PolyMet Technical Design Evaluation Report RS52

Mine Closure Plan Report

Prepared for
PolyMet Mining Inc.

July 2007

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PolyMet
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McDonald, D.M., J. A. Webb and J. Taylor, 2006. Chemical Stability of Acid Rock Drainage Treatment Sludge and Implications for Sludge Management, *Environmental Science and Technology*. Vol. 40, No. 6, pp. 1984-1990.

NTS, 2002. Phase I – Environmental Site Assessment – Cliffs Erie Properties Including; The Hoyt Lakes Facility, Dunka Property, Taconite Harbor and Railroad Corridors. Prepared for Cliffs Erie, LLC. September 2002.

Ohmann, L.F; Batzer, H.O.; Buech, R.R.; Lothner, D.C.; Perala, D. A.; Schipper, A.L.; Verry, E.S. 1978. *Some Harvest Options and their Consequences for the Aspen, Birch, and Associated Forest Types of the Lake States*. General Technical Report NC-48. St. Paul, MN: U.S. Dept. of Agriculture, Forest Service, North Central Forest Experiment Station

Verry, E.S. 1976. Estimating Water Yield Differences Between Hardwood and Pine Forest. USDA Forest Service Research Paper NC-128. North Central Forest Research Station, St. Paul, MN.

1.0 Introduction

1.1 Closure

This document was prepared to present plans for closure of NorthMet facilities at the conclusion of mining and mineral processing activities 20 years after operations begin. Closure activities at the Plant Site and Tailings Basin are shown in Figure 1-1 while closure activities at the Mine Site are shown in Figure 1-2. Figure 1-2 shows features that will remain at the Mine Site in the post-closure period.

Several decisions were made in the development of the Closure Plan to avoid, minimize and mitigate environmental impacts, including:

- A significant portion of the Virginia Formation that will be above the final pit water elevation will be covered to prevent water from contacting it thereby minimizing the buildup of pollutants in the pit overflow water
- Accelerated flooding of mine pits to minimize the buildup of pollutants in the pit overflow water and achieving a stable closure sooner
- Installation of a cap on the final dam crest extending across the exposed coarse tailings beach to minimize infiltration of precipitation through the exposed coarse tailings
- Accelerated dewatering of the tailings basin to minimize seepage from the Tailings Basin
- Accelerated reclamation of the Tailings Basin and development of wetlands

The Closure Cost Estimate included in the Detailed Project Description in January 2007 differs from the Contingency Closure Estimate that will be submitted with the Permit to Mine application which assumes that the facility closes one year after starting. The contingency closure estimate will be updated annually as part of the Permit to Mine annual report. The Permit to Mine requires financial assurance to cover the Contingency Closure Estimate.

The estimate in the January 2007 Detailed Project Description assumes that the facility is closed at the end of the 20-year proposed mine life. This estimate has not been updated to reflect changes resulting from the Supplemental Detailed Project Description submitted in July 2007. The significant differences are in the area of land that must be reclaimed in the Tailings Basin and at the Mine Site. Both estimates include remediation obligations assumed with the acquisition of the Cliffs Erie property.

1.2 Preceding Reports

Hydrology – Mine Water Model & Balance (RS21)

Mine Waste Water Management (RS22)

Reactive Waste Rock, Lean Ore and Deferred Ore Segregation (RS23T), Draft January 2007 – Golder Associates

Mine Surface Water Runoff (RS24)

Mine Diking/Ditching Effectiveness Study (RS25)

Hydrometallurgical Residue and Flotation Tailings Cell Design and Location (RS28T), February 2007

Waste Water Treatment Study (RS29T)

Technical Design Evaluation Report (RS39/40T), February 2007

Stockpile Conceptual Design (RS49), Draft January 2007 – Golder Associates

Streamflow and Lake Level Changes (RS73)

Mine Pit Water Quality (RS31)

1.3 Goals and Objectives

This report describes the existing and planned facilities at the Mine Site, Plant Site and Tailings Basin. This report also describes the proposed staged approach to closure at the end of the mine life. Activities are planned for each of the first three years after closure, plans for monitoring required parameters as well as criteria for operations of the critical features such as the Wastewater Treatment Facility (WWTF).

Chapter 6132, Nonferrous Metallic Minerals Mineland Reclamation Rules, by the Minnesota Department of Natural Resources contains requirements for preparation of a mine closure plan. A copy of Section 6132.3200, Closure and Post Closure Maintenance is included in Appendix B. It should be noted that this report was prepared in support of the PolyMet NorthMet EIS, and that additional information (e.g., contingency closure cost estimate) will be provided in the closure plan submitted as part of the application for the permit to mine.

This report makes use of information from other reports (listed above) and contains the essential components described in the Final Scoping Decision and the detailed outline for Closure Plan (see Appendix A for detailed outline). However, it should noted that the outline for the closure plan anticipated that certain alternatives for project design would be evaluated in the plan. It is now evident that EIS will evaluate appropriate design alternatives as determined by the EIS team. In addition, some alternatives listed in the detailed outline have been incorporated into the proposed project (e.g., subaqueous disposal of reactive waste rock). As stated above, this report only addresses the proposed staged approach to closure at the end of the mine life (i.e., the proposed action closure).

1.4 Report Outline

The following is this report's outline listing the major headings.

1.0 Introduction
    1.1 Closure

2.0 Structure Demolition

2.1 Building/Structure Demolition

Within four years after closure begins, all buildings and structures will be removed and foundations razed and covered with a minimum of two feet of surface overburden according to Minnesota Rules 6132.3200.

2.1.1 Mine & Plant Facility Buildings

The timing of demolition for the individual buildings is shown in Table 2-1. These building structures along with any roads, parking areas, or storage pads built to access these facilities will be removed during this four-year schedule. Provisions may be made for continued subsequent use of mine facilities that will have future benefits to the area including, pipelines, transmission lines, roads, and railroad lines.

Table 2-1 Building Demolition Schedule

Time	Demolition Activity
Demolition - Year 1	Additive Building & Heating Plant (#10)
Demolition - Year 1	Area 1 Buildings (#33, 35, 36, 37)
Demolition - Year 1	Area 2 Buildings (#27-30)
Demolition - Year 1	Booster Pump House (#1)
Demolition - Year 1	Colby Pumphouse (#17)
Demolition - Year 2	Course Crusher (#2)
Demolition - Year 2	Drive House #1 (#3)
Demolition - Year 2	Drive House #2 (#5)
Demolition - Year 2	Fine Crusher (#4)
Demolition - Year 2	Hydromet (#45)
Demolition - Year 2	Solvent Extraction (#46)
Demolition - Year 2	Electrowinning (#47)
Demolition - Year 2	Rail Transfer Hopper
Demolition – Year 3	Concentrator (#6) – asbestos abatement
Demolition – Year 3	General Shops (#12)
Demolition – Year 3	Rebuild Shop (#13)
Demolition – Year 3	Rubber Shop (#7)
Demolition – Year 4	Warehouse Electrical (#15)
Demolition – Year 4	Warehouse 49 (#14)
Demolition – Year 3	Miscellaneous Buildings (not listed separately)
Demolition – Year 4	Administration Building (#44)
Demolition – Year 3	Water Tower(s) - Area 2 & Plantside
Demolition – Year 3	A-Lab (#25)
Demolition – Year 3	Lube House (#8)
Demolition – Year 4	Concentrator (#6)

2.1.2 Rail Transfer Hopper Demolition and Reclamation

The locations of above-ground concrete and steel structures will be covered with at least two feet of soil and vegetated according to Minnesota Rules 6132.2700 and 3200.

The constructed rock platform from which trucks dumped into the hopper will be sloped and covered with two feet of material and vegetated. If the rock platform is composed of Category 1/2 waste rock, it will be covered in the same manner as the Category 1/2 Stockpile (see Section 3.2.1).

The hopper itself and the surrounding area at the elevation of the rail line will have been an Ore Handling Area and will be handled as follows:

- Sediment will be removed from ditches and sedimentation ponds and placed in the Category 4 Stockpile
- Any ore remaining in the hopper, the direct ore loadout area, the Lean Ore surge pile or anywhere else in the vicinity of the Rail Transfer Hopper will be placed in the Category 4 Stockpile
- Ground surface material at the top of the rail loading platform and at rail level in the vicinity of the Rail Transfer Hopper will be tested and
    - if Category 4 or 3 criteria are exceeded the material will be placed in the Category 4 Stockpile
    - if Category 4 or 3 criteria are not exceeded the material will be covered with at least two feet of soil and vegetated according to Minnesota Rules 6132.2700 and 3200
- Seeding will be based on PolyMet Mining Company, Specifications for Seeding and Mulching (Appendix C)

2.1.3 Demolition

All mine and plant area buildings listed in Table 2-1, including the Rail Transfer Hopper will be demolished over a period of four years. Appropriate controls for airborne asbestos will be in place during demolition. Utility tunnels will be sealed and closed in place. Asphalt from paved surfaces will be removed and recycled. Railroad track and ties will be removed and recycled.

All mine equipment (dozers, drills, shovels, loaders, haul trucks), railroad equipment (locomotives, cars, rails, ties and switches), service equipment (scrapers, medium fleet, small fleet, mine dewatering pumps, pipe) and electrical equipment (substations, switchhouses, cable, wire, poles) will be moved to locations that are above the expected pit water elevations and are suitable for scrapping or decommissioning.

2.1.4 Demolition Waste Disposal Plan

Demolition waste from structure removal will be properly disposed in the existing on-site demolition landfill (SW-619) located northwest of the Area 1 Shops. Concrete from demolition will be placed in building basements where possible including coarse crusher basement, fine crusher basement and concentrator basement.

2.1.5 Special Material Disposal

An initial survey has been completed of the existing facility for Asbestos-Containing Materials (ACMs). Asbestos will not be used in new construction. A more detailed survey of the facility will be performed prior to demolition. ACMs (i.e., pipe and electrical insulation) in utility tunnels will be sealed prior to the tunnels being sealed. ACMs (siding, hot water heating system insulation, lube system insulation, floor tile, etc.) from structure demolition will be removed intact, properly packaged and disposed in the on-site demolition landfill. Location of any ACMs in demolition landfills will be noted on the property deed.

During initial closure of the Cliffs Erie facility, all PCB transformers (including sixteen large ones) and capacitors were removed and properly disposed. Because PolyMet will not be using PCB-containing equipment, this will not be an issue in closure and reclamation.

Most of the nuclear sources will be located in the Concentrator and are critical to grinding line operation. During closure of the Cliffs Erie facility, all nuclear sources were inventoried and disposed. PolyMet will install new measurement devices to replace those that have been disposed. At the commencement of closure the new nuclear sources will be removed and properly disposed.

Partially used paint, chemical and petroleum products will be collected and properly disposed.

2.1.6 Product Disposal

In general, any remaining reagents will be removed by the reagent suppliers under contract to PolyMet. Principal plant reagents are listed in Table 2-2.

Table 2-2 Principle Reagents and Proposed Disposal

Reagent	Proposed Disposal
Flotation Circuit	
Collector - Potassium-Amyl Xanthate (PAX)	Returned to vendor
Frother - MIBC & DF250	Returned to vendor
Activator - Copper Sulphate	Returned to vendor
Flocculant - Magnafloc 10	Returned to vendor
Limestone	Returned to vendor
Lime	Returned to vendor
Hydrochloric Acid (32%)	Returned to vendor
Magnesium Hydroxide Slurry (61%w/w)	Returned to vendor
Caustic Soda (50%)	Returned to vendor
Sulphuric Acid (93%)	Returned to vendor
Liquid Sulphur Dioxide	Returned to vendor
Sodium Hydrogen Sulphide (45%)	Returned to vendor
Leach Residue Flocculant - Magnafloc 351	Returned to vendor
Plant Flocculant - Magnafloc 342	Returned to vendor

Reagent	Proposed Disposal
SX - Diluent	Returned to vendor
SX - Cu Extractant	Returned to vendor
EW - Cobalt sulphate	Returned to vendor
EW - Guar Gum	Returned to vendor

The inventory of tanks that will require demolition is included in Table 2-3. This inventory includes both existing tanks from the former Cliffs Erie facility and new tanks constructed by PolyMet.

Large above-ground storage tanks will be cleaned and tested for lead paint prior to demolition. Tank cleaning will remove remaining materials and sludge. The tanks will be washed down and both the remaining materials and sludges and the wash materials will be sent to an appropriate recycling or waste disposal facility.

Tanks will be disassembled for disposal or recycling as appropriate. Where lead paint abatement is required, the disposal/recycling will be modified to accommodate the lead content.

Below-grade foundations will be left in place and buried. Smaller above-ground storage tanks will be cleaned and removed without disassembly. In many cases it is anticipated that suppliers of chemicals and equipment will be responsible for furnishing tanks and will be required to remove and dispose of them after closure.

Table 2-3 Inventory of Tanks Requiring Demolition

Type	AST Contents *(Above-Ground Storage Tanks)	Size Range	Anticipated Mix Tank Size	Anticipated Storage Tank Size
Chemical/Reactive				
New	H2SO4 (Sulfuric Acid)	1,000 - 10,000 gallons	n/a	40,000 gallons
New	HCl (Hydrochloric Acid)	1,000 - 10,000 gallons	n/a	60,000 gallons
New	Liquid SO2 (Sulfur Dioxide)	1,000 - 10,000 gallons	n/a	21,000 gallon storage bullet
New	NaHS (Sodium Hydrosulfide)	1,000 - 10,000 gallons	n/a	13,200 gallons
New	Caustic NaOH (Sodium Hydroxide)	1,000 - 10,000 gallons	n/a	40,000 gallons
New	Magnesium Hydroxide Slurry [$Mg(OH)_2$]		80,000 gallons	n/a
New	Lime		22,500 gallons	n/a
Non-Reactive				
New	Guar Gum	500 - 1,000 gallons	1,320 gallons	1,850 gallons
New	CuSO4 (Copper Sulfate)	500 - 1,000 gallons	2,640 gallons	7,930 gallons
New	Diluent	1,000 - 10,000 gallons	n/a	7,400 gallons
New	PAX	500 - 1,000 gallons	2,640 gallons	5,280 gallons
New	MIBC		900 gallons	13,200 gallons

Type	AST Contents *(Above-Ground Storage Tanks)	Size Range	Anticipated Mix Tank Size	Anticipated Storage Tank Size
New	DF250		combined w/ MIBC	13,200 gallons
New	Flocculant - Magnafloc 10		10,600 gallons	n/a
New	Flocculant - Magnafloc 10		10,600 gallons	n/a
New	Flocculant - Magnafloc 342		1,320 gallons	2,640 gallons
New	Flocculant - Magnafloc 351		1,700 gallons	3,400 gallons
Petroleum Products				
Exist	Fuel Oil	500 - 1,000 gallons		12,000 gallons
Exist	Fuel Oil	10,000 - 20,000 gallons		
Exist	Fuel Oil			120 gallons
Exist	Lube Oil	1,000 - 10,000 gallons		
Exist	Mineral Oil	10,000 - 20,000 gallons		12,000 gallons
Exist	Gasoline			6,000 gallons
Exist	Gasoline			26,000 gallons
Miscellaneous				
Exist	Used Antifreeze	1,000 - 10,000 gallons		
Exist	Alcohol	10,000 - 20,000 gallons		
Bunker C Tanks				
Exist	Fuel Oil	n/a		20,000 gallons
Exist	Fuel Oil	n/a		3,384,000 gallons
Exist	Fuel Oil	n/a		3,384,000 gallons
Exist	Fuel Oil	n/a		3,384,000 gallons

*Tank information was collected from information provided by PolyMet, including the listing of existing and new tanks to be demolished on their “Task Detail Report - Closure Estimate for Financial Assurance” and the new process storage and mixing tanks designated on the process engineers’ [Bateman Engineering] preliminary figures. Bateman Metals – Figure 4 “Polymet Feasibility Study Process Consumables Schematic Flow Diagram” denoted tank capacities and chemical concentrations. The tanks listed on the “Task Detail Report” were designated as a range of capacities for a specific product.

2.1.7 Sanitary System and Well Closure

The septic systems will be pumped out and the tanks filled with soil or crushed rock and backfilled. Wells will be sealed by a licensed well driller in accordance with Minnesota Department of Health rules.

2.1.8 Power Line and Pipeline Removal

Pipelines that will not remain as regional infrastructure will be removed and recycled or abandoned in place. Major pipeline systems include:

- Tailings pipeline, tailings seepage collection pipelines, water transfer line, and water reclaim line (between the Process Plant and Tailings Basin)
- Hydrometallurgical residue pipeline and water reclaim line (between the Process Plant and Hydrometallurgical Residue Facility)
- Treated water pipeline from the Mine Site to the Plant Site
- Water supply pipeline from Colby Lake Pumphouse to the Plant Reservoir
- Pipeline from the Plant Reservoir to the Area 1 Shop and Area 2 Shop

Hydrometallurgical Residue pipelines will be cleaned. Cleaning will include rinsing with water and (if appropriate) other agents to achieve neutralization and removal of residual pipeline contents. Cleaning success will be determined by analyzing final water rinsate from the pipeline. Upon successful cleaning, above-ground pipelines and other facilities (e.g., pump booster station, associated controls) will be disassembled or demolished and the material recycled or disposed. Underground pipelines will be abandoned in place. Manholes and above-ground pipeline supports and foundations will be demolished to ground level or below and covered with at least two feet of soil. Surface disturbances will be ripped and revegetated to achieve final reclamation.

Power lines (poles, pole hardware and conductors) and substations that will not remain as regional infrastructure will be removed and recycled. Foundations and anchors will be removed or demolished to at least ground surface and covered with at least two feet of soil and revegetated to achieve final reclamation. Power lines to be removed include:

- 13.8 Kv distribution system at Mine Site back to Minnesota Power substation
- 13.8 Kv distribution system from the Tailings Basin back to the Coarse Crusher
- 13.8 Kv Line from the Main Substation to Colby Lake Pumphouse
- 13.8 Kv Lines from the Main Substation to Area 1 Shop and Area 2 Shop
- 4.16 Kv distribution lines at the Mine Site and Tailings Basin

2.1.9 Culvert Removal

Where roads and railroads will be abandoned, culverts will be removed to prevent potential flow obstruction due to damming by clogged culverts and to minimize impediments to access and movement in the stream by aquatic life. Any culverts requiring removal will be replaced with channels; culvert locations will be graded and vegetated to provide a stable stream bank approximating a natural channel and floodplain configuration.

3.0 Mine Site Reclamation

3.1 Mine Pit

3.1.1 Removal of Dewatering System

During operation, precipitation runoff and groundwater inflow to the pits will be directed to low cells in the pits where it will be collected in sumps and pumped to the surface; these dewatering systems are described in RS22. The East and Central Pits will be backfilled and their primary dewatering systems removed prior to closure; however some temporary pumps may remain in these pits for selected dewatering that will need to be performed during closure. Because the East and Central Pits ultimately merge into one pit, they are hereinafter referred to as the East Pit.

All power lines, substations, pumps, hoses, pipes and appurtenances used for dewatering the pits will be removed and the pits will be allowed to fill with water. Figure 3-1 shows the pumps and pipes to be maintained or removed. The pipes from the pits to the Central Pumping Station (CPS) and the Wastewater Treatment Facility (WWTF) will also be removed, with the exceptions of the pipe between the WWTF and the East Pit that will be used during closure to route treated water to the East Pit and the pipe from the West Pit to the WWTF which may be used to convey overflow from the WWTF to the West Pit in closure.

All areas disturbed during pipe removal will be graded and revegetated.

3.1.2 East and West Pit Overflow Elevations

In order to determine whether outlet structures will be needed for the pits, natural overflow locations and elevations were determined and potential steady-state water levels for the East and West Pits were predicted.

An evaluation of the surface topography along the pit rims was conducted to determine where and at what elevation natural overflow from the pits would occur. Evaluations were conducted using the available maps with 2-foot contours.

- The low point in the ground surface along the rim of the East Pit is approximately 1,596 feet above mean sea level (ft-MSL), located in the northeast corner of the pit. Water leaving the pit at this location would overflow toward the Partridge River to the southeast. Three other low points occur on the ground surface between elevations 1,598 and 1,600 ft-MSL along the rim of the East Pit.
- The low point in the ground surface along the rim of the West Pit is approximately 1,581 ft-MSL, located near the southwest corner of the pit. Water leaving the pit at this location would overflow toward the south. The next low point on the ground surface along the rim of the West Pit is at elevation 1,588 ft-MSL.

The potential future steady-state water levels for the pit lakes are dependent on the pre-mining groundwater elevations in the bedrock and the surficial deposits, as well as the transmissivities of these units. The groundwater model that was used to determine groundwater flow rates during mine operations (RS22) was also used to predict the steady-state water levels in each of the pits assuming no surface overflow outlet was available. The water level in both the East and West Pits was predicted to stabilize above the natural outflow elevations for each pit. The steady-state water level in the East Pit is above the elevation of the rock wall separating the East and Central pits; therefore, these pits would be connected and act as a single body of water.

Because the predicted maximum water levels for both the East and West Pits were higher than the natural overflow elevations, both of these pits are predicted to have a net outflow to surface water. The actual steady-state water levels in the East and West Pits after Year 20 will therefore be established by outlet structures that will be used to route surface overflows from the East Pit into the West Pit, and from the West Pit to a final discharge location in the Partridge River. The water level in the East Pit was designed to stabilize at an elevation of 1,592 ft-MSL to provide an adequate buffer between the overflow to the West Pit (1,592 ft-MSL) and the natural overflow elevation of 1,596 ft-MSL. The West Pit was designed to stabilize at an elevation of 1,581 ft-MSL, which is the natural overflow elevation of the West Pit.

3.1.3 Outlet Control Structures

3.1.3.1 East Pit Outlet Structure and Connection to West Pit

Overflows from the East Pit will be directed to the West Pit through a channel that will be excavated from the southwest corner of the East Pit to the northeast corner of the West Pit. The overflow will be set at elevation 1,592 ft-MSL. Based on available bedrock data, it is anticipated that the East Pit overflow structure will be excavated in bedrock. The annual average overflow from the East Pit to the West Pit will vary depending on the sources used to fill the pits with water. The outlet structure was designed for the expected peak overflow rate of 187 cubic feet per second (cfs), based on removal of 10 percent of the runoff from a 100-year, 24-hour rainfall event (5.2 inches of precipitation) within one hour. This is a conservative estimate based on total runoff volume and does not consider the potential reductions in peak flow due to the specific characteristics of the East Pit watershed.

The East Pit outlet structure will be formed out of bedrock (assuming bedrock conditions are stable) or a reinforced concrete weir will be cast-in-place; the invert of the outlet will be set at the East Pit overflow elevation previously described. The weir will be 20 feet wide, resulting in a 2-foot head over the weir during the 100-year storm event. A 425-foot-long channel with a bottom slope of about 1% will connect the East Pit overflow to the West Pit. The channel will have a 6 foot wide bottom with side slopes of 3H:1V, resulting in a maximum flow velocity of 6 feet per second during the 100-year overflow. Based on available bedrock elevations, it is expected the entire length of the channel will be excavated in bedrock.

The final locations of the intake and discharge of the connection channel will be determined once more detailed investigations of the bedrock topography along the proposed route are completed prior to closure.

3.1.3.2 West Pit Outlet Structure

An outlet structure will be constructed on the southeastern side of the West Pit at elevation 1,581 ft-MSL near the natural overflow location. Based on available bedrock data, it is anticipated that, similar to the channel connecting the East and West Pit, the West Pit overflow structure will be excavated in bedrock. The West Pit outlet structure will be formed out of bedrock (assuming bedrock conditions are stable) or a reinforced concrete weir will be cast-in-place; the weir will be 50 feet wide, able to convey the 100-year, 24-hour storm event with approximately 2 feet of head over the weir.

The West Pit outlet structure will direct overflows into an existing wetland that flows towards Dunka Road at Outlet Structure OS-5 and into the Partridge River through a natural drainage path (Figure 3-2). The wetland may be altered to provide a final stage of treatment before discharge, if necessary (see Section 7.5). The annual average overflow from the West Pit will range between 1,500 and 2,000 acre-feet/year with an expected 100-year, 24-hour storm event peak flow of 481 cfs. This peak flow is a conservative estimate based on 10 percent of the total runoff volume occurring in 1 hour and does not consider the possible reduction in peak flow due to specific characteristics of the West Pit watershed.

3.1.4 Filling of the West Pit

Upon completion of mining operations at the end of Year 20 and after pit dewatering systems are removed, the West Pit will begin to fill naturally with water from groundwater inflows, precipitation and stormwater runoff from the tributary watershed. The East Pit will also fill naturally to the outlet structure elevation and begin overflowing into the West Pit in approximately Year 21. These sources would fill the West Pit approximately 53 years after dewatering ceases.

Water may also be diverted from other sources to expedite West Pit filling. The reasons for evaluating such diversions are related to the potential increase of rock oxidation, acid generation, and metal leaching from the walls of the West Pit. Expedited pit filling may reduce the potential for oxidation of the material exposed in the pit walls and could therefore minimize the aforementioned risk of generating acid waters from the West Pit after closure.

This section presents the data and assumptions used to quantify the potential sources of water for the West Pit filling. This section also describes the duration of filling and impacts on the flow regime of the affected watersheds. After considering the potential impacts of using the various sources and the pit water chemistry resulting from not using some of these additional sources, PolyMet decided to only use excess water and seepage collected from the Tailings Basin, direct groundwater inflows and surface runoff / stockpile drainage from the Mine Site (described in Section 3.1.4.3). This results in filling the West Pit in 39 years.

3.1.4.1 Potential Sources of Water for West Pit Filling

In general, there are six potential sources of water to fill the West Pit: A) direct groundwater inflows to the West Pit; B) surface runoff / stockpile drainage collection within the Mine Site; C) dewatering discharges from Peter Mitchell taconite pits; D) excess water and seepage collected from the Tailings Basin; E) high flows from three locations along the Partridge River (no diversions during baseflow conditions); and F) water pumped from Colby Lake. The conceptual plans for the diversions and an approximation of the available volumes are provided in the following paragraphs for each source. Figure 3-2 presents the preferred scenario of the sources of water for West Pit filling.

