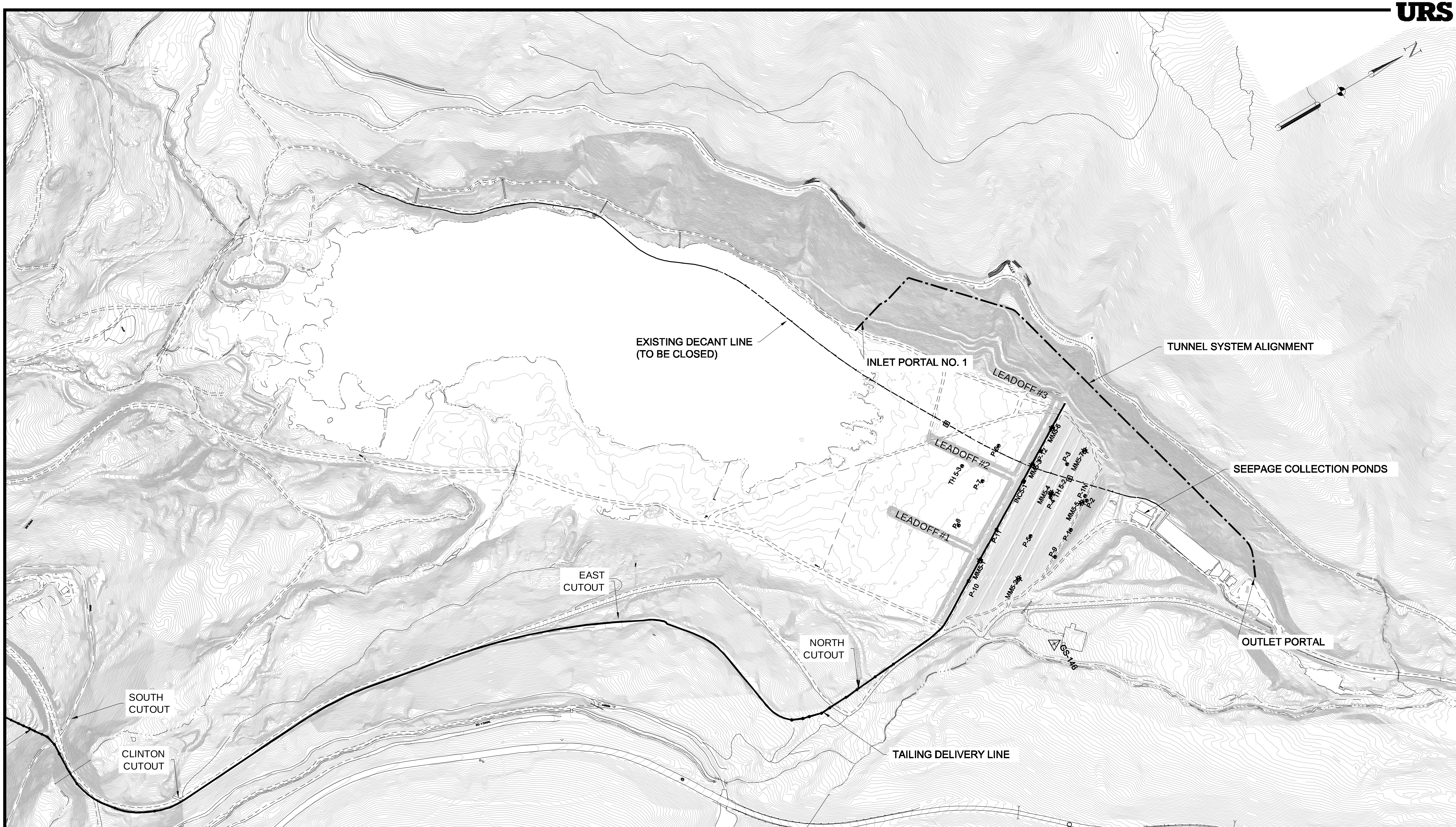
1. THE BASE TOPOGRAPHY FROM A 2006 AERIAL SURVEY WITH 2012 AS-BUILT SURVEY OF DEPOSITION BERM AND SURVEYED EXISTING PIEZOMETER LOCATIONS WERE PROVIDED BY CLIMAX.

0 1000 2000 4000
SCALE IN FEET

Job No. :	22243088	CLIMAX MINE TAILING STORAGE FACILITIES SITE PLAN
Prepared By :	KJW	
Date :	AUGUST 2013	

FIG. 3-1

N:\Projects\22243088_Mayflower_Eval_Des\Sub_00\9.0_Constr_Design\Plan_Sheets\CLIMAX SITE PLAN-MAYFLOWER 3-1AND2.dwg



LEGEND

INC5-1	■	INCLINOMETER
MM5-1	⌖	MOVEMENT MONUMENT
P-5	⊕	PIEZOMETER

NOTE:

1. THE BASE TOPOGRAPHY FROM A 2006 AERIAL SURVEY WITH 2012 AS-BUILT SURVEY OF DEPOSITION BERM AND SURVEYED EXISTING PIEZOMETER LOCATIONS WERE PROVIDED BY CLIMAX.

0 400 800 1600
SCALE IN FEET

Job No. :	22243088
Prepared By :	KJW
Date :	AUGUST 2013

MAYFLOWER TSF
SITE PLAN

FIG. 3-2

Tailing generated from the mill will be deposited at Mayflower TSF through the tailing delivery line (TDL) to the distribution system at the deposition berm crest. A plan view of Mayflower TSF and its associated facilities is presented on Figure 3-2. 5 Dam will be raised using the upstream construction method. As tailing is deposited, the slurry flows toward the decant pond allowing coarser tailing sands to settle out and finer tailing, or slimes, to be transported to the decant pond where they eventually settle. This process creates the tailing beach, lengthens the crest, and effectively raises the height of the tailing dam crest, thereby creating additional water and tailing storage capacity. The tailing slimes simultaneously reduce the water storage capacity of the decant pond.

Climax uses seasonal deposition because the high altitude and extreme precipitation (including significant snowfall) impacts dam construction and operation. In summer months, when snow is not accumulating upstream of the raise berm, traditional header and spigot deposition is used. This period generally lasts five to six months of the year and is important as this method promotes beach aggradation and increases crest height and storage capacity. Experience has shown that traditional header and spigot deposition during the winter months will emplace layers of snow and ice into the tailing beach that can impact dam stability.

During the winter months, leadoff deposition is used. The leadoff berms, or leadoffs, extend out into the impoundment and away from the crest. The tailing is deposited through larger-diameter pipes located on the leadoffs as more localized slurry stream that tends to flow directly into the decant pond. No effective dam crest raise is realized during leadoff deposition and water storage capacity is reduced.

The tailing slurry flow will contribute inflow into Mayflower TSF. At a production rate of 28,000 tons of tailing per day and tailing slurry with an estimated 35 percent solids content, the water inflow to Mayflower TSF would be about 8,700 gpm. As the production rate and solids content fluctuates, the amount of water entering Mayflower TSF will vary accordingly. The following equation can be used to estimate the amount of tailing water inflow to the facility:

$$GPM = TPD * \frac{1 - TSS}{TSS} * 0.1665$$

Where:

GPM = gallons per minute of water flow

TPD = tailing production in tons per day

TSS = tailing solids content as decimal number (i.e., 35% solids = 0.35)

The following sections describe the operation and maintenance of the tailing delivery and distribution systems to the TSF and its components.

4.1 TAILING DELIVERY LINE

The TDL consists of approximately 30,000 linear feet of gravity line from the mill to the distribution header at the eastern abutment of 5 Dam at Mayflower TSF. The TDL consists of a combination of 36-inch diameter high density polyethylene (HDPE) SDR 17 pipe and 36-inch diameter and 42-inch diameter reinforced concrete pipe (RCP). From 3 Dam to 5 Dam, the majority of the TDL is at-grade. The TDL is buried in some sections and supported on steel trusses leading to drop structures in others, with slopes ranging from 0.6 to about 2.0 percent.

There are 20 drop structures along the line for grade control and 4 single point discharges (cutouts) along the east side of Mayflower TSF.

At least one, possibly both, of the 2 cutouts at Tenmile TSF will remain operational to discharge tailing to Tenmile TSF in case of emergency or upset conditions at Mayflower TSF.

TDL Drawings are provided in Appendix B.

4.1.1 Operation and Maintenance

The TDL is a critical structure and represents the highest risk for tailing release in the operation of 5 Dam. It should be noted the TDL lies within the area tributary to the Mayflower TSF. The TDL will require regular inspections and maintenance during its operational lifetime. Routine inspections will include evaluations of pipe integrity, drop structures, valves, and gates.

Detailed visual inspections that include walking on-foot the entire TDL length will be performed biannually, in spring and fall. The above-ground TDL portions will be visually inspected for cracking, displacement, seepage, leaking, or other signs of failure. The buried sections will be inspected at least every 5 years using remote video.

General observations, typically made from adjacent access roads, will be performed on a daily basis when snow depth permits to identify signs of significant distress. Additional visual inspections will be conducted immediately following events such as seismic events, heavy precipitation (0.5 or more inches of rainfall in 24 hours), or other unusual conditions. The additional inspections may include remote video inspection of the line if applicable.

Inspection forms will be completed for each regular and additional (unscheduled) inspection. Repair or maintenance forms will be completed after repairs or maintenance events occur. Copies of daily checklists, inspection forms, and repair and maintenance records/forms will be kept on file in the Tailing Supervisor's office. See Section 7 for daily checklist and event inspection forms.

The tailing delivery system at the Climax Mine is located entirely within the process water containment area. In the event of any leakage that may occur from the TDL, tailing material will be contained in most locations by existing earthen ditches, berms, roadways, and natural topography. Based on the amount of observed leakage, additional containment measures and/or repairs to the TDL may be implemented.

4.1.2 Instrumentation

Instrumentation on the TDL is expected to include a pressure transducer at the first leadoff on 5 Dam. A high pressure reading at this gage will automatically initiate operation of cutout valves located upstream of the 5 Dam header system, as described in Section 4.4.1.2.

4.2 EAST TAILING DELIVERY LINE (ETDL)

The ETDL generally functions to collect and deliver impacted water from the underground mine working at Climax to the SDP. It also can be used to bypass tailing slurry from the TDL through a crossover located just downstream of the first drop structure on the TDL, near the Gate House.

The ETDL is comprised primarily of 36-inch reinforced concrete pipe (RCP). However, some sections have been replaced with 36-inch HDPE pipe.

4.2.1 Operation and Maintenance

The TDL system includes a bypass crossover that can used to divert the tailing slurry into the ETDL in the event of a significant problem with the TDL. The crossover is located at TDL Station 10+94, which is approximately 300 feet north of the old Tailing Distribution House (TDH). The cutout (piping to allow deposition into Tenmile TSF) from the ETDL to 3 Dam is located approximately 200 feet south of the Lime Station.

The crossover consists of two 36-inch knifegate valves at the crossover, and a 36-inch and 26-inch valves located at the ETDL cutout to 3 Dam. To initiate the bypass, the 26-inch tee branch valve at the cutout is opened and then the in-line TDL 36-inch valve at the cutout is closed. At the crossover, the tee branch valve is opened and then the in-line TDL valve is closed. The valves are not automated but are equipped with hydraulic actuators that require a mobile hydraulic powerpack to operate. Valves that are generally kept in a closed position will be exercised on an annual basis.

Note that the ETDL normally conveys process water to the SDP for treatment. These flows include impacted mine water from 5-Shaft, as well as several other water sources. In addition, the ETDL collects runoff flows from collection systems (discussed in Section 5). Depending on the time of year, it may be necessary to divert these process water flows to the East Side Channel while the ETDL is being used for tailing conveyance.

Detailed visual inspections that include walking on-foot the entire ETDL length will be performed biannually, in spring and fall. The ETDL will be visually inspected for cracking, displacement, seepage, leaking, or other signs of failure.

General observations, typically made from adjacent access roads, will be performed on a daily basis when snow depth permits to identify signs of significant distress. Additional visual inspections will be conducted immediately following events such as seismic events, heavy precipitation (0.5 or more inches of rainfall in 24 hours), or other unusual conditions. The additional inspections may include remote video inspection of the line if applicable.

Inspection forms will be completed for each regular and additional (unscheduled) inspection. Repair or maintenance forms will be completed after repairs or maintenance events occur. Copies of daily checklists, inspection forms, and repair and maintenance records/forms will be kept on file in the Tailing Supervisor’s office. See Section 7 for daily checklist and event inspection forms.

The tailing delivery system at the Climax Mine is located entirely within the process water containment area. In the event of any leakage that may occur from the ETDL, tailing material will be contained in most locations by existing earthen ditches, berms, roadways, and natural topography. Based on the amount of observed leakage, additional containment measures and/or repairs to the ETDL may be implemented.

4.2.2 Instrumentation

There is no instrumentation associated with the ETDL.

4.3 DROP STRUCTURES

There are 20 drop structures along the TDL in areas where the change in surface grade along the alignment is overly steep. These structures consist of 8-foot diameter concrete pipe sections stacked vertically on a concrete base. The structure heights range from 10 to 25 feet; most have steel trusses to support the TDL pipe as it approaches the upper end of the structure. The drop structures dissipate energy through turbulence while keeping solids in solution. Each structure has a 3-foot concrete base and baffles to account for and prevent excess wear.

4.3.1 Operation and Maintenance

The drop structures represent a risk for tailing release in the operation of 5 Dam. The drop structures will require regular inspections and maintenance during the TDL operational lifetime. Routine inspections will include evaluations of pipe, tower, and truss integrity.

Detailed visual inspection of the drop towers will be performed biannually, in spring and fall, to look for cracking, displacement, seepage or other signs of failure.

General observations, typically made from adjacent access roads, will be performed on a daily basis when snow depth permits to identify signs of significant distress. Additional visual inspections will be conducted immediately following events such as seismic events, heavy precipitation (0.5 or more inches of rainfall in 24 hours), or other unusual conditions. The additional inspections may include remote video inspection of the towers if applicable.

Inspection forms will be completed for each formal inspection. Repair or maintenance forms will be completed after repairs or maintenance events occur. Copies of daily checklists, inspection forms, and repair and maintenance records/forms will be kept on file in the Tailing Supervisor's office. See Section 7 for daily checklist and event inspection forms.

The tailing delivery system at the Climax Mine is located entirely within the process water containment area. Operational upsets can and do occur and Climax has anticipated and planned for these. In the event of an operational upset, tailing that escapes from the drop structures will be contained to minimize environmental impacts. Containment of spills from the drop structures will rely on a combination of earthen ditches, berms, roadways, and the use of natural topography to hold and/or divert the material towards the area of the Mayflower TSF. The approximate locations of containment/diversion routes in the vicinity of the drop structures are shown on the site drawing in Appendix B.

4.3.2 Instrumentation

There is no instrumentation associated with the drop structures.

4.4 CYCLONE SYSTEM

A system or manifold of cyclones can be used in tailing dam construction to segregate the finer suspended solids in the tailing slurry to create a more favorable (coarser) slurry gradation. The coarser gradation improves the draining properties of the tailing and can help attain a desired tailing beach slope for faster crest development. Climax will be constructing a 16-unit cyclone system adjacent to the TDL drop structures near 5 Dam to provide a means of adjusting the slurry gradation that is deposited on 5 Dam. The cyclone system will divert a portion of the tailing slurry from the TDL from an upstream drop structure and convey this slurry to the cyclone manifold through an 18-inch-diameter HDPE pipe equipped with an equivalent sized knife gate valve. Two discharge pipelines will convey the flows from the cyclone manifold. The coarser cyclone underflow will be returned to the TDL via a 16-inch-diameter HDPE pipe, and the finer cyclone overflow will be discharged to the TSF (beyond the end of the 5 Dam crest line leadoffs) by a 18-inch-diameter HDPE pipe. The cyclone system will only be used during the summer spigot season when dam building is occurring.

4.4.1 Operation and Maintenance

The cyclone system represents a risk for tailing release in the operation of 5 Dam. The cyclone system will require regular inspections and maintenance during the TDL operational lifetime. Routine inspections will include evaluations of pipe, cyclone manifold, and the manifold support structure integrity.

Detailed visual inspection of the cyclone system will be performed biannually, in spring and fall, to look for cracking, displacement, seepage or other signs of failure of the manifold.

General observations, typically made from adjacent access roads, will be performed on a daily basis when the cyclone is in operation to identify signs of significant distress. Additional visual inspections of the cyclone manifold will be conducted immediately following events such as seismic events, heavy precipitation (0.5 or more inches of rainfall in 24 hours), or other unusual conditions. The feed and discharge pipelines will be visually inspected at least monthly during use for cracks, unexpected displacement, or other signs of failure, with particular attention to joints and valves.

Inspection forms will be completed for each formal inspection. Repair or maintenance forms will be completed after repairs or maintenance events occur. Copies of daily checklists, inspection forms, and repair and maintenance records/forms will be kept on file in the Tailing Supervisor’s office. See Section 7 for daily checklist and event inspection forms.

The tailing delivery system at the Climax Mine is located entirely within the process water containment area. Operational upsets can and do occur and Climax has anticipated and planned for these. In the event of an operational upset, tailing that escapes from the cyclone system will be contained to minimize environmental impacts. Containment of spills from the drop structures will rely on a combination of earthen ditches, berms, roadways, and the use of natural topography to hold and/or divert the material towards the area of the Mayflower TSF. The approximate locations of containment/diversion routes in the vicinity of the cyclone system are shown on the site drawing in Appendix B.

4.4.2 Instrumentation

A manually read pressure gage will be installed on the feed pipeline inlet to the cyclone manifold. The gage will be read and recorded by Climax personnel twice daily when the system is in use and upon flow or condition changes.

4.5 TAILING DISTRIBUTION SYSTEMS

4.5.1 Header Line with Spigots

Tailing is distributed to the Mayflower impoundment area through a 30-inch diameter HDPE header pipe and a system of spigots. Summer operations involve the header and spigot method utilizing 6-inch diameter HDPE off-takes (spigots) on 40-foot centers along the header. The header is located on top of the deposition berm at a nominal elevation of 10,630 feet. The header will be raised regularly as the tailing dam height increases through tailing deposition.

4.5.1.1 Operation and Maintenance

The primary operating issue associated with the spigots will be related to deposition and aggrading of the tailing beach. The goal is to maximize hydraulic sorting of the tailing so that a uniform and relatively free-draining shell is created in the tailing dam. This is discussed further in Section 4.5.2.

The header line will be relocated during the operational life of Mayflower TSF as the height of the deposition berm increases. A Standard Operating Procedure for this process will be developed and included in future revisions to this O&M manual.

The header line and spigots will be inspected each shift for cracks, unexpected displacement, or other signs of failure, with particular attention to joints and valves. Observations from the inspections will be recorded on the daily checklists.

4.5.1.2 Instrumentation

A pressure transducer is located in the header line near the eastern-most leadoff (Leadoff #1). The transducer reports line pressures to the mill. If measured line pressure exceeds the maximum allowable pressure, two automatic valves at an upstream cutout operate to divert tailing flow into Mayflower TSF, away from the crest and by-passing the distribution header.

4.5.2 Leadoffs

Whole tailing deposition occurs from leadoffs during winter months. Three leadoffs are located along the crest line header at 5 Dam and are numbered 1 through 3 from an east to west direction. The eastern leadoffs consist of 26-inch diameter HDPE pipe placed on 800-foot long berms extending from the dam crest toward the decant pond. The pipe at the third leadoff is placed on natural ground. Each leadoff pipe is installed at the end of each bank of spigots to allow for single-point discharge for winter operations. Leadoff pipes are extended toward the decant pond for 800 feet to reduce fine tailing deposition near the dam and minimize risk of ice lens formation.

4.5.2.1 Operation and Maintenance

The leadoff pipes will be inspected and maintained in a fashion similar to that described above for spigots. In addition, since the pipes are founded on narrow berms extending toward the decant pond, the leadoff berms must also be inspected for defects such as excessive settlement or slope failure that may be detrimental to operation of the leadoff pipes.

Excessive mounding at the ends of the leadoffs may create excessive backflow toward the dam crest. If this occurs, it may be necessary to move to another leadoff or adjust the tailing slurry density.

4.5.2.2 Instrumentation

There is no instrumentation associated with the leadoffs, however the pressure transducer near Leadoff #1 will provide useful information during leadoff deposition.

4.5.3 Cutouts

Cutouts provide whole tailing deposition similar to leadoffs and are typically used for system upsets or for scheduled shutdowns, repairs or maintenance in the TDL system near or on the dam, or maintenance periods on the tailing dam itself. The relatively short crest length of 5 Dam may call for additional cutout use during winter months to distribute tailing into the impoundment area. There are 4 cutouts on the TDL along the east side of the decant pond, known as the South Cutout (Station 213+00), Clinton Cutout (Station 226+00), East Cutout (Station 267+50) and the North Cutout (Station 293+00). The cutout pipes range from 26 to 42 inches in diameter.