A. Groundwater Inflows to the West Pit

Figure 3-3 presents estimates of groundwater inflows to the West Pit as a function of water level in the pit. The groundwater contribution is more significant during the initial stages of the filling operation, with a maximum groundwater inflow of 1,229 acre-feet per year (762 gallons per minute - gpm) when the pit level is at 925 feet above mean sea level (ft-MSL), and a minimum groundwater inflow of 89 acre-feet per year (55 gpm) when the pit level is at 1,581 ft-MSL. As described in RS22 Appendix B, a range of input parameters were evaluated for the groundwater analyses; the inflow estimates used in this evaluation correspond to average values within a relatively wide range of possible groundwater inflow values.

B. Surface Runoff/Stockpile Drainage Collection from the Mine Site

There are two primary components of the water in this source: surface runoff and stockpile drainage. These sources are located at the Mine Site, and readily available for filling the West Pit.

- Stormwater runoff from the tributary watershed will be routed into the West Pit though a series of ditches maintained and/or constructed during closure (further discussed in Section 5.1.1.2). The contributing areas include the footprints of the West and East Pits and all other areas within the Mine Site that can be drained by gravity to the pits (noted as West Pit Drainage Area on Figure 5-2). This includes stormwater from the tops of reclaimed stockpiles and stormwater from other undisturbed or reclaimed areas.

  RS24 describes the assumptions made to quantify the surface runoff volumes within the Mine Site from reclaimed stockpiles. Mean values assumed for the calculations are 28.2 inches of annual precipitation based on precipitation records compiled between 1971 and 2001 from 16 weather stations located within 30 miles from the Mine Site, and 20.0 inches of annual open water evaporation based on pan evaporation records at Hoyt Lakes. For this analysis, the annual runoff from stockpile covers was assumed to be 44 percent of annual precipitation for evapotranspirative covers and 60 percent of annual precipitation for membrane covers (the "natural" runoff is approximately 40 percent).

  Surface runoff to the West Pit from reclaimed stockpiles and undisturbed areas is 1,148 acre-feet per year (712 gpm), approximately 53% of which is stormwater runoff from the Overburden and Category 1/2 Stockpile. Net precipitation falling directly on the East and West Pits contributes another 308 acre-feet per year (191 gpm), while groundwater seepage from the constructed wetland in the East Pit to the underlying bedrock was assumed to be a loss of 73 acre-feet per year (45 gpm), as described in RS22 Appendix B. Surface runoff and net precipitation to the East Pit will outflow to the West Pit through the East Pit outlet structure and constructed channel, discussed in Section 3.1.3.1.

- Process water from stockpile drainage will be treated at the WWTF and then pumped to the East Pit. The pumping rate is estimated to decrease over time as the stockpile yields decrease, from a maximum of about 197 acre-feet per year (122 gpm) in Year 21 to a minimum of about 77 acre-feet per year (48 gpm) in Year 30; the annual average flow will then remain fairly steady.

The total flow routed to the West Pit from surface runoff and stockpile drainage within the Mine Site, net precipitation falling over the pits, and groundwater loss from the East Pit is 1,602 acre-feet per year (993 gpm) in Year 21, decreasing to a steady rate of 1,460 acre-feet per year (905 gpm) by Year 30.

C. Tailings Basin Water

At closure, the Tailings Basin will hold approximately 19,000 acre-feet of water in the combined basin 1E/2E. This surplus water volume would be pumped from the Tailings Basin (located in the Embarrass River watershed) to the West Pit (located in the Partridge River watershed) to facilitate closure activities as soon as the Process Plant stops mineral processing.

In addition to the initial volume of water, water collected by the Tailings Basin seepage management system is estimated to provide an average of 1,236 additional acre-feet per year (766 gpm) which would be pumped to the West Pit for a period of up to 15 years following closure. After this time, collected seepage would no longer require treatment.

Seepage collected from the Hydrometallurgical Residue Cell will be treated at the WWTF in the Mine Site. Estimated seepage ranges from a maximum initial rate of 480 acre-feet per year (300 gpm) in Year 21 down to 96 acre-feet per year (60 gpm) after 10 years.

Water from the Tailings Basin would be routed through the Treated Water Pipeline between the Central Pumping Station and the Tailings Basin by reversing the flow (see RS22). The approximate distance from the Tailings Basin to the West Pit is 39,000 feet as measured along the pipe. Tailings Basin water is predicted to meet water discharge limits.

D. Dewatering Discharges from Peter Mitchell Pits

There are two inundated pits (Peter Mitchell pits) owned by Northshore Mining Company that are located just north of the Mine Site. The Peter Mitchell pits are located in the Biwabik Iron Formation. Information provided by Northshore Mining Company (email communication from Doug Halverson on December 18, 2006) indicates the total volume of water stored in the Peter Mitchell pits is approximately 20,000 acre-feet (see storage-elevation curves presented in Figures 3-4 and 3-5). Furthermore, natural runoff from the watersheds of these two pits during periods of high flows (using the same approach to determine Partridge River diversion flows described under Source E) as well as direct net precipitation onto the two pits represent an additional amount of water that can be pumped from the Peter Mitchell pits and therefore increase the volume of water routed to the West Pit by an average value of approximately 473 acre-feet per year (293 gpm).

The required pumping head was computed assuming the lowest 1,000 acre-feet stored in each pit will not be pumped out to the West Pit due to a potential for high solids concentrations and other unknown conditions. The volume-weighted average static head to pump up to elevation 1,630 ft-MSL (i.e., 5 feet above the approximate pit rim elevations) is 27 feet for the Peter Mitchell - West 1 open pit and 24 feet for the Peter Mitchell - West 2 open pit. The approximate distance from these pits to the West Pit is

9,400 feet. A temporary pipeline would need to be installed across One Hundred Mile Swamp to route the water to the West Pit. This source will demand a high cost and might have potential impacts to One Hundred Mile Swamp. It would also require permits to construct the pipeline and Northshore Mining Company permission to dewater these two pits.

E. High Flows from the Partridge River

Figure 3-6 shows three locations along the Partridge River that have been identified as potential sites to divert water by gravity and/or pumping to the West Pit. These locations were selected to bracket the feasibility of routing the flows and volumes available from various Partridge River locations near the Mine Site. These diversions would be temporary until the West Pit fills to the overflow elevation.

Flows at these three locations were estimated based on simulations conducted using the XP-SWMM hydrologic/hydraulic model for the Partridge River watershed above Colby Lake and analyzed for the base period of 1978-1988 (see RS73). A conservative approach was used for this analysis, to provide rough volumes that do not overestimate the availability of flows.

Following the nomenclature used in XP-SWMM, the three potential sites on the Partridge River include:

- Location L12, north of the Mine Site, at elevation 1,598 ft-MSL and approximately 5,000 feet from the West Pit. It has a catchment area of about 5,280 acres (excluding the Peter Mitchell - West 1 and West 2 watersheds as per Source D). The hydrologic/hydraulic model predicts a mean annual flow of 4.6 cfs at this location. Water could be diverted by gravity through a 1,400 foot-long open channel to the East Pit with a slope of 0.3%; water from the East Pit will flow by gravity to the West Pit. An outlet structure may be required near the Partridge River to restrict the elevation that flows are allowed to divert.

- Location L15, northeast of the Mine Site, at elevation 1,582 ft-MSL and approximately 11,700 feet from the West Pit. It has a catchment area of about 6,353 acres (excluding the Peter Mitchell - West 1 and West 2 watersheds as per Source D). The hydrologic/hydraulic model predicts a mean annual flow of 5.6 cfs. The water levels in this location are about 15 feet lower than the elevation of the rim of the West Pit. Water could be diverted by pumping from the Partridge River to a 1,700 foot-long open channel with a slope of 0.2%, which would discharge into the East Pit; water from the East Pit will flow by gravity to the West Pit. The static head to pump is 16 feet. A control structure (e.g., a low-head weir) may be required on the Partridge River, to maintain a pool for pumping.

- Location L48, immediately downstream of the confluence of the north and south branches of the Partridge River, at elevation 1,526 ft-MSL and approximately 5,600 feet from the West Pit. It has a catchment area of about 29,452 acres (excluding the Peter Mitchell - West 1 and West 2 watersheds as per Source D). The hydrologic/hydraulic model predicts that the mean annual flow is 26.7 cfs. Water levels in this location are significantly lower than the elevation of the rim of the West Pit. Water could be diverted by pumping from the Partridge River directly to the West Pit. The static head to pump is about 64 feet; therefore pumping costs would be high. A control structure (e.g., a low-head weir) may be required on the Partridge River, to maintain a pool for pumping.

Flows in the Partridge River are highly variable and seasonal, with average daily maximum flows about 15 to 20 times the mean annual flow and nearly 500 times the average daily minimum flows. The computations for available water volume were based on two goals in relation to the potential impacts on the Partridge River flows: (1) minimize the impacts on the base flows in the Partridge River, and (2) minimize the impacts on the sediment transport capacity in the Partridge River. In accordance with these two goals, the following criterion was used in this analysis to determine the flows that could be diverted from any of the three locations (L12, L15 or L48); these flows are henceforth called diversion flows. The diversion flows were defined as 20% of the mean of the flows exceeding the base flow (defined as the average flow over the 30-day period of minimum flows). The diversion flows could be withdrawn during the periods when flows are greater than the corresponding base flows.

With the assumptions listed previously, and averaging the results over 365 days, the diversion flow for site L12 is estimated to be 841 acre-feet per year (521 gpm), for site L15 is 1,024 acre-feet per year (635 gpm), and for site L48 is 4,513 acre-feet per year (2,798 gpm).

The two upstream diversion locations provide minimal flows for West Pit filling and the control structures would block the flows on the Partridge River which may impact fisheries, alter the natural stream channel and change the downstream sediment load. The L48 diversion location would have high construction and operation costs, and would require a larger control structure that would also block flows on the Partridge River.

F. Water Pumped from Colby Lake

The Colby Lake-Whitewater Reservoir system is the farthest downstream location along the Partridge River that would be feasible to withdraw water to divert to the West Pit. Water from this system could be pumped through the existing pipeline that will be used for make-up water for the Process Plant, and then routed to the Tailings Basin and to the West Pit through the Treated Water Pipeline to the Central Pumping Station.

Using a similar criterion to that for the other locations along the Partridge River (described under Source E), the diversion flows from Colby Lake were estimated using data from the Partridge River at the USGS gage located immediately upstream of its confluence with Wyman Creek (approximately 2,000 feet upstream of the discharge into Colby Lake) at 9,884 acre-feet per year (6,128 gpm). However, this is higher than the anticipated maximum annual make-up water demand of 4,400 gpm during mining operations (see RS13). the diversion flows from Colby Lake were assumed to be 8,065 acre-feet per year (5,000 gpm); the static head to pump is about 142 feet.

A diversion flow of 5,000 gpm is equivalent to about 13% of the average daily flow in the Partridge River at the USGS gaging station. Water balance assessments for make-up water demand conducted in response to a request from the Minnesota Department of Natural Resources (MDNR) during a meeting held on June 7, 2007 provide a good comparison. Even in the case of a hypothetical, extreme drought in which inflows to the Colby Lake-Whitewater Reservoir system are reduced by 50% for a 4-year period, the Colby Lake-Whitewater Reservoir system would satisfy a make-up water demand of 5,000 gpm while still complying with the requirements established in Permit 49-135 for water appropriation from Colby Lake. The make-up water would not be needed after mine closure; however this analysis indicates that the 5,000 gpm diversion flow would also not violate the permit conditions. However, the operational costs would be high and it would require adding a section of pipe to connect the Colby Lake line with the Treated Water Pipeline. This would also increase the duration of impacts to Colby Lake-Whitewater Reservoir water level fluctuations.

3.1.4.2 Water Management Scenarios for Filling Operation

This section describes seven scenarios evaluated for pit filling that use different combinations of the six sources of water described in the previous section. The total storage volume within the West Pit is approximately 108,000 acre-feet at the end of mining at elevation 1581 ft-MSL. Figure 3-7 presents the predicted filling rates for each of the following seven scenarios.

1. Local Sources (Groundwater, Surface Runoff, and Stockpile Drainage from the Mine Site)

The first scenario assumes that only direct groundwater inflows (Source A) and surface runoff/stockpile drainage collection from the Mine Site (Source B) will be available for filling the West Pit with water after mine closure. It would take about 51 years to complete the filling operation under this first scenario.

2. Local Sources and Tailings Basin Water

In Scenario 2, Tailings Basin pond water and Tailings Basin seepage water (Source C) is pumped to the West Pit at a rate of 4,000 gpm (6,452 acre-feet per year) during the first four years of closure. Additional Tailings Basin seepage water is pumped to the West Pit at a rate of 766 gpm (1,236 acre-feet per year) for the following eleven years. After fifteen years following closure, reduced seepage rates from the Tailings Basin make pumping to the West Pit infeasible. Combined with groundwater, surface runoff, and stockpile drainage from the Mine Site (Sources A and B), it would take approximately 39 years for the West Pit to fill. This scenario was selected as the best option because of the low initial and operating costs, its suitability with the closure plan proposed for the Tailings Basin (see Section 4.1) and because the predicted water quality concentrations of the West Pit overflows (see Section 3.1.5) result in compliance at the Partridge River with the Minnesota Water Quality Standards (see RS74).

3. Local Sources, Tailings Basin Water, and Peter Mitchell Open Pits

The third scenario assumes that in addition to Sources A, B, and C, water from the Peter Mitchell pits (Source D) will be pumped to the West Pit for seven years at a rate of 2,000 gpm (3,226 acre-feet per year). It would take about 29 years to complete the filling operation under this third scenario. This scenario was eliminated because of the high costs and potential environmental impacts to One Hundred Mile Swamp. The expedited pit filling is also not required to be in compliance at the Partridge River with Minnesota Water Quality Standards (see discussions under Scenario 2 above and Section 3.1.5 below).

4-6. Local Sources, Tailings Basin Water, Peter Mitchell Open Pits, and Partridge River Flows

The fourth, fifth and sixth scenarios build off the third scenario as the base and add water from the Partridge River (Source E) diverted from Location L12 (in Scenario 4), L15 (in Scenario 5), or L48 (in Scenario 6).

The fourth scenario considers that high flows from location L12 in the Partridge River (Source E) will be diverted to the West Pit during the whole time of the filling operation at an annual-average rate of 521 gpm (841 acre-feet per year). In combination with Sources A, B, C and D, it would take about 20 years to complete the filling operation under this fourth scenario.

The fifth scenario includes high flows at Location L15 in the Partridge River (Source E) during the whole time of the filling operation at an annual-average rate of 635 gpm (1,024 acre-feet per year). It would take about 18 years to complete the filling operation under this scenario. Although the West Pit can be filled one to two years sooner in this scenario, pumping from the Partridge River would be required; the shorter filling time does not necessarily justify the added costs of pumping instead of diverting by gravity as with the fourth scenario.

The sixth scenario considers that high flows from Location L48 in the Partridge River (Source E) will be diverted during the whole time of the filling operation at an annual-average rate of 2,798 gpm (4,513 acre-feet per year). Combined with Sources A, B, C, and D it would take about 9 years to complete the filling operation under this scenario. The shorter filling time (11 years less than with the fourth scenario) may justify the additional costs of pumping if the water quality of the West Pit overflows were significantly improved. However, this expedited filling is not required to be in compliance at the Partridge River with Minnesota Water Quality Standards (see discussions under Scenario 2 above and Section 3.1.5 below).

All of these scenarios were eliminated because of the high costs and potential environmental impacts to One Hundred Mile Swamp as well as the limited benefits on the West Pit water quality at overflow (see Section 3.1.5).

7. Local Sources, Tailings Basin Water, Peter Mitchell Open Pits, and Colby Lake Water

The seventh scenario also builds off the third scenario as the base and considers that water from Colby Lake (Source F) will be diverted during the whole time of the filling operation at an annual-average rate of 5,000 gpm (8,065 acre-feet per year). Combined with Sources A, B, C, and D it would take about 6 years to complete the filling operation under this scenario. The shorter filling time (23 years less than Scenario 3) may justify the additional costs of pumping if there were significant improvement to the water quality of the West Pit overflows. However, this scenario was eliminated because of the high costs and because the expedited filling is not required to be in compliance at the Partridge River with Minnesota Water Quality Standards (see discussions under Scenario 2 above and Section 3.1.5 below).

3.1.4.3 Preferred West Pit Filling Scenario

Of the seven proposed scenarios for filling the West Pit previously described, Scenario 2 (including mine site surface runoff, groundwater flows, stockpile drainage, and Tailings Basin water) was selected as the preferred option. Water from the Tailings Basin can be routed to the West Pit via the Treated Water Pipeline and the Central Pumping Station without the construction of a new channel or pipeline across potentially sensitive areas. This scenario has no negative impacts on flows in the Partridge River or the Colby Lake-Whitewater Reservoir system. The contributions of the various water sources utilized in this scenario are shown in Figure 3-8. A diagram of this filling option is presented in Figure 3-2. This option fills the West Pit approximately 39 years after closure (in Year 59). Surface water overflow from the West Pit to the Partridge River is expected to begin about 40 years after pit dewatering ceases.

3.1.5 West Pit Water Quality (RS31)

The West Pit is predicted to take about 40 years to fill. According to the discussion presented in RS31, the West Pit will initially fill rapidly at first due to pumpback from the tailings pond, collected tailings basin seepage, and initially elevated groundwater inflow rates. During this period, the pit lake will experience greatest effects from the exposed walls which will have relatively large exposures and greatest leaching rates. Because weathering rates are expected to decrease with time once walls become acidic, the load added to the pit will also decrease as the pit fills.

Figures 3-9 and 3-10 show predicted concentration trends for Sulfate, Cobalt, Copper and Nickel in the East Pit and West Pit, respectively. Figure 3-10 shows trends in selected parameters relative to their minimum surface water quality discharge limits. The trend in sulfate shows the effects of changing inputs. An initial decrease occurs due to flooding of walls, rapid groundwater inflow and pumpback of tailings pond water. As the latter is stopped, concentrations level off due to pumpback of tailings basin seepage containing elevated sulfate concentrations. Once this source is not pumped to the West Pit, sulfate steadily decays with time as the pit lake fills reaching a long term level that will reflect the balance between overflow from the pit and the long term inflows which will be groundwater, precipitation, surface water inflow from the reclaimed site, leakage from the Category 1/2 stockpile and overflow from the East Pit and its wetland. The final highwall is negligible and long term chemistry is expected to be controlled by external sources to the pit. nickel and cobalt show similar trends.

Copper concentrations are shown as steady in Figure 3-10 up to about 60 years because the equilibrium pit lake pH was calculated to be 7.9 based on the mixture of inflows. Use of generic adsorption parameters in Geochemist's Workbench (Bethke 2005) showed that significant sorption of copper could occur resulting in concentrations of copper of 0.006 mg/L which is below the minimum surface water quality discharge limit. Sorption will occur due to precipitation of iron and manganese oxides in the pit lake. These oxides will form because acidic walls will release iron and manganese which will in turn be oxidized and neutralized in the water column.

In summary, West Pit waters are predicted to be non-acidic during flooding as a result of alkaline inflowing waters. When the pit overflows, sulfate, hardness, copper, nickel, cobalt and zinc concentrations are conservatively predicted to be below the water quality discharge limits, as shown in RS31.

3.1.6 Mine Wall Sloping and Revegetation

The toe of the overburden portion of the pit walls will be set back at least 20 feet from the crest of the rock portion of the pit wall. The overburden portions of the pit walls will be sloped and graded at no greater than 2.5H: 1V. The sloped areas will be vegetated to conform to Minnesota Rules 6132.2700 by a qualified reclamation contractor.

3.1.6.1 East Pit Category 4 Head Wall Cover

The portion of the north wall of the East Pit where significant Category 4 rock will be exposed at the conclusion of mining operations will be isolated from future runoff during closure. Approximately 5,000 lineal feet of the north wall of the East Pit is expected to consist of Virginia Formation or other Category 4-type rock material. If left exposed, oxidation of this surface would continue indefinitely and would result in elevated concentrations of dissolved salts (sulfate) and metals entering the East Pit surface water. To mitigate this potential impact to surface water quality, a membrane cover system will be placed over this area as shown on Figure 3-11. The cover system will be similar to the membrane cover system that will be placed over the Category 4 stockpile.

The cover system over the north wall of the East Pit will be constructed by placing overburden above the waste rock from an elevation of approximately 1,588ft-MSL to approximately one-foot above the top of the bedrock, from approximately station 1,500 to station 8,500, where the top of bedrock elevation is above 1,590 ft-MSL. The slope of the fill material will be 3.5H: 1V on the surface entering the pit lake. Overburden fill will be used for the core of the membrane cover system. A select bedding layer will be used to prepare the core-fill surface for installation of a textured geomembrane. The membrane will be keyed into both the upper and lower limits of the fill. A vegetative soil layer will be placed above the membrane cover. The toe of the slope will include additional fill for the establishment of wetland vegetation that will help to further stabilize the slope cover system.

3.1.7 Access to Pit Lake

Safe access to the bottom of each mine pit (Minnesota Rules 6132.3200) will be provided by selected original haul roads built during pit development. A gated entrance will be placed at each of the pit access locations. The access road will be selected such that, as pit water level rises, there will always be a clear path to the water surface.

3.1.8 Fencing Pit Perimeter

A pit perimeter fencing system will be installed. The system will consist of fences, rock barricades, ditches, stockpiles and berms. The fencing system plan will be submitted to and approved by the St. Louis County Mine Inspector before construction. Fencing will consist of barbed wire in most locations, but when roads will remain adjacent to the fences, non-climbable mesh fencing will be installed.

3.2 Mine Stockpiles

3.2.1 Stockpile Cover and Design

All waste rock stockpiles will be covered as part of closure. To provide an adequate base for sloping of cover materials, waste rock stockpile side slopes will be no steeper than 2.5H: 1V and the outermost layer of covering will consist of screened overburden soils adequate for vegetation growth. To provide erosion control, catch benches at least 30 feet in width will remain on all waste rock stockpiles.

Vegetated evapotranspiration (ET) cover systems are proposed for some stockpiles. ET cover systems mimic the natural environment and are used extensively as a Standard-of-Practice for reclamation of mine-site stockpiles. Based on the preliminary geotechnical investigation (Golder, 2006), the soils at the NorthMet site are predicted to exhibit favorable performance as ET cover materials. The concept of the ET cover is to design the cover to promote runoff with minimal erosion and with a sufficient volume of soil to trap water (precipitation) during the period when the vegetation is dormant. The trapped water is then removed from the cover system by the evapotranspiration process during the growing season. Select vegetation species (e.g., pine trees) transpire moisture year round and from significant depths in the cover system. The vegetation also deters erosion and promotes runoff from the cover thereby limiting infiltration. In addition, the coarser layer of material (e.g., waste rock) beneath the vegetative layer of the cover system acts as a hydraulic break further reducing infiltration. The cover methods planned for each type of waste rock stockpile are described as follows:

- Category 1/2: The cover system is a 2-foot thick ET cover constructed of local till soils and revegetated to establish coniferous evergreen plantings. It will take several years for these plantings to develop a full root system, but infiltration rates to the stockpile will decrease as the ET cover becomes established. Once mature, it is estimated that infiltration rates will range from zero to 28%, decreasing annual process water flow volumes collected at the sumps to a range of 70 acre-feet (44 gpm) to 254 acre-feet (157 gpm). This results in a liner leakage of approximately 0 to 127 gallons per acre per day. Depending on the type of tree chosen, it may take between 10 and 30 years after planting to obtain these predicted rates of flow, with flow rates reducing over time until reaching these levels. The tree species proposed for reclamation, red pine, can obtain uptake potential after 10 years of growth according to Verry (1976) and Ohmann et al (1978).

- Category 3 and Category 3 Lean Ore: The cover system for the Category 3 stockpiles includes a 3-foot ET cover on the 2.5(H):1(V) regraded side slopes constructed of local till soils and revegetated to support an evergreen forest ecosystem. A textured geomembrane barrier with an overlying 1.5-foot-thick grass vegetated cover soil is proposed for the top and bench areas (which block further precipitation from entering the stockpiles in these areas). Precipitation will still enter the stockpiles through the ET cover, but if mature coniferous forests are developed on these slopes, the expected process water flows from the liner would decrease as infiltration rates decrease. The Category 3 Stockpile annual flow estimates decrease to a range from 0.3 gpm (0.5 acre-feet) to 17 gpm (27 acre-feet) with mature coniferous forests, and the Category 3 Lean Ore Stockpile flows decrease to a range between 0.6 gpm (1 acre-foot) and 37 gpm (59 acre-feet). As mentioned above, the length of time required to obtain these reductions in flow will depend on the type of pine chosen, but flow rates are generally expected to decrease to this level between 10 and 30 years after planting. The potential liner leakage rates from Category 3 Stockpile range from 0.01 to 0.33 gallons per acre per day, and from Category 3 Lean Ore Stockpile range from 0.0005 to 0.017 gallons per acre per day.

- Category 4: The cover system for the Category 4 Stockpile is a textured geomembrane with a 1.5-foot-thick grass vegetated cover soil, which will not only prevent any further precipitation from contacting the waste rock, but it will also prevent from occurring within the stockpile. The side slopes will be graded to 3.75(H):1(V) to allow placement of the geomembrane. The predicted average annual process water flow rates from the liner at the end of Year 20 range from

1 gpm (1 acre-foot) to 5 gpm (7 acre-feet). These flow rates will decrease over time as the moisture content of the stockpile decreases. Depending on a number of variables, such as the amount of precipitation that occurs during the 20 years of operation, the field capacity of the rock, the development of preferential flow paths, etc., the length of time this stockpile will continue draining could range from a few years to much longer. The liner leakage rates for the Category 4 Stockpile ranges from 0.001 to 0.005 gallons per acre per day.