4.5.3.1 Operation and Maintenance

Operation and maintenance of the cutouts is similar to that of the leadoffs and spigots. Additionally the Clinton Cutout valve will be automated with a control system that will automatically operate under upset conditions (high pressure in the header line or as initiated by a tailing operator), as discussed in Section 4.4.1.2.

The cutout pipes will be visually inspected, as snow depth permits, at least monthly or daily during use for cracks, unexpected displacement, or other signs of failure, with particular attention to joints and valves. The automated valve will be inspected daily.

4.5.3.2 Instrumentation

There is no instrumentation associated with the cutouts.

4.6 TAILING DAM

The tailing dam was constructed using the upstream deposition method to raise the dam. The dam currently has a downstream slope of approximately 3.8H:1V, a crest length of approximately 2,100 feet, and a maximum height of about 190 feet with a crest elevation of 10,612 feet. The stepped-back deposition berm has a crest elevation of about 10,630 feet. The upstream construction method will continue to be utilized for dam raises.

4.6.1 Tailing Storage Capacity

The storage capacity is dependent upon the dry unit weight of the tailing stored. The current life of mine crest elevation of 5 Dam is 10,820 feet; the dam will impound the currently planned deposition of about 156 million tons (at a dry unit weight of 88 pounds per cubic foot) of tailing.

4.6.2 Beach

The tailing beach refers to the area between the raise berm and the decant pond. The beach is anticipated to develop a slope of about 0.5% to 0.7% towards the decant pond. The beach is what forms the free-draining shell as the impoundment height is raised. A well-maintained beach is critical to dam stability. The minimum recommended beach width is 800 feet under normal conditions, although a wider beach is preferred.

4.6.2.1 Operation and Maintenance

Climax will monitor spigot discharge and conditions that result in meandering of the tailing stream during spigot operation. Climax will observe the tailing beach consistency and slope, and look for conditions that would cause accumulation of tailing fines near the beach. The beach will be operated such that tailing is placed in a controlled fashion so that the tailing beach aggrades to a generally uniform slope. The intent is to maximize the hydraulic sorting of the whole tailing so that a uniform and a relatively free-draining shell of the tailing dam is created. Climax will perform beach profile sampling to evaluate the newly deposited tailing to verify that material properties are consistent with those envisioned in the design. This will be an annual task initially; the frequency may be reduced as the dam is constructed.

During deposition the tailing stream may tend to meander and deposit whole tailing near the tailing dam crest. Tailing fines drop out of suspension, creating a layer of slimes that can adversely impact beach drainage and tailing dam stability. Climax will monitor deposition and conditions where the tailing stream meanders towards the crest of the dam. If this occurs, deposition in the area will be immediately suspended and moved to another area.

The beach is maintained through active deposition. Low-ground pressure dozers may be required to even the tailing surface if the beach has not properly aggraded or fines are observed encroaching within 800 feet of the raise berm. The area will be regraded to match surrounding conditions and push the fine materials toward the decant pond.

4.6.2.2 Instrumentation

No permanent instrumentation is utilized at the tailing beach. Temporary survey stakes are utilized to indicate fill levels and elevations to assist tailing operators. Beach surveys will be completed at least twice per year to evaluate the slope of the beach.

4.6.3 Embankment (Downstream Face) and Toe

The downstream face of 5 Dam was reclaimed in the 1990s and was regraded, covered with an approximate 2-foot layer of glacial till soil and revegetated with grasses and forbs.

4.6.3.1 Operation and Maintenance

The embankment is expected to be relatively free of operating problems; however, potential issues may include the development of cracks or depressions, sinkholes, increased or cloudy seepage, and other signs of local instability.

Erosion features on the face or at the toe are likely to be filled in with sandy soils or tailing and lightly compacted. Cracks, depressions and sinkholes are reviewed by engineering staff and the Engineer of Record. The features are generally repaired by installing a reverse filter. The reverse filter installation consists of placing drain gravel, filter sand, and tailing into the sinkhole and then compacting the repaired area by tracking over it or tamping with a bucket or other suitable attachment. Further potential indications of instability will be reviewed by engineering personnel and the Engineer of Record.

4.6.3.2 Instrumentation

Fourteen (14) open-well piezometers are located at 5 Dam. Piezometer levels are automated and recorded on a twice-daily basis. The readings are reviewed on a weekly basis for fluctuation in measured readings. The automated system also includes alerts when threshold elevations are exceeded, which trigger additional review of piezometer functionality and impoundment performance. The threshold elevations will be reevaluated as necessary as the dam height increases and changes in conditions occur.

One (1) inclinometer is located just below the crest of 5 Dam at the maximum section to monitor movement in the embankment. Manual readings are recorded and evaluated twice per year

Seven (7) movement monuments are located on the dam face to monitor embankment settlement. The monuments are surveyed and are evaluated once per year.

4.6.4 Dust Control - Coherex System

Wind-generated dust is of high concern at Climax. The tailing beach and downstream slope is treated for dust control. The primary method utilized to reduce dust is application of petroleum-based soil coagulant/stabilizer known as Coherex. Climax will be constructing a Coherex storage and loading station near 5 Dam prior to deposition in August 2014.

4.6.4.1 Operation and Maintenance

Concentrated Coherex is mixed with water to create a slurry that is to be applied to the specified tailing surface. The mixture is pumped into a Terragator, which is a specially-designed low-ground pressure vehicle outfitted with storage tanks and spray systems. The Terragator drives out onto the tailing beach or embankment benches to spread the mixture on the potentially dust-generating surfaces.

The Coherex mixture will typically be applied in the spring after the snow has melted from the beach and dam crest. Additional application may be required after spigot deposition has been completed in one area and moves to another. Dust-control measures are not typically required during winter months due to the snow cover.

Proper vehicle maintenance will be utilized to keep the Terragator operational and in good condition. The storage tanks and associated piping and pumps will be inspected for rust damage and cracking as part of pre-operation inspection.

4.6.4.2 Instrumentation

No instrumentation is required for operation of the Coherex system.

Water levels in the Mayflower TSF decant pond are continually fluctuating. Climax has developed and constructed multiple systems and facilities to handle the inflows and effluent from the water pool. Sources of inflow to the TSF are discussed in Section 3.

5.1 INTERCEPTOR SYSTEM

An extensive system of interception and bypass facilities has been developed at Climax. The purpose of these facilities is to limit the inflow of fresh water into the process water system where the flows could become impacted and require treatment prior to release to Tenmile Creek. The facilities generally consist of canals, culverts, and pipelines that traverse along the perimeter of the impacted areas and discharge below 5 Dam.

The following bypass systems are currently in operation at the site:

- East Interceptor (open channel, culverts, pipeline)
- Clinton Reservoir and Canal (open channel and culverts)
- West Interceptor (open channel, culverts, pipeline)
- West Interceptor South (open channel)
- Chalk Mountain Interceptor (open channel and culverts)
- Storke Area Interceptor (open channel and culverts)

These facilities are generally designed to convey normal snowmelt and rainfall runoff. With the exception of Clinton Reservoir, the facilities are not designed to convey runoff from extreme precipitation events.

5.1.1 Operation and Maintenance

Operation and maintenance of the interceptor systems is an ongoing process. One of the primary operational needs is removing snow and ice from the open channel portions of the interceptors and clearing culvert openings prior to the snowmelt runoff period each spring. Snowmelt typically occurs throughout May and June and therefore interceptor clearing will generally be accomplished during late March or April. Spring snow storms could warrant multiple interceptor clearings.

The interceptors operate at the highest flow rates during the snowmelt runoff period during May and June. The systems are most susceptible to erosion, seepage, sloughing, and other maintenance concerns during this period. The canal and culvert sections will be inspected weekly during this period so that periodic minor repairs and improvements can be made to the facilities as necessary.

5.1.2 Instrumentation

A Parshall flume is located near the downstream end of the West Interceptor, near Tucker Gulch. This flume appears to be accurate and reliable. The flume has been automated with a pressure transducer and flow rate data is collected hourly and recorded in a database which that monitored periodically.

5.2 BARGES AND MAYFLOWER TUNNEL SYSTEMS

The decant pond operation and flood routing at Mayflower TSF is currently controlled by a decant system that consists of 2 side-by-side 42-inch diameter concrete-encased steel pipes connected to sidehill riser inlet structures. The pipes functions as a decant line and an emergency spillway. The decant function is being replaced by two barges while a tunnel system will act as the emergency spillway.

The barges, the Millwater Barge and PDWTP Barge, are currently being constructed for Mayflower TSF. The Millwater Barge pumps water from the decant pond to Supply Canal No. 2, which then delivers this water to the Tenmile Tunnel and eventually Robinson Lake. This system constitutes the primary reclaim water system to return process water to Robinson Lake during tailing deposition on 5 Dam. The nominal capacity of the Millwater Barge is 10,000 gpm with 2 of the 3 pumps running. The PDWTP Barge pumps water from the decant pond to the former Mayflower Process Water Pipeline, which delivers water to the PDWTP for treatment. This system constitutes the primary system to release treated water to the permitted outfall on Tenmile Creek. The nominal capacity of the PDWTP Barge is 14,000 gpm with 3 of the 4 pumps running.

The Mayflower Tunnel is located in the bedrock of the left abutment. The inlet structures, currently being designed, will be similar in form and function to the existing sidehill risers. The first inlet structure will service the decant pond for up to a 70-foot vertical rise in crest elevation. Additional structures will be constructed as required as the tailing dam height increases.

O&M Manuals specific to the barges and tunnel systems will be developed after design and commissioning for each system is completed. However, the systems are related to decant pond operation, which is discussed in detail below.

5.2.1 Decant Pond Operation

The decant pond will be operated between two prescribed limits, called the upper and lower operating levels. A discussion on setting the operating limits and operation of the water pool level is included below.

Upper Operating Level

The upper operating level is controlled by dam safety considerations and the pond's ability to safely route extreme flood events. The Mayflower Tunnel inlet structure serves as the sole emergency spillway to pass extreme flood events through Mayflower Pond. Therefore, the pond level should be maintained below a certain threshold to allow adequate detention storage to safely route the PMP flood. Based on the Wheeler hydrology model, approximately 2,000 acre-feet of flood storage capacity within 6 feet of operational freeboard should be allocated for flood storage at Mayflower TSF. In addition, URS recommends a minimum beach width of 800 feet for stability, as measured from dam crest under normal conditions. This distance approximately coincides with the end of the leadoffs on 5 Dam.

The upper operating level at Mayflower TSF will be set at the lowest level out of the following:

- The 800-foot beach width,
- the level corresponding to approximately 2,000 acre-feet of flood storage, or

- 6 feet below the dam crest.

The control crest on the Mayflower Tunnel inlet structure will be adjusted as the dam crest rises and in accordance with the flood surcharge capacity criteria as defined above. The upper operating level should be maintained below the crest of the emergency spillway to provide a buffer pool to accommodate upset conditions and reduce the potential for accidental overflows into the Mayflower Tunnel. The timing of the control crest changes will be governed by the spigot deposition period and the anticipated crest raise. Once the control crest is raised, it is not expected that it will need to be lowered under normal operating conditions.

Lower Operating Level

The lower operating level is considered to be the limit below which water is considered to be physically inaccessible or has a high solids content thereby rendering the water undesirable for mill use. A certain volume, or area, of water at the deepest depths of the decant pond will be turbid and contain a relatively high amount of suspended solids. The active water level will be controlled through operation of two barges, namely the Millwater Barge and PDWTP Barge. The lower operating level of the decant pond will typically be dictated by the lowest level that the barges can reach at their docked positions at any given time. However, there may be times when the physical depth of the water pool will limit the lower operating level.

The decant pond elevation between the upper and lower operating levels defines the amount of process water storage that is available for operational use. The operational water pool provides a cache of available process water that could be used to fulfill mill water demands in a drought scenario, could be used to fulfill consumptive uses when Climax's water rights are not in priority, or could be treated and released. The operational water pool can also be managed to provide attenuation capacity to regulate the rate at which water is released. Setting the lower operating level as low as comfortably possible without drawing tailing slimes into the barge systems is advantageous to provide operational flexibility and risk mitigation.

Careful planning and management of the barges will be implemented to provide the largest process water storage capacity in the Mayflower TSF decant pond without compromising the quality of the pond outflow or jeopardizing barge operations. Note that attempts have not been made to academically define the stratification of the dam's water pool, and therefore, control of the lower operating level will be based on observation and experience.

Water Pool Operation

During tailing deposition, the tailing slurry will provide a continuous water inflow of about 8,700 gpm when tailing is being deposited at Mayflower TSF. That tailing slurry flow rate corresponds to a mill production rate of 28,000 tons of tailing per day. This inflow will be in addition to the normal inflows from the area below the interceptor system. Note that after about 54 million tons of tailing has been deposited into the Mayflower TSF, the 3 Dam Pump Station will be decommissioned thereby allowing seepage and surface runoff from 3 Dam to discharge directly into the Mayflower TSF decant pond.

Wheeler recommends the water level in the 5 Dam decant pond be maintained as near as practicable to the prescribed upper operating level. This philosophy will provide the greatest amount of process water storage available to meet the mill demands and still provide flood surcharge capacity to safely pass the PMP flood. A cache of process water stored within the process water system would be beneficial to mitigate risks associated with unusually dry years. A higher water level would also reduce the exposed beach area, reduce the potential for dusting, and promote tailing beach development.

The water level between the upper and lower operating limits is regulated by the two barges on the decant pond. These barges will be managed to maintain the water level below upper operating level. During spring snowmelt runoff, it will be advantageous to lower the water level by several feet prior to the period of peak snowmelt runoff to provide attenuation capacity to dampen discharges to the PDWTP. Based on various input factors, including the peak SNOTEL measurement for that year, Climax will determine the appropriate amount of drawdown each spring.

5.2.2 Decant Pond Instrumentation

The water level for the decant pond is currently measured by a pressure transducer located at Riser 7.1 of the current decant system. The design and installation of an automated water level indicator is part of the designs for the barges, which are currently under construction. The water level will be recorded daily to facilitate water management and water rights accounting.

Surveys will be performed at least twice per year to establish pool (bathymetric) and beach (ground) limits for developing contour maps and elevation-area-capacity tables. This information is critical to manage tailing deposition and monitor tailing depositional patterns and for water rights accounting. The surveys will be conducted at the beginning and end of the spigot deposition period.

5.3 SUBDRAIN SYSTEM

The subdrain system consists of 12-inch diameter perforated Hel-Cor corrugated steel pipes placed in 6 excavated trenches that were dug in the native valley floor generally perpendicular to the main 24-inch RCP collection pipe extending across the valley. Lateral 8-inch diameter perforated Hel-Cor corrugated steel pipes were placed in trenches extending outward from the 6 main subdrain branches. The drain pipes are surrounded by gravel and sand, and the subdrain system was then covered with cycloned sands as a drainage blanket.

In 2013 Climax upgraded the subdrain system, including replacing the historic 24-inch corrugated steel collector pipeline with a new corrugated HDPE pipeline; adding manholes at the subdrain tie-ins; and installation of new flow measuring instrumentation. The new manholes along the collector pipe allow visual observations of flows at the subdrain tie-in locations as well as remote inspection access. Instrumentation was installed to separately capture the flows from the right abutment groin, the left abutment groin, and the center portion of the dam. The three measured flows sum to the total seepage flows collected within the subdrain system. The flows pumped from the Mayflower pump station continue to be monitored.

The main subdrain lines are about 1,600 feet in length. Climax will extend the subdrain system as necessary as the dam crest rises and lengthens during future deposition.

5.3.1.1 Operation and Maintenance

The drains operate freely and convey water through the drains and main collection pipe to the 5 Dam concrete seepage collection ponds. The drains were inspected in 2012 and portions of the main collection pipe were replaced in 2013 (see above).

Remote video inspections will be conducted every 5 years and may also be conducted if evidence exists the main line has become compromised; otherwise little other maintenance is anticipated.

5.3.1.2 Instrumentation

Historically there has not been instrumentation installed specifically within the subdrain system, although flows have been measured at the Mayflower pump station for many years. The measured flow rate potentially includes minor surface runoff that contributes to the seepage collection ponds, but generally reflects the seepage collected within the subdrain system.

New flow monitoring instrumentation was installed during the 2013 collector pipe replacement. Instrumentation consisting of "Montana flumes" was installed to separately measure the flows from the right abutment groin, the left abutment groin, and the center portion of the dam. The three measured flows sum to the total seepage flows collected within the subdrain system. The flows pumped from the Mayflower pump station continue to be monitored.

The "Montana flumes" are coupled with electronic pressure transducers to measure flow rate, which is then stored in a local data logger, transmitted wirelessly through a radio signal, and stored on a server. The flow rate data is collected hourly and recorded in a database that is monitored periodically. However, the center portion flow will only be measured during non-freezing months due to fixed invert elevations. Visual monitoring for changes in clarity will also be performed periodically as part of normal operation of the tailing storage facility.

Inspections are essential in order to identify problems requiring maintenance or repair of the dam, and safety deficiencies that could threaten the dam, workers, visitors, and downstream populations, if not detected early. This Section is intended to identify personnel responsible for performing inspections, the frequency of the inspections, and the items requiring inspection. A summary of inspections and monitoring to be performed is provided in Table 6-1. Complete and accurate records and reports of inspections provide information critical to proper operation of the dam. Records and reports provide important, continuous documentation of performance, and are valuable tools.

6.1 INSTRUMENTATION MONITORING PROGRAM

Fourteen (14) open-well piezometers are located at 5 Dam. An automated telemetry system records piezometric levels twice daily. Designated Climax personnel have access to the central data base to download recorded data. The system will trigger notification for further review at designated fluctuations that are based on stability analyses for the impoundment.

One (1) inclinometer is located just below the crest of 5 Dam at the maximum section to monitor movement in the embankment. Manual readings are recorded and evaluated twice per year.

Seven (7) movement monuments are located on the dam face to monitor embankment settlement. The monuments are surveyed and are evaluated once per year.

Additional instrumentation, as deemed necessary, will be installed along the crest and face of the dam to evaluate the phreatic surface and changes resulting from deposition. Frequency and location of piezometer installation will be established during regularly scheduled inspection and instrumentation data review. Laboratory testing on selected materials will also be completed during piezometer installation to confirm design assumptions, as deemed necessary by the Engineer of Record.

Table 6-1
Summary of Monitoring and Inspection

Area to Be Inspected/Monitored	Inspection / Monitoring	Minimum Frequency
Tailing Delivery Line	General observations	Daily
	Detailed visual inspection by walking line	Bi-annually
	Video buried sections	Every 5 years
East Tailing Delivery Line	General observations	Daily
	Detailed walking inspection by walking line	Bi-annually
Drop Structures	General observations	Daily
	Detailed inspection	Bi-annually
Cutouts	Visual inspection	Monthly or when in use daily
Automated Cutout Valve	Visual inspection	Daily
Cyclone System	General observations	Daily
	Pressure gage manual reading	Daily
	Detailed inspection	Bi-annually
Header Line and Spigots	Visual inspection	Twice per day
	Line pressure gage manual readings	Daily
	Line pressure gage automated readings	Data reported nearly continuous
Leadoffs	Visual inspection	Twice per day
Tailing Dam (beach, crest, and downstream slope)	Visual monitoring (Daily Checklist)	Daily
Dam Beach	Monitor beach width	Daily
	Elevation – fill stake readings or point survey	As needed based on changing conditions
	Survey	Bi-annually
	Profile sampling	Initially annually but may reduce based on observations
Dam Embankment	14 Piezometers automated (dam face)	Data collected twice per day and evaluated weekly
	1 Inclinometer manual reading (dam face center)	Bi-annually
	7 movement monuments – survey (dam face)	Annually
Decant Pond Levels	Pressure transducer automated (barge mount)	Data reported nearly continuous and evaluated daily
	Visual monitoring	Daily
	Bathymetric survey	Bi-annually
Surface Water Interceptor System	Visual inspection	Weekly during Spring runoff (typically May-June)
West Interceptor	Parshall flume (automated)	Data recorded hourly and evaluated periodically
Subdrain System	Montana flumes (automated) Remote video inspection	Data recorded hourly and evaluated periodically; Flows periodically visually monitored for changes in clarity Every 5 years

6.2 CLIMAX STAFF INSPECTIONS

It is the responsibility of each tailing dam operator to observe the dam during his or her shift and report any unusual or abnormal conditions. An operator is a person with the most exposure to the tailing dam facility, who has the most intimate knowledge of "usual" conditions. The operator will also inspect his or her respective facility, area, and/or equipment during or after any intense storm or seismic event if he or she can do so safely. An intense storm event or major rainfall is defined as greater than 0.5 inches of rainfall in 24 hours. If safety precautions prevent inspection or observation during or immediately after an event, the facility or area will be inspected as soon as safely possible. Designated tailing engineers will also complete event-driven inspections, routinely inspect the tailing dam for cracking, seepage, signs of instability, and erosion, and inspect the dam following heavy precipitation or other unusual events (e.g., earthquakes).

Identified personnel will visually monitor the dam on a daily basis. Observations will be recorded and are to include, at a minimum, the following:

- Date and time of inspection
- Inspection personnel
- Decant pond level
- General condition of the dam and appurtenances
- Equipment condition/status (if applicable)
- Signs of vandalism or damage (if applicable)
- Signs of erosion, displacement, or additional cracking (if applicable)
- Abnormal conditions (if applicable)

Additional detail for monitoring is included below.

Beach, Dam Crest, and Downstream Slope

Inspect all portions of the beach, dam crest, and downstream slope for erosion, distortion, or cracking. Visually inspect the downstream face for leakage and seepage and document any differences from normal leakage patterns in the inspection checklist. Inspect the slopes in the vicinity of the dam for any indications of impending landslides or other signs of distress.

Inspect the dam crest for debris. Remove debris as soon as removal can be conducted safely. Inspect the tailing beach area for erosion, distortion, or cracking. Additionally, check that the beach width has not become less than 800 feet using an electronic distance meter or other suitable method.

Decant Pond

Observe the general location of the decant pond and water elevation relative to the crest. Document obstructions or debris observed in the decant pond. A minimum of 6 feet of freeboard, as measured from the crest, should be maintained within the decant pond at all times under normal conditions. If the pond reaches a higher level, then the site will begin dewatering procedures until the level reaches the minimum freeboard requirement. Unusual discoloration of the water pool will be noted as this could be an indication of subaqueous sludge migration or sloughing. Decanted water should be relatively clear and free of significant suspended solids and tailing slimes.

Abnormal Conditions

Contact management personnel immediately if any abnormal or unusual observation is made. Unusual or abnormal observations include, but are not limited to, the following:

- Wet spots or visible seepage (or increase in seepage in areas already identified) on the embankment
- Piezometric levels that trigger the system alarm
- Variation in vegetation color or density that might indicate seepage
- Significant increase in measured levels of seepage
- Sinkholes
- Sliding, slumping, or cracking of the downstream slope, crest, and abutments
- Significant erosion features on the face of the dam
- Unusual discoloration of the water pool
- Discoloration or evidence of tailing slimes in decant flows.

Each abnormal condition will be evaluated immediately by Climax engineering staff and others as appropriate. A monitoring and mitigation strategy will be developed and implemented as necessary.

6.3 EVENT MONITORING

A visual inspection of the dam will be made by tailing operators and engineering staff after major storms or after any other event that is determined to be a potential cause of damage to the structures, including but not limited to wildfires or seismic activity. The personnel completing the inspection will document, at a minimum, the following:

- Date
- Weather
- Event Description
- Inspector
- Reason for Inspection
- Precipitation Depth (as applicable)
- Areas Examined
- Visual Assessment
- Conclusions and Recommendations

Additionally, URS provides on-call support to Climax to perform event monitoring and evaluation of unusual site conditions identified by Climax personnel.

6.4 MONTHLY TAILING DAM INSPECTION PROGRAM

URS will provide third-party monthly inspections during summer deposition operations. A URS engineer will walk the top surface of the dam, the abutment, and the toe area to observe site conditions. Conditions that have changed from the previous inspection will be evaluated and discussed with Climax personnel for additional monitoring as necessary.

Monthly inspections will be suspended in winter months when heavy snow covers the dam features to be visually reviewed. Piezometer data will be reviewed by URS weekly upon start-up. When deemed appropriate by the Engineer of Record, piezometric levels and drain flows will be evaluated on a monthly basis.

6.5 ANNUAL TAILING DAM INSPECTION PROGRAM

Freeport-McMoRan has implemented an internal tailing dam review program. The program includes an annual comprehensive walk-over inspection and review of instrument and operations data. The inspection is performed by a team of Climax tailing and engineering staff, Freeport-McMoRan engineers, and URS engineers. The inspection includes the crest, downstream slope, abutments, surface and subsurface drain systems. Items of concern will be noted related to movements (settlement, slope movement, cracking), seepage and piping, and erosion. Photographs are collected by inspection team members.

Complete and accurate records and reports of operations provide a continuous record of performance and other information critical to proper operation of the dam. This includes documentation of the annual observations that are made for the dam.

7.1 GENERAL

Records and reports will be kept by the Climax tailing operators. The records will provide documentation of the inspections and their frequencies, type and frequency of maintenance performed, and provide actual data to management for data tracking procedures.

7.2 TYPES OF RECORDS

Records maintained to comply with this O&M manual include the Operating Log, Weekly Inspection Reports, Event Inspection Reports, Maintenance Reports, and the Maintenance File.

7.2.1 Operating Log

Each operator will record day-to-day activities in an Operating Log so that decisions and actions can be tracked if necessary. The Operating Log will be specific to each operator and stored with the Superintendent when the operator is off-duty. Daily entries will include at least the following:

- Date
- Weather
- Time of shift worked
- Spigot section(s), leadoff(s) and/or cutout(s) operated and visual inspection results
- Results of TDL visual inspection and measurements from cyclone system gage
- Key communications with other operators, Superintendent, or Mill personnel
- Issues, problems, or unusual event(s).

7.2.2 Daily Inspections by Climax

Tailing operators will perform scheduled daily dam inspections and communicate all unusual observations to the Site Services Superintendent or designated engineer as discussed in Section 6.2. All other standard operations will be recorded on the daily inspection form. The inspection form is included following this Section.

Formal monthly and annual inspections are performed by third parties. Third party inspection documentation is not included in the manual.

7.2.3 Event Inspections

A visual inspection of the dam will be made by tailing operators and engineering personnel after major storms or after any other event that is determined to be a potential cause of damage to the structures. A basic checklist for inspection is included in Section 6.3. Event inspections will be documented on the form following this Section.

7.2.4 Maintenance File

The operators will maintain pertinent documents for O&M of the dam in a designated storage/filing location. Documents will include, but are not limited to, the following:

- O&M Manual
- Engineering Drawings
- Emergency contact list
- All inspection reports, in chronological order
- Relevant correspondence
- Operating Log(s)
- Geotechnical and hydrologic reports (Mill Engineering Office)

5-Dam Operator Daily Checklist

Operator Name: ______________________________ **Date:** ____________ Day/Night

Reviewer Signature: ______________________________

General	Action / Comments
☐ Gate Condition:	
☐ Road Condition:	
☐ Signage Condition:	
☐ Check in with Mill Control:	
☐ % Mill Water Valve Is Open:	
☐ Area Inspected Work Orders Written:	
TDL/ETDL	**Action / Comments**
☐ Conditions of Lines:	
☐ Conditions of Dropboxes:	
☐ Leaks (Lines or Dropboxes):	☐ Yes ☐ No
☐ 1st Drop Box Condition:	
☐ Cyclone System Pressure Gage	
☐ % Solids Checked at 1st Drop Box	
☐ pH Checked at 1st Drop Box:	
Cutouts to be inspected on the 10th of each month, or daily while in use	
☐ #1 (Lime Station) Cutout/Valves Checked:	☐ NA
☐ #2 Cutout and Valves Checked:	☐ NA
☐ South Cutout and Valves Checked:	☐ NA
☐ Clinton Cutout and Valves Checked:	☐ NA *Automated valve to be checked daily
☐ East Cutout and Valves Checked:	☐ NA
☐ North Cutout and Valves Checked:	☐ NA
Tailing Distribution System	**Action / Comments**
☐ Condition of Lines:	
☐ Condition of Valves:	
☐ Leadoff in use:	☐ Yes ☐ No Leadoff # in use
☐ Cell(s) being deposited:	☐ NA
☐ # of spigots by cell:	☐ NA
☐ # of spigots by cell (con't):	☐ NA
☐ Any Deposition Interruptions (w/time):	
☐ TDL Average Pressure:	
☐ Area Inspected Work Orders Written:	

5-Dam Operator Daily Checklist (concluded)

5 Dam, Crest Area	Action / Comments			
☐ Area Accessible:	☐ Yes	☐ No		
☐ Crest Road Condition:				
☐ Dam Crest Berm/Area Condition:				
☐ Dam Beach/Area Condition:				
☐ Dam Face Condition:				
☐ Groin Condition:				
☐ Sinkholes / Significant Erosion:	☐ Yes	☐ No		
☐ Dust Conditions	☐ Extreme	☐ Moderate	☐ Low	☐ None
☐ Area Inspected Work Orders Written:				
5 Dam, Toe Area	**Action / Comments**			
☐ Area Accessible:	☐ Yes	☐ No		
☐ Road Condition:				
☐ Seepage Collection Ponds Condition:				
☐ Dam Face Condition:				
☐ Groin Condition:				
☐ Sinkholes / Significant Erosion	☐ Yes	☐ No		
☐ Seeps:	☐ Yes	☐ No		
☐ Area Inspected Work Orders Written:				

Notes: ____

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In case of emergency with Climax Tailings Facility please contact the Tailings Engineer and/or Tailings Supervisor.

Tailings Engineer - Mike Waldron: Office:(719) 486-7545 Cell: (719) 271-1643

Tailings Supervisor – Rod Cordova: Office:(719) 486-7736 Cell: (719) 231-1248

Tailings Event Inspection Form

This form to be used for Inspection of Tailing Facilities after a major storm event including heavy precipitation, wildfires, seismic activity, or any other event determined to be a potential cause of damage to the structures.

Name: ______________________________ **Date:** ______________

Reviewer Signature: ______________________________

Item	Information / Comments
Weather:	temp: sunny/cloudy: wind: other:
Precipitation Depth:	(as applicable)
Event Description:	
Reason for Inspection:	
Areas Examined:	
Visual Assessment	
Conclusions and Recommendations	

Additional Notes: ______________________________

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This report is a living document and will be revised throughout the operation of the tailing impoundment. Updates and revisions to the O&M manual will be coordinated through the Climax tailing engineer so that all copies reflect the changes and they remain identical. Revisions will be distributed to the entities listed in Section 2.1.

The original version is identified as Revision 1.0. Subsequent revisions will be renumbered as Revision 1.1, Revision 1.2 and so on. Updates to the manual will follow the following format:

Date Submitted:

Personnel Conducting Update and Revision:

Reason for Update:

Pages Modified, Added or Replaced:

Comments:

Date Submitted: May 2014 (Rev 1.1)

Personnel Conducting Update and Revision: Ray Lazuk, Climax Molybdenum Company

Reason for Update: Include MDE stability results; add information about the cyclone system (Section 4.4); include updates identified in Revision 1.0; Address DRMS comments to TR-23; correct identified errors.

Pages Modified, Added or Replaced (page numbers refer to pages within this Revision 1.1):

- Page 3-1 (added 2013 subdrain construction discussion)
- Page 3-2 (corrected to state 3 leadoffs constructed)
- Pages 3-9 and 3-10 (updated language to include post-closure conditions and include MDE stability results in Table 3-6)
- Pages 4-1 and 5-3 (clarified 8,700 gpm is water only portion of slurry)
- Page 4-4 and remaining Section 4 pages (added cyclone system text)
- Page 4-6 (changed “open” to “operate” cutout valves)
- Page 4-8 (added beach profile sampling discussion)
- Page 4-9 (revised inclinometer monitoring as recorded and evaluated twice per year)
- Pages 4-9 and 6-1 (moved additional instrumentation from Section 4.6.3.2 to Section 6.1. and added lab testing to be performed)
- Page 5-1 (automation of Parshall flume)
- Pages 5-4 and 5-5 (added recent 2013 upgrade of subdrain system, maintenance inspections and installation of associated new monitoring system)
- Pages 6-1 and 6-5 (added Table 6-1 inspection and monitoring summary)
- Page 6-3 (removed horizontal drain readings and seep areas evaluations; added initial weekly piezometer readings at start-up)

- Page 7-1 (added cyclone system measurements to operating log bullet list)
- Revised Operator Daily Checklist (added cyclone system gage readings, removed bi-monthly tailing sample collection, and added beach inspection)
- Table of Contents updated
- First drawing of Appendix B replaced
- Ten (10) Drawings added to Appendix C showing design of subdrain and monitoring system improvements constructed in 2013

Comments: None.

Appendix A

Hydrology Discussion
(Provided by W.W. Wheeler and Associates, Inc.)

Wheeler provides hydrology consulting services to Climax and has prepared the following discussions on probable maximum precipitation, design rainfall events, snowmelt runoff rates, and flood routing requirements for the facility.

Probable Maximum Precipitation

Applied Weather Associates has performed a site-specific probable maximum precipitation (PMP) evaluation for the Climax site. That analysis transposes actual historical storms to the Climax site and maximizes the amount of precipitation that could potentially fall. That approach has been frequently used and accepted widely throughout Colorado for determining site-specific PMP events. The analysis resulted in a 6-hour local storm PMP depth of 4.41 inches, which is considered to be the worst case PMP event determined for the study.

Design Rainfall Events

Design rainfall depth-duration data for various return periods ranging from 2 to 200 years were estimated using the Log Pearson Type III statistical analyses of the historical daily precipitation data and empirically using NOAA Atlas 2. The Log Pearson Type III values have been adopted as the appropriate design storm depths. The 24-hour rainfall depths from both design rainfall analyses are provided in the table below.

Table 3-5
Summary of 24-Hour Rainfall Depths

Return Period	Log Pearson III (inches)	NOAA Atlas 2 (inches)
2-year	0.94	1.39
5-year	1.22	1.90
10-year	1.40	2.20
25-year	1.64	2.80
50-year	1.81	3.10
100-year	1.99	3.51
200-year	2.16	3.88

The Log Pearson Type III analysis is based on 55 years of available daily precipitation data from the Climax Weather Station. Although this methodology provides estimates for storms with longer return periods, the storms with return periods greater than about 100 years should be considered an approximation; and, as additional rainfall data is collected, the results of a statistical analysis may change somewhat. NOAA Atlas 2 provides broad regional rainfall depths, which are not site-specific and for return periods up to 100 years; the rainfall depths shown for the 200-year event were extrapolated and should be considered approximate. The largest 24-hour rainfall depth recorded by the Climax weather station is 2.00 inches, which occurred in May 1973. This fact as well as a review of other peak rainfall events at the Climax weather station suggests that the NOAA Atlas 2 results may be conservatively high for return periods up to about 100 years.

Snowmelt Runoff Rates

Snowmelt at Climax plays a significant role in water handling. The highest snowmelt runoff typically occurs in June, and, in some years, extends into the first few weeks of July. Wheeler completed a snowmelt runoff analysis of the Black Gore Creek basin and transposed that analysis to the Climax basins. The result of that analysis suggests a one-day 100-year snowmelt runoff rate of 21.78 cfs per square mile.

Flood Routing Requirements

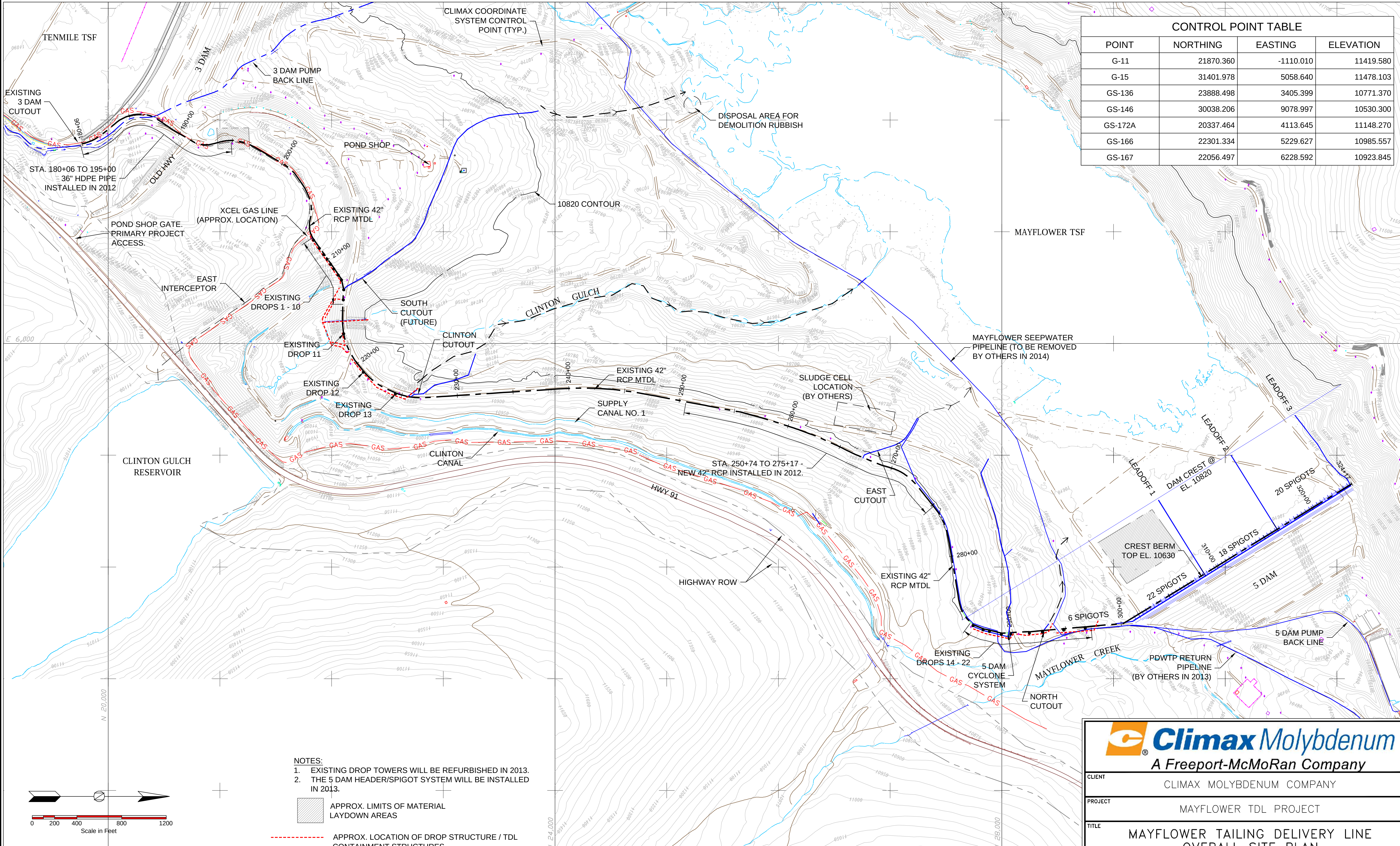
Tailing dams fall under the jurisdiction of DRMS, who does not publish well defined flood routing criteria for tailing dams. However, Climax recognizes the importance of dam safety and has historically strived to meet the dam safety and flood routing criteria established by the Dam Safety Branch of the Colorado Division of Water Resources (DWR). According to the DWR Rules and Regulations for Dam Safety and Dam Construction, 5 Dam would be classified as a large-size, high-hazard dam and would therefore be required to safely pass 100 percent of the site-specific PMP event with one foot of residual freeboard above the maximum water level during the inflow design flood.

PMP-type rainfall events would normally only occur during July or August. However, the site-specific PMP analysis performed by Applied Weather Associates indicated that it was possible for the Climax PMP event to occur in June. Therefore, it is possible that the PMP rainfall event could occur concurrently with high snowmelt runoff. To account for this, Climax has historically operated the water pools on the tailing dams to have adequate capacity to pass the PMP event simultaneously with the peak of the 100-year snowmelt runoff. The following key assumptions are critical for establishing the inflow design flood for Mayflower TSF:

- The spillway must pass 100 percent of the site-specific PMP with one foot of residual freeboard above the maximum flood water level.
- The PMP occurs during the peak one-day 100-year snowmelt runoff.
- The initial water level in the Mayflower TSF decant pond at the onset of the PMP is at the level of the spillway crest. It will be necessary to operate the water pool on the pond to ensure that the water level does not exceed the prerequisite spillway crest.
- The interceptor system would fail at the onset of the PMP.

The HEC-1 hydrology model developed by Wheeler for the 2005 Hydrology Report was modified to evaluate the future flood routing criteria for Mayflower TSF. The overall configuration of the drainage basins will remain relatively unchanged throughout mining; however, as tailing is deposited, the storage capacity and spillway hydraulics of the decant ponds will be continuously changing. The model results indicate that approximately 2,000 acre-feet of flood storage capacity along within six feet of operational freeboard would be sufficient to route the PMP through Mayflower TSF's decant pond with one foot of residual freeboard.