3.2.2 Sloping and Revegetation

Overburden and surface stockpiles will have bench heights no higher than 40 feet and will be sloped no steeper than 2.5H:1V to conform to Minnesota Rules 6132.2400. To provide erosion control, catch benches at least 30 feet in width will be constructed to reduce uninterrupted slope length and aid in erosion control. Catch bench width is measured from the crest of the lower lift to the toe of the lift above. All side slopes and benches will be vegetated by a qualified reclamation contractor to conform to Minnesota Rules 6132.2700. Seeding will be based on the appropriate mixture contained in PolyMet's specifications for seeding and mulching (Appendix C). Section drawings of the overburden stockpiles at final grade are shown in Figure 3-12. The MDNR will approve all final plans before construction.

3.2.3 Stockpile Runoff and Drainage in Closure

This section describes the estimates of waste rock stockpile drainage and the collection and conveyance of process water from waste rock stockpiles after closure. Since stockpile reclamation will be progressive during operation, runoff and drainage details were provided in RS22, RS24, and R49. Conveyance of stormwater on reclaimed stockpiles is also discussed.

All stockpiles will be completely reclaimed by the end of Year 20, and, once vegetation is green and growing or the stockpile has a final cover, runoff from the tops and sides of reclaimed stockpiles is classified as stormwater that is routed to sedimentation ponds through a system of ditches prior to being discharged into the natural drainage system. Closure of the ditches and stormwater sedimentation ponds is discussed in Section 5.1.1. Ditches on the stockpile surface will direct stormwater flows into channels that will route flows down the sides of the stockpile.

Due to the current water quality predictions of the water draining from stockpile liners after closure, it is anticipated that all drainage from the stockpile liners and from the foundation underdrains will need to be treated to meet water quality discharge limits. Post-closure water treatment is discussed in Section 7.5. Figure 3-1 shows the pump and pipeline alignments that will remain in place after closure to collect the stockpile drainage and route it to the WWTF.

The Category 4 Lean Ore Surge Pile will be depleted during Year 20, and the liner and foundation will be removed. The Overburden Storage and Laydown area southeast of the West Pit will also be depleted during Year 20, and the area will be reclaimed.

3.2.3.1 Stockpile Drainage Estimates

The water balance predicted for the NorthMet stockpiles was based on information obtained from previous studies of test piles at mines in northern Minnesota and Saskatchewan (discussed in greater detail in RS22 and RS24). That information was compiled to provide estimates of stockpile drainage requiring treatment and to evaluate reductions in flows to the Partridge River. The process water flows will decrease over time, depending on the stockpile cover, as discussed in Section 3.2.1 and listed in Tables 3-1 and 3-2.

Table 3-1 Average Annual Stockpile Liner Leakage after Closure

		High		Low	
		acre-ft	gpm	acre-ft	gpm
Stockpile Category 1/2	Year 20[1]	90	56	41	25
	+5 years[2]	80	50	0	0
	+10 years[2]	80	50	0	0
Stockpile Category 3	Year 20[1]	0.030	0.019	0.012	0.008
	+5 years[3]	0.028	0.018	0.007	0.004
	+10 years[3]	0.027	0.017	0.001	0.0005
Stockpile Category 3 Lean Ore	Year 20[1]	0.0032	0.0020	0.0012	0.0008
	+5 years[3]	0.0031	0.0019	0.0007	0.0004
	+10 years[3]	0.0029	0.0018	0.0001	0.00005
Stockpile Category 4	Year 20[1]	0.00036	0.00022	0.000071	0.00004
	+5 years[4]	0.00036	0.00022	0.000071	0.00004
	+10 years[4]	0.00036	0.00022	0.000071	0.00004

Acre-ft: acre-feet. gpm: gallons per minute.

[1] Year 20 estimates were also presented in RS22 and include grasses and forbs on all stockpiles. These numbers are provided here for comparison to those after closure.

[2] Category 1/2 closure estimates include mature coniferous forests covering the stockpile 5 years after closure, 10 years after reclaiming the stockpile, with little change afterwards.

[3] Category 3 and 3 Lean Ore closure estimates include mature coniferous forests covering the stockpile 10 years after closure with little change afterwards.

[4] Category 4 closure estimates vary with the rate of drainage of the stockpile. Annual volume after closure depends on water volume stored in the stockpile while active (uncovered). The cover will prohibit additional precipitation to the waste rock.

Table 3-2 Average Annual Stockpile Liner Drainage after Closure

		High		Low	
		acre-ft	gpm	acre-ft	gpm
Stockpile Category 1/2	Year 20[1]	332	206	148	92
	+5 years[2]	254	157	70	44
	+10 years[2]	254	157	70	44
Stockpile Category 3	Year 20[1]	37	23	16	10
	+5 years[3]	32	20	8	5
	+10 years[3]	27	17	0.5	0.3
Stockpile Category 3 Lean Ore	Year 20[1]	84	52	36	22
	+5 years[3]	71	44	19	12
	+10 years[3]	59	37	1	1
Stockpile Category 4	Year 20[1]	7	5	1	1
	+5 years[4]	7	5	0	0
	+10 years[4]	7	5	0	0

Note: Liner drainage includes water collected from the liner and underdrain.

[1,2,3,4] See notes at the bottom of Table 3-1.

3.2.4 Water Management Systems

During mining operations, pumps will convey process water collected from stockpile liners to the WWTF. The modifications to these systems during closure are presented in this section.

Modifications to the water management systems that route stormwater runoff from reclaimed stockpiles through a network of dikes and ditches to stormwater sedimentation ponds are described in Section 5.0.

3.2.4.1 Pump and Pipeline Removal and Rerouting

In closure, much of the pump and pipeline system designed to collect and route process water to the WWTF will be removed (Figure 3-1). The pump and pipeline design for stockpile drainage collection and conveyance from the Category 1/2, Category 3, and Category 4 stockpiles to the WWTF (described in greater detail in RS22) will remain in place following closure until analyses show the water quality meets water discharge limits. The pump and pipeline design for the Lean Ore Surge Pile (west of the Category 4 Stockpile) and Overburden Storage Area (southeast of the West Pit) will be removed during closure. The Lean Ore Surge Pile and Overburden Storage Area and all appurtenances will be removed and the area restored at closure, including the pumps and drainage systems that will no longer be required. This includes removal of Sumps S-6 and S-7 (see RS22). The pumps and drainage systems from all of the process water ponds, PW-1 through PW-6 will also be removed (see RS22).

In closure, sections of pipe originally used to route water from the East Pit to the WWTF and approximately 1,500 feet of new pipe will be reversed to route water from the WWTF to the east side of the East Pit (Figure 3-1). The overflow pipe from the CPS pond to the West Pit will remain in place after closure to route treated water to the West Pit in the event of an emergency. The CPS pond stores water that has already been treated at the WWTF and is waiting conveyance to the East Pit.

3.3 Cover and Revegetation of Mine Site Building Area, Roads and Parking Lots

After demolition of mine site buildings and parking areas, 2 feet of overburden material that is suitable for vegetation will be placed over the facility’s former footprint. Mine roads which are not deemed necessary for access by the commissioner will also be abandoned and, if necessary, covered with 2 feet of overburden material that is suitable for vegetation.

Building areas, roads and parking lots will be reclaimed and vegetated according to Minnesota Rules 6132.2700 by a qualified reclamation contractor. Any roads, which include mine access roads (Minnesota Rules 6132.3200) that may develop into unofficial off-road vehicle trails, will require a variance to allow a 15-foot wide unpaved and unvegetated track down the centerline of the road.

3.4 Mine Site Rail Lines

The rail spur constructed to serve the Mine Site will be removed and the roadbed vegetated by a qualified reclamation contractor. Areas near the Rail Transfer Hopper where locomotives may have remained stationary for extended periods will be inspected for potential petroleum product release, and if necessary, remediation measures will be initiated. Remediation at closure is described in Section 6.3.

4.0 Plant Site Reclamation

4.1 Flotation Tailings Basin

The Tailings Basin consists of three cells. Cell 2W is generally the western half of the overall basin. Cell 1E is generally the southeastern portion of the basin and Cell 2E is generally the northeastern portion of the basin. This section describes Tailings Basin reclamation.

Fugitive dust will be controlled by mulching and temporary vegetating as described in PolyMet Mining Company's fugitive emission control plan. Copies of the plant (ER08) and mine (ER09) fugitive dust control plans are included as Appendix D. Appendix C is PolyMet Mining Company's specifications for seeding and mulching.

A qualified geotechnical engineer will evaluate stability of the tailings dam as described in Section 7.3 of this report.

A seepage management system will be implemented as part of the project. It is expected that seepage will continue into closure although at greatly reduced rates. Seepage water quality will be monitored as described in Section 7.2 of this report If it is determined that water treatment is required, treatment will be implemented as described in Section 7.5 of this report.

4.1.1 Reclamation – Tailings Basin

Once the basin has stabilized, it will be contoured so that wetlands will be created and vegetated according to Minnesota Rules 6132.2700.

Channels and/or an outfall structure will be constructed to carry storm water from the basin's two cells to the adjacent wetland. The channels and/or outfall structure will be sized and designed to safely discharge the design discharge while minimizing surface erosion. These channels and/or outfall structure will be lined with vegetation or rip rap to protect the channel from erosion. A rip rap delta will be installed where the drainage channel enters the wetland to distribute the storm water.

The determination of need for the channels and/or outfall structure and rip rap delta as well as detailed design of such structures will be based on results of a hydrology study to be submitted to the MDNR and MPCA prior to implementation of closure. The detailed plans will be submitted to the MDNR and the MPCA for approval. The conceptual location of the spillway from the single Cell 2E/1E to the adjoining land is shown on Figure 4-1.

At the time of closure, construction of a cap on the dam and the exposed beach will be required. Construction of the cap will require removal of vegetative cover, regrading the surface, construction of a dam/beach cover system, placement of protective cover fill, establishment of vegetation and surface water controls. The following sections describe the beach dewatering, cap construction, and vegetation establishment activities that will be implemented for closure of the tailings basin.

4.1.2 Dewatering/Drainage

At closure there will be several sources of water from the tailing basin to be closed that requires management, including:

- Ponded water from within the basin,
- Water in the void spaces of the tailings (stored water),
- Surface-water runoff from crest and beaches, and
- Precipitation falling on the basin.

Each water source will be managed somewhat differently, depending on the timing of its recovery/ release and also on its quality.

4.1.2.1 Ponded Water

The ponded water from the cell to be closed will be removed at closure. Predictions of pond water quality at closure indicate that this water is expected to meet anticipated discharge limits. Therefore this water will be pumped to the Mine Site and be used to accelerate the filling of the West Pit.

4.1.2.2 Stored Water

Stored water is water held in the pore spaces of the tailings. A portion of this water will be released as the pond level within the basin is lowered following the end of mining operations. The volume of stored water that will drain from the tailings will depend on climatic conditions (precipitation, evaporation) and the rate of drainage through the tailings perimeter embankments and to the foundation (see Section 4.1.2.3), and on the volume of water permanently retained in the tailings. This water will be managed as part of the pond water (described above).

4.1.2.3 Drainage Collection and Treatment

Drainage refers to liquid that passes from the tailings deposited in the cell and is collected by the seepage collection system. Drainage from the tailings basin will be collected from the base of the existing perimeter dams. Drainage collected at the base of the existing LTVSMC dams and possibly at the base of the PolyMet dams will be through a series of horizontal drain pipes and lateral headers. During pond dewatering, this water will be recycled back into the pond water and thus also sent to the West Pit to accelerate filling of the pit.

The rate of drainage will decrease over time as the pore water within the tailings basin drains is collected and removed. Therefore, in the long term the volume of water requiring handling will decline and the remaining closure activity will consist of periodic inspection of the closed dams and water collection systems for integrity of the closure systems. Drainage collected after pond dewatering will be pumped via the existing pipeline to the Mine Site where it will be used to accelerate the filling of the West Pit. If this water requires treatment to maintain the West Pit water quality objectives, then it could be sent to the Mine Site WWTF or to the East Pit wetland treatment system prior to being allowed to flow to the West Pit.

4.1.3 Cover and Revegetate

In order to achieve a closure system that is largely maintenance-free as required by MNDR rules, the open-meadow closure approach depicted in cross-section on Figure 4-3 will be used. This approach will yield a gently sloping closure surface that readily sheds surface water runoff, accommodates future differential settlement of the underlying tailings, and maximizes ponding of water in the closed tailings basin pond for the development of constructed wetlands.

Once the entire facility is closed, any water draining from the seepage collection systems will be sent to the Mine Site until it can be demonstrated that it is no longer necessary to actively manage tailings basin seepage.

4.1.4 Reclamation – Emergency Basin

The 35-acre Emergency Basin is adjacent to the Tailings Basin and received material that overflowed from sumps in the concentrator during LTVSMC operations. The location and configuration of the Emergency Basin is shown in Figure 4-4.

As part of the LTVSMC closure process, the Emergency Basin was identified as an Area of Concern under the MPCA's VIC program. Three samples will be extracted from the sediments in the Emergency Basin for analysis. These samples will determine if any further work will be required to identify possible contamination, which will require cleanup. If no contamination requiring cleanup is found, the area will be contoured to create wetlands and vegetated according to Minnesota Rules 6132.2700. In the unlikely event that contamination requiring cleanup is found, a Corrective Action Plan to address the contamination will be developed and submitted to the MPCA for approval. The initial concept for the plan will be to minimize the amount of stormwater reaching the contaminated soil and, therefore, reduce the potential for contamination to be transported out of the Emergency Basin area.

In either event, detailed plans for any required drainage channels and/or outfall structure will be based on relevant hydrologic data and will be submitted to the MPCA and the MDNR for approval. The emergency basin stormwater outflow will be monitored and inspected as approved by the MPCA or as defined in the SDS permit for the Tailings Basin.

The Emergency Basin overflows through a T-culvert. It is PolyMet's intention to reclaim the Emergency Basin to create wetlands and therefore an earthen overflow spillway berm will be constructed near the existing outlet to maintain water levels in the created wetlands and reduce long-term maintenance costs associated with a T-culvert.

PolyMet does not currently plan to use the Emergency Basin and intends to precede with assessment, remediation (if necessary) and reclamation of the Emergency Basin prior to the end of life mine closure.

4.1.5 Cover and Revegetate

After completion of reclamation activities for closure, any existing areas of exposed tailings will be vegetated by a qualified reclamation contractor according to MN Rules 6132.2700.

4.1.6 Emergency Discharge Channels

In order to restrict the upper amount of water contained in the tailings basin, a discharge channel will be constructed from the interior of the basin, around the east end of the north dam in Cell 2E, to the wetlands north of the basin. The crest of the outflow channel at the basin will be established more than 7 feet below the crest of the perimeter dam. The channel will be graded to provide a uniformly sloping channel from the basin to the wetlands. The channel will be trapezoidal in cross-section with 2.5H to 1V side slopes. The bottom of the channel may have a geotextile reinforcing placed along with appropriate soil capable of sustaining a vegetative cover. Flows that become channelized will be routed downslope in rip-rapped swales.

4.2 Hydrometallurgical Residue Facility

4.2.1 Hydrometallurgical Residue Cell Reclamation

At the time of closure, one of the four hydrometallurgical residue cells will require closure. The remaining three cells will have previously been closed as part of routine operations at the site. Reclamation of the remaining open hydrometallurgical residue cell will include removal of ponded water from the cell surface, removal of drainage water from the residue, construction of the cell cover system, and establishment of vegetation and surface water runoff controls. As described in RS28T, construction of the cover system for each cell is planned to occur in increments over a three-year time period. The following sections describe the cell dewatering, cover construction, and vegetation establishment activities that will be implemented for closure of the final cell. Additional detail on closure of hydrometallurgical cells is available in RS28T.

4.2.2 Dewatering/Drainage

At closure there will be several sources of water from the remaining hydrometallurgical residue cell to be closed that requires management, including:

- Ponded water from within the cell,
- Water that drains from the void spaces of the hydrometallurgical residue (stored water), and
- Precipitation falling on the cells.

Each water source will be managed somewhat differently, depending on the timing of its recovery/ release and also on its quality.

4.2.2.1 Ponded Water

The hydrometallurgical residue facility will be developed in increments consisting of stand-alone lined cells, each serving residue disposal needs for a 5-year increment of the 20-year operating life of the ore processing operations. A portion of each cell will be reserved for ponding of water that will aid in settling the hydrometallurgical residue solids that are discharged into the operating cell and will aid with clarification of water before it is returned to the plant for reuse.

The ponded water from the final cell to be closed will require removal and treatment. Water treatment is addressed in RS29T. During removal of ponded water, and removal of the majority of stored water as subsequently described, water will be pumped or hauled by tanker truck to the Mine Site WWTF for treatment and subsequent discharge to the East Pit wetland treatment system. Once the majority of ponded and stored water has been removed, remaining water will be collected by tanker truck for off-site treatment and discharge at a permitted wastewater treatment plant.

4.2.2.2 Drainage

The hydrometallurgical residue cells will act as sedimentation basins, so will remain full or partially full of water during routine operations. At closure, the void spaces in the residue will be full of water. A portion of this water will be retained in the residue while a portion of the water will subsequently drain from the residue. Drainage refers to liquid that passes from the residue deposited in the cell and is collected by the drainage collection system. In addition, some of the water remaining from operations will be stored in the cell. Stored water is water held in the pore spaces of the hydrometallurgical residue. As with ponded water, drainage collected from the residue will be pumped or hauled to the mine site WWTF for treatment and subsequent discharge to the East Pit wetland treatment system. The volume of water that will drain from the residue is somewhat unpredictable, as it will depend on the in-place density of the residue, which will be unknown until facility operations are terminated, and on the volume of water permanently retained (stored) by the residue. The rate of drainage will also be somewhat unpredictable, as it will depend on the in-place hydraulic conductivity of the residue. Table 4-1 provides an estimate of water volume that will drain from the last cell. The estimates are based on assumptions regarding residue void ratio, they assume 100 percent initial saturation of the residue, and assume discharge of 60 percent of the water as drainage following cell closure. The void ratio estimates cover a range of void ratios that can reasonably be expected for a water-transported and -deposited silt-size material like the hydrometallurgical residue.

Table 4-1 Estimated Drainage Recovery Volume at Cell Closure		
In-Place Residue Volume (cubic yards)	**In-Place Void Ratio $e = V_v / V_s$**	**Estimated Drainage Volume Requiring Management (millions of gallons)**
3,000,000	0.8	162
3,000,000	1.0	182
3,000,000	1.2	198
3,000,000	1.4	212
3,500,000	0.8	188
3,500,000	1.0	212
3,500,000	1.2	231
3,500,000	1.4	247
4,000,000	0.8	215
4,000,000	1.0	242
4,000,000	1.2	264
4,000,000	1.4	283

The values in Table 4-1 assume that 60 percent of water that fills voids in the residue deposit at closure is released as drainage and that the other 40 percent remains permanently held by the hydrometallurgical residue. The 40 percent is analogous to an estimated field capacity for the residue. The values estimate drainage of water volume from the final cell. During closure, precipitation will fall on the cell, a portion of which will infiltrate and add to the volume of drainage water requiring management. For a cell that is open for a year prior to geomembrane cover placement as planned for the final hydrometallurgical residue cells, it is assumed that roughly 10 inches of precipitation will infiltrate, adding on the order of 15 to 20 million additional gallons of drainage water requiring management. Table 4-2 provides estimates of time in days required to remove drainage from the cell at closure, under a series of assumed pumping rates from a drainage collection system.

Table 4-2 Estimated Time for Drainage Removal at Cell Closure (days)						
Pumping Rate (gallons/minute)	**Drainage Volume (millions of gallons)**					
	100	**150**	**200**	**250**	**300**	**350**
100	694	1,042	1,389	1,736	2,083	2,431
200	347	521	694	868	1,042	1,215
300	231	347	463	579	694	810

The pumping rate will be variable over the term of the cell dewatering effort. Early in cell dewatering, flow rates close to 300 gpm are expected. Later in cell dewatering when hydraulic head in the residue has been partially reduced by the cell dewatering activities, flow rates closer to 100 gpm are expected.

4.2.2.3 Drainage Collection and Treatment

As with drainage from each preceding cell, drainage from the final cell to be closed will be collected from the base of the cell area by the granular drainage layer and the geocomposite drainage system. Figure 4-3 depicts in plan view and cross-section the planned drainage collection system using a geocomposite drainage system. As with the ponded water, the drainage will be pumped or hauled by tank truck to the mine site WWTF for treatment and subsequent discharge to the East Pit wetland treatment system. Treatment will be such that the water in the mine pit will not be degraded. The rate of drainage will decrease over time as the pore water within the hydrometallurgical residue is collected and removed. Once the entire facility is closed, the volume of water draining from the cell drainage collection systems will decline and continued operation of the pipeline to the WWTF may no longer be justified. Therefore, in the long term the volume of water requiring transport and treatment will decline and the remaining closure activity may consist of periodic pumping of remaining drainage into tank trucks for transport, treatment, and disposal as appropriate, and of inspection of the closed cells for integrity of the closure systems.

4.2.3 Cover and Surface Water Runoff Control

In order to achieve a closure system that is largely maintenance-free as required by MNDR rules, the open-meadow closure approach depicted in cross-section on Figure 4-4 will be used. This approach will yield a gently sloping closure surface that readily sheds surface water runoff, accommodates future differential settlement of the underlying residue, and minimizes ponding of water on the closed hydrometallurgical residue fill surface. The closure will generally consist of placement of a layer of flotation tailings immediately above the hydrometallurgical residue with geotextile reinforcing placed in-between the residue and tailings if needed to create a working surface on which a geomembrane barrier layer can easily be constructed. A 40-mil low density polyethylene or similar agency-approved geomembrane barrier layer will be placed, after which additional flotation tailings and cover soils will be placed to create a covered surface capable of sustaining a vegetated cover. If based on flotation tailing particle size and angularity it is necessary to protect the geomembrane barrier layer from puncture, it will be protected by use of non-woven needle-punched geotextile fabric above and below the geomembrane.

To accommodate control of surface water runoff, the cover will slope gently toward the site perimeter to accommodate natural drainage of the runoff. Final cover slopes on the cell interior will be relatively shallow (on the order of 2 to 5 percent) to minimize surface water runoff flow velocity and the erosion that can result from elevated flow velocity. Runoff that becomes channelized along the cell perimeter will be routed down-slope in rip-rapped drainage swales or plug-resistant inlet structures and piping systems. These drainage swales and/or piping systems, which are commonly used at closed solid waste management facilities, will be used to safely transmit runoff down-slope, particularly after the transition of the relatively flat top slope (at slopes in the range of 2 to 5 percent) to the steeper slope of the perimeter embankment of the cell (at slopes in the range of 20 to 30 percent). Once runoff is transmitted down the cell embankment, it will be routed to an onsite infiltration basin in Cell 2W such that the rainwater can infiltrate just as it does now.

4.3 Cover and Revegetate Building Area

After demolition of Plant Site buildings, 2 feet of overburden material suitable for vegetation will be placed upon the facility's former footprint. Plant area roads which are not deemed necessary for access by the commissioner will also be abandoned and, if necessary, covered with 2 feet of overburden material that is suitable for vegetation

Building areas, roads and parking lots will be reclaimed and vegetated according to Minnesota Rules 6132.2700. Any roads that may develop into unofficial off-road vehicle trails (Minnesota Rules 6132.3200) will require a variance to allow a 15-foot wide unpaved and unvegetated track down the centerline of the road.

5.0 Watershed Restoration

5.1 Water Management Systems

During mining operations, stormwater runoff from reclaimed stockpiles will be routed through a network of dikes and ditches to stormwater sedimentation ponds. This section discusses modifications to these water management systems during closure.

5.1.1.1 Dike Removal

This section describes the removal of dikes during closure after Year 20. Pit rim and Mine Site perimeter dikes will be progressively constructed during mine development to control the lateral movement of surface waters and shallow groundwater within the surficial deposits (described in detail in RS25). Pit rim dikes are intended to prevent stormwater runoff from undisturbed (natural) and reclaimed areas within the Mine Site from discharging into process areas (stockpile construction areas, pits, etc.). Perimeter dikes are intended to minimize flows into the Mine Site from wetlands located outside the site boundary and to protect the mine facilities against large flood events in the Partridge River, in particular on the northern side of the Mine Site.

Figure 5-1 shows dikes that will be removed during closure after Year 20. Most perimeter dikes are intended to protect active stockpiles against flood levels in the Partridge River and minimize flows onto or off the Mine Site during mining activities. The dikes were also placed to prevent erosion of the active material placed in the stockpiles due to the high water. The risk of erosion is reduced after reclaiming the sloping surface of the stockpiles due to the establishment of vegetative cover. The perimeter dike located north of the Central and East Pits will be maintained in order to minimize mixing of Partridge River flows with the East Pit water. Perimeter dikes located on the north side of the Category 1/2 Stockpile and along the east boundary of the Mine Site (Figure 5-1) will be maintained to provide access to groundwater monitoring locations.

Most pit rim dikes will be removed. In closure, stormwater runoff within the Mine Site will be routed to the mine pits using a combination of existing and new ditches (see Section 5.1.1.2). Some portions of the pit rim dikes might remain in place after closure if they are needed to prevent an uncontrolled discharge inflow to the pits and potential erosion (headcutting) of the pits walls. A more detailed evaluation of this requirement will be conducted prior to Year 20.

Material will be removed from the main body of the dikes and will be used at the site for restoration of disturbed surfaces prior to reclamation. To minimize disturbance of subsurface soils, the subsurface seepage control component of the dikes will remain in place. Typical construction erosion control measures will be taken as part of the dike removal work, such as installing silt fence on the down slope side of disturbed areas and control of surface water runoff. The reclaimed surface will be scarified, topsoil placed, and the area will be revegetated with native species within the time required by construction stormwater NPDES rules.

5.1.1.2 Ditch Filling and Rerouting

Ditches will be progressively constructed during mine development (see RS24 and RS25) to divert stormwater runoff from undisturbed (natural) and reclaimed areas from process areas (stockpiles, pits, haul roads, etc.). Figure 5-2 shows the proposed alignment of ditches that will be maintained to direct stormwater into the West Pit for filling. Use of ditches that already exist in Year 20 has been maximized, but several new ditches will need to be constructed to direct stormwater runoff from the northern half of the Mine Site into the East or West pits during closure. New ditches will be designed using the same criteria as other ditches at the Mine Site (described in RS24).

An overflow will be constructed from the East Pit to the West Pit, see Section 3.1.3. Overflows from the West Pit are described in Section 3.1.3.