Appendix B
Tailing Delivery Line (Provided by W.W. Wheeler and Associates, Inc.)
and Deposition Berm Drawings



CONTROL POINT TABLE

POINT	NORTHING	EASTING	ELEVATION
G-11	21870.360	-1110.010	11419.580
G-15	31401.978	5058.640	11478.103
GS-136	23888.498	3405.399	10771.370
GS-146	30038.206	9078.997	10530.300
GS-172A	20337.464	4113.645	11148.270
GS-166	22301.334	5229.627	10985.557
GS-167	22056.497	6228.592	10923.845

NOTES:

1. EXISTING DROP TOWERS WILL BE REFURBISHED IN 2013.
2. THE 5 DAM HEADER/SPIGOT SYSTEM WILL BE INSTALLED IN 2013.

APPROX. LIMITS OF MATERIAL LAYDOWN AREAS

APPROX. LOCATION OF DROP STRUCTURE / TDL CONTAINMENT STRUCTURES

REFERENCES

REVISIONS

0	6/12/12	ISSUED FOR CONSTRUCTION	DCM	SMM
1	2/20/13	UPDATED FOR 2013 CONSTRUCTION	SAA	SMM
2	3/18/13	ISSUED FOR BIDDING – 2013 CONSTRUCTION	DCM	SMM
3	5/10/13	ISSUED FOR CONSTRUCTION	DCM	SMM

DISCLAIMER

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Climax Molybdenum
A Freeport-McMoRan Company

CLIENT: CLIMAX MOLYBDENUM COMPANY

PROJECT: MAYFLOWER TDL PROJECT

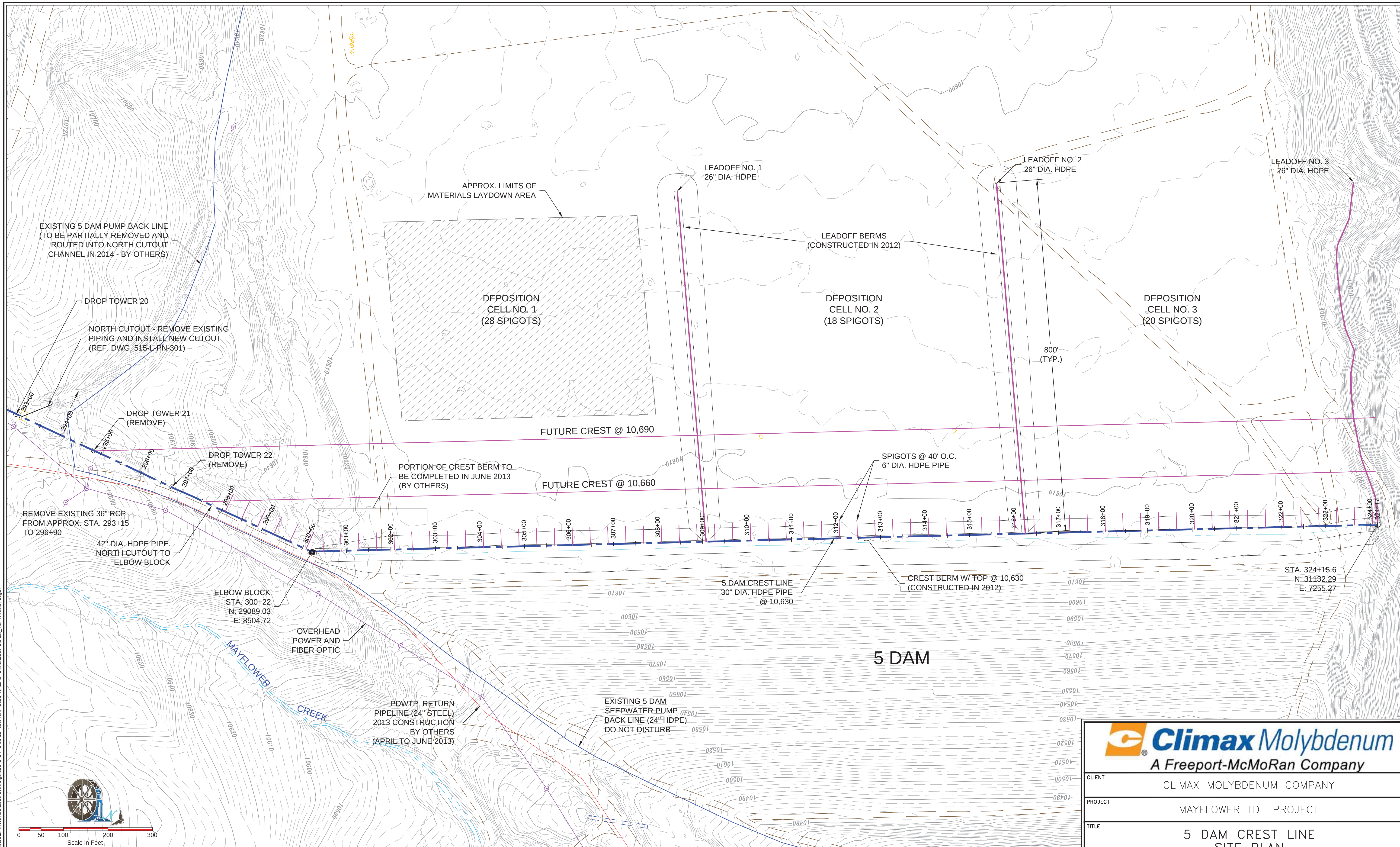
TITLE: MAYFLOWER TAILING DELIVERY LINE OVERALL SITE PLAN GENERAL ARRANGEMENT

W. W. WHEELER & ASSOCIATES, INC.
Water Resources Engineers
3700 S. Inca Street | Englewood, CO 80110
303-761-4130 | Fax 303-761-2802

DESIGNED BY	SMM	CHECKED BY	MDS
DRAWN BY	SAA	APPROVED BY	MSM

FILENAME	DRAWING No.	REV
515-C-GA-100.DWG	515-C-GA-100	3

R:\1000\1051\1051.36 MTDL\1051.36.01\DRAWINGS\2013 Drawings\515-C-GA-100 4-11-14 05:14pm trevor XREFS: Climax2006; 5; 6; 8; 9; 12; 11; 16; 15; INDEX Climax_4C; Wheeler Logo; 5 lo; 6 lo; 8 lo; 9 lo; 12 lo; 11 lo; 16 lo; 15 lo;



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Climax Molybdenum
A Freeport-McMoRan Company

CLIENT	CLIMAX MOLYBDENUM COMPANY
PROJECT	MAYFLOWER TDL PROJECT
TITLE	5 DAM CREST LINE SITE PLAN GENERAL ARRANGEMENT

REFERENCES

REVISIONS

0	3/18/13	ISSUED FOR BIDDING	DCM	SMM
1	5/10/13	ISSUED FOR CONSTRUCTION	DCM	SMM

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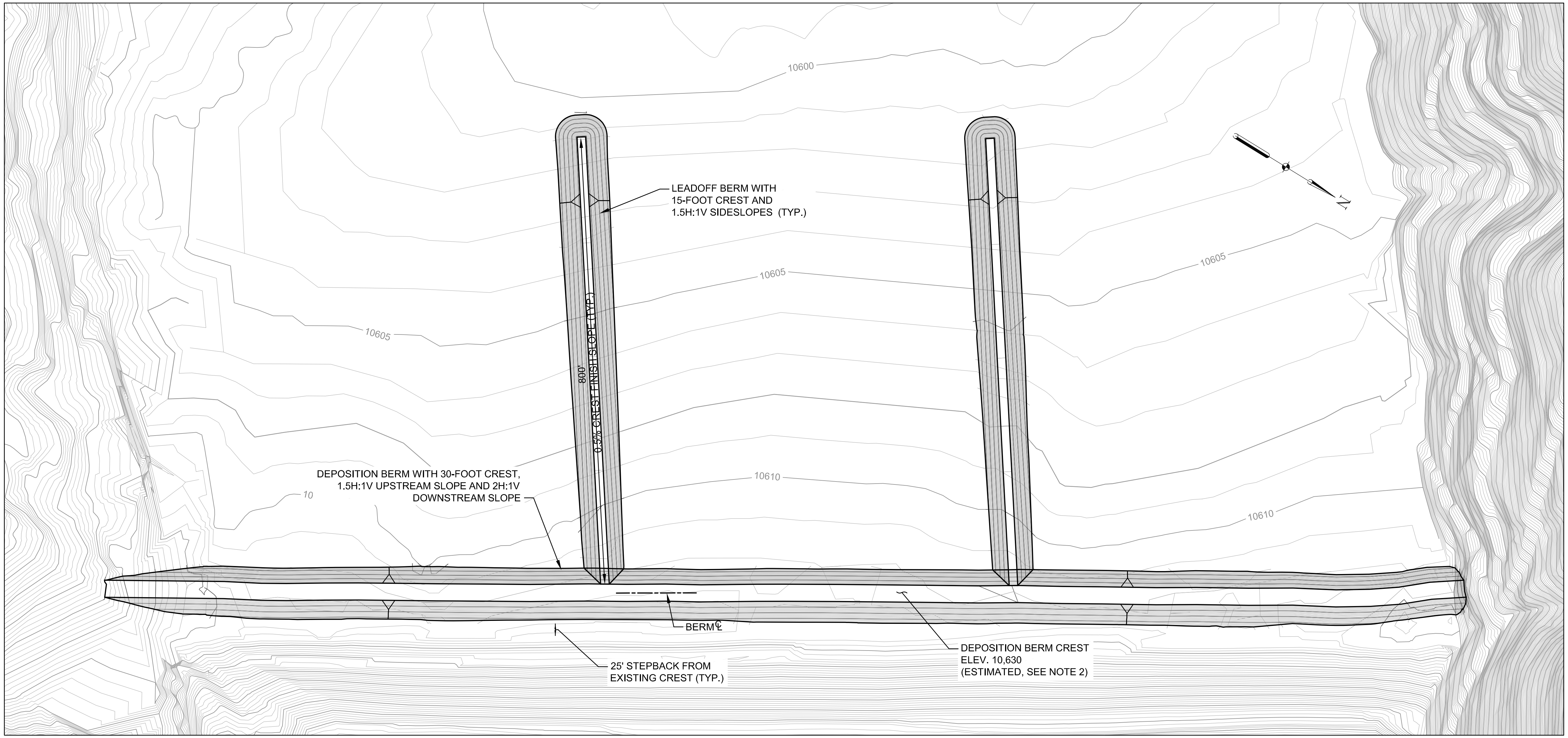
W. W. WHEELER & ASSOCIATES, INC.
Water Resources Engineers
3700 S. Inca Street | Englewood, CO 80110
303·761·4130 | Fax 303·761·2802

DESIGNED BY	SMM	CHECKED BY	DCM
DRAWN BY	SAA	APPROVED BY	MSM
FILENAME	515-C-CV.DWG	DRAWING No. 515-C-GA-101	REV 1

EVERARD, JOHN, 5/31/2013 1:03 PM

URS



NOTE:

TOPOGRAPHIC SURVEY FROM 2006 AERIAL USED AS BASE MAP. BEACH SURFACE TOPOGRAPHY WITHIN BERMS LIMITS SHOWN WITH CAP MATERIAL REMOVED (BASED UPON ESTIMATED THICKNESSES PER HABITAT CONSTRUCTION DATA). CONTOURS OUTSIDE OF FOOTPRINT REPRESENT EXISTING CONDITIONS. CONTRACTOR TO FIELD VERIFY ACTUAL TOPOGRAPHY PRIOR TO STARTING BERM CONSTRUCTION WORK.

0 100' 200' 400'

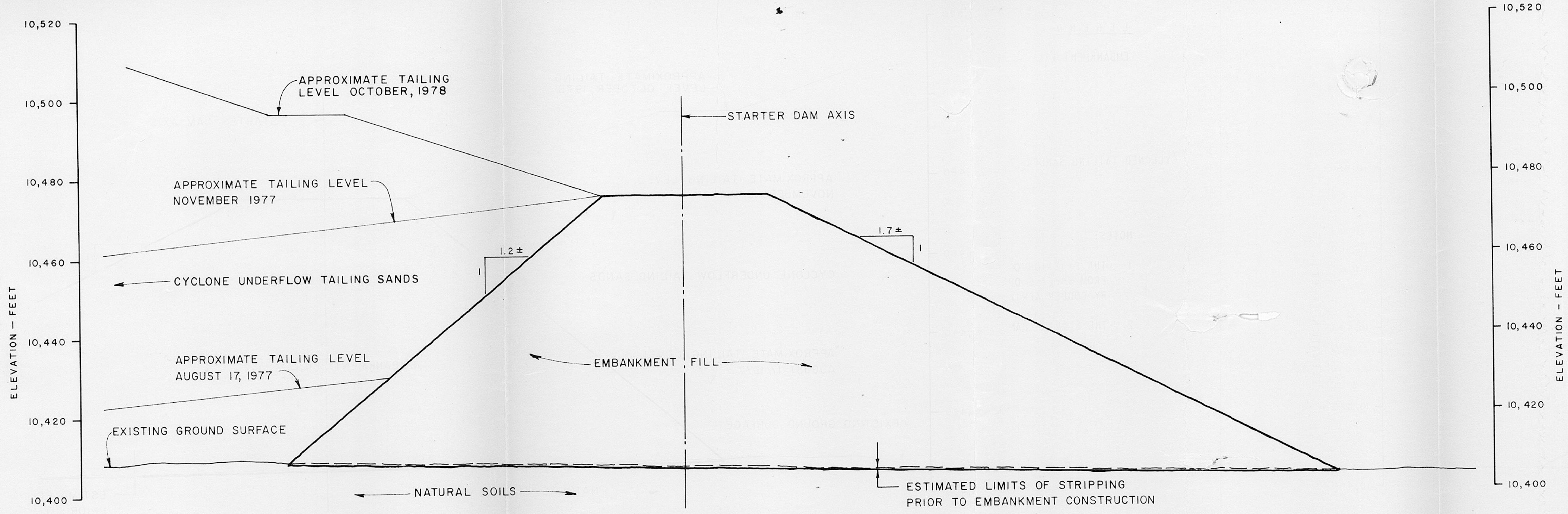
SCALE IN FEET

Job No. : 22243088	MAYFLOWER TAILING DAM DEPOSITION AND LEADOFF BERMS PLAN
Prepared By : JSE	
Date : MAY 2012	

URS DRAWING PATH: N:\Projects\22242736_ClimaxMyflwr_ErthwrlSub_0017_0_CAD_GIS\MAYFLOWER BERM W LEADOFFS.dwg

Appendix C

Starter Dam and Subdrain System Drawings



LEGEND

EMBANKMENT FILL – SLIGHTLY MOIST TO MOIST, SLIGHTLY SILTY OR CLAYEY TO SILTY OR CLAYEY, SANDY, COBBLY, BOULDERY (2 TO 3 FOOT MAXIMUM SIZE), GRAVELS (GP-GM, GP-GC, GM, GC), PLACED IN 2½ TO 3½ FOOT THICK LIFTS AND COMPACTED BY ABOUT 4 PASSES OF A DOZER AND CONTROLLED ROUTING OF THE HAULING EQUIPMENT.

CYCLONED TAILING SANDS – MEDIUM TO FINE GRAINED CYCLONED UNDERFLOW SANDS GENERALLY CONTAINING LESS THAN 15% MINUS NO. 200 SIEVE SIZE MATERIALS PLACED BY SLURRY DEPOSITION.

NOTES:

1. THE EXTERIOR CONFIGURATION OF THE EMBANKMENT SECTION SHOWN WAS TAKEN FROM SHEET 6 OF CLIMAX MOLYBDENUM COMPANY'S CLIMAX TOPOGRAPHIC MAP BY COOPER AERIAL SURVEYS DATED AUGUST 2, 1977.

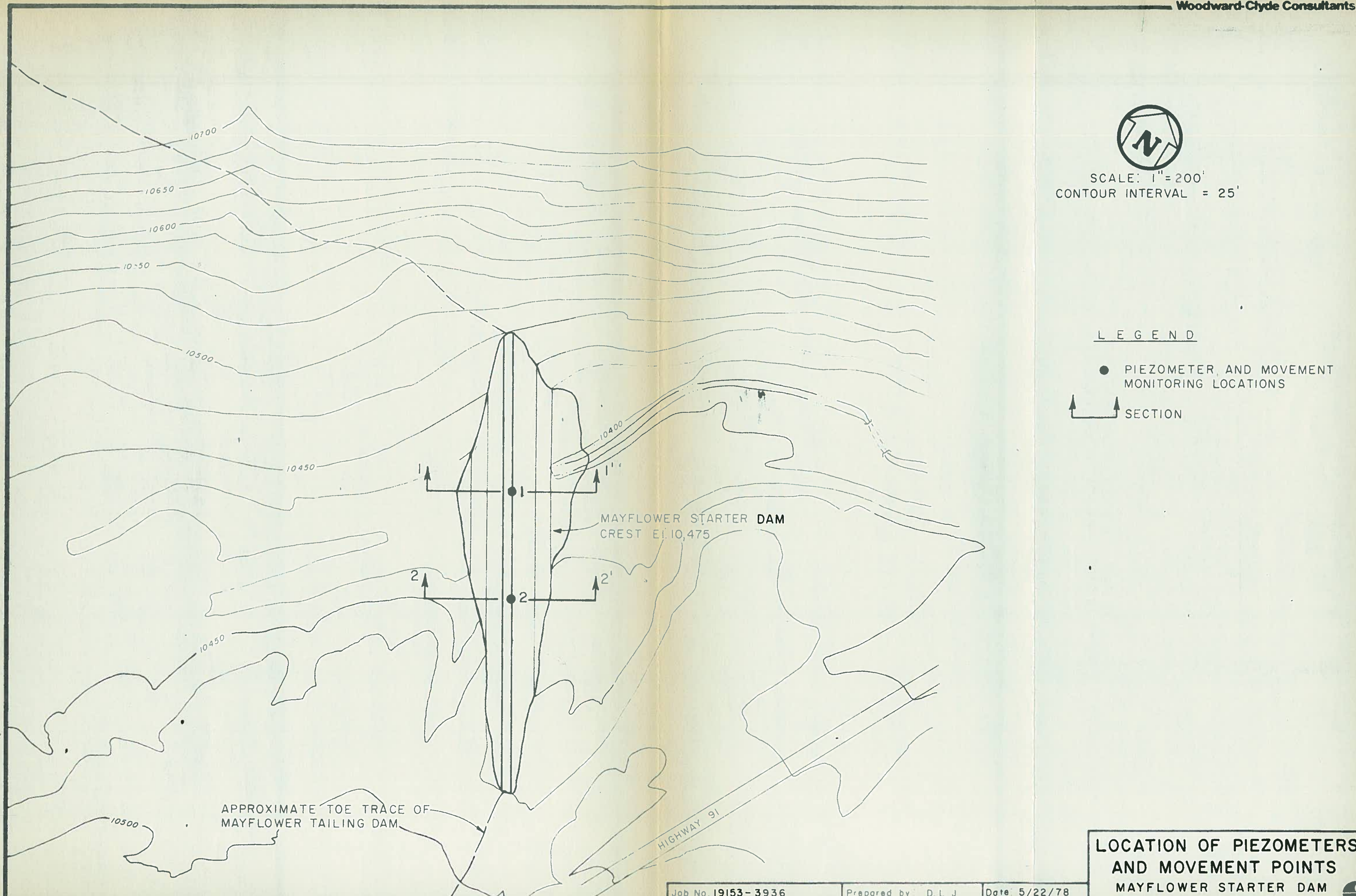
2. THE STARTER DAM WAS CONSTRUCTED IN SEPTEMBER, 1974.