Closure of ditches will include filling, covering with topsoil and vegetating the restored surface.

5.1.1.3 Stormwater and Process Water Sedimentation Pond Restoration

At closure, all seven stormwater sedimentation ponds and the six process water ponds will be filled, covered with topsoil and revegetated or turned into wetlands. The outlet control structures from most sedimentation ponds will be removed to restore the drainage flow paths to their natural conditions to the degree this is practicable. Outlet control structures OS-4, OS-5, and OS-7 will remain in-place to direct water under Dunka Road and the railroad to the Partridge River along natural drainage paths. If the process water ponds are turned into wetlands, any sedimentation that occurred within the pond will be removed or capped prior to restoration.

5.2 Impact of Closure on Flows in the Partridge River

The impacts of Mine Site closure activities on stream flows in the Partridge River were estimated using the XP-SWMM hydrologic/hydraulic model developed for the Partridge River watershed (see RS73). In this section, the relative impacts of closure on streamflow are estimated by comparing modeled flows during and after closure to modeled flows representing conditions prior to mine development and during Year 20 of mine operation.

5.2.1 Modeling Flow in the Partridge River Using XP-SWMM

The hydrologic/hydraulic model developed for the Partridge River watershed was built in XP-SWMM, a physically-based model based on the U.S. EPA's Storm Water Management Model (SWMM). A detailed description of model setup and calibration is included in RS73A. This model was used to estimate flows prior to mine development (referred to as the "Existing Conditions" model) and during Year 20 of mine operation (referred to as the "Year 20" model).

The calibrated Partridge River model was modified to evaluate Mine Site closure for two different conditions: during filling of the West Pit and after the West Pit is filled. The following sections describe key differences between these two closure models and the Existing Conditions and Year 20 models. A detailed description of model setup for the Existing Conditions and Year 20 models is included in RS73.

5.2.1.1 Modeling Flows During West Pit Filling

During filling of the West Pit, drainage from approximately 54% of the Mine Site will be routed to the West Pit (Figure 5-2) and will not contribute to flows in the Partridge River. All areas draining to the West Pit via ditches and dikes remaining in closure (Figures 5-1 and 5-2) were included in the West Pit watershed and removed from the model to account for the collection of water in the West Pit. The remaining area is considered to drain to the Partridge River. Watersheds divides within the contributing area were delineated based upon the topography of the Mine Site at closure and remaining ditches and dikes (see Section 5.1). Parameters including slope, flowpath, width, and effective drainage area were calculated for the contributing watersheds.

The area occupied by each reclaimed stockpile was divided according to the percent of net precipitation expected to infiltrate the reclaimed stockpile for collection on the liner and the area that will drain as surface runoff. These percentages are based on average summer runoff coefficients as described in RS24 and average liner yields as described in RS22. The area corresponding to surface runoff was included in the watershed to which that area would naturally drain (or removed from the model if that area was included in the West Pit watershed). The area corresponding to infiltration liner yield was removed from the watershed, as it would be routed to fill the West Pit after treatment. All areas occupied by reclaimed stockpiles were accounted for by one of the previously described methods.

5.2.1.2 Modeling Flows After West Pit Filling

Once filled, overflow from the West Pit will drain south, eventually reaching the Partridge River. The area draining to the West Pit (Figure 5-1) will then be considered contributing area to the Partridge River watershed. A portion of the runoff from the Category 1/2 stockpile that was tributary to the West Pit watershed during filling will be diverted north to the Partridge River to return flows closer to natural watershed conditions (see Figure 5-1). To model this condition, the model previously described was modified so that the area draining to the West Pit was not removed from the model, but was included as a single contributing watershed with its outlet located near the West Pit overflow; the area draining north to the Partridge River was input as a separate watershed. Within the West Pit watershed, the areas occupied by the East and West Pits were classified as wetland and open water, respectively. New watershed parameters were calculated for the West Pit watershed. The areas occupied by reclaimed stockpiles were treated as previously described with the exception that all the area corresponding to infiltration was added to the West Pit watershed, as were areas corresponding to surface runoff that drain to the West Pit,

5.2.2 Closure Model Results

The XP-SWMM hydrologic/hydraulic model was run for the period of 1978-1988 for the two scenarios previously described. Flow statistics were calculated at each of the six surface water monitoring locations and also at the location of USGS gage 04015475 (Figure 7-1). The model results were compared to two previously modeled scenarios: (1) Existing Conditions – prior to NorthMet Mine Site development, and (2) during Mine Year 20.

Plots depicting the trends in Mean Annual Flow, Maximum Daily Flow, and Minimum Daily Flow are given in Figures 5-4 through 5-10 for surface water monitoring locations SW-001, SW-002, SW-003, SW-004, SW-004a and SW-005 and at the location of USGS gage 04015475, respectively.

5.2.2.1 Impacts at the Mine Site

Upstream of the confluence of the North and South Branch of the Partridge River, decreases of less than 7 percent in mean annual flows from Existing Conditions are expected throughout closure. Decreases of less than 9 percent (at SW-004) and 12 percent (at SW-002) in average maximum and minimum daily flows from Existing Conditions are expected during West Pit filling, respectively. During closure, some areas that drained north prior to and during mine operation are routed to the south to fill the West Pit. After the West Pit is filled, the area draining north to the Partridge River is maximized to the extent possible following Mine Site development, but remains reduced relative to conditions prior to mine operation. As a result, a larger percentage of drainage from the Mine Site enters the Partridge River farther downstream than prior to Mine Site development, resulting in a flow reduction of about 2 to 4 percent in mean annual flows between SW-002 and SW-004 (Figures 5-5 through 5-7) after the filling of the West Pit is complete.

Immediately downstream of the confluence of the North and South Branch of the Partridge River (that is, at surface water monitoring location SW-004a, which is downstream of 99 percent of the Mine Site facilities), decreases of less than 6 percent in mean annual flows from Existing Conditions are expected during West Pit filling. After filling of the West Pit is complete, however, an increase of less than 3 percent in mean annual flows from Existing Conditions is expected at SW-004a. An increase of less than 1 percent in average minimum daily flows is expected, whereas a decrease of less than 3 percent in average maximum daily flows is expected. Overflows from the East and West Pits (see Section 3.1.3) are certainly contributing to the increase in average and minimum flows as the percent imperviousness of the Mine Site sub-watersheds increases with respect to Existing Conditions. On the other hand, as expected, the attenuation capacity of the two new large water bodies (i.e. the East and West Pits) is contributing to the decrease in maximum flows.

5.2.2.2 Impacts Downstream of the Mine Site

During West Pit filling, flows well downstream of the Mine Site (i.e. downstream of the confluence of the North and South Branches) are similar to those observed in Year 20 of mine operation, due to much of the drainage from the Mine Site being routed to the West Pit instead of the Partridge River (Figure 5-9). After the West Pit is filled, average daily flow in the Partridge River downstream of the confluence of the North and South Branches increases less than 2 percent over the conditions prior to Mine Site development. The total area contributing to flow in the Partridge River after closure is equal to the contributing area prior to Mine Site development, indicating that the increase in flow is due to changes in Mine Site hydrology. Small differences are observed in the maximum flows (less than 1%) and minimum flows (less than 2%) between the Existing Conditions model and the After Closure model.

6.0 Remediation

Remediation of releases to the environment, for example the inadvertent release of petroleum products or other hazardous chemicals, will be conducted as necessary throughout the operation of NorthMet. Because NorthMet is using a former taconite processing facility for part of its operation, historical potential releases, which have already been identified, will need to be investigated and, if necessary, remediated. In addition, if releases occur during the proposed operation, remedial activities will be initiated promptly. Finally, at closure, activities that are likely to contribute minimal, but perhaps continuous, releases of petroleum products (for example lubricants) or other hazardous materials to the environment – soil, groundwater, surface water, or sediments – and which may have the potential to adversely impact human health or the environment will be identified and investigated.

6.1 Remediation of Historic Potential Releases

Prior to selling the processing plant to PolyMet, Cliffs Erie, L.L.C. commissioned the completion of a Phase I Environmental Site Assessment (ESA) (NTS, 2002) for the purpose of closing the taconite mining and processing operations. The work completed and reported in the ESA identified several areas of potential concern (AOC) for the property. With the purchase of a portion of the site, PolyMet accepted 29 of the identified AOCs. Of the accepted AOCs several have already been closed or have received a no further action letter from the MPCA, including:

Mill Rejects Area (AOC 12)

Tailings Basin Reporting (AOC 47)

Line 9 Area 5 Petroleum Contaminated Soil (AOC 37)

Coarse Crusher Petroleum Contaminated Soil (AOC 49)

Hornfels (AOC 53)

In addition, the following AOCs accepted by PolyMet are closed, formerly permitted landfills that will each require post-closure monitoring per the Minnesota Solid Waste Landfill requirements:

Private Landfill (AOC 8) now Industrial Landfill SW-619

Coal Ash Landfill (AOC 36) – closed landfill, but still requires monitoring

The remaining AOCs accepted by PolyMet will require further investigation to determine whether or not they require any further action. PolyMet intends to continue the Voluntary Inspection and Cleanup (VIC) program that Cliffs Erie started. The AOCs that will not be used by PolyMet will be investigated and remediated as necessary on a schedule agreed to by the MPCA. AOCs that will be used by PolyMet will be investigated during the closure of PolyMet operations. These remaining AOCs are summarized in Table 6-1.

Table 6-1 Areas of Concern for Remediation

Area of Concern	Description	Activity	Contaminants of Potential Concern	Status
38	Area 2 Shops (reuse planned)	Fueling Equipment, Rebuild and Repair, Paint Shop, Carpenter Shop	DRO, GRO, VOC, RCRA SVOC	Site investigation complete - no solvents detected; will be handled as LUST - CAP approved
1	Area 1 Shops and Reporting (reuse planed)	Fueling Equipment, Rebuild and Repair, Steam Cleaning Electrical Shop	DRO, GRO, VOC, RCRA SVOC	
25	Area 5 Loading Pocket and Storage	Materials storage, salvaging operations	DRO, VOC, RCRA	Sell for scrap
24	Area 5 Reporting	General materials storage adjacent to the reporting area	DRO, VOC, RCRA	Buildings removed
7	Bull Gear Disposal	One-time disposal of heavy lubricant	PAH, Pb	
6	Oily Waste Disposal Area	Oily waste from oil/water separator of the WWTP disposal	DRO, GRO, VOC, PAH, RCRA	
13	2001 Storage Area	Equipment salvage Materials storage Transformer storage	DRO, GRO. VOC, PAH, PCB, RCRA Metals	
14	Large Equipment Paint Area	Sandblasting and painting	RCRA, VOC	Buildings sold
10	Airport	Equipment salvage & tear-down area, Materials storage	DRO, GRO, VOC, RCRA	Scrap to be sold - trash to be disposed
9	RR Panel Yard	RR siding area, Fabrication of rail panels Disposal of railroad ties, Locomotive fueling	DRO, VOC, RCRA, PAH	Scrap to be sold - trash to be disposed
11	Stoker Coal Ash Disposal	Coal ash industrial waste disposal	B, Sr,	
51	Salvage and Scrap Areas	Storage and salvaging various equipment. These are small areas scattered on the southwest side of the Tailings Basin	DRO, PAH, PCB, RCRA Metals	
52	Cell 2W Salvage Area	Storage of materials and equipment	DRO, PAH, Pb	
35	Dunka WTP Sludge	Stockpiling area for WTP sludge	RCRA Metals	
48	Transformers (reuse planned)	Transformers associated with pumps located within the Tailings Basin	DRO, PCB	
50	Emergency Basin	Drain Outfall for storm water, and process waste water for the Plant Site.	DRO, VOC, PAH, RCRA	
42	Bunker C Tank Farm	Large AST storage of #4 to #6 fuel oil	DRO	Formal closure underway - investigation complete - sump drain removed - inspection procedure to be developed -
46	Plant Site proper and General Shops (reuse planned)	Crushing, concentrating, pelletizing and general maintenance facilities.	DRO, GRO, VOC, PAH, PCB, RCRA	
59	Colby Lake Pumping Station (reuse planned)	Heating oil AST Transformer	DRO, BTEX	
40	Heavy Duty Garage	Equipment maintenance	DRO, GRO, VOC, PAH	Building removed
43	Administration Building (reuse planned)	Heating oil tank	DRO, BTEX	Active - removal with building demo
44	Main gate Vehicle Fueling Area (reuse planned)	Two 6000 gallon AST	GRO/DRO/VOC	Active

The MPCA VIC program will be used to oversee the remediation activity for potential historical releases. The process to clear an AOC beyond the Phase I ESA is documented in the Quality Assurance Project Plan (QAPP) that has been prepared for the property. Within the QAPP, a process for preparing a Sampling and Analysis Plan (SAP) is included. Record searches to confirm the presence of a recognized environmental condition (REC) are completed during preparation of SAP for each AOC. If a REC is identified, a SAP will also be used to detail the scope of the Phase II ESA investigation work that will help determine if a release to the environment has occurred. A Phase II ESA investigation is also intended to define the nature, magnitude, and extent of the release (if found). The results of the Phase II ESA will be used to perform an MPCA VIC Program Risk Based Site Evaluation (RBSE) based on intended land use, to determine if remediation is necessary to mitigate risk.

6.2 Assessment and Remediation of Operational Releases

In addition to these historic AOCs, potential future AOCs may include reagent storage areas, mine truck fueling areas, and the railroad sidings. Because all handling, storage, and use of hazardous materials during the operation will be conducted in accordance with appropriate Spill Prevention, Control and Countermeasures (SPCC) plans (ER04 and ER05), it is anticipated that any further releases from these operations will be identified and addressed immediately, including following procedures for reporting releases and responding to these releases with appropriate clean-up, assessment, and remediation, as necessary.

6.3 Remediation at Closure

At closure, all historic and operational releases will have been identified and either remediated to facilitate closure, or will be in the process of being investigated for the purpose of implementing appropriate remedial activities.

Additional items that may need to be remediated at closure could include areas where de-minimus amounts of petroleum fuels or lubricants, or other materials that could adversely impact the environment have been released over time. Likely areas that will be investigated and, if necessary, remediated at closure will include fuel handling areas, reagent/additive receiving and storage areas, solid waste storage/disposal areas, and rail sidings. For example, it is plausible that petroleum releases may be identified along rail sidings when tracks are removed at closure. These areas would be identified as new AOCs and would be reported, assessed and remediated in accordance with MPCA-VIC guidance.

7.0 Monitoring and Maintenance

7.1 Landfill Monitoring and Maintenance

7.1.1 Coal Ash Disposal Area

Coal ash from LTV Steel Mining Company's (LTVSMC's) Taconite Harbor facility was disposed at the Hoyt Lakes Coal Ash Disposal Area (the disposal area) located southeast of the tailing basin. As part of a Compliance Agreement with the MPCA, LTVSMC agreed to close the disposal area. A Closure Plan and Post-Closure Plan (see ER10) were subsequently submitted to the MPCA during May 2000. That plan indicated that LTVSMC would stop accepting coal ash at the disposal area by approximately August 1, 2000. The Closure Plan was prepared in accordance with Minnesota Rules 7035.2815 subp. 5 (D) (E), and subp. 6, and subp. 16 and specified that closure activities be completed by September 2000. Closure activities included site preparation and grading, and installation of a final cover system and surface water control system. A groundwater monitoring system was not specified or installed as part of the closure process.

Post-closure care of the disposal site is defined in the Post-Closure Plan (PCP) portion of the May 2000 document. Minnesota Rules 7035.2645 and 7035.2655 were used to determine post-closure requirements presented in the PCP. The PCP indicates that the post-closure care period will continue for 30 years from the final closure certification which certifies that the disposal area has been closed in accordance with approved plans and specifications as required by Minnesota Rules 7035.2610. Approximately 24 years remain in the post-closure care period during which inspections of the final cover system and surface water control system will be performed three times a year (spring, summer, and fall) and maintenance will be performed as necessary. A report describing the inspection(s), conditions observed, corrective actions, maintenance activities and monitoring activities is required to be submitted to MPCA annually.

7.1.2 Industrial Landfill SW-619

In December 2006 PolyMet purchased Cliffs Erie LLC's Industrial Landfill, which operated under MPCA Solid Waste Management Permit 619 (SW-619). The MPCA issued SW-619 on October 14, 2004, in accordance with Minnesota Statutes, Chapters 115, 115A, and 116 and Minnesota Rules 7000, 7001, and 7035. A Solid Waste License was obtained from St. Louis County in order to operate Industrial Landfill SW-619. Industrial Landfill SW-619 was permitted for disposal of demolition debris, asbestos-containing materials (i.e., industrial waste), and construction debris generated at the former LTVSMC properties as part of closure and economic development activities.

In order to keep waste consolidated within one area at the Hoyt Lakes facility, Industrial Landfill SW-619 is located at the old LTVSMC industrial waste landfill site. A groundwater monitoring system and a methane ventilation system were already present at the old LTVSMC industrial waste landfill and are used to monitor conditions at Industrial Landfill SW-619. Industrial Landfill SW-619 includes an Industrial Waste Disposal Area (IL001) and a Solid Waste Storage Area (ST001). ST001 was permitted to allow accumulation of up to 1,500 cubic yards (for up to 30 days) of demolition and construction type debris, recyclable materials, and waste not acceptable for disposal at Industrial Landfill SW-619. Asbestos-containing material cannot be stored at ST001.

Groundwater and methane monitoring is performed annually during October each year. An Annual Facility Report is completed and submitted by February 1 each year that includes the following required reports:

IL001 Annual Waste Activity Report;

ST001 Annual Waste Activity Report;

Annual Gas Monitoring Evaluation Report; and,

Annual Water Monitoring Evaluation Report.

A Closure Plan was prepared and was approved in accordance with Minnesota Rules 7035.2625, including closure procedures that ensure performance of closure in accordance with Minnesota Rules 7035.2635. A Post-Closure Plan (ER11) was prepared and approved in accordance with Minnesota Rules 7035.2645 including post-closure care procedures that ensure performance of post-closure care in accordance with Minnesota Rules 7035.2655, subp. 1. Post-closure care and use of the property must be in accordance with Minnesota Rules 7035.2655, subp. 2. The post-closure care period will continue for 30 years from the final closure certification, which certifies that the disposal area has been closed in accordance with approved plans and specifications as required by Minnesota Rules 7035.2610.

7.1.3 Hydrometallurgical Residue Facility

This section describes the inspection, maintenance, and reporting activities planned for the Hydrometallurgical Residue Facility after closure. This includes the cell perimeter embankments, the cell liner and cover systems, and the drainage collection system. Water quality monitoring is described in Section 7.2 of this report and water treatment is described in Section 7.5 of this report.

7.1.3.1 Facility Inspection

A facility inspection program will be finalized in the permitting process. The expected inspection program for the hydrometallurgical residue cells consists of scheduled visual inspection of the hydrometallurgical residue cell infrastructure for things such as excessive settlement and erosion and stability monitoring. The inspections will occur twice a year—conducted in the spring after snow melt and in the fall before freezing. Special inspections may also be warranted and undertaken after severe rain events to confirm condition of on-site facilities.

Areas to be inspected for erosion include the exterior face of cell embankments and areas where surface water runoff may be channelized and causing erosion.

Areas to be inspected for settlement include cell embankments and areas adjacent the embankment toe. Settlement of the hydrometallurgical residue cell system is anticipated. Only those areas where settlement is rapid or excessive require special attention and possible identification for future remediation.

Areas to be inspected for signs of instability include cell embankments; including the crest of the embankments, the embankment side slopes, and areas along and adjacent the embankment toe. Items to note include cracking in the embankment fill, large-scale horizontal and/or vertical movement of the embankment fill and/or of the materials near but outside the embankment toe-of-slope, and apparent rotation of previously horizontal fill surfaces. In addition, inspection for seepage from embankment side slopes and toe-of-slope from sources other than precipitation will be included. Areas of persistent seepage, particularly during extended dry spells, should be identified and evaluated further.

An inspection log will be maintained and records retained at least five years after the date of inspection. All records involving enforcement actions will be retained until the action is resolved. The inspection records will include the following:

- Date and time of the inspection
- Name of inspector
- List of observations made
- Date and nature of any repairs or other actions taken

A facility inspection and maintenance plan is shown on Table 7-1. Facility maintenance is described in greater detail in the following section.

Table 7-1 Inspection and Maintenance Plan

Item	Operation	Frequency
Hydrometallurgical Residue Cell Embankments	Inspect	Detailed twice per year
	Repair	When an inspection reveals damage
Turf and Final Cover	Mow	Once per year or as needed
	Fertilize	When visual inspection indicates poor vegetation growth
	Repair	Within 4 weeks after visual inspection indicates erosion or stressed vegetation
Diversion Berms/Drainage Swales	Inspect for Sedimentation and Erosion	Detailed twice per year
	Remove Sediment	When sediment depth exceeds sediment design depth
	Reseed	When visual inspection indicates that vegetation is no longer present
Riprap	Inspect for Damage	Detailed twice per year
	Repair	When an inspection reveals damage
Leachate and Seep Collection Systems	Inspect	Detailed twice per year
	Clean	As needed to maintain proper operation
Note: Maintain documentation of specific inspection events previously noted.		

7.1.3.2 Maintenance

Routine maintenance will be required to ensure maintenance of proper closure of the Hydrometallurgical Residue Facility. Routine maintenance will include inspection and repair of all drainage systems designed to keep water from the toe of the cell embankments and remove stormwater from the tops of cells. Turf maintenance will include the following:

- Routine maintenance of exterior slopes of embankments including periodic mowing as appropriate, reestablishment of turf in areas of poor turf development, and repair of areas where erosion is developing or progressing to the extent that, if left unchecked, more severe problems may develop.
- Mowing of grassed waterways and diversion ditches as needed to maintain the required flow capacity. Other critical areas will be mowed as needed to maintain vegetation and to prevent the establishment of trees and other deep rooted plants in the final cover soil as necessary.
- Where erosion has left soils unprotected and where turf cannot immediately be reestablished, temporary silt fences will be placed to intercept and detain sediment where there is risk of transport of sediment off-site from the closed facility.

For a number of years after final facility closure, water collected from the drainage collection systems of the closed cells will be pumped or transported to the mine pit. The rate of leachate drainage will decrease over time as the pore water within the hydrometallurgical residue is collected and removed. Therefore, in the long term the volume of water requiring transport and treatment will decline and the remaining closure activity will consist of periodic pumping of remaining leachate into tank trucks for transport, treatment, and disposal as appropriate, and of inspection of the closed cells for integrity of the closure systems.

7.1.3.3 Records and Reporting

Records of inspections at the facility will be submitted to the regulatory agency in accordance with permit requirements. The anticipated reporting requirements are summarized as follows.

- Date and time of facility inspection.
- Name and firm of person/persons performing inspection.
- Completed facility inspection checklist.
- Results from/findings of inspection.
- Inspection note distribution list.

An annual report will be prepared and submitted in accordance with permit requirements. The annual report will cover all facility activities during the previous calendar year and include the information required by the facility permit.

7.2 Water Quality Monitoring

Water quality monitoring programs that PolyMet expects to be required by the various permits and regulatory programs applicable to the closure of mine and plant operations are summarized in Table 7-2. These programs will be finalized in the permitting process.

Table 7-2 Overview of Monitoring Programs During Closure

Monitoring Program	Purpose	Monitoring Plan Summary	General Locations
Mine Site			
Surface water monitoring	Evaluate trends in surface water quality of Partridge River during closure period.	Continuation of Operations Monitoring Program (Six sampling locations, see Table 7-3)	Partridge River (*See* Figure 7-1)
Stormwater monitoring	Evaluate trends in stormwater quality during closure period.	Continuation of Operations Monitoring Program (Seven sampling locations, see Table 7-4)	Outflows from the Mine Site (*See* Figure 7-2)
Pit water monitoring	Compare water balance with expected conditions. Evaluate trends in pit water quality during closure period.	One monitoring station at each pit, see Table 7-5	Stations installed to monitor levels and water quality in the Pit (*See* Figure 7-2)
Stockpile drainage monitoring	Compare water balance with expected conditions. Evaluate trends in stockpile drainage water quality during closure period.	Continuation of Operations Monitoring Program (Eleven sampling locations, see Table 7-6)	Stations installed to monitor drainage from each stockpile liner (*See* Figure 7-2) Stations installed to monitor drainage from the underdrain at each stockpile (*See* Figure 7-2)
Groundwater monitoring	Define groundwater flow rate and direction and evaluate water quality trends.	Continuation of Operations Monitoring Program (Thirty-three monitoring wells, see Table 7-7)	Surficial aquifer monitoring wells installed up gradient and down gradient of each stockpile (*See* Figure 7-3)
	Define groundwater flow rate and direction in the lower aquifer	(Three water level monitoring locations)	Existing lower aquifer monitoring wells (*See* Figure 7-3)
WWTF monitoring	Optimize the treatment operations and demonstrate acceptable effluent characteristics.	Continuation of Operations Monitoring Program (Influent and effluent monitoring, see Table 7-8)	WWTF
Pumping stations and pipeline flow monitoring	Compare water balance with expected conditions.	Two monitoring locations, see Table 7-9	Same locations as operations monitoring program. (*See* Figure 7-2)
Wetlands monitoring	Evaluate potential effects on mining operations on wetlands and provide the necessary information to reissue the Section 404 Clean Water Act wetland permit.	Twenty-five monitoring locations, see Table 7-10	Same locations as the baseline monitoring program (*See* Figure 7-4)

Monitoring Program	Purpose	Monitoring Plan Summary	General Locations
Plant Site			
Tailings Basin Pond	Monitor trends in basin pond water elevation and characteristics during the closure period.	One station sampled three times per year , see Table 7-11	Pond barge will be removed. A pond level and water quality sampling station will be established.
Tailings Basin seepage	Evaluate seepage rate and trends in effluent characteristics during the closure period.	Continuation of Operations Monitoring Program (Three samples per year from three seepage sumps, see Table 7-12)	Same locations as operations monitoring program (*See* Figure 7-1).
Groundwater	Evaluate groundwater quality trends during the closure period.	Continuation of Operations Monitoring Program (Six wells sampled April, July, October, see Table 7-12)	Same locations as operations monitoring program (*See* Figure 7-1).
Hydrometallurgical residue drainage	Evaluate water quantity and characteristics during the closure period.	Quarterly monitoring of leachate during closure, see Table 7-13	Underdrain from each disposal cell during initial closure phase

In aggregate, the monitoring programs will provide a comprehensive and thorough evaluation of water flow, water elevation and/or water quality on a continuous, or three times a year (first month of non freezing quarters –April, July, October) basis depending upon the monitoring program. The surface water monitoring, stormwater monitoring, stockpile drainage monitoring, Tailings Basin seepage, WWTF monitoring, and groundwater monitoring programs will be a continuation of the operational monitoring programs. During closure operations, the water elevation and quality of the pit water will be monitoring three times a year. The water flow between the Tailings Basin and mine pit will be monitored in a manner similar to the operations monitoring program, although the flow direction will be reversed. Tailings pond water elevation and quality will be monitored three times per year until the tailings pond level has stabilized. Finally, the characteristics of residue cell leachate during closure will be monitored quarterly.