SCALE: 1" = 20'

"AS-BUILT" STARTER DAM EMBANKMENT SECTION

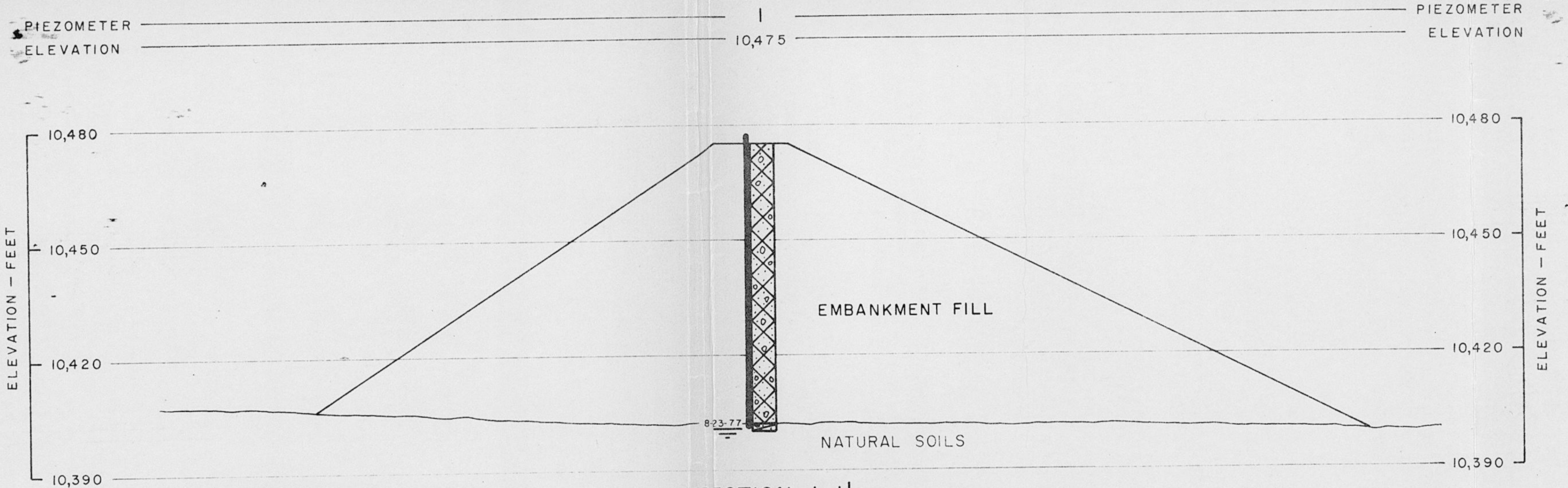
Job No. 19153 - 3936	Prepared by: A. H. G.	Date: 5/9/78

FIG. 11

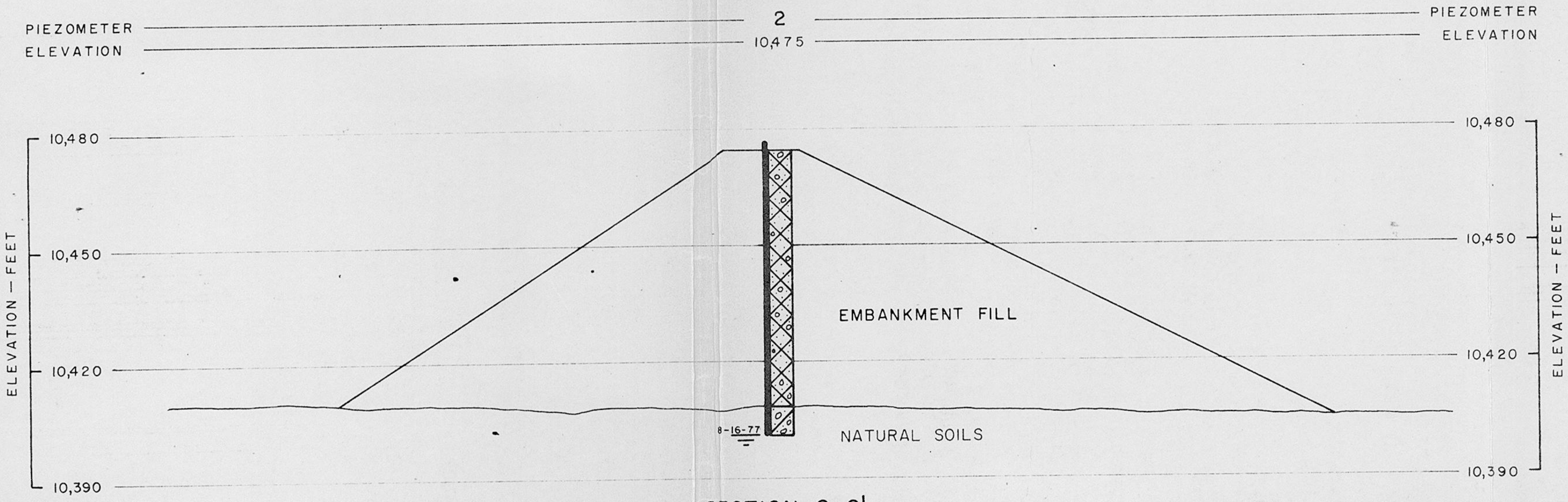


LOCATION OF PIEZOMETERS AND MOVEMENT POINTS
MAYFLOWER STARTER DAM

FIG. 17



SECTION 1-1'



SECTION 2-2'

SCALE: 1" = 30'

LEGEND

GRAVEL, DENSE, COBBLY, BOULDERY, SANDY, SLIGHTLY SILTY OR CLAYEY TO SILTY OR CLAYEY, SLIGHTLY MOIST TO MOIST, BROWN, GRAY (GP-GM, GP-GC, GM, GC)(EMBANKMENT FILL).

GRAVEL, DENSE, SANDY, SILTY, COBBLY, MOIST TO WET, BROWN (GM).

8-16-77 INDICATES FREE WATER LEVEL AND DATE MEASUREMENT WAS TAKEN.

INDICATES 1½-INCH DIAMETER SLOTTED PLASTIC PIPE OPEN WELL PIEZOMETER INSTALLED TO DEPTH SHOWN.

NOTES:

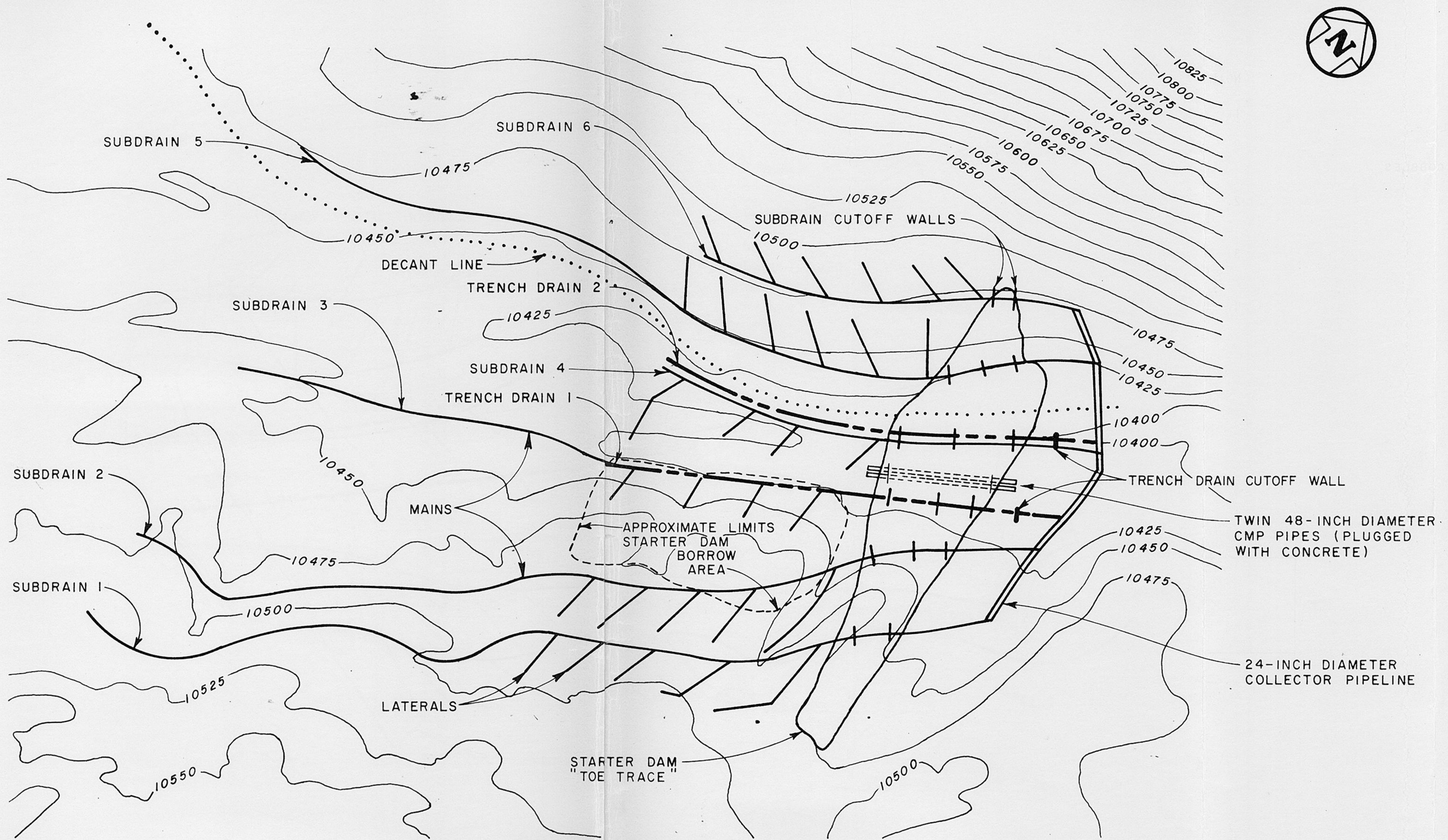
1. PIEZOMETER HOLES WERE DRILLED BETWEEN AUGUST 16 AND 23, 1977, WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT AUGER POWERED BY A CENTRAL MINE EQUIPMENT (CME-55) DRILLING RIG (PIEZOMETER NO. 2) OR A BECKER MODEL 80 DRILLING RIG WITH A 5½-INCH DIAMETER 3 TOOTH WEB TILL BIT USING REVERSE AIR CIRCULATION (PIEZOMETER NO. 1).

2. PIEZOMETER ELEVATION SHOWN IS THE GROUND SURFACE ELEVATION.

Job No. 19153-3936	Prepared by: D.L.S.	Date: 5/22/78

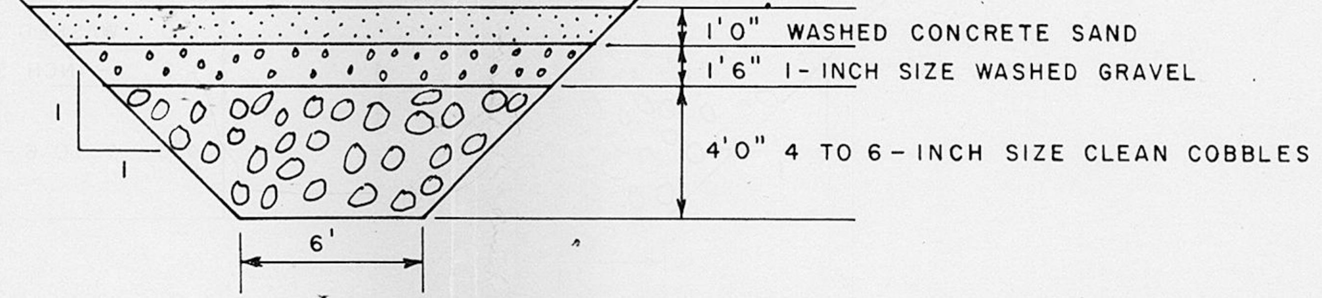
MONITORING STUDY SECTIONS
MAYFLOWER STARTER DAM

FIG. 20



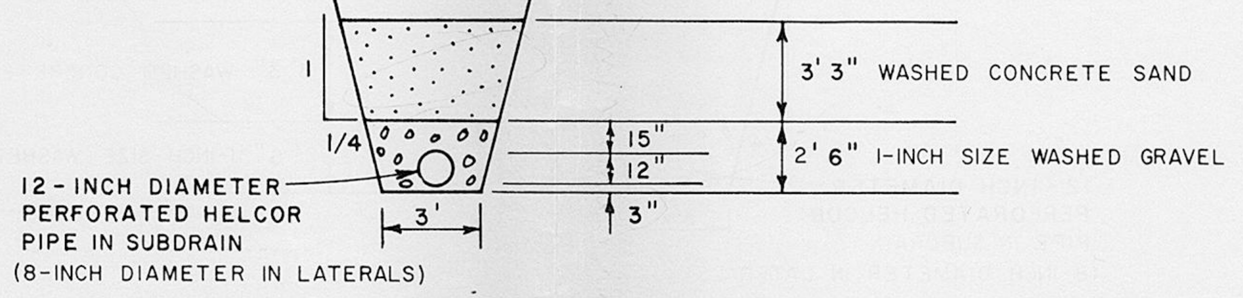
SUBDRAIN SYSTEM PLAN

SCALE: 1" = 200'



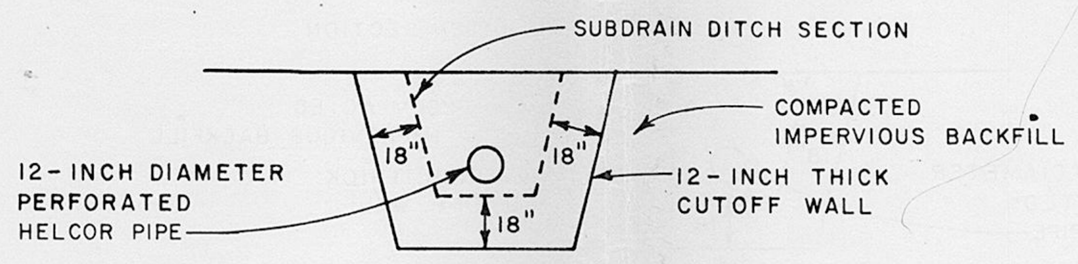
TYPICAL TRENCH DRAIN SECTION

SCALE: 1" = 6'



TYPICAL SUBDRAIN AND LATERAL SECTION

SCALE: 1" = 6'



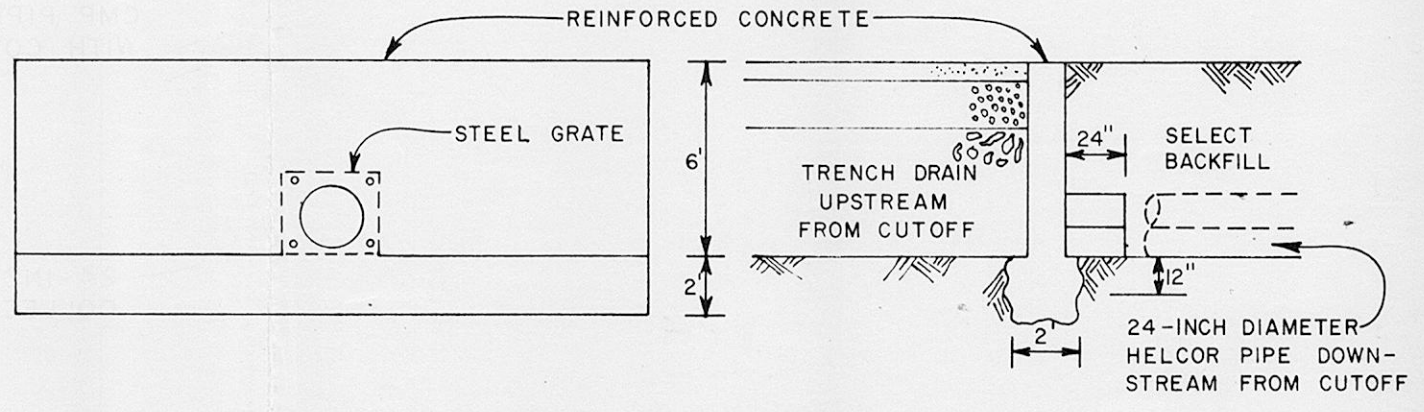
TYPICAL SUBDRAIN REINFORCED CONCRETE CUTOFF WALL

(REINFORCEMENT NOT SHOWN)

SCALE: 1" = 6'

NOTES:

1. BASE MAP FOR SUBDRAIN SYSTEM PLAN AFTER CLIMAX MOLYBDENUM, CO. DRAWING NO. 11f3-42 DATED FEBRUARY 23, 1976. APPROXIMATE LOCATION OF SUBDRAIN NO. 3 AND CUTOFF WALLS TAKEN FROM CLIMAX MOLYBDENUM, CO. DRAWING NO. 11f3-6 DATED MARCH 16, 1972.
2. TYPICAL TRENCH DRAIN SECTION AFTER CLIMAX MOLYBDENUM CO. DRAWING NO. 11f3-29 DATED 1974.
3. TYPICAL SUBDRAIN SECTION AND TYPICAL REINFORCED CONCRETE CUTOFF WALL AFTER CLIMAX MOLYBDENUM CO. DRAWING NO. 11f3-7 DATED 1972.
4. CLIMAX MOLYBDENUM CO. PLANS TO EXPAND THE SUBDRAIN SYSTEM AS THE TAILING DAM IS RAISED.

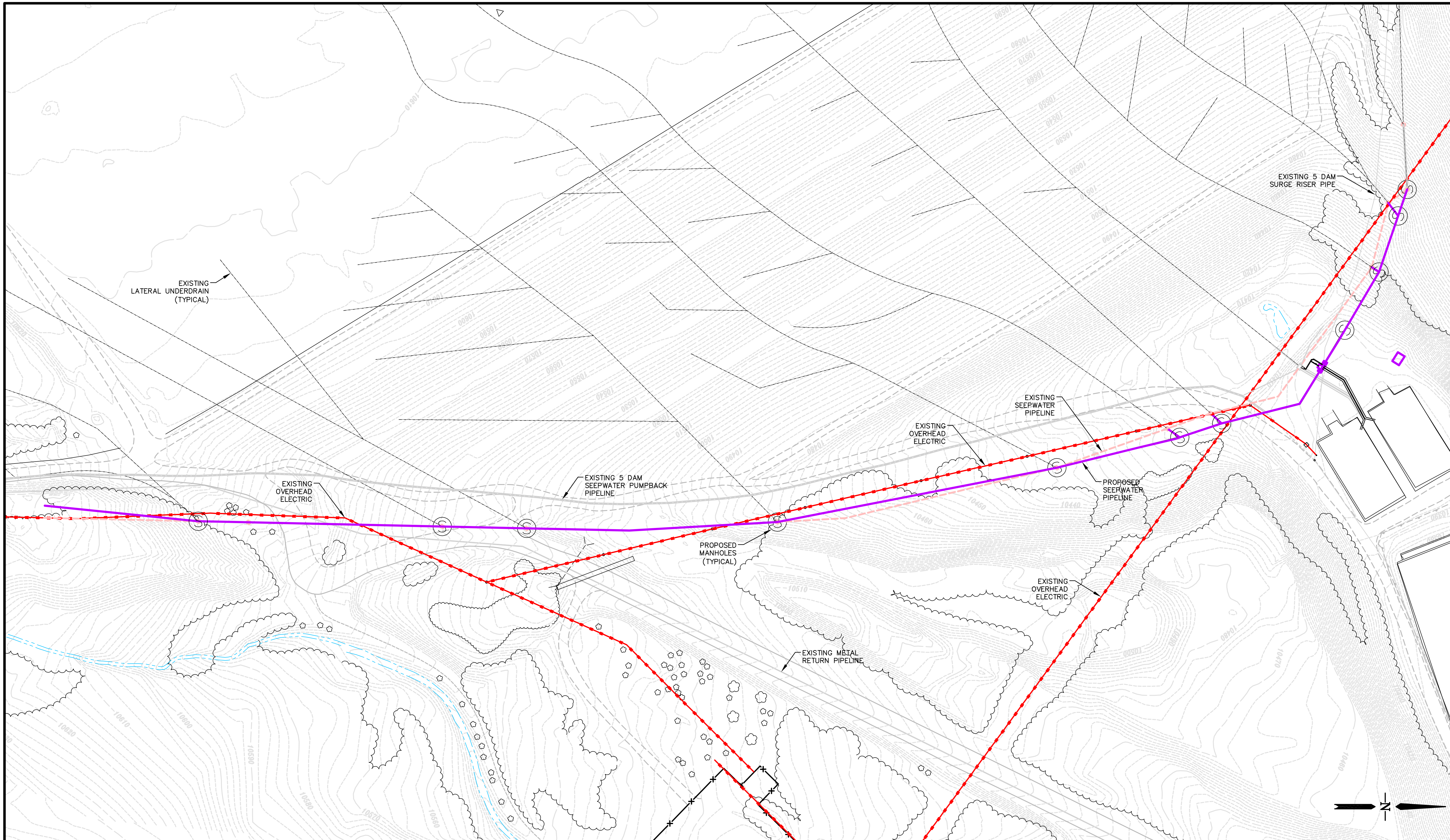


TYPICAL TRENCH DRAIN CUTOFF WALL

SCALE: 1" = 6'

Job No. 19153 - 3936	Prepared by: A.H.G.	Date: 5/19/78	MAYFLOWER TAILING DAM SUBDRAIN SYSTEM

FIG: 10



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CHKD BY:	DATE:
ENGD BY: TMR	DATE: 04/29/13
APVD BY:	DATE:

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A Freeport-McMoRan Company

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DIVISION: MILL ENGINEERING

AREA: MAYFLOWER

TITLE: MAYFLOWER 5 DAM TOE DRAIN REPAIR OVERALL SITE PLAN

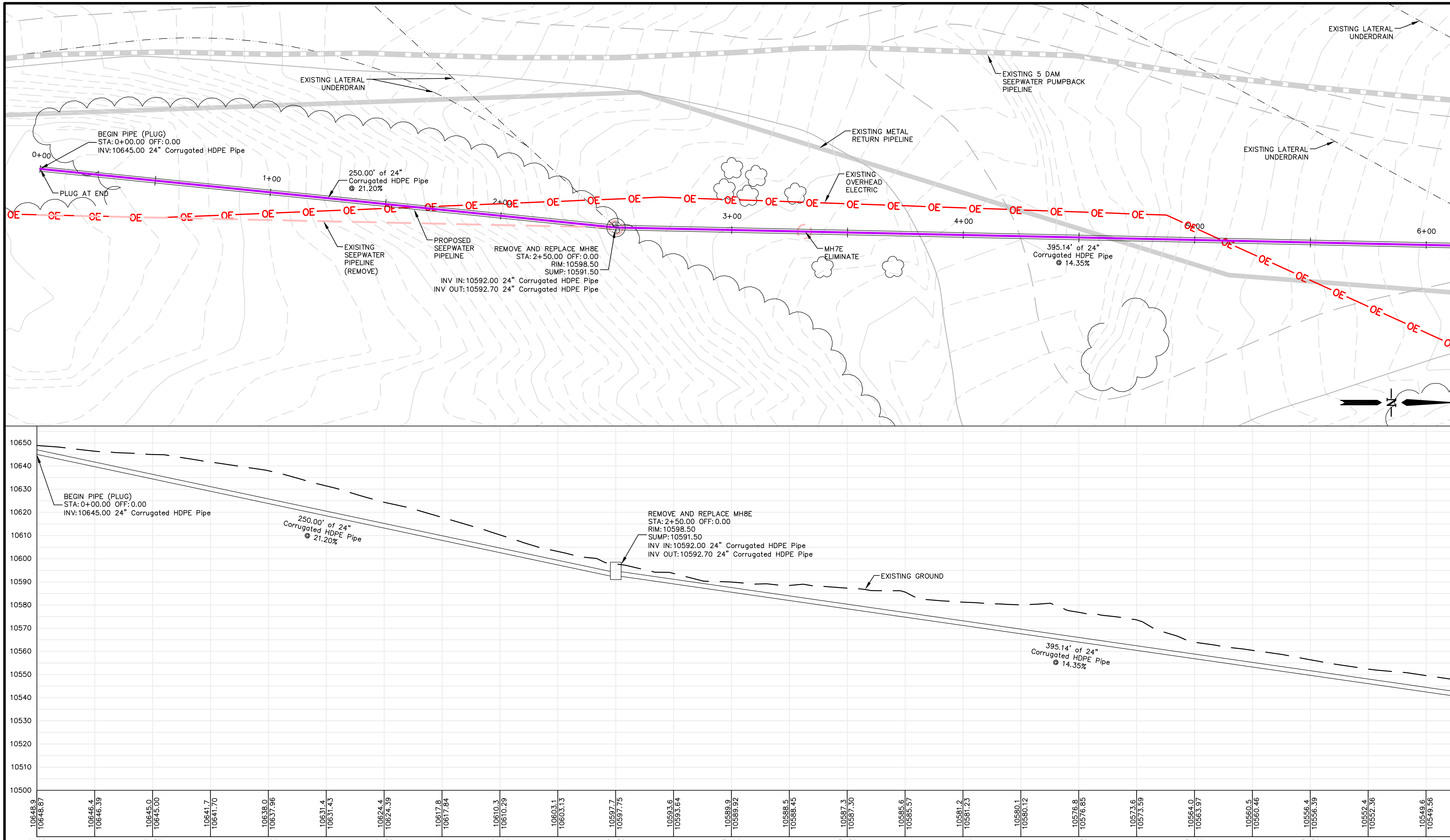
JOB NO.