A summary of each monitoring plan that has changed from the operations monitoring program is provided in Tables 7-3 through 7-13. For each monitoring program (see preceding discussion), the tables specify the following:

Media to be monitored

- GW = groundwater
- PS = process stream
- PW = process water
- S = seepage

Status of Monitoring System:

– E = existing

– P = proposed

– TBD = to be determined

Station ID: monitoring station nomenclature as shown in Tables 7-3 through 7-13

Location Map: Refers to figures that provide the location of monitoring stations

Frequency: the frequency of monitoring

Parameter Groups(s): Tables 7-14.1 through 7-15.6 provides lists of monitoring parameters for each program

Reporting Requirements: the frequency of monitoring report submittal

Table 7-3 Monitoring Plan – Surface Water (Partridge River) — NorthMet Project

Monitoring Plan (Overview & Purpose)	Media	Status	Station ID (Nomenclature)	Location Map	Frequency	Parameter Group(s)	Reporting Requirements	Additional Information
Surface Water Monitoring	SW	P	SW001 SW002 (PM-2) SW003 (PM-3) SW004 (PM-16) SW-004a SW005 (PM-4)	Figure 7-1	April, July, October	Flow Rate	Flow Rate Monitoring Reports • Annual • May, August, November	Monitoring of the Partridge River to define trends in water flow.
	SW	P	SWQ001 SWQ002 (PM-2) SWQ003 (PM-3) SWQ004 (PM-16) SWQ004a SWQ005 (PM-4)	Figure 7-1	April, July, October	Water quality SW List 1 (see Table 7-14.1)	Water Quality Monitoring Reports • Annual • May, August, November	Monitoring of the Partridge River to define trends on water quality

Table 7-4 Monitoring Plan – Stormwater — NorthMet Project

Monitoring Plan (Overview & Purpose)	Media	Status	Station ID (Nomenclature)	Location Map	Frequency	Parameter Group(s)	Reporting Requirements	Additional Information
Stormwater Monitoring	SW	P P P P P P P	OS-1 OS-2 OS-3 OS-4 OS-5 OS-6 OS-7	Figure 7-2	April, July, October	Flow Rate	Flow Rate Monitoring Reports • Annual • May, August, November	Monitor stormwater outflows from the Mine Site – there will be 7 outlet locations.
	SW	P P P P P P P	OSQ-1 OSQ-2 OSQ-3 OSQ-4 OSQ-5 OSQ-6 OSQ-7	Figure 7-2	April, July, October	Water quality SW List 2 (see Table 7-14.2)	Water Quality Monitoring Reports • Annual • May, August, November	Monitor water quality of stormwater outflows from Mine Site.

Table 7-5 Monitoring Plan – Pit Water — NorthMet Project

Monitoring Plan (Overview & Purpose)	Media	Status	Station ID (Nomenclature)	Location Map	Frequency	Parameter Group(s)	Reporting Requirements	Additional Information
Pit Water Monitoring	GW/ SW	TBD	Stations to be installed at East and West Pit	Figure 7-2	April, July, October	Elevation (prior to pit outflow) Flow (when continuous outflow occurs)	Elevation and Flow Monitoring Reports • Annual	Staff gages to be installed to monitor the filling of the east and west pit.
	GW/ SW	TBD	Stations to be installed at East and West Pit	Figure 7-2	April, July, October	Water Quality GW List 1 (see Table 7-14.4)	Water Quality Monitoring Reports • Annual	Monitor water quality of pit water during closure operations.

Table 7-6 Monitoring Plan – Stockpile Drainage — NorthMet Project

Monitoring Plan (Overview & Purpose)	Media	Status	Station ID (Nomenclature)	Location Map	Frequency	Parameter Group(s)	Reporting Requirements	Additional Information
Stockpile Drainage Monitoring	D	P P P P P P P P P P P	SL001 SL002 SL003 SL004 SL005 SL006 SL007 SL008 SL009 SL010 SL011	Figure 7-2	Continuous	Flow Rate	Flow Rate Monitoring • Annual • May, August, November	Monitor drainage from stockpile liners to compare water balance to expected conditions and define future pumping requirements – at least 1 location from each stockpile to define flows from various cover types (ET, Membrane, and combined). Accumulation of pump run hours and application of pump curves to calculate flow.
	D	P P P P P P P P P P P	SLQ001 SLQ002 SLQ003 SLQ004 SLQ005 SLQ006 SLQ007 SLQ008 SLQ009 SLQ010 SLQ011	Figure 7-2	April, July, October	Water Quality Drainage List 2 (see Table 7-14.3)	Water Quality Monitoring • Annual • May, August, November	Monitor water quality of drainage from stockpile liners.

Monitoring Plan (Overview & Purpose)	Media	Status	Station ID (Nomenclature)	Location Map	Frequency	Parameter Group(s)	Reporting Requirements	Additional Information
Stockpile Drainage Monitoring	D	P P P P P P P P P P P	SU001 SU002 SU003 SU004 SU005 SU006 SU007 SU008 SU009 SU010 SU011	Figure 7-2	Continuous	Flow Rate	Flow Rate Monitoring • Annual • May, August, November	Monitor drainage from the underdrains (beneath the liner) when flows are present. Accumulation of pump run hours and application of pump curves to calculate flow.
	D	P P P P P P P P P P P	SUQ001 SUQ002 SUQ003 SUQ004 SUQ005 SUQ006 SUQ007 SUQ008 SUQ009 SUQ010 SUQ011	Figure 7-2	April, July, October	Water Quality Drainage List 2 (see Table 7-14.3)	Water Quality Monitoring • Annual • May, August, November	Monitor drainage from the underdrains (beneath the liner) when flows are present.

Table 7-7 Monitoring Plan – Groundwater — NorthMet Project

Monitoring Plan (Overview & Purpose)	Media	Status	Station ID (Nomenclature)	Location Map	Frequency	Parameter Group(s)	Reporting Requirements	Additional Information
Monitor for impacts to groundwater quality resulting from stockpiles. Groundwater elevations will be monitored to evaluate the groundwater flow direction and gradient at each stockpile area. Groundwater elevations in the lower aquifer will be monitored to evaluate the groundwater flow direction and gradient across the mine area.	GW	P	Surficial aquifer: M-GW-001 through M-GW-031	Figure 7-3	Quarterly	Elevation, GW List 1 (see Table 7-14.4)	Annual Monitoring Report • Summarize water quality data and evaluate trends. • Evaluate groundwater flow gradient and direction.	Monitoring wells will be constructed as part of the initial stockpile construction activities. Surficial aquifer wells will be located upgradient and downgradient of each stockpile area. Wells will be near each water collection sump because water would be present at these locations. Groundwater is expected to flow toward the mine pit during mine dewatering operations. Groundwater flow direction is expected to revert to the natural flow direction after mine closure.
		E	MW-05-02, MW-05-08					
	GW	E	Lower aquifer: Ob1, Ob4, P1	Figure 7-3	Quarterly	Elevation, only		

Table 7-8 Monitoring Plan – WWTF — NorthMet Project

Monitoring Plan (Overview & Purpose)	Media	Status	Station ID (Nomenclature)	Location Map	Frequency	Parameter Group(s)	Reporting Requirements	Additional Information
Influent Streams • Category 3/4 • Category 1/2 • Hydrometallurgical Residue Leachate	PW	TBD	One station per influent stream	TBD	Continuous	Flow Rate	Annual Monthly	Operational monitoring of influent streams to evaluate if treatment is required.
					Daily Grab	WWTP List 1, Table 7-14.5		
Combined (Stage 1) Influent • Consists of Category 3/4 stockpiles and hydrometallurgical residue leachate.	Combined PW	TBD	Combined Influent	TBD	Continuous	Flow Rate	Annual Monthly	Monitor influent characteristics to modify and/or optimize treatment operations.
					Daily Grab	WWTP List 1, Table 7-14.5		
					Daily: 24-Hr Composite	WWTP List 2, Table 7-14.6		
					Monthly	WWTP List 3, Table 7-14.7		
Combined (Stage 2) Influent • Consists of flows from mine pit dewatering, Category 1 / 2 and Stage 1 effluent. • Monitor influent characteristics to modify and/or optimize treatment operations.	Combined PW	TBD	Combined Influent	TBD	Continuous	Flow Rate	Annual Monthly	Monitor influent characteristics to modify and/or optimize treatment operations.
					Daily Grab	WWTP List 1, Table 7-14.5		
					Daily: 24-Hr Composite	WWTP List 2, Table 7-14.6		
					Monthly	WWTP List 3, Table 7-14.7		
Effluent Monitor effluent characteristics to document water quality prior to reuse in closure operations.	TW	TBD	Effluent	TBD	Continuous	Flow Rate	Annual Monthly	Monitor performance of treatment operations
					Daily: 24-Hr Composite	WWTP List 2, Table 7-14.6		
					Monthly	WWTP List 3, Table 7-14.7		

Table 7-9 Monitoring Plan - Pumping Station - NorthMet Project

Monitoring Plan (Overview & Purpose)	Media	Status	Station ID (Nomenclature)	Location Map	Frequency	Parameter Group(s)	Reporting Requirements	Additional Information
Pumping Station and Pipeline Flows	P	P	PP-1 PP-2	Figure 7-3	Continuous	Flow rate and pressure	Annual	Monitoring both ends of the pipeline to detect leaks.

Table 7-10 Monitoring Plan – Wetlands: Closure — NorthMet Project

Monitoring Plan (Overview & Purpose)	Media	Status	Station ID[1] (Nomenclature)	Location Map	Frequency	Parameter Group(s)	Reporting Requirements	Additional Information
Wetlands – Operations Monitoring								
Mine Site Wetlands - Document effects of reclamation activities on wetlands. - Identify groundwater and surface water interaction in wetlands.	GW	E	1-20, 4A, 1M, 4M, 7M, 12M (Same as baseline)	Figure 7-4	Each year of the active reclamation plus 1 year. 1X / 2 Weeks during non-freezing months. Continuous at 4 stations during non-freezing months.	Elevation – relative to ground surface.	Annual Monitoring Report - Data summary and evaluation. - Identify future actions or changes to the reclamation program.	Provide sufficient hydrology information to evaluate reclamation impacts.

[1] Wells will be inspected and replaced as needed during the specified monitoring period.

Table 7-11 Monitoring Plan - Tailings Basin Pond Water Quality - NorthMet Project

Monitoring Plan (Overview & Purpose)	Media	Status	Station ID (Nomenclature)	Location	Frequency	Parameter Group(s)	Reporting Requirements	Additional Information
Tailings Basin Pond – Operations								
Tailings Basin Pond Water	Water	TBD	TBD	New Station	April, July, October	Elevation TP List 1, Table 7-15.1	Water Quality Monitoring Report • Annual	Monitoring intended to evaluate in-pond trends of water quality

Table 7-12 Monitoring Plan - Tailings Basin - NorthMet Project

Monitoring Plan (Overview & Purpose)	Media	Status	Station ID (Nomenclature)	Location Map	Frequency	Parameter Group(s)	Reporting Requirements	Additional Information
Seepage Collection System - Installed to collect seepage from Tailings Basin. - Seepage will be conveyed to the Tailings Basin.	Seep	P	SCS001 SCS002 SCS003	Figure 7-5	Monthly for first 2 years then April, July, October, if results allow	Flow rate SCS List 1, Table 7-15.2	Annual Report • Summarize volume of seepage collected. • Summarize seepage quality data and comparison to baseline. • Monthly then May, August, November	Tailings Basin seepage will be removed by horizontal drains installed at locations (2 stations) and by a seepage barrier at a third location. Samples collected from seepage sumps. Accumulation of pump run hours and application of pump curves to calculate flow. Initial monitoring period will establish a baseline for comparison of future seepage water quality data. Installation of the seepage collection system eliminates the need for monitoring stations SD001 - SD006 and WS011 – WS013
Groundwater Monitoring Wells - Evaluate compliance with permit conditions. - Establish procedure to develop compliance plan(s) for conditions that do not comply with permit conditions. - Establish reporting requirements for compliance plan(s).	GW	E E E E E	GW001 GW002 GW006 GW007 GW008 GW009	Figure 7-5	Monthly for first 2 years then April, July, October, if results allow	GW List 1, see Table 7-15.5	Annual Report • Summarize water quality data and evaluate trends • Monthly then May, August, November	Well GW009 is proposed as a background/reference area monitoring well.
		E E E	~~GW003~~ (Dry) GW004 GW005	Figure 7-5	Monthly for first 2 years then April, July, October is results allow	GW List 2, Table 7-15.6		Monitoring wells GW003, GW004, and GW005 will continue to be monitored if water is present in each well. The monitoring program will cease when the water level drops below the bottom of the existing wells. Monitoring will recommence if water rises.

Table 7-13 Monitoring Plan – Plant Site - NorthMet Project

Monitoring Plan (Overview & Purpose)	Media	Status	Station ID (Nomenclature)	Location	Frequency	Parameter Group(s)	Reporting Requirements	Additional Information
Hydrometallurgical Residue Drainage								
Closed disposal cell(s)		P	TBD	TBD	Annually for 5 years, thereafter Once every 5 Years for additional 15 years.	Settlement Closure Inspection	To be specified in permit, annual reports.	Elevation survey to monitor settlement/ consolidation of residue. Closure inspection as specified in permit.
Leachate transfer to active cell	L	P	TBD	TBD	Quarterly for first year, thereafter Annually when leachate is present.	Volume HR List 2 Table 7-15.4	To be specified in permit, annual reports.	Evaluate trends in quantity and characteristics over time.

PS – Production Solids
CS – Combined Solids
TBD – to be determined
PW – Process Water
HR – Hydrometallurgical Residue

Table 7-14 Monitoring Plan – Mine Site Parameter Lists — NorthMet Project

Table 7-14.1 SW List 1 (Partridge River)

- Cobalt (total & dissolved)
- Copper (total & dissolved)
- Iron (total & dissolved)
- Nickel (total & dissolved)
- Zinc (total & dissolved)

- Sulfate
- pH
- Specific Conductance
- Temperature
- Flow

- Calcium, Total
- Chloride
- Fluoride, Total
- Magnesium, Total
- Phosphorus, total

- Alkalinity, Total
- TDS
- Dissolved oxygen
- Hardness (calculated)
- TOC

Table 7-14.2 SW List 2 (Storm Water Outflows)

- Cobalt (total & dissolved)
- Copper (total & dissolved)
- Iron (total & dissolved)
- Nickel (total & dissolved)
- Zinc (total & dissolved)

- Sulfate
- pH
- Specific Conductance
- Temperature

- Calcium, Total
- Magnesium, Total

- TSS

Table 7-14.3 Drainage List 2 (Stockpile)

- Cobalt, dissolved
- Copper, dissolved
- Iron, dissolved
- Nickel, dissolved
- Zinc, dissolved

- Sulfate
- pH
- Specific Conductance
- Temperature
- Elevation

- Aluminum
- Calcium
- Chloride
- Magnesium
- Potassium
- Sodium
- Sulfate

- Alkalinity
- pH
- Conductivity
- TDS
- TSS
- Mercury, Total

Table 7-14.4 Groundwater Parameter List 1

- Cobalt, dissolved
- Copper, dissolved
- Iron, dissolved
- Nickel, dissolved
- Zinc, dissolved

- Sulfate
- pH
- Specific Conductance
- Temperature
- Elevation

- Aluminum
- Calcium
- Chloride
- Magnesium
- Potassium
- Sodium

- Alkalinity
- TDS
- TSS
- Mercury, Total

Table 7-14.5 WWTF Influent (WWTF List 1)

- Cobalt, dissolved
- Copper, dissolved
- Nickel, dissolved
- Zinc, dissolved
- Sulfate
- pH
- Specific Conductance

Table 7-14.6 WWTF Daily Effluent (WWTF List 2)

- Cobalt, dissolved
- Copper, dissolved
- Iron, dissolved
- Nickel, dissolved
- Zinc, dissolved
- Sulfate
- pH
- Specific Conductance
- Temperature
- Aluminum
- Calcium
- Chloride
- Magnesium
- Potassium
- Sodium
- Alkalinity
- TDS
- TSS
- Ammonium
- Nitrate
- Hardness
- Phosphorus

Table 7-14.7 WWTF Monthly Effluent (WWTF List 3)

- ICP Metals scan
- Mercury (low level)
- Additive Acute Toxicity (Calc.) (based on total copper, total nickel, and total zinc)

Table 7-15 Monitoring Plan – Plant Site Parameter Lists - NorthMet Project

Table 7-15.1 Tailings Basin Pond Water List 1 (TP List 1)

• Cobalt, dissolved • Copper, dissolved • Iron, dissolved • Nickel, dissolved • Zinc, dissolved	• Sulfate • pH • Specific Conductance		

Table 7-15.2 Seepage Collections Sumps List 1 (SCS List 1)

• Cobalt, dissolved • Copper, dissolved • Iron, dissolved • Nickel, dissolved • Zinc, dissolved	• Sulfate • pH • Specific Conductance • Alkalinity • Hardness		

Table 7-15.3 Hydrometallurgical Residue List 1 (HR List 1)

	• Sulfate • pH • Specific Conductance	• Calcium • Magnesium • Sodium	• Chlorine

Table 7-15.4 Hydrometallurgical Residue List (HR List 2)

• Cobalt, dissolved • Copper, dissolved • Nickel, dissolved • Zinc, dissolved	• Sulfate • pH • Specific Conductance	• Calcium • Magnesium • Sodium	• Chlorine

Table 7-15.5 Groundwater Parameter List 1 (GW List 1)

• Cobalt, dissolved • Copper, dissolved • Iron, dissolved • Nickel, dissolved • Zinc, dissolved • Boron • Molybdenum	• Sulfate • pH • Specific Conductance • Temperature • Elevation	• Aluminum • Calcium • Chloride • Magnesium • Potassium • Sodium	• Alkalinity • TDS • TSS

Table 7-15.6 Groundwater (Hornfels Monitoring Wells) Parameter List 2 (GW List 2)	
• Cobalt, dissolved	• Sulfate
• Copper, dissolved	• pH
• Iron, dissolved	• Specific Conductance
• Nickel, dissolved	• Temperature
• Zinc, dissolved	• Elevation

These monitoring programs will be detailed in Sampling and Analysis Plans (SAP) that will prepared as part of the permit application process or as required by other regulatory programs. Each SAP will detail the monitoring stations, sampling frequency, sample collection protocol, analytical methods and parameters, and quality assurance requirements. At a minimum, the SAP will consist of a Field Sampling Plan (FSP) and a Quality Assurance Project Plan. The FSP will detail the field activities and documentation requirements for the sample collection and management in the field. The field activities and documentation requirements will be organized as Standard Operating Procedures specific to the various activities to be performed. The QAPP will detail the data quality objectives for the monitoring program, summarize the monitoring stations, analytical methods, parameters and quality control limits, data validation procedures, and data management practices.

The SAPs will incorporate analytical methods or standard practices approved by EPA or other agency as appropriate. Sample collection frequency was selected based on conditions specified in permits for similar operations, and considered potential rate of transport where appropriate.

7.3 Dam Safety Monitoring

Following closure, and for as long as the dams are deemed by the appropriate Dam Safety Regulatory Agency to be structures containing significant amounts of water, monitoring and reporting will be conducted to provide adequate information to measure the geotechnical performance of the dams. The primary reporting and monitoring requirements relevant to the dams are flood storage and freeboard requirements, and dam instrumentation as discussed in the following sections.

7.3.1 Flood Storage and Freeboard Requirements

The dams must be maintained with sufficient freeboard to store water from a Probable Maximum Precipitation (PMP) event. During operations the site PMP is estimated to raise the pond level by approximately 2 to 3 feet. The operational Tailings Basin and dams design also requires an additional 1 foot of freeboard above the PMP level to allow for wave run-up when water is stored within the basin. The total PMP freeboard requirement is 3 to 4 feet. All dams will meet this permit requirement prior to closure.

7.3.2 Instrumentation

Perimeter dams have instruments including inclinometers, piezometers, and movement monitoring locations. These instruments will be monitored and reported as required under the supervision of a professional engineer experienced in dam engineering. Instruments that are damaged or become inoperative may be replaced or abandoned and new instruments added as required at the direction of the engineer.

7.3.3 Inspection

The dams and basins will be visually inspected annually to verify that performance of the tailings and dams are within the predicted values, excess water is not accumulating in the basin, the spillway (if there is one) is discharging water that temporarily accumulates due to precipitation events, and properly maintained.

7.3.4 Reporting

A qualified licensed, engineer familiar with the site will complete a yearly dam safety review report. The review will consist of a site visit touring the basin to evaluate the current condition of the slopes, foundations, and vegetation as well as a review of available instrumentation data. The report will provide a summary of the conditions and recommendations for remedial work if required.

7.4 Reclamation Maintenance

Monitoring and maintenance of all reclaimed areas (mine slopes, stockpiles, Rail Transfer Hopper, Mine Site Building areas, Plant Site Building Areas and the Tailings Basin) will be inspected in the spring and fall.

Any areas that have been damaged by erosion or that have lost vegetation will be identified and plans to make repairs or reseed developed and implemented.

Inspection and repair will continue until the MDNR determines that the reclamation is stable and self-sustaining.

7.5 Post-Closure Water Treatment

At closure, Mine Site process water will continue to require treatment. In addition, leachate from the Hydrometallurgical Residue Facility at the Plant Site will no longer be routed back to the hydrometallurgical operations and will also require treatment. Treatment of these flows will be accomplished using the existing WWTF as the primary treatment mechanism and a constructed wetland treatment system that will be built within the former area of the East Pit to provide additional treatment prior to discharging the treated water to the West Pit. The treated water will flow from the East Pit into the West Pit and will eventually discharge to the Partridge River after the West Pit has been filled. This section summarizes the influent (process) water quality, the treatment operations that will be required, and the effluent quality.

7.5.1 Wastewater Treatment Influent Quantity and Quality after Closure

The anticipated influent water quality for the WWTF after closure is summarized in Table 7-16. The influent to the WWTF at closure will include the remaining Mine Site process water as well as drainage water from the closed cells at Hydrometallurgical Residue Facility.

Table 7-16 Post-Closure WWTF and Wetland Influent and Effluent Water Quality

Parameter	units	WWTF Influent			WWTF Effluent/ Wetland Influent			Wetland Effluent			Process Water Quality Target
		Year 21	Year 25	Year 30	Year 21	Year 25	Year 30	Year 21	Year 25	Year 30	
Flow	gpm	422	164	108	422	164	108	422	164	108	
Hardness	mg/L	4,554	4,306	3,761	546	532	504	546	532	504	
Fluoride (F)	mg/L	15.7	40.3	61.0	3.9	10.1	15.3	3.9	10.1	15.3	2.0
Chloride (Cl)	mg/L	145	125	113	145	125	113	145	125	113	230
Sulfate (SO_4)	mg/L	6,417	6,137	5,182	1,500	1,500	1,500	300	300	300	250
Aluminum (Al)	mg/L	6.26	8.95	1.42	0.06	0.09	0.014	0.06	0.09	0.014	0.125
Arsenic (As)	mg/L	0.21	0.28	0.32	0.02	0.03	0.03	0.010	0.014	0.016	0.01
Barium (Ba)	mg/L	0.057	0.076	0.086	0.028	0.038	0.043	0.028	0.038	0.043	2.0
Beryllium (Be)	mg/L	0.00021	0.00029	0.00011	0.00021	0.00029	0.00011	0.00021	0.00029	0.00011	0.004
Boron (B)	mg/L	0.30	0.36	0.40	0.28	0.34	0.38	0.28	0.34	0.38	0.5
Cadmium (Cd)	mg/L	0.0011	0.0016	0.0002	0.0011	0.0016	0.0002	0.0011	0.0016	0.0002	0.004
Calcium (Ca)	mg/L	448	458	471	150	150	150	150	150	150	
Chromium (Cr)	mg/L	0.036	0.031	0.028	0.036	0.031	0.028	0.036	0.031	0.028	0.10
Cobalt (Co)	mg/L	3.14	4.50	0.39	0.006	0.009	0.0008	0.0006	0.0009	0.00008	0.005
Copper (Cu)	mg/L	14.3	20.6	1.73	0.07	0.10	0.009	0.007	0.010	0.0009	0.030
Iron (Fe)	mg/L	17.2	24.4	2.53	0.02	0.02	0.003	0.002	0.002	0.0003	0.30
Lead (Pb)	mg/L	0.015	0.021	0.023	0.0076	0.0103	0.0117	0.0076	0.0103	0.0117	0.019
Magnesium (Mg)	mg/L	833	767	627	41.7	38.3	31.3	41.7	38.3	31.3	
Manganese (Mn)	mg/L	3.50	5.01	0.72	0.00	0.01	0.001	0.001	0.001	0.0002	0.05
Mercury (Hg)	mg/L	6.96E-06	9.24E-06	1.31E-05	6.96E-06	9.24E-06	1.31E-05	6.96E-06	9.24E-06	1.31E-05	1.30E-06
Molybdenum (Mo)	mg/L	0.101	0.087	0.080	0.101	0.087	0.080	0.101	0.087	0.080	0.10
Nickel (Ni)	mg/L	54.3	77.9	6.69	0.05	0.08	0.007	0.005	0.008	0.0007	0.10
Phosphorous (P)	mg/L	0.058	0.078	0.089	0.02888	0.03895	0.04444	0.02888	0.03895	0.04444	
Potassium (K)	mg/L	19.9	23.6	26.8	19.9	23.6	26.8	19.9	23.6	26.8	
Selenium (Se)	mg/L	0.039	0.034	0.031	0.039	0.034	0.031	0.039	0.034	0.031	0.005
Silicon (Si)	mg/L	15.7	14.5	14.4	15.7	14.5	14.4	15.7	14.5	14.4	
Silver (Ag)	mg/L	0.00020	0.00027	0.00031	0.00020	0.00027	0.00031	0.00020	0.00027	0.00031	0.001
Sodium (Na)	mg/L	1,061	993	994	1,061	993	994	1,061	993	994	
Thallium (Tl)	mg/L	0.0000086	0.000012	0.0000092	0.000009	0.000012	0.0000092	0.0000086	0.000012	0.0000092	0.00056
Zinc (Zn)	mg/L	1.87	2.68	0.26	0.19	0.27	0.03	0.19	0.27	0.026	0.388
Nitrate (NO_3)	mg/L	0.0016	0.0	0.0	0.0016	0.0	0.0	0.0016	0.0	0.0	10.0
Ammonium (NH_4)	mg/L	0.0016	0.0	0.0	0.0016	0.0	0.0	0.0016	0.0	0.0	

The only process water flows that will remain at the Mine Site after closure will be waste rock stockpile drainage. In Year 21, the quantity of this water will begin to decrease as the stockpile covers are completed, and will continue to decrease for the first ten years after closure, reaching a steady-state flow in approximately Year 30 as shown in Table 3-2. These flows will also vary seasonally. The quality of the waste rock stockpile drainage water is not expected to change significantly after Year 20. The predicted stockpile water quality values for post-closure are included in Appendix I of RS53/RS42.