DWG. NO. 877-C-GA-100

CAD NO.

REVISION:

SHT. 1 OF 8



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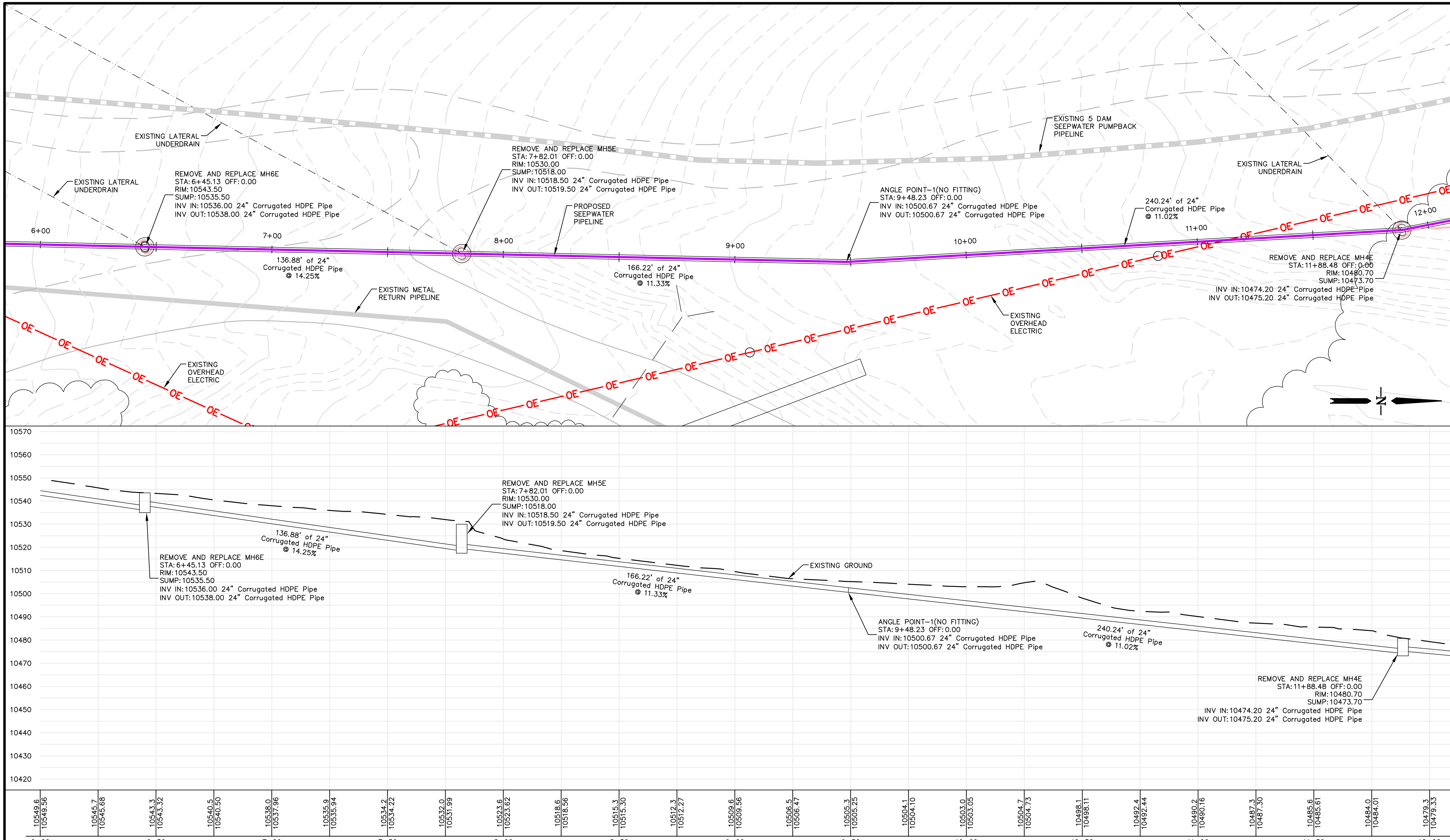
TITLE: MAYFLOWER 5 DAM TOE DRAIN REPAIR PLAN AND PROFILE SHEETS	DWG. NO. 877-C-CV-101
	CAD NO.
	REVISION:
	SHT. 2 OF 8



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TITLE: MAYFLOWER 5 DAM TOE DRAIN REPAIR PLAN AND PROFILE SHEETS	DWG. NO. 877-C-CV-102
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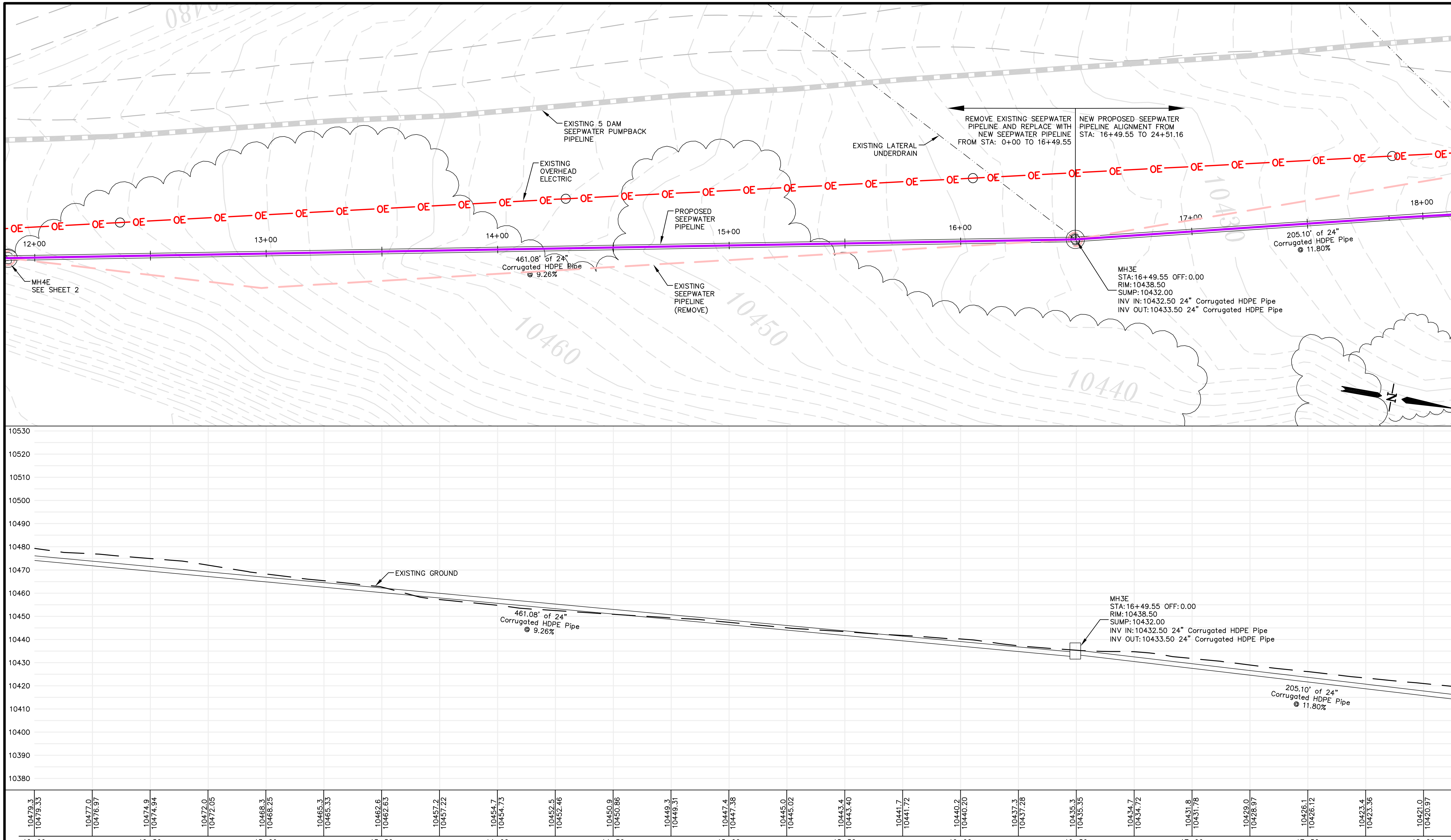

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APVD BY:	DATE:

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JOB NO.
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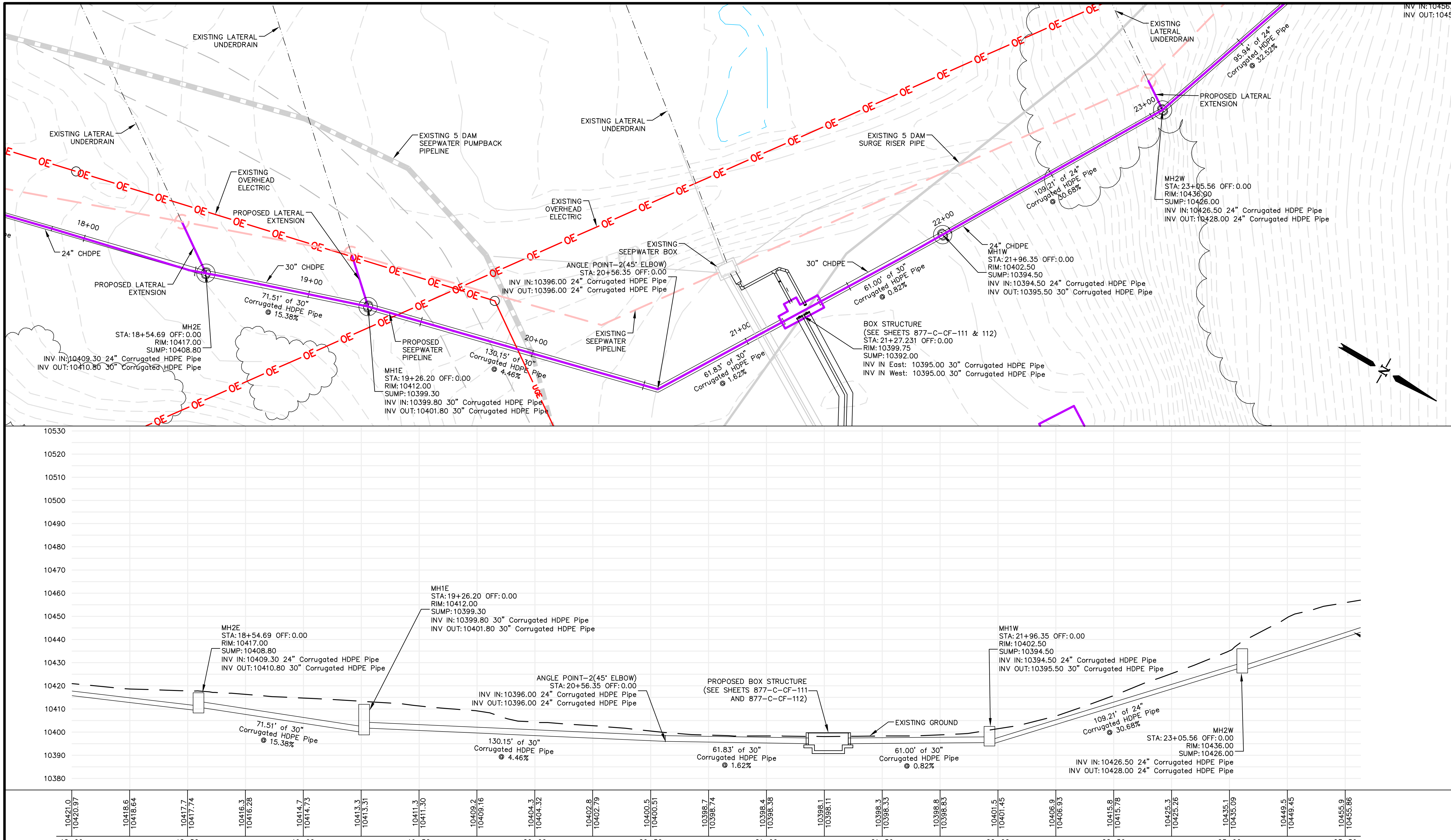

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SCALE: 1"=40'-0"	SHEET SIZE ANSI B
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CHKD BY:	DATE:
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APVD BY:	DATE:

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DIVISION:	MILL ENGINEERING	
AREA:	MAYFLOWER	JOB NO.
TITLE:	MAYFLOWER 5 DAM TOE DRAIN REPAIR PLAN AND PROFILE SHEETS	DWG. NO. 877-C-CV-104
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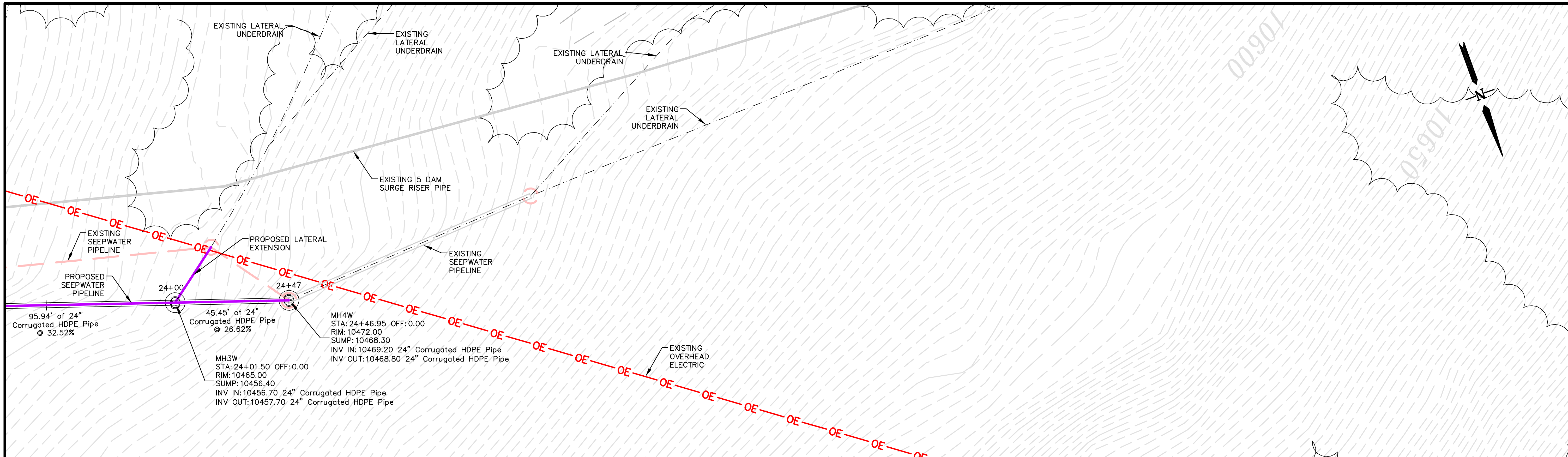

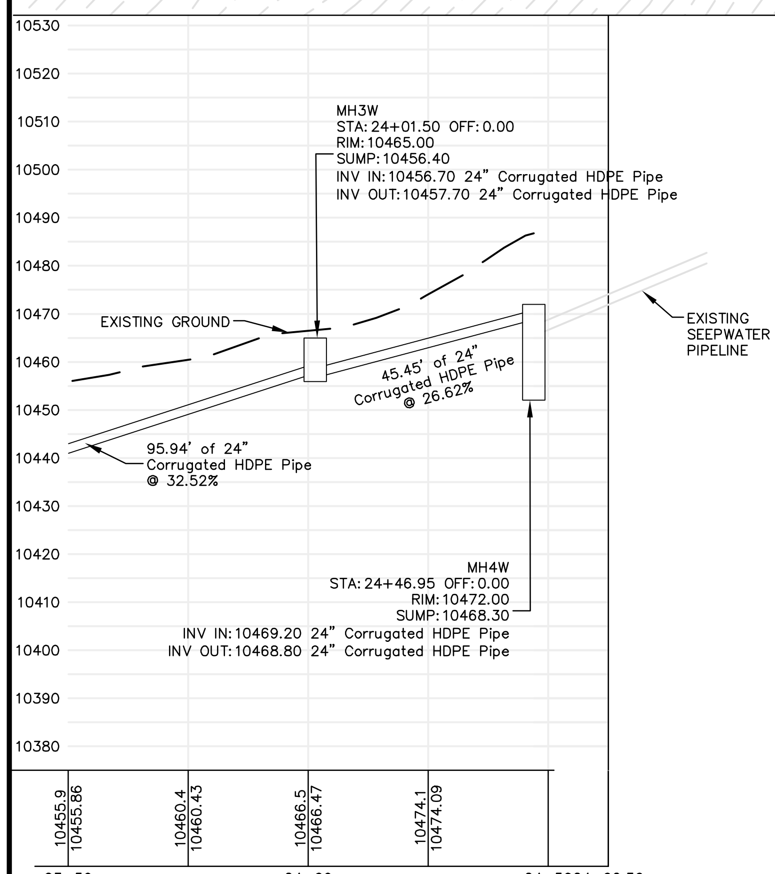

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SCALE: 1"=40'-0"	SHEET SIZE ANSI B	
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APVD BY:	DATE:	

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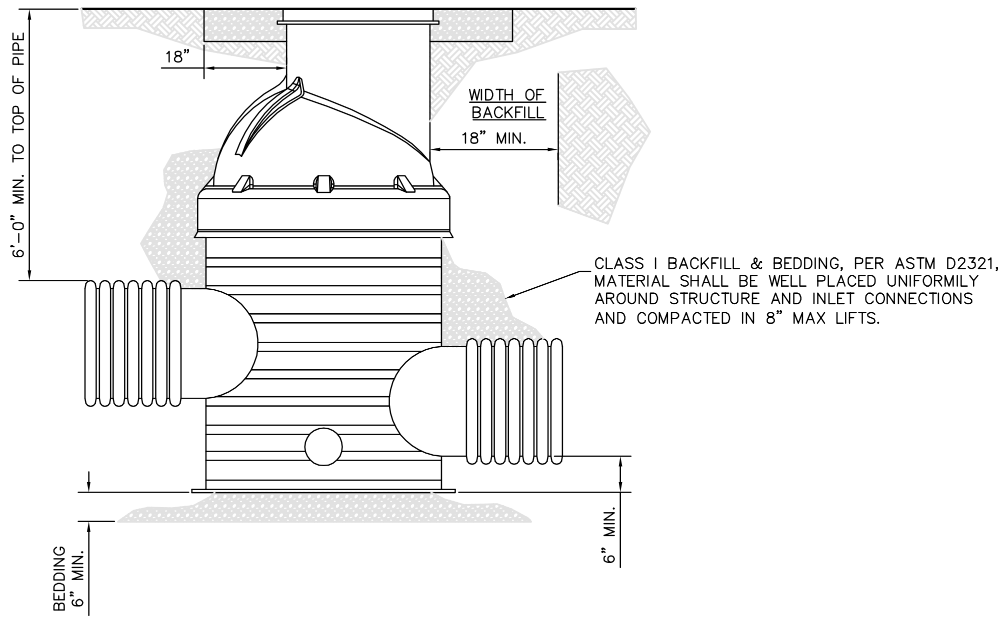
CLIMAX OPERATIONS