The quantity of the hydrometallurgical residue drainage is expected to be approximately 300 gpm in the first year of closure and will decrease, similarly to the stockpile drainage, to a long-term steady-state flow of approximately 60 gpm or less by Year 30. The potential quality of this leachate has been predicted based on humidity cell testing and is described in detail in RS65.

7.5.2 Post-Closure Treatment Facility Operations

The WWTF described in RS29T will continue to be used during closure to treat the process water from the drainage of the Category 1/2, Category 3, and Category 4 waste rock stockpiles as well as the Hydrometallurgical Residue Facility drainage water. The WWTF will include nanofiltration to produce a clean permeate and a concentrated brine from the Category 1/2 drainage. The brine from the nanofiltration unit and the drainage from the Category 3 and Category 4 stockpiles will be treated using chemical precipitation to remove metals. Sulfate removal from the concentrated stream and the hydrometallurgical residue drainage will also be accomplished using chemical precipitation, most likely in a second treatment step. The permeate will be mixed with the water from the chemical precipitation process prior to a discharge to the East Pit wetland, as described below.

In addition to the WWTF operations, a constructed wetland will be built within the area of the former East Pit to provide additional treatment of the stockpile drainage water as shown conceptually on Figure 7-6). The wetland treatment system will be designed for passive operation. It will be sized to accommodate a peak flow of 450 gpm and a long-term flow of approximately 150 gpm, including the net groundwater inflow to the East Pit. The entire area of the East Pit, approximately 170 acres, will be used for the wetland treatment during the high flow condition, which occurs in the first year after closure. In the long-term, between 30 and 50 percent of the combined East Pit and Central Pit area (60 to 90 acres) will be used to treat the WWTF effluent.

The constructed wetland will be designed with an inflow area along the eastern boundary that will include a small equalization pond and an infiltration gallery to direct the influent to the subsurface of the wetland, approximately one meter below the wetland surface. Installation at this depth will facilitate winter operations, and allow the entire flow to encounter anoxic conditions as it moves through the treatment wetland. The wetland will be constructed above the waste rock fill in the East Pit and will be separated from the waste rock by a one-foot thick barrier layer constructed of compacted glacial till overburden from the Mine Site.

The wetland will be constructed with a splitter dike to allow flow to both the north and south sections of the wetland during high flow conditions. After flows decrease, the WWTF effluent will be directed to only to the south section of the wetland and the splitter dike will be notched to allow water from the north section to flow into the south section.

After being distributed into the subsurface, the water flowing through the wetland will flow out into a small equalization and re-aeration pond located immediately upstream of the outlet from the East Pit to the West Pit. Re-aeration will facilitate the precipitation of iron before this water is discharged to the West Pit.

7.5.3 Treatment Performance

The expected treatment performance for the wastewater treatment operations at closure are similar to the effectiveness anticipated during the mining operations. Metals will be precipitated as hydroxides while sulfate will be removed as gypsum. The expected water quality of the treated effluent in Years 21, 25 and 30 are summarized in Table 7-16. Year 30 effluent can used to conservatively represent long term water quality.

The wetland treatment system will provide additional treatment of sulfate and metals. The wetland vegetation will provide binding sites for adsorption of metals and the organic matter and plant extrudates will provide a source of organic carbon for use by sulfate reducing bacteria. Microbiological activity within the wetland will reduce the concentrations of both metals and sulfate. However, other dissolved salts such as sodium and chloride will be present at relatively high concentrations and will only be minimally treated by the constructed wetland operation. In the event that sodium and chloride concentrations adversely impact the wetland treatment performance, additional treatment for removal of these salts (for example, reverse osmosis treatment of a portion of the wastewater flow) will be used at the WWTF.

7.5.4 Treatment of West Pit Outflow to the Partridge River

Discharge of water from the Mine Site to the Partridge River will occur via the West Pit overflow beginning in approximately Year 59 (39 years after closure) as described in Section 3.1.3.2. When the West Pit overflow commences, the inflows to the West Pit will include the treated effluent from the WWTF – via the constructed wetland treatment system in the former East Pit – as well as inflows from direct precipitation, storm water runoff from the reclaimed areas of the Mine Site, and groundwater inflow to the East and West Pits.

The quality of the West Pit overflow water has been evaluated and is described in Section 3.1.5. The quality of the discharge water is expected to meet the chronic, in-stream water quality standards for the Partridge River. However, several parameters, in particular copper and cobalt have predicted values that are close to the potential discharge limits.

Additional treatment of the West Pit overflow, if necessary, would be accomplished using a constructed wetland treatment system that would be constructed between the West Pit outlet and Dunka Road, in the approximate area shown on Figure 3-2. The additional constructed wetland could be expected to reduce the metals concentrations by 50 percent or more, which would reduce the effluent concentrations to well below the potential discharge limits.

7.5.5 Post-Closure Wastewater Treatment Monitoring

Monitoring for treated wastewater facility effluent after closure is described in the monitoring plan described in Section 7.2.

7.5.6 Water Treatment Solid Waste Residuals Management – Post-Closure

After closure of the Hydrometallurgical Residue Facility, solid waste (chemical precipitates) generated from wastewater treatment operations will be characterized and then disposed in an off-site, licensed solid waste disposal facility. Solid wastes from other wastewater treatment operations used in the treatment of acidic drainage from mining operations have been tested and shown to be non-hazardous, as defined by U.S. EPA toxicity characteristic leaching procedure (McDonald, *et. al*., 2006).

8.0 Closure Estimate

PolyMet Mining proposes to provide a contingency cost estimate in the Permit to Mine application that will describe the necessary components and unit costs. The contingency cost estimate will provide an up-to-date and relevant assessment of the costs for closure at the end of the first year of operation. This information will be a central part of the financial assurance that PolyMet will provide to the State of Minnesota. The contingency cost estimate will be updated regularly as part of the required operating permit and the financial assurances. The estimate includes remediation obligations assumed with the acquisition of the Cliffs Erie property.

The estimate in the January 2007 Detailed Project Description assumes that the facility is closed at the end of the 20-year proposed mine life. That estimate has not been updated to reflect changes resulting from the Supplemental Detailed Project Description submitted in July 2007.

9.0 Financial Assurance

This section describes the plan that PolyMet proposes to provide financial assurance to the State of Minnesota that the Closure Plan for proposed mining and processing activity at the Mine Site and Plant Site will be completed. The Closure Plan is described in Sections 2.0 to 7.0 and will be more fully detailed and finalized in the Permit to Mine. Section 8.0 is the Closure Estimate referencing the contingency closure cost estimate that will be included in the Permit to Mine application. The actual proof of financial assurance will be provided as part of the MDNR Permit to Mine process.

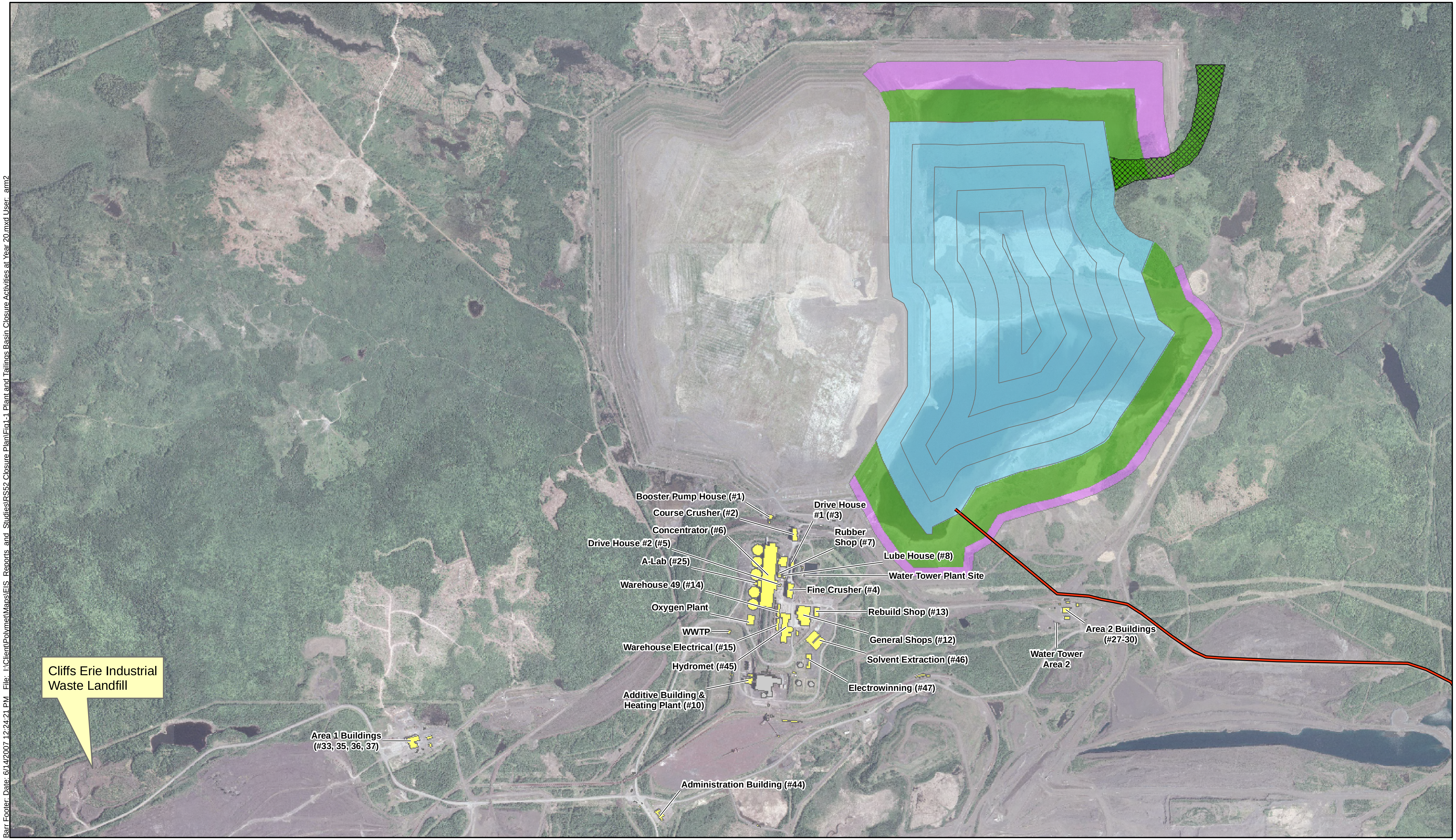
The central part of the plan is a Reclamation Cost Insurance (RCI) policy that will provide the State with a defined pool of capital combined with experienced operators and reclamation experts to ensure that the Closure Plan is completed to the satisfaction of State regulating agencies.

The RCI policy is the cornerstone of the reclamation and remediation program, both for existing liabilities transferred from Cliffs Erie to PolyMet and for future liabilities resulting from the proposed operations.

This approach offers several key advantages to the State compared with traditional corporate guarantees or simple performance bonds or letters of credit.

The RCI policy will be designed to provide coverage for reclamation costs necessary to implement and complete the Closure Plan. The policy will provide cost overrun protection that responds in the event that the actual cost to complete the required work is greater than originally estimated – this is a feature that does not exist with either a performance bond or a letter of credit. The cost overrun response is not limited to any single cause or causes but is typically a reflection of unanticipated reclamation work to fulfill the closure plan or increases in the cost of labor, equipment or materials encountered during site reclamation.

The policy can extend coverage to the regulatory agency in the event that PolyMet fails to perform the work. Adding the regulatory agency to the policy in this manner effectively provides the agency with Financial Assurance for the required reclamation work. Furthermore, it enables the agency to use the insurer to perform the required work in the event that the sponsor (PolyMet) fails to perform. This is in contrast to a performance bond or letter of credit where the agency's last resort is to use the pool money to do the work itself.

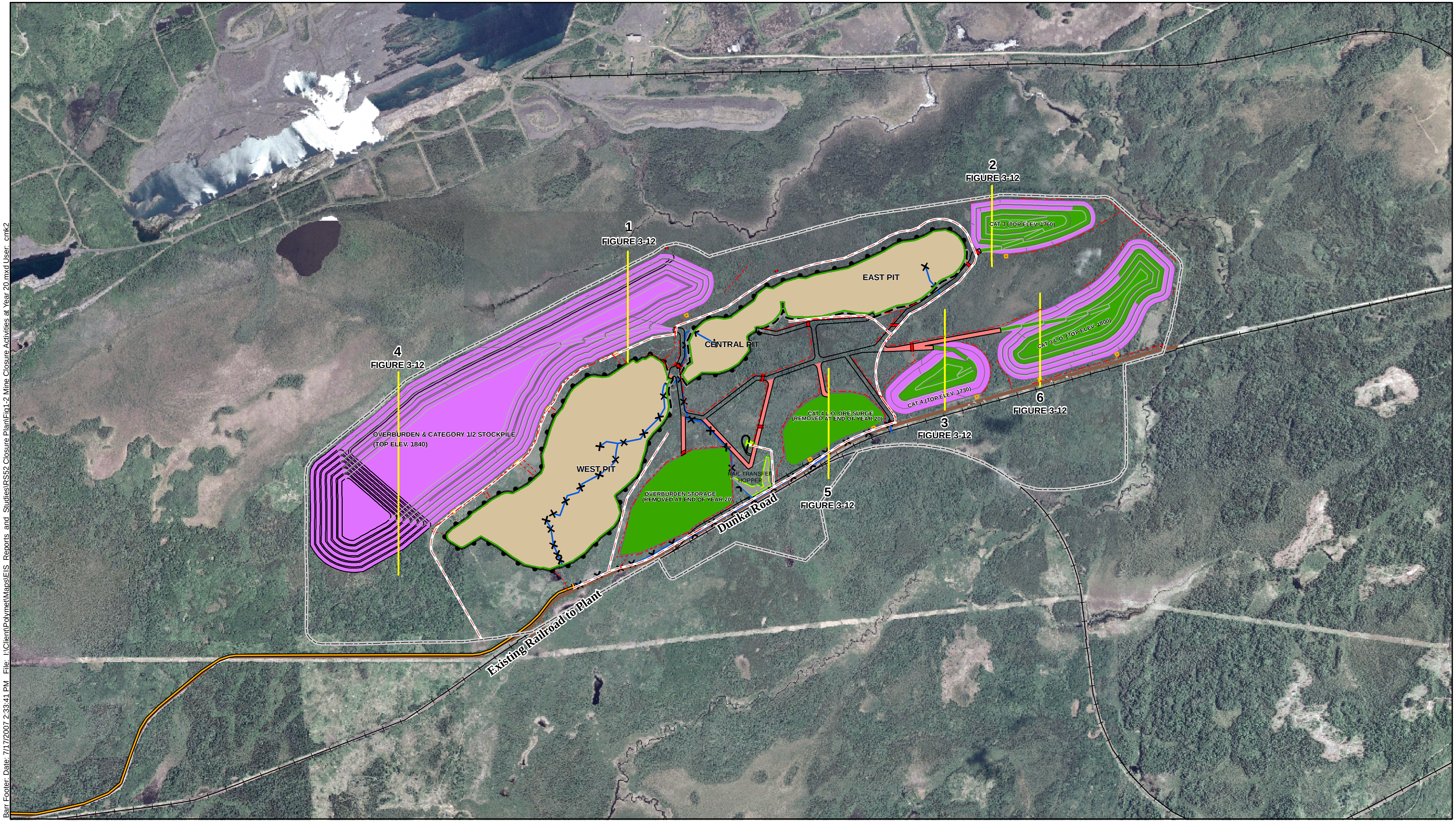


Building to be Demolished
Not PolyMet Building
Pipeline to be Demolished After Completion of Tailings Basin Drainage

Tailings Basin Reclamation
Current Reclamation
Previous Reclamation
Pond Area
Spillway

2,000 0 2,000
Feet

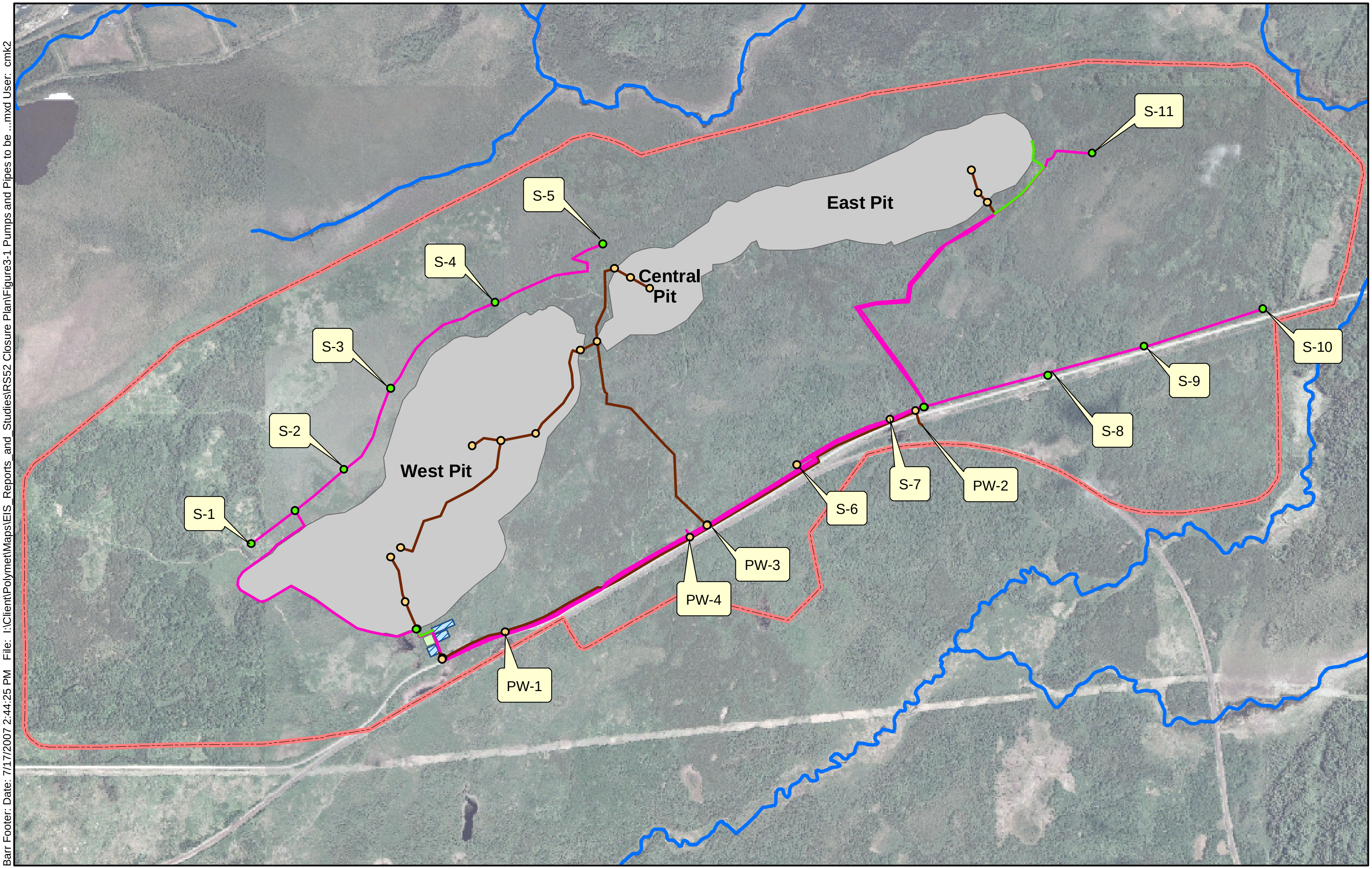
Figure 1-1
PLANT AND TAILINGS BASIN CLOSURE ACTIVITIES AT YEAR 20
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, MN



Mine Site
Removed 13.8KV Mine Powerline
Removed Pipe
Filled Ditch
Removed Culverts
Barbed Wire Fencing
Fencing Gates
Non-Climbable Fencing
Pipeline to be Demolished After Completion of Tailings Basin Drainage
Cross Section Locations
Current Reclamation Area
Previously Reclaimed Areas
Cover and Revegetation of Building Areas
Haul Roads Closed and Reclaimed
20 Yr Pit Extent

0 750 1,500 3,000 4,500
Feet

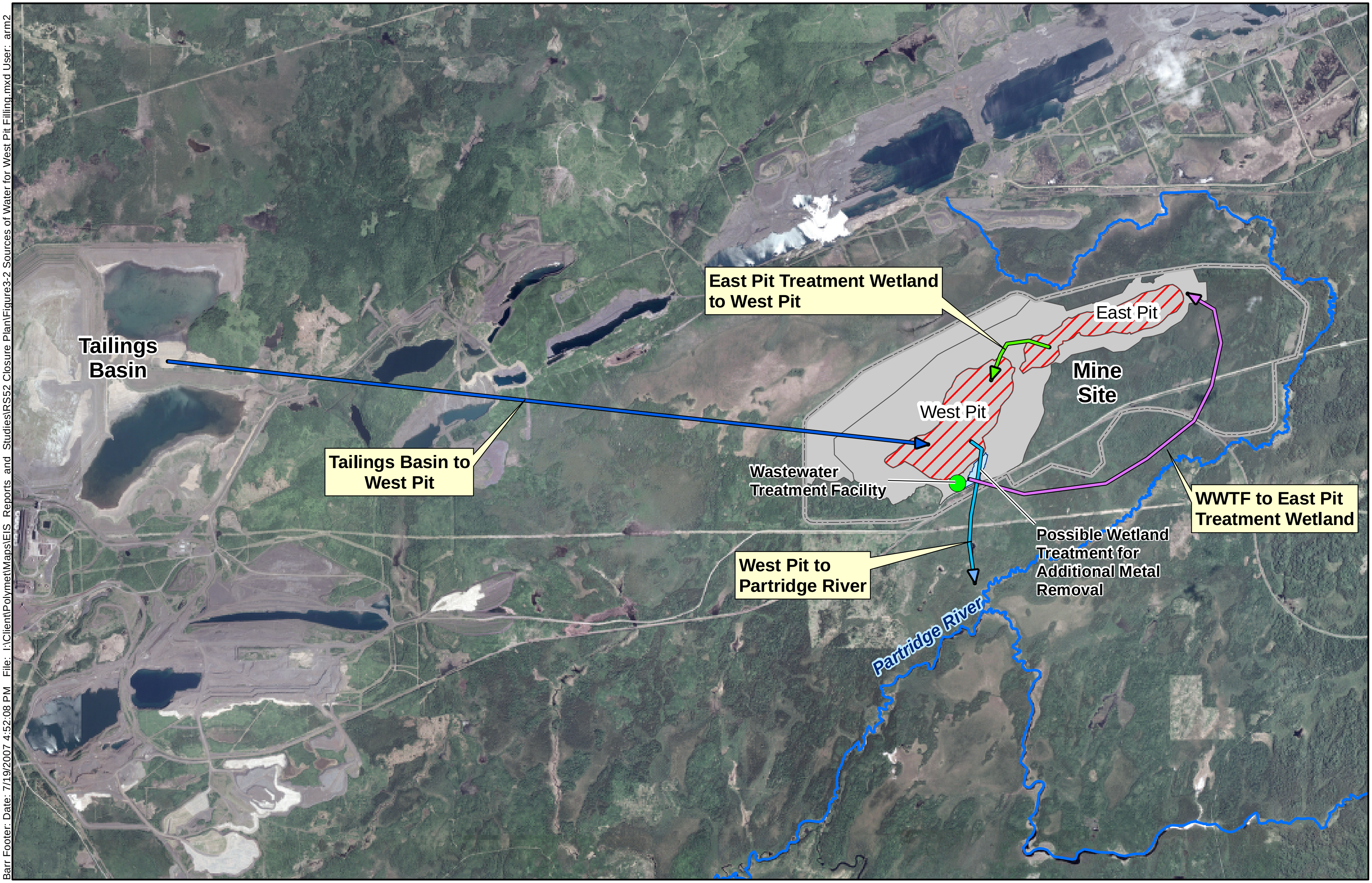
Figure 1-2
MINE CLOSURE ACTIVITIES
AT YEAR 20
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, MN



- Mine Site
- Mine Pits
- Wastewater Treatment Facility
- Equilization Ponds
- Streams/Rivers
- Maintained Pump
- Removed Pump
- New Pipe
- Removed Pipe
- Maintained Pipe