DIVISION: MILL ENGINEERING

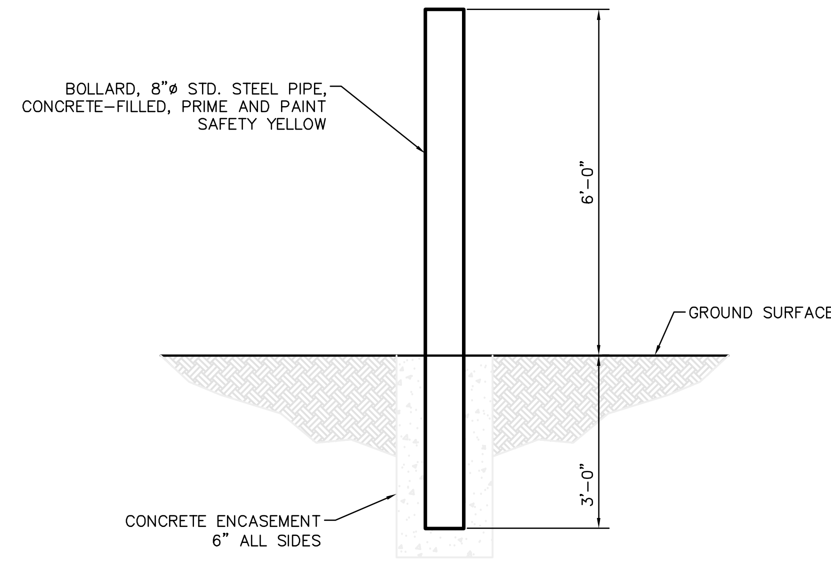
AREA: MAYFLOWER

TITLE: MAYFLOWER
5 DAM TOE DRAIN REPAIR
PLAN AND PROFILE SHEETS

JOB NO.:
DWG. NO.: 877-C-CV-105
CAD NO.:
REVISION:
SHT. 6 OF 8



MANHOLE
INSTALLATION DETAIL



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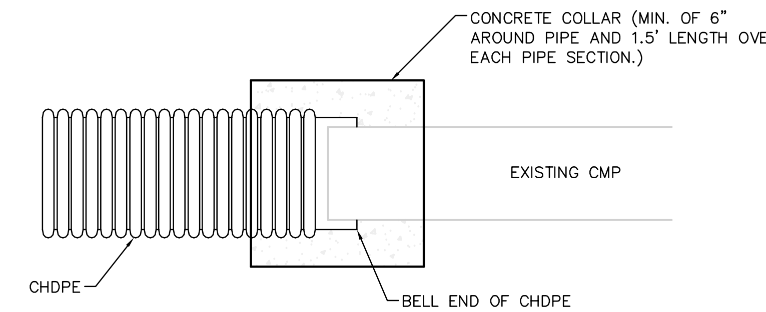
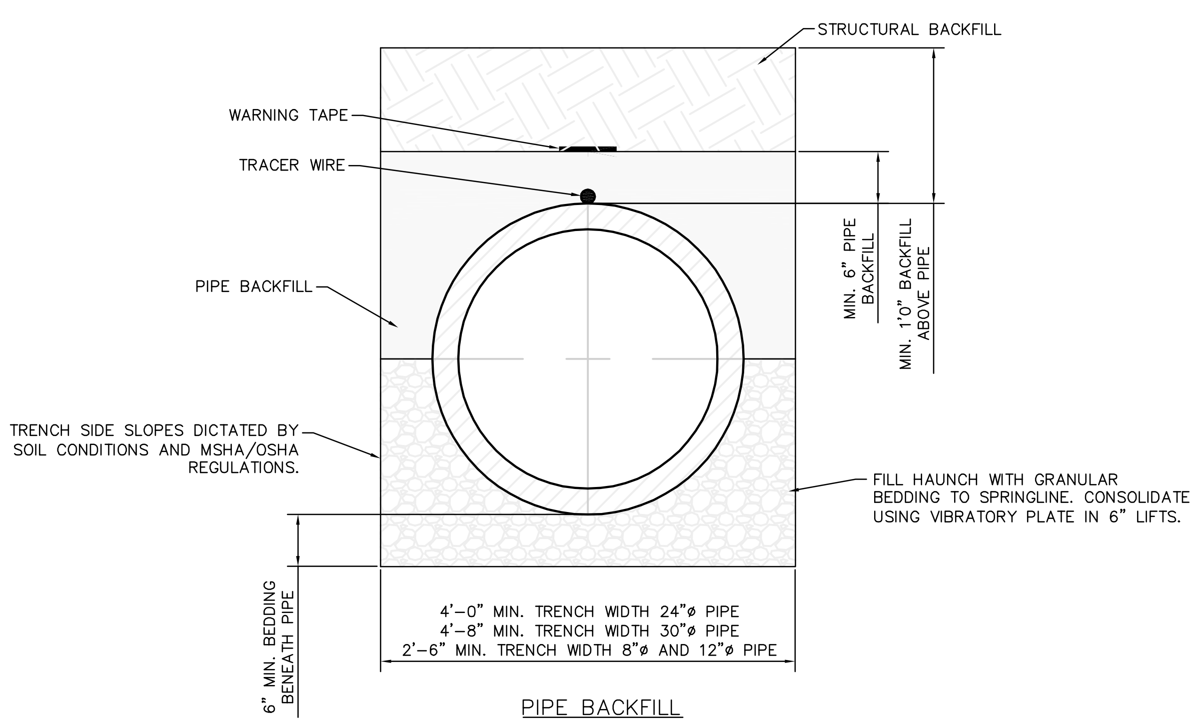
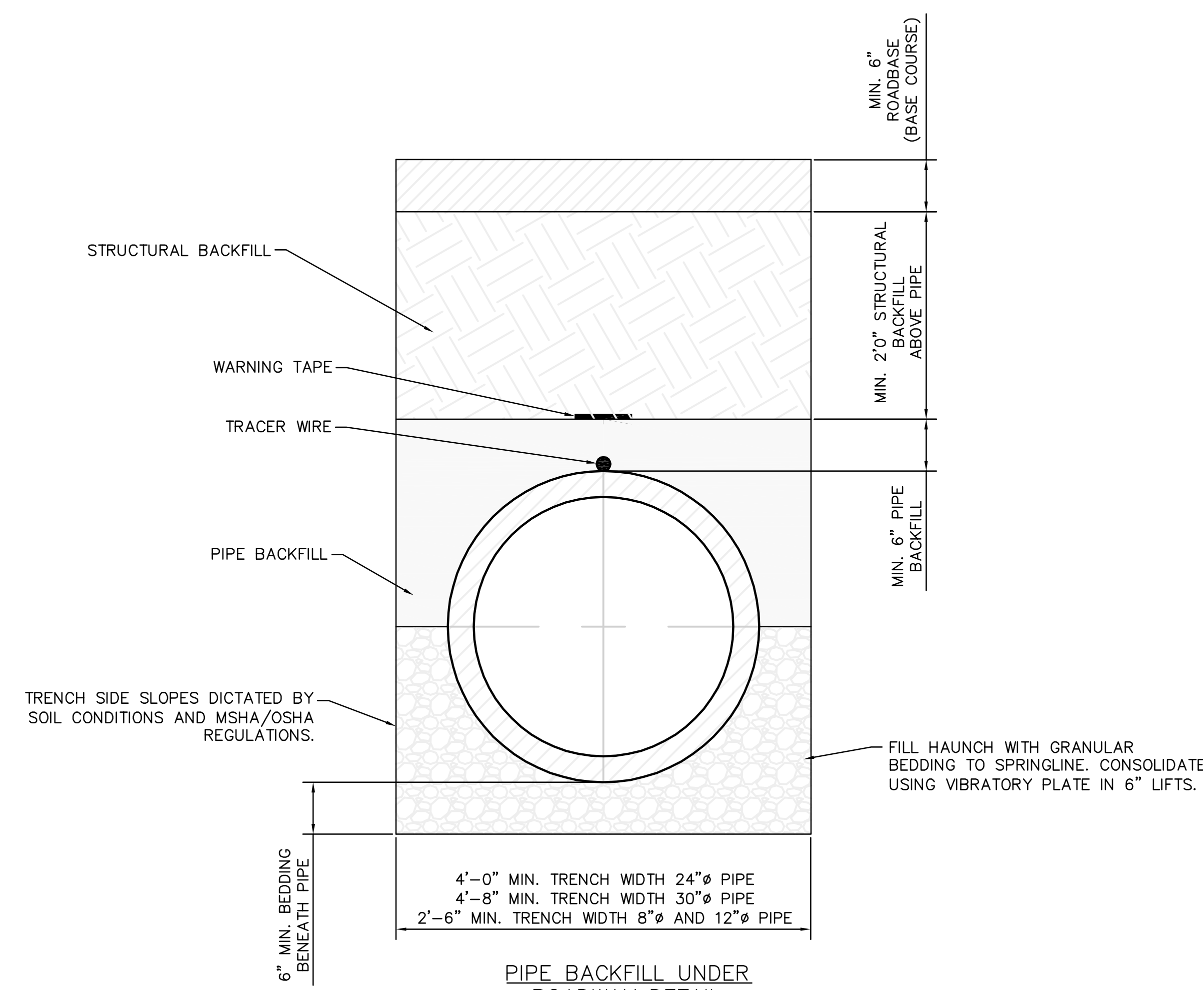


PIPE COLLAR DETAIL



PIPE BACKFILL
DETAIL



PIPE BACKFILL UNDER
ROADWAY DETAIL

REVISIONS

NO.	BY	DATE	DESCRIPTION
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SCALE: N.T.S.	SHEET SIZE ANSI B
DWN BY: DTO	DATE: 04/29/13
CHKD BY:	DATE:
ENGD BY: TMR	DATE: 04/29/13
APVD BY:	DATE:

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CLIMAX OPERATIONS

DIVISION: MILL ENGINEERING
AREA: MAYFLOWER
TITLE: MAYFLOWER
5 DAM TOE DRAIN REPAIR
BACKFILL DETAILS

JOB NO.
DWG. NO. 877-C-CV-107
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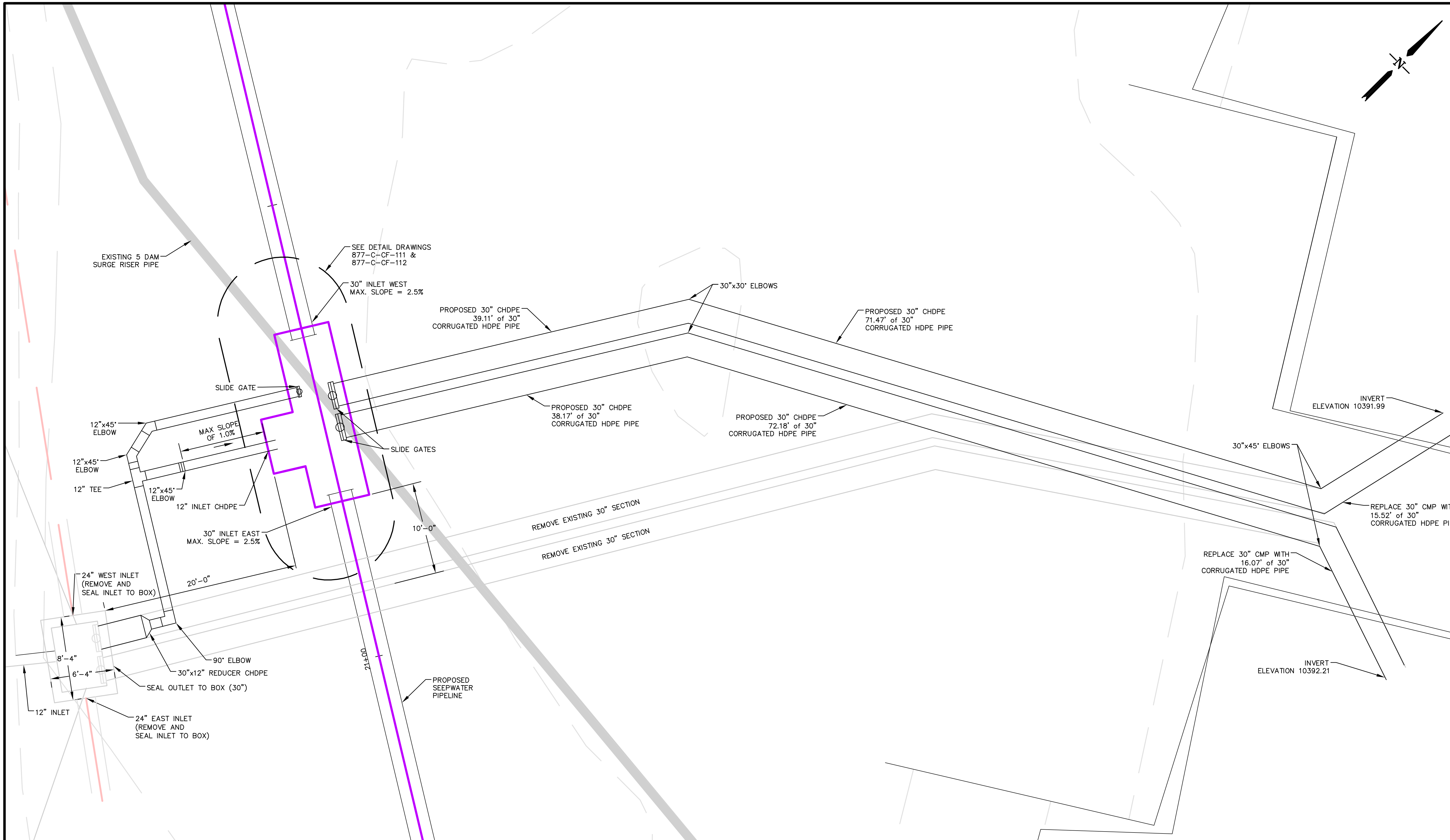
REVISION:



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APVD BY:	DATE:

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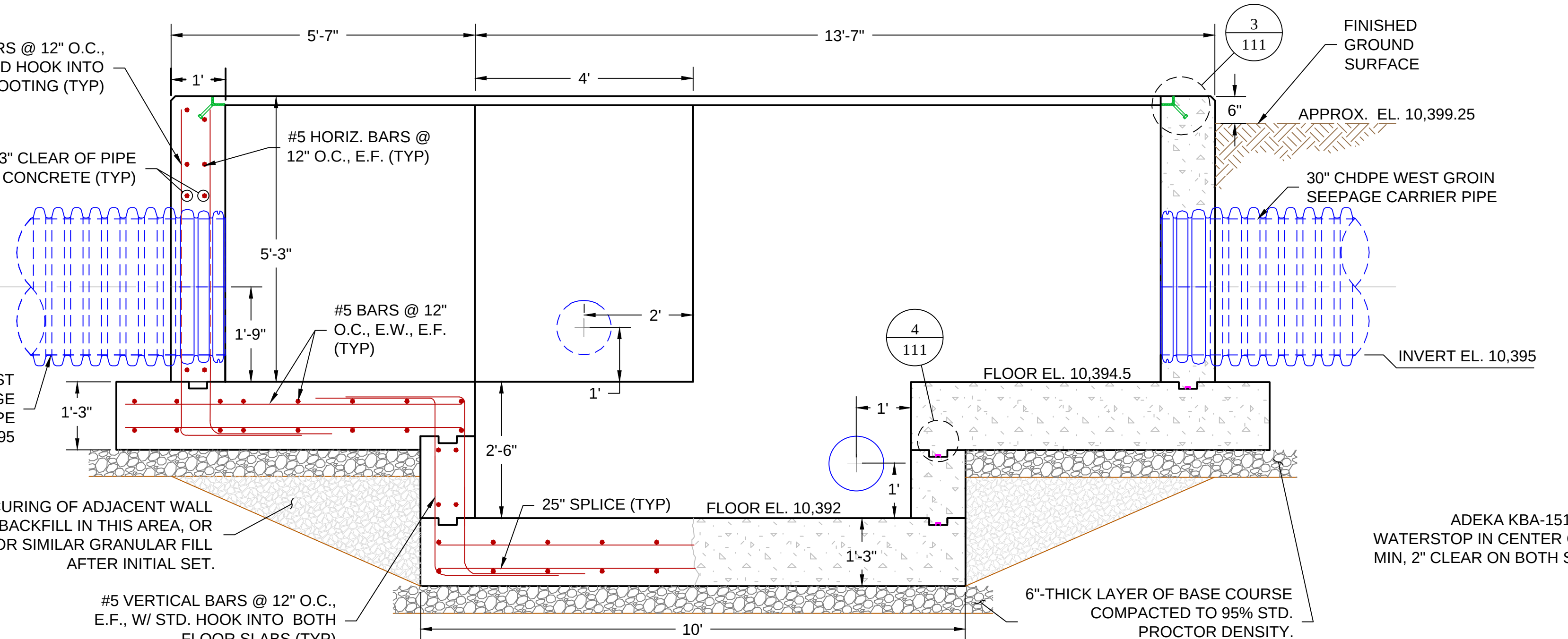
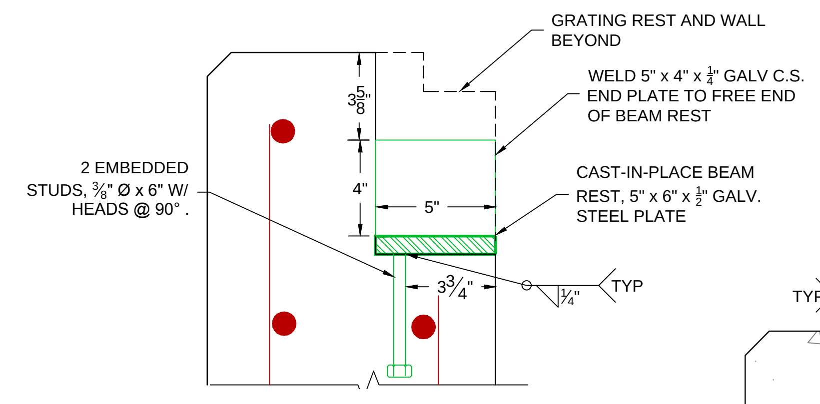
CLIMAX OPERATIONS

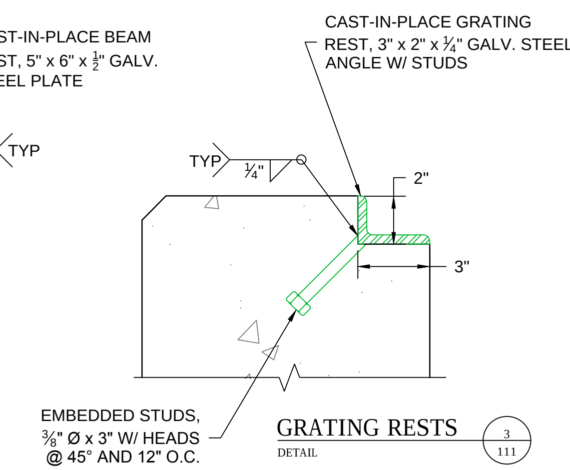
DIVISION: MILL ENGINEERING		
AREA: MAYFLOWER		JOB NO.
TITLE: MAYFLOWER 5 DAM TOE DRAIN REPAIR DIVERSION BOX ROUTING (EXISTING TO NEW)		DWG. NO. 877-C-CV-110
		CAD NO.
		REVISION:
		SHT. 8 OF 8



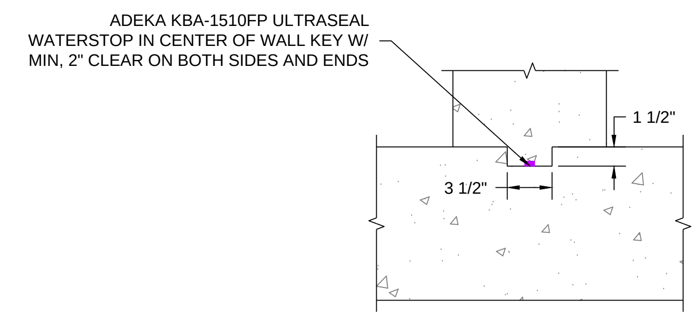
SEEPAGE COLLECTION AND MEASUREMENT VAULT
SECTION A 111