0 1,500 3,000
Feet

Figure 3-1
PUMPS AND PIPES TO BE MAINTAINED OR REMOVED IN CLOSURE
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, MN



Generalized Flow Direction

- East Pit Treatment Wetland to West Pit
- Tailings Basin to West Pit
- WWTF to East Pit Treatment Wetland
- West Pit to Partridge River

- Wastewater Treatment Facility
- Mine Site
- Open Pits
- Areas Draining to West Pit-East Pit

0 0.5 1 2
Miles

Figure 3-2
SOURCES OF WATER FOR WEST PIT FILLING
PREFERRED SCENARIO
NothMet Project
PolyMet Mining Inc.
Hoyt Lakes, MN

Figure 3-3 **Estimates of groundwater inflow rates to the West Pit**

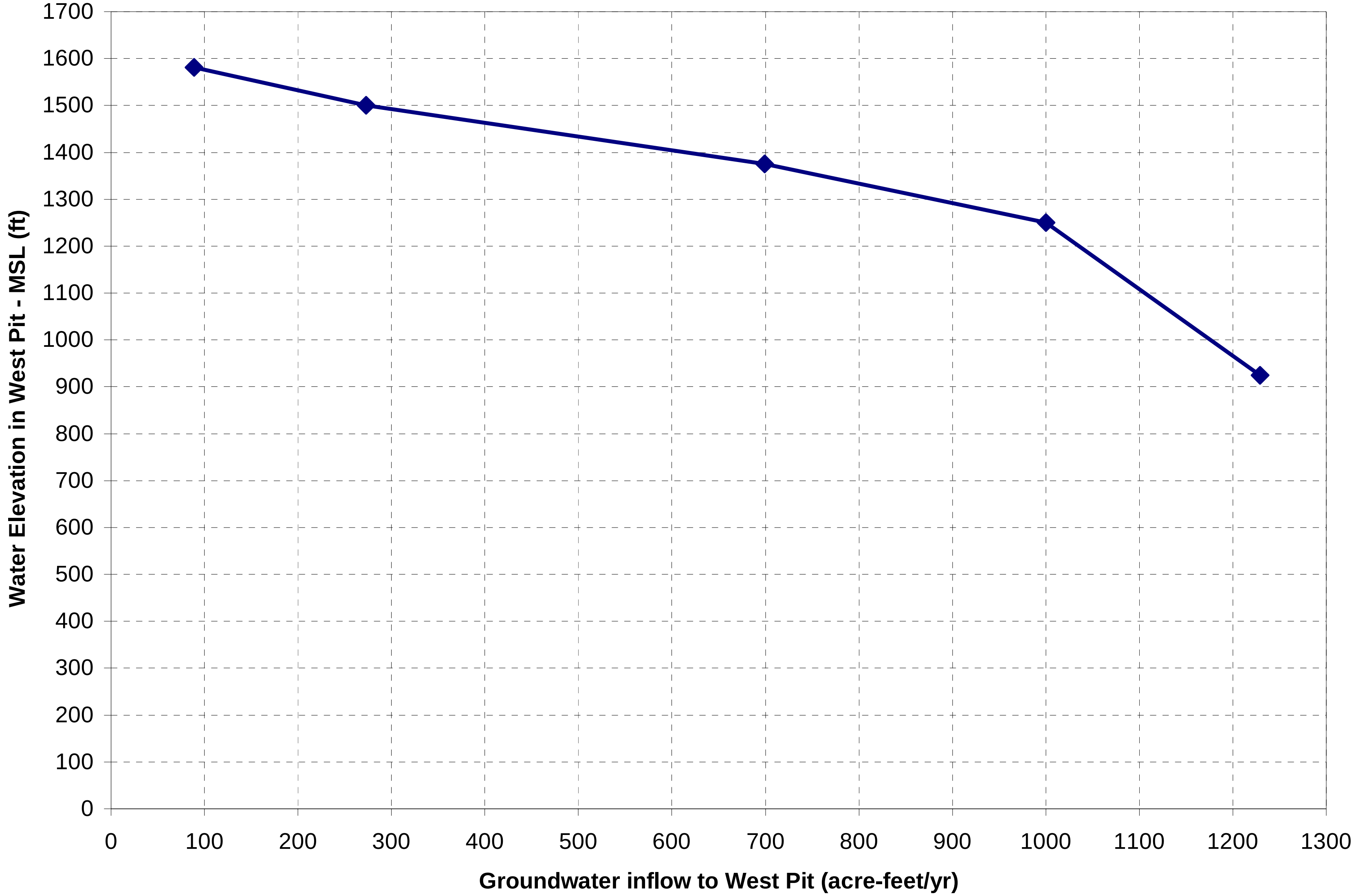


Figure 3-4 **Storage-elevation curve for Peter Mitchell Open Pit (West 1)**

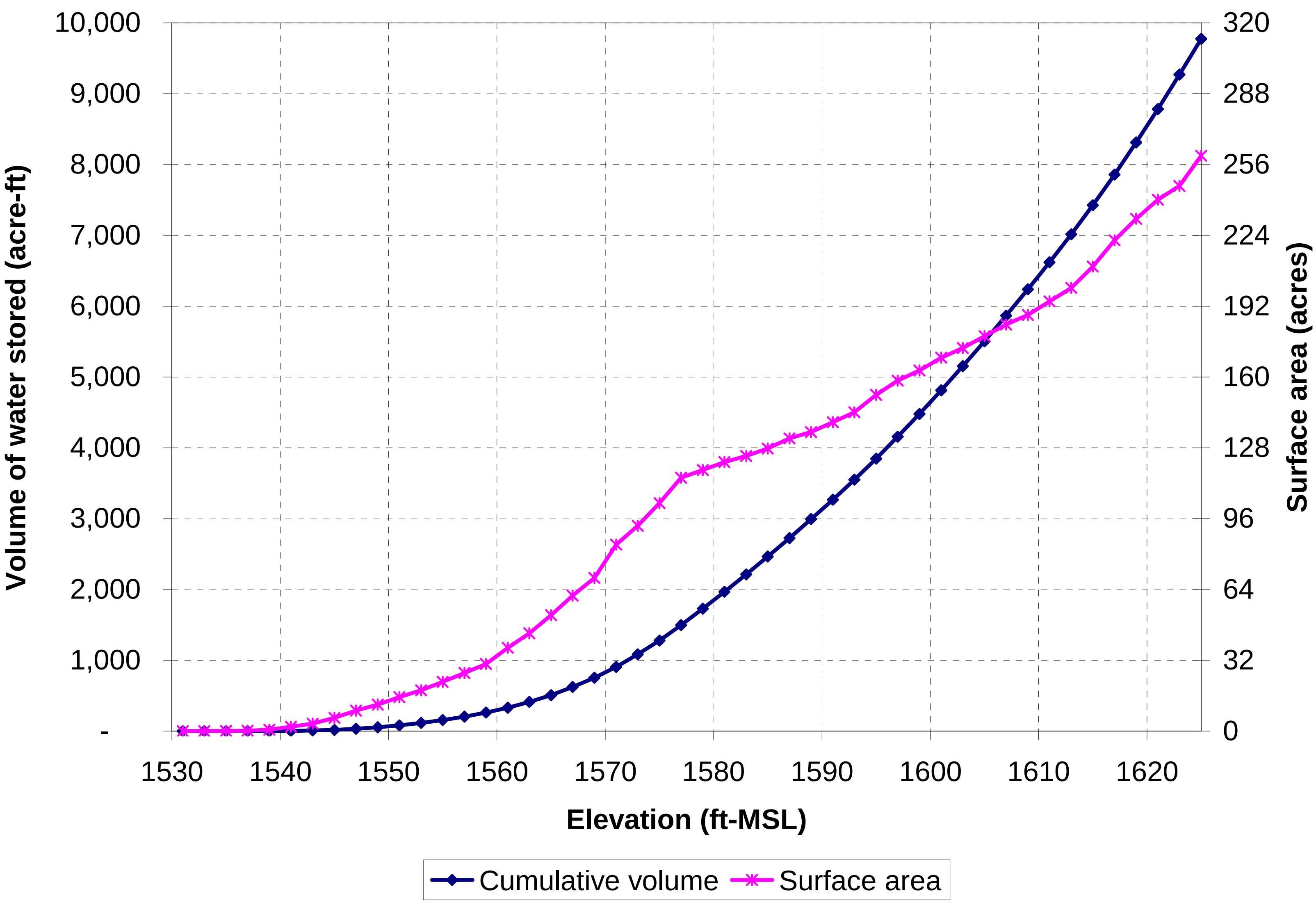
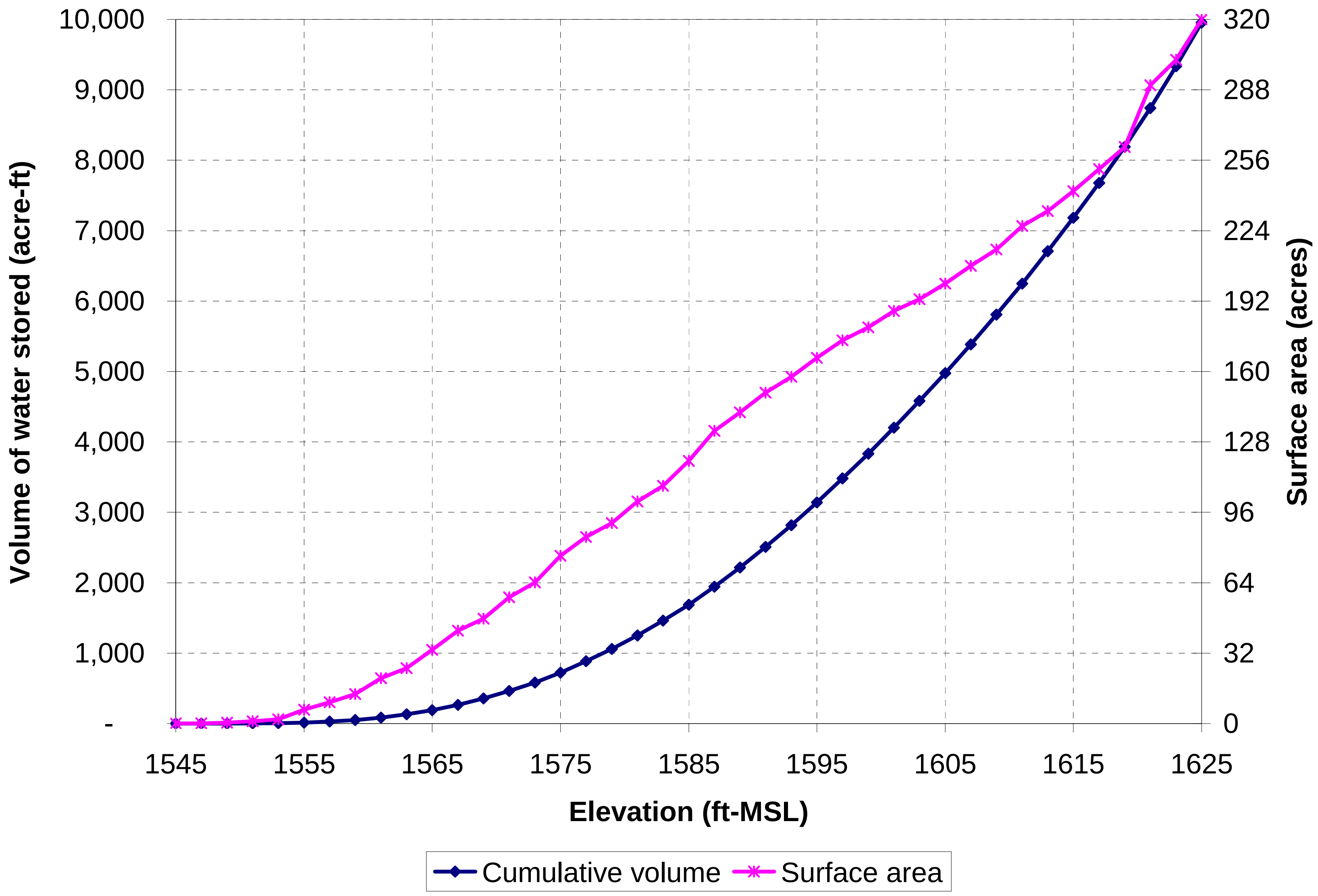
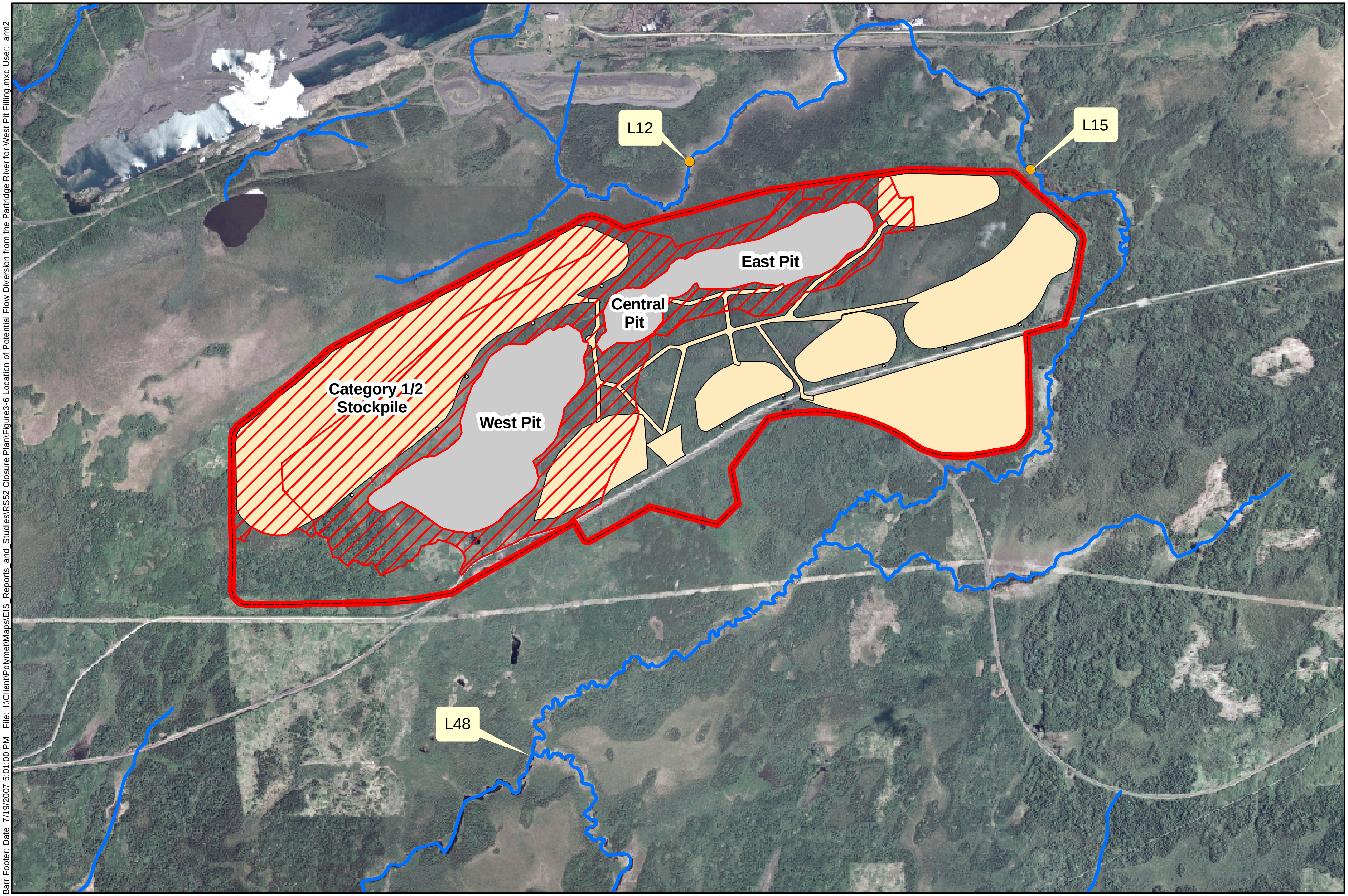


Figure 3-5 **Storage-elevation curve for Peter Mitchell Open Pit (West 2)**





Mine Site
West Pit Drainage Area
Mine Pits
Mine Facilities (Year 20)
Potential Diversion Locations
Partridge River System

0 0.5 1
Miles

Figure 3-6
LOCATION OF POTENTIAL FLOW DIVERSION FROM THE PARTRIDGE RIVER FOR WEST PIT FILLING
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, MN

Figure 3-7 **Rates of West Pit filling presented for different combinations of source water**

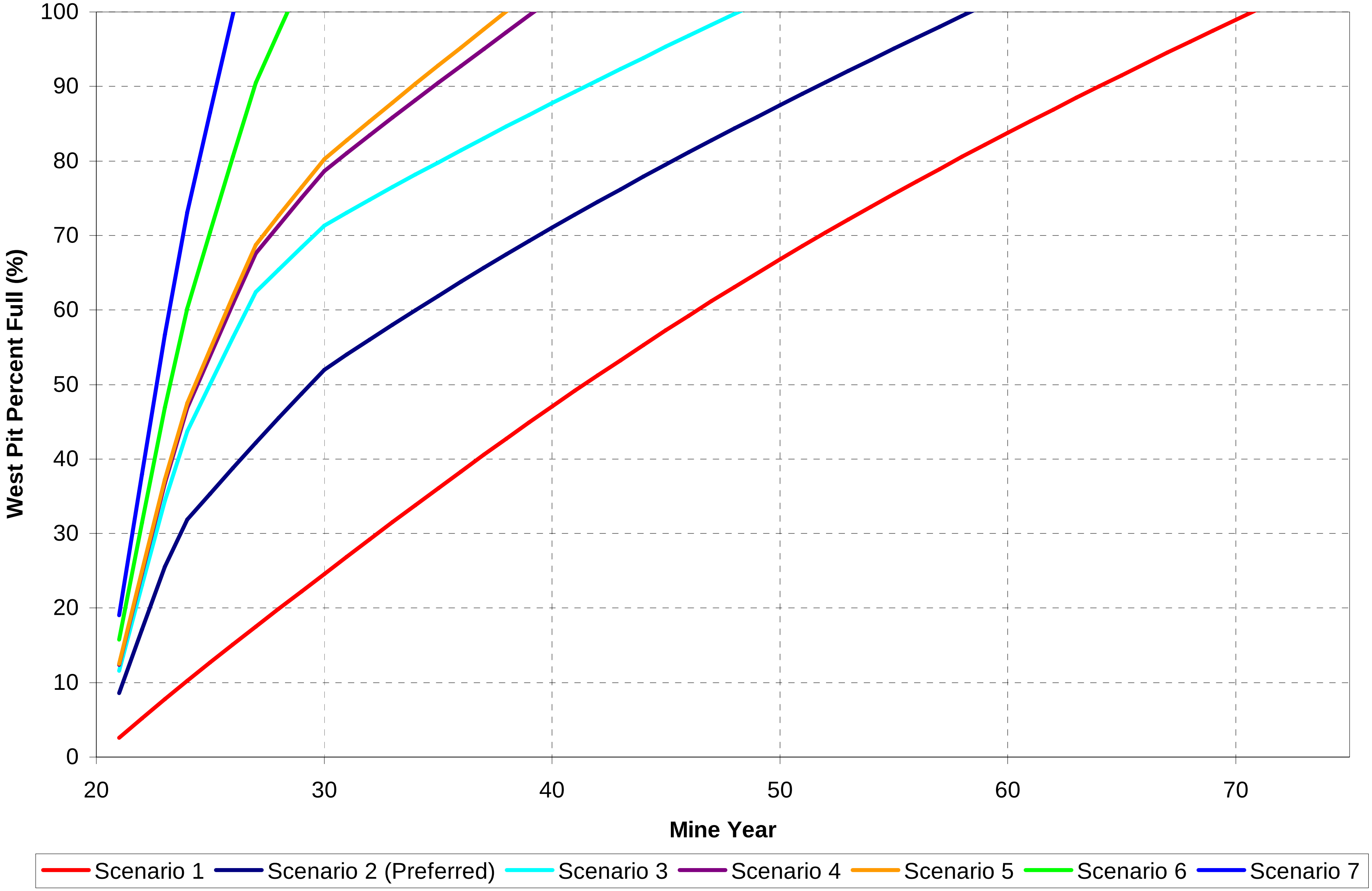


Figure 3-8 **Breakdown of water sources for West Pit filling, preferred scenario**

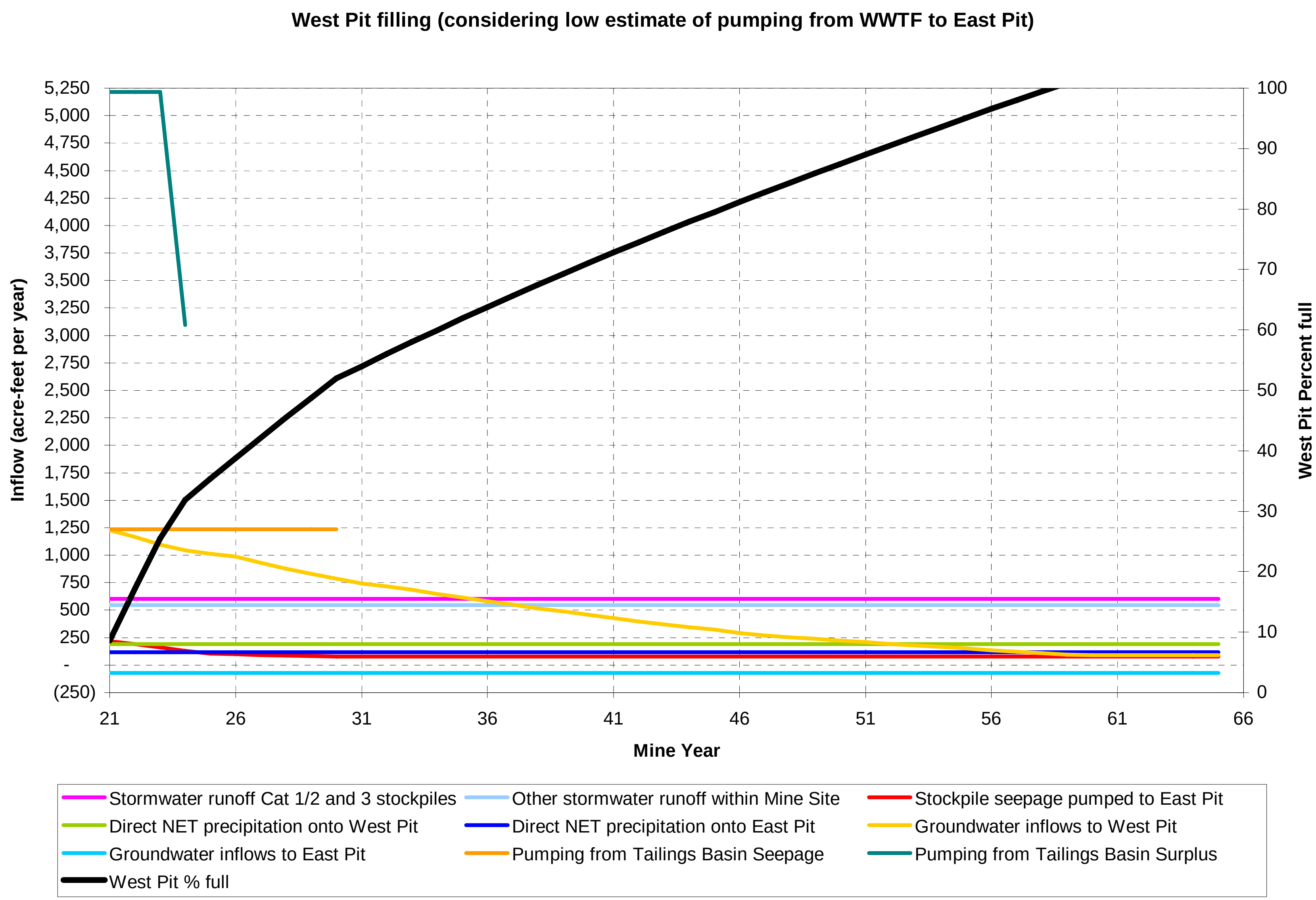


Figure 3-9 Predicted Concentration Trends for Sulfate, Cobalt, Copper and Nickel in East Pit Water