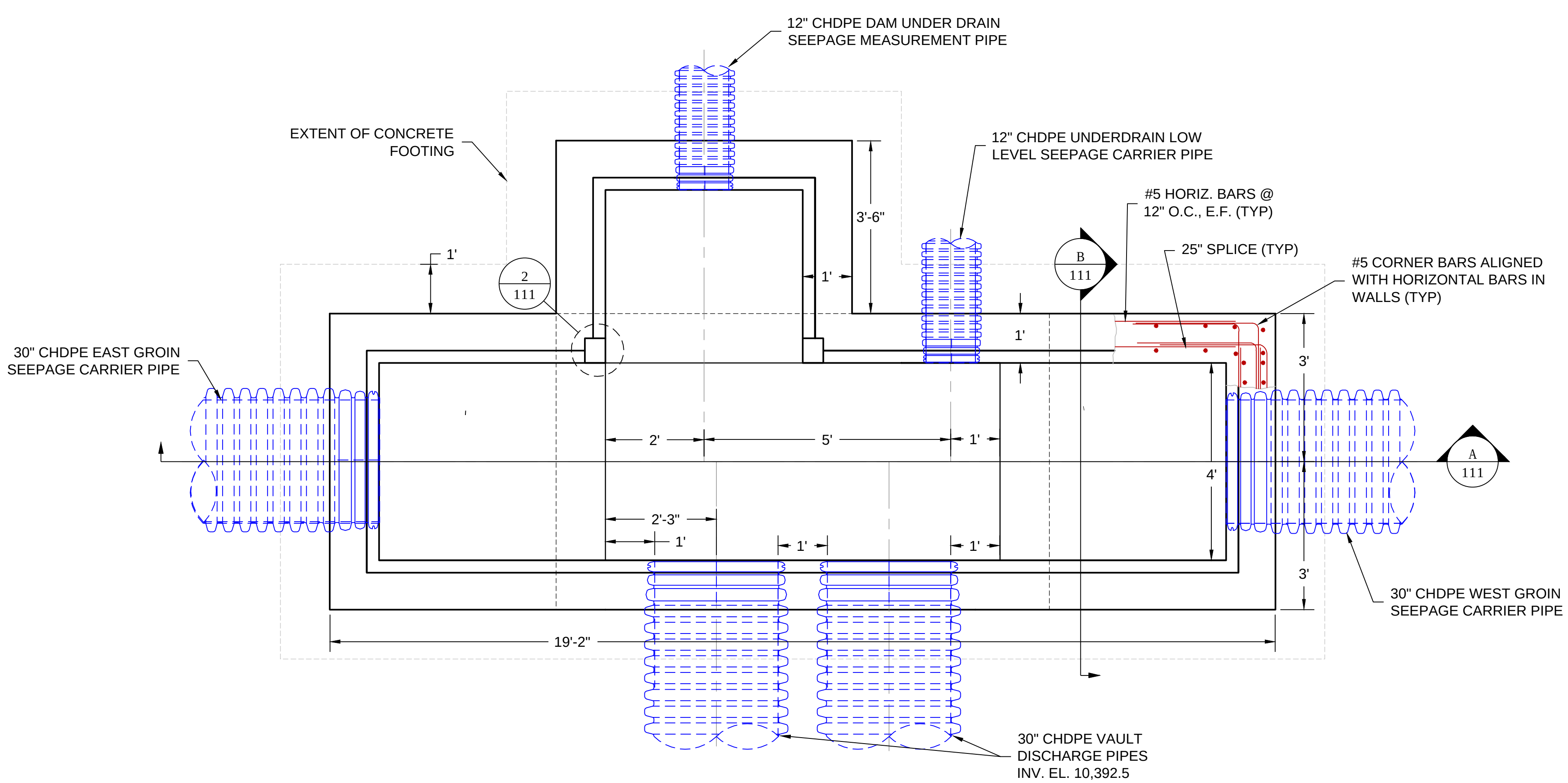
BEAM BEARING POCKETS
DETAIL 2 111



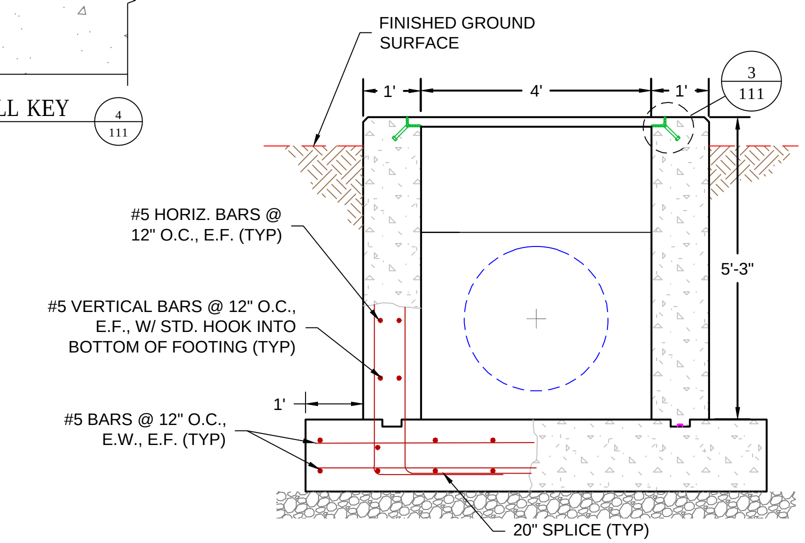
GRATING RESTS
DETAIL 3 111



CONCRETE WALL KEY
DETAIL (N.T.S.) 4 111



1 SEEPAGE COLLECTION AND MEASUREMENT VAULT
PLAN VIEW



9" MONTANA FLUME BAY
SECTION B 111

MATERIAL SPECIFICATIONS:

1. CONCRETE SHALL BE MIXED IN ACCORDANCE WITH ASTM C94 AND SHALL MEET THE FOLLOWING REQUIREMENTS, UNLESS SPECIFIED OTHERWISE:
   - A. 28-DAY COMPRESSIVE STRENGTH: ≥ 4,500 PSI
   - B. SLUMP: 3.0" ± 1"
   - C. ENTRAINED AIR: SIX PERCENT (6%) ± ONE PERCENT (1%) AT POINT OF PLACEMENT
   - D. TEMPERATURE DURING PLACEMENT: FIFTY-FIVE DEGREES FAHRENHEIT TO EIGHTY DEGREES FAHRENHEIT (55°F-80°F)
   - E. WATER CEMENT RATIO: ≤ 0.45 (INCLUDING FLY ASH)
   - F. INCLUDE A CEMENT/FLY ASH MIXTURE WITH TWENTY-FIVE PERCENT (25%) CLASS F FLY ASH BY WEIGHT.

2. REBAR SHALL BE REGULAR CARBON STEEL WITH A TENSILE STRENGTH OF 60 KSI. PLACE ALL REBAR WITH 3" CONCRETE COVER ON ALL SIDES.

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REVISIONS

No.	Date	Made	Checked	Remarks
A	4/5/13	TEM	MDS	ISSUED FOR REVIEW
B	5/20/13	TEM	MDS	ISSUED FOR REVIEW
C	6/10/13	TEM	MDS	ISSUED FOR BID

REFERENCE

Sheet No.	Drawing No.	Title

ISSUED FOR BID NOT FOR CONSTRUCTION

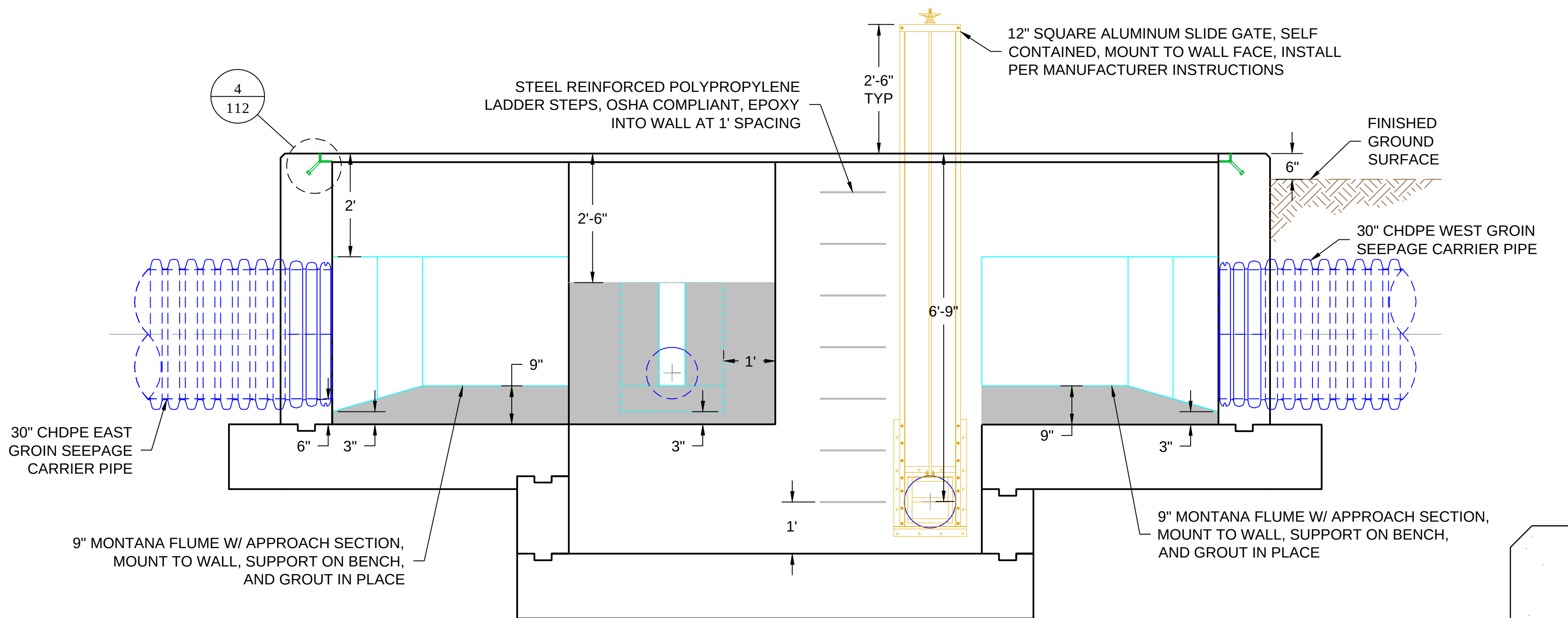
W. W. WHEELER & ASSOCIATES, INC
Water Resources Engineers
3700 S. INCA STREET | ENGLEWOOD, CO 80110-3405
303-761-4130 | FAX 303-761-2802

CLIMAX MINE INSTRUMENTATION
CLIMAX WATER BALANCE
2013 PROJECT WORK
5 DAM SEEPAGE COLLECTION AND MEASUREMENT VAULT
CIVIL CONCRETE PLANS AND DETAILS

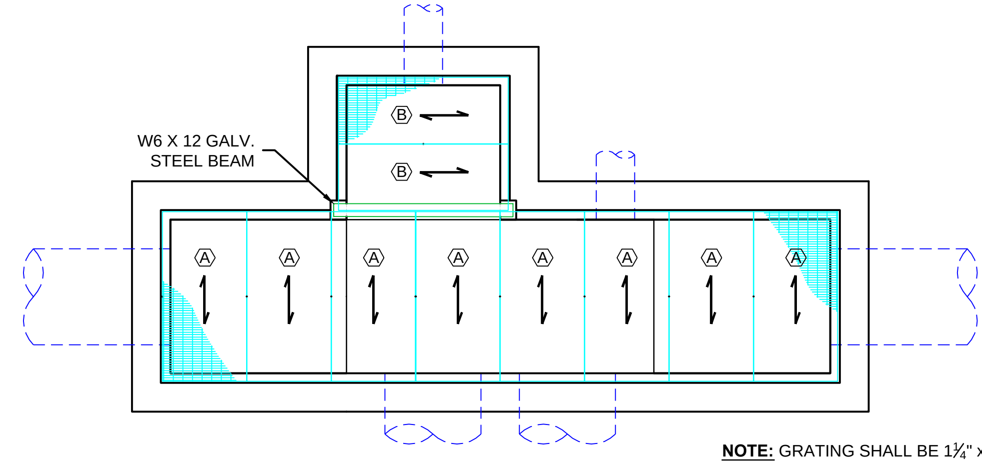
CLIENT: CLIMAX MOLYBDENUM COMPANY

DESIGN	TEM	4/13
DRAWN	TEM	4/13
CHECK	MDS	4/13
PLOT DATE	06/10/2013	C

WHEELER NO. 1051.32.07
SHEET NO.
DRAWING NO. 877-C-CF-111



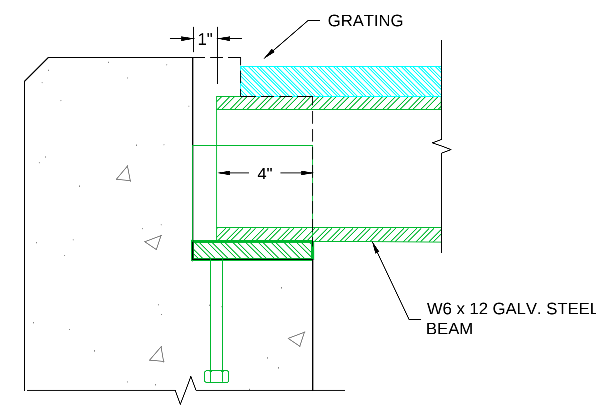
SEEPAGE COLLECTION AND MEASUREMENT VAULT
SECTION
A
112



2 GRATING PLAN
PLAN VIEW

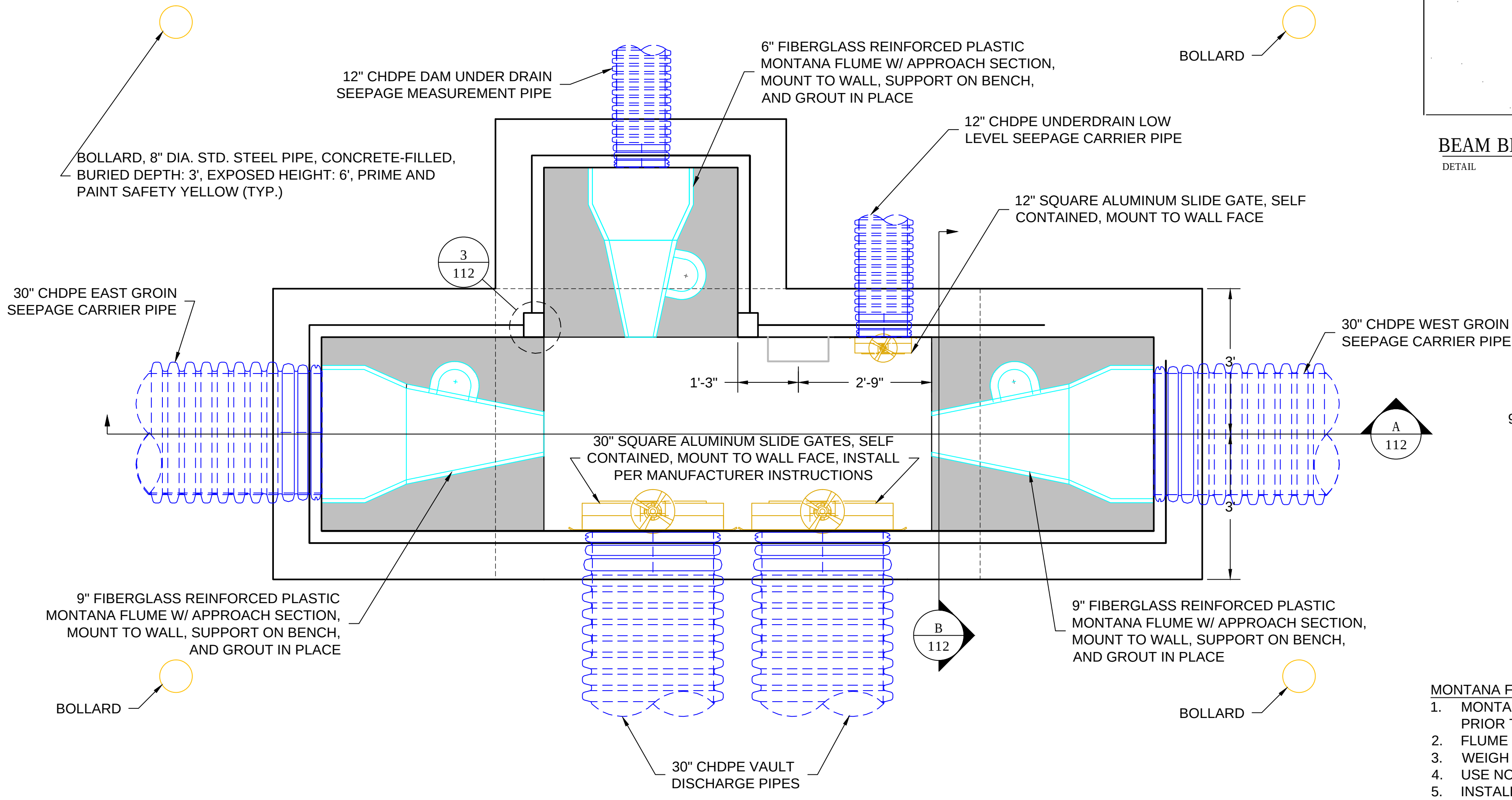
NOTE: GRATING SHALL BE 1¼" x 3⁄16" GALV. STEEL, TYPE W-19-4, SERRATED, BANDED.

⟵⟶ INDICATES DIRECTION OF BEARING BARS

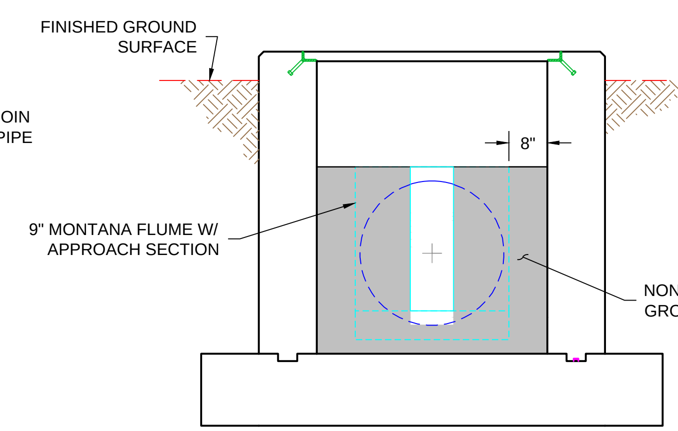


BEAM BEARING POCKETS
DETAIL
3
112

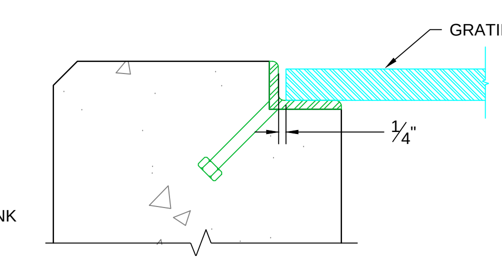
GRATING PANEL DIMENSIONS		
LETTER	WIDTH (IN.)	LENGTH (IN.)
A	26 1/4	53
B	20 3/4	53



1 SEEPAGE COLLECTION AND MEASUREMENT VAULT
PLAN VIEW



9" MONTANA FLUME BAY
SECTION
B
112



GRATING RESTS
DETAIL
4
112

MONTANA FLUME INSTALLATION NOTES:
1. MONTANA FLUME SHALL BE INSTALLED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS. VERIFY OUTSIDE DIMENSIONS OF FLUME PRIOR TO FORMWORK.
2. FLUME CREST MUST BE LEVEL IN BOTH DIRECTIONS. SUPPORT THE FLUME CREST DURING INSTALLATION TO ENSURE LEVELNESS.
3. WEIGH DOWN OR ANCHOR FLUME DURING GROUTING TO PREVENT FLOATING.
4. USE NON-SHRINK GROUT AND PLACE IN LIFTS WHICH SHALL NOT EXCEED 6 INCHES TO PREVENT WALL DEFORMATION.
5. INSTALL TEMPORARY BRACING AS NEEDED TO PREVENT FLUME DEFORMATION DURING INSTALLATION, BACKFILL, AND GROUTING.

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REVISIONS

No.	Date	Made	Checked	Remarks
A	4/5/13	TEM	MDS	ISSUED FOR REVIEW
B	5/20/13	TEM	MDS	ISSUED FOR REVIEW
C	6/10/13	TEM	MDS	ISSUED FOR BID

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& ASSOCIATES, INC
Water Resources Engineers
3700 S. Inca Street | Englewood, CO 80110-3405
303-761-4130 | FAX 303-761-2802

CLIMAX MINE INSTRUMENTATION
CLIMAX WATER BALANCE
2013 PROJECT WORK
5 DAM SEEPAGE COLLECTION AND MEASUREMENT VAULT
FLUME, GRATING, AND GATE DETAILS

Client: CLIMAX MOLYBDENUM COMPANY

Design	TEM	4/13	Wheeler No.	1051.32.07
Drawn	TEM	4/13	Sheet No.	
Check	MDS	4/13		
Plot Date	06/10/2013	C	Drawing No.	877-C-CF-112