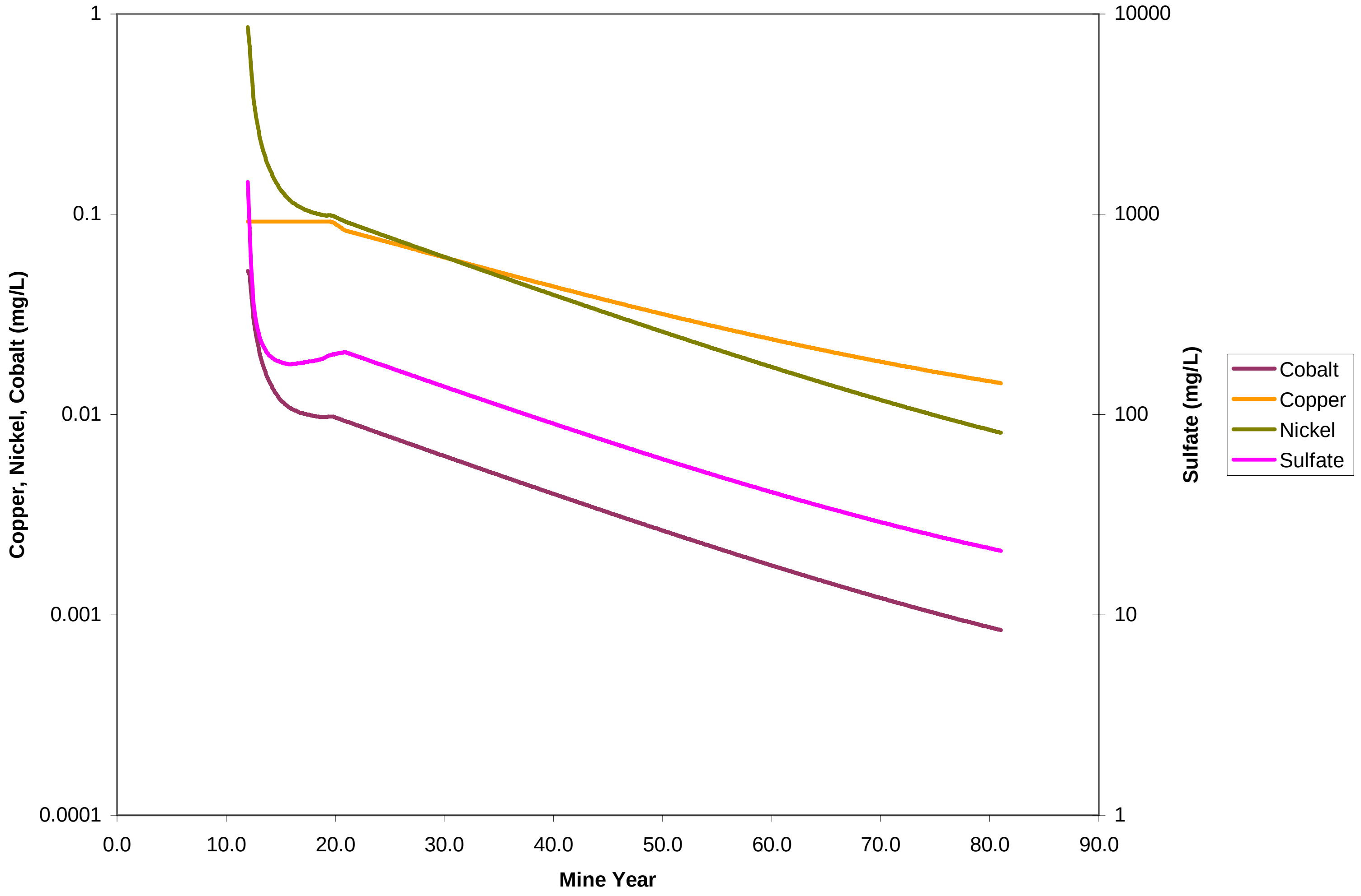


Figure 3-10 Predicted Concentration Trends for Sulfate, Cobalt, Copper and Nickel in West Pit Water

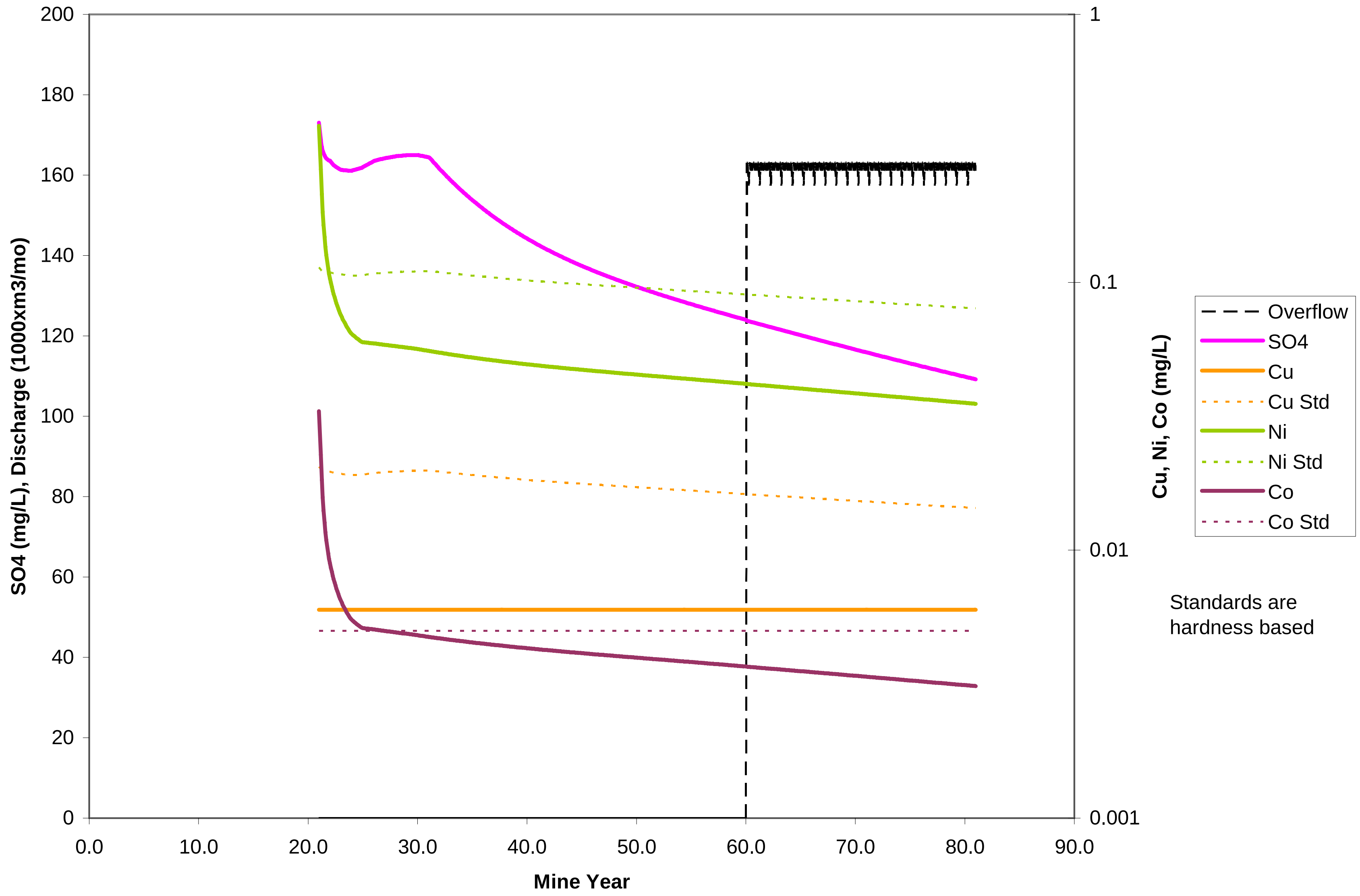


Figure 3-11 Typical cross section: East Pit head-wall cover membrane

P:23\69\862\Figures_Graphics\Quarry wall Slope Protection.CDR RLG 01-17-07

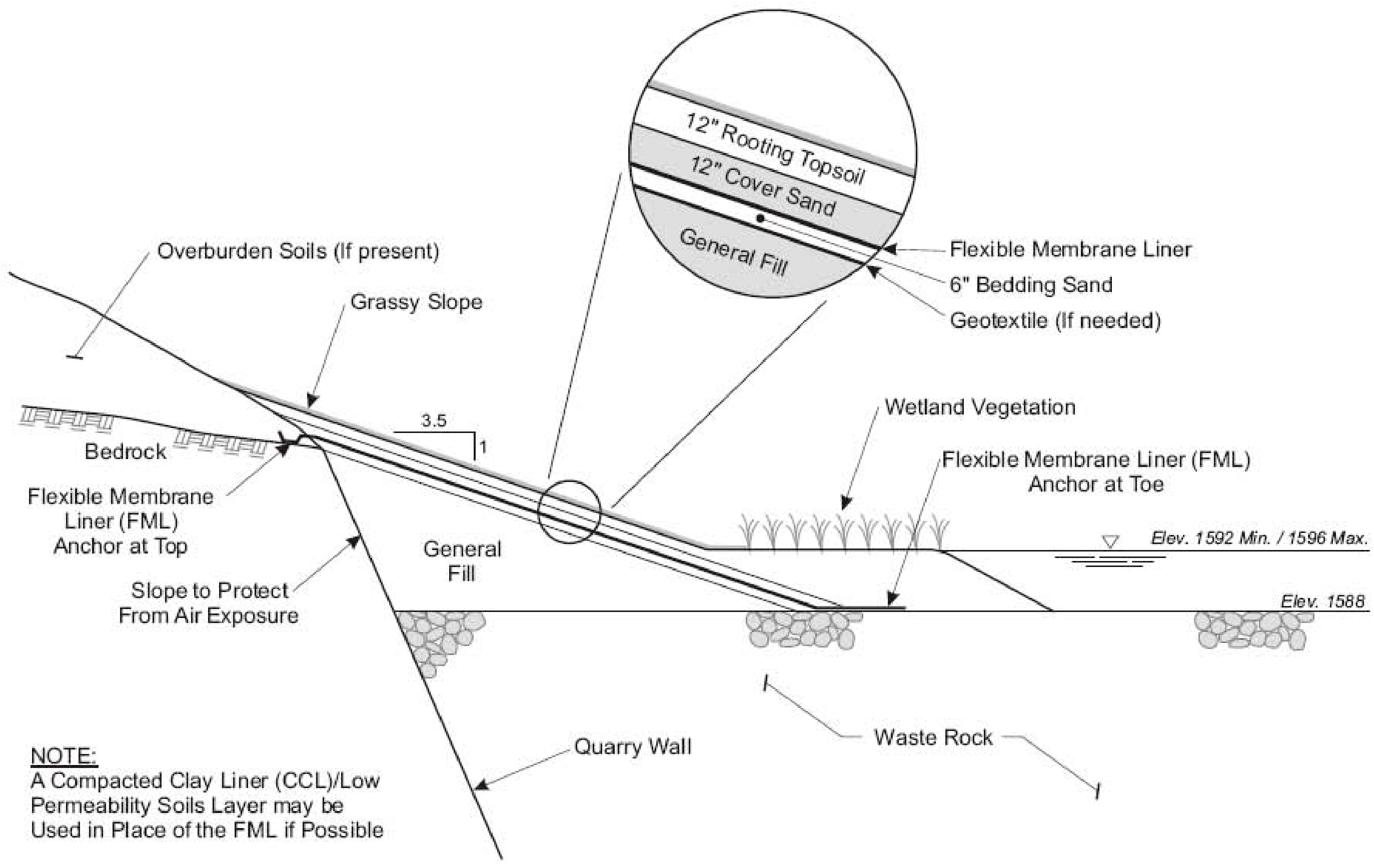
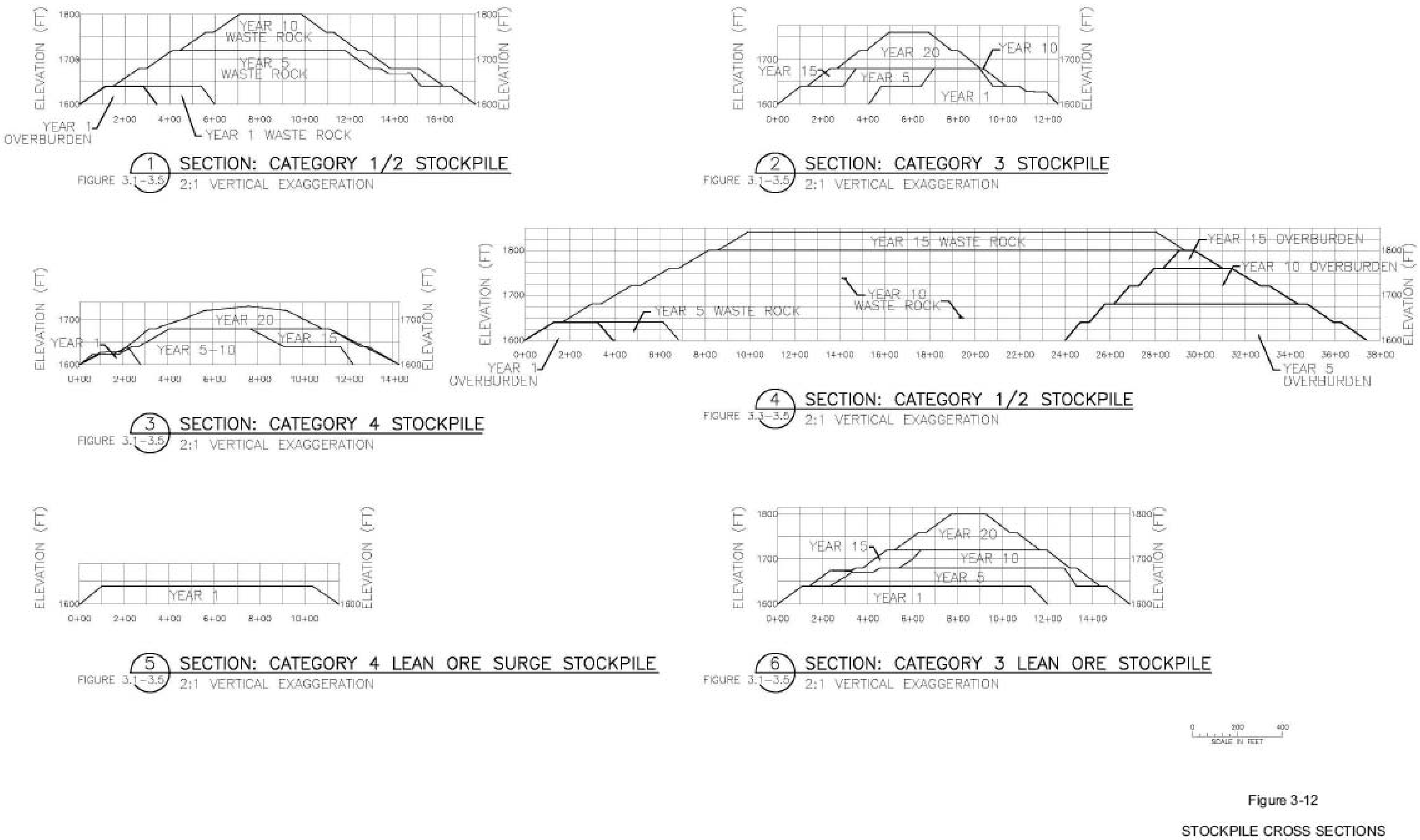


Figure 3-12 Stockpile cross sections



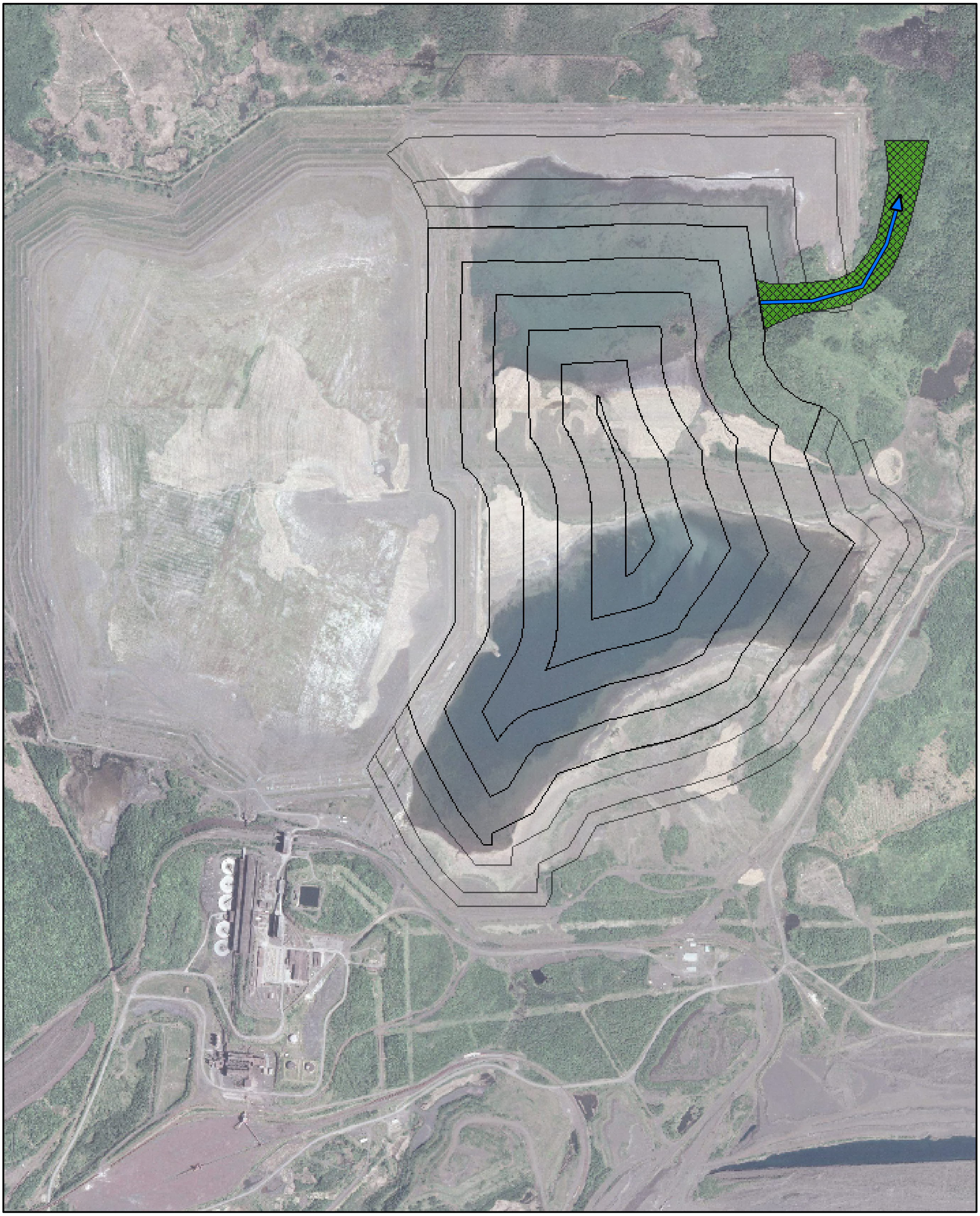
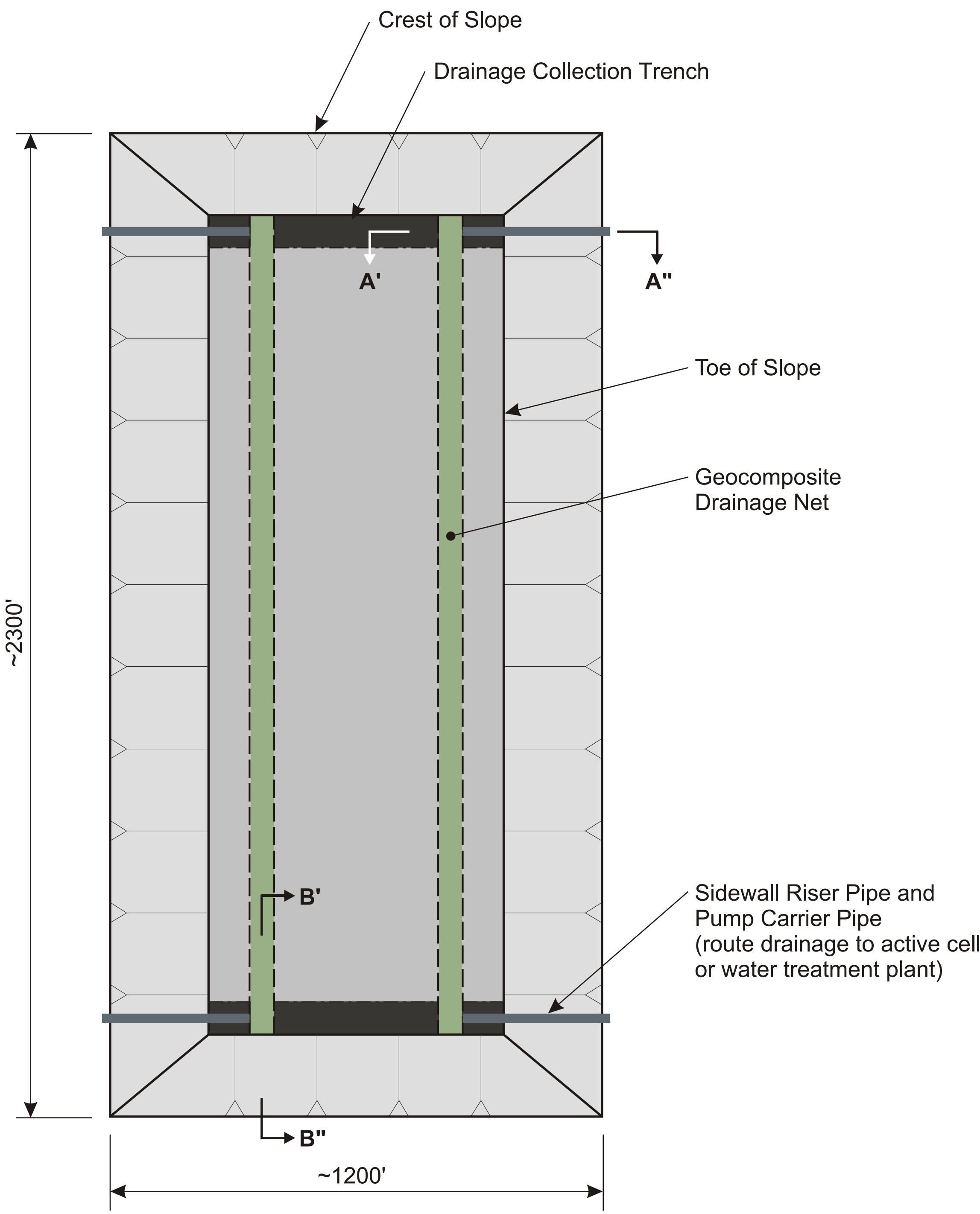
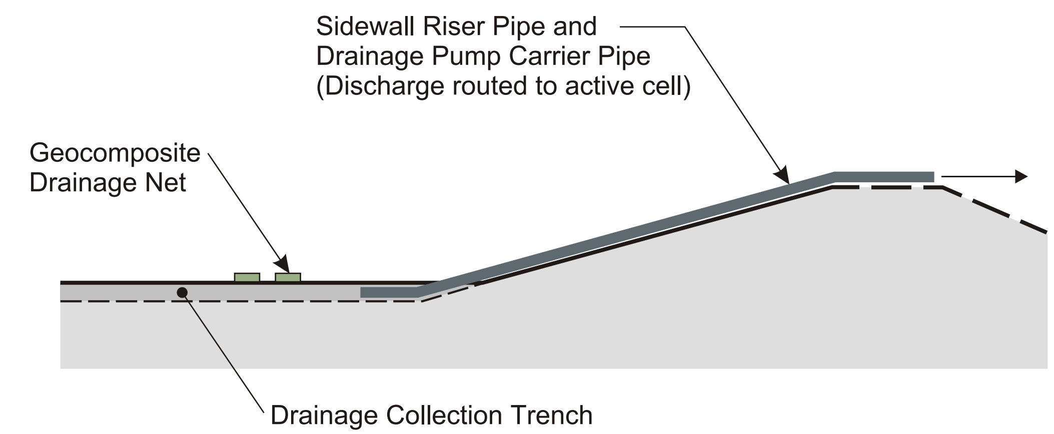


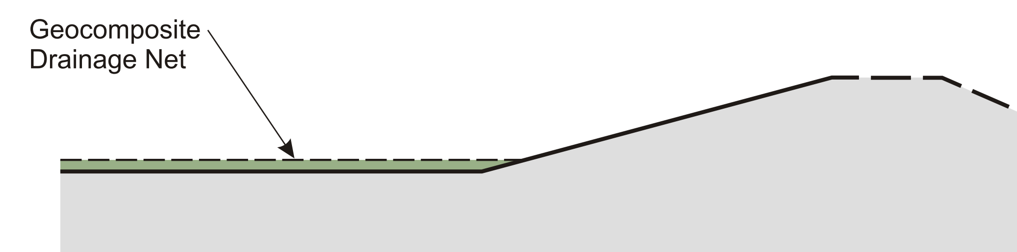
Figure 4-1
CLOSURE SPILLWAY
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, MN



PLAN VIEW



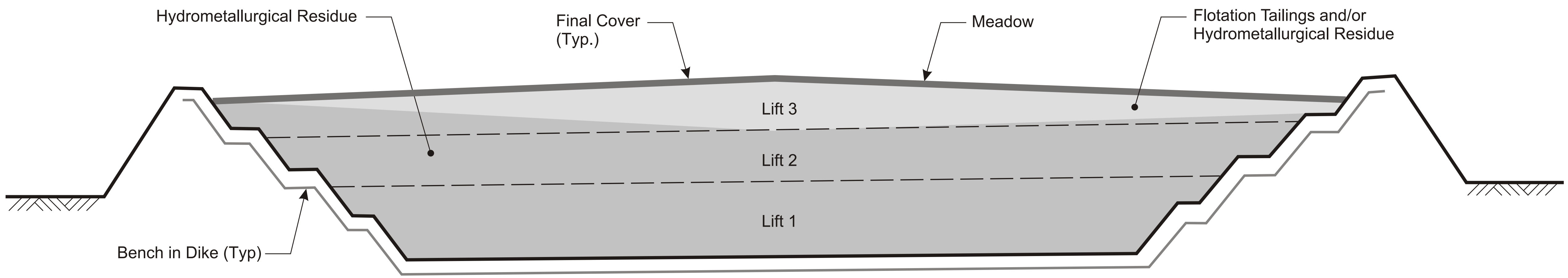
SECTION A' - A"



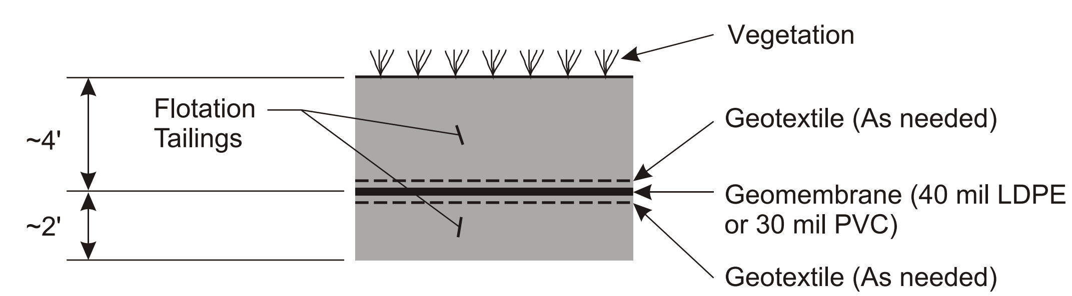
SECTION B' - B"

Figure 4-2

HYDROMETALLURGICAL RESIDUE FACILITY
DRAINAGE REMOVAL SYSTEM CONCEPT



NOT TO SCALE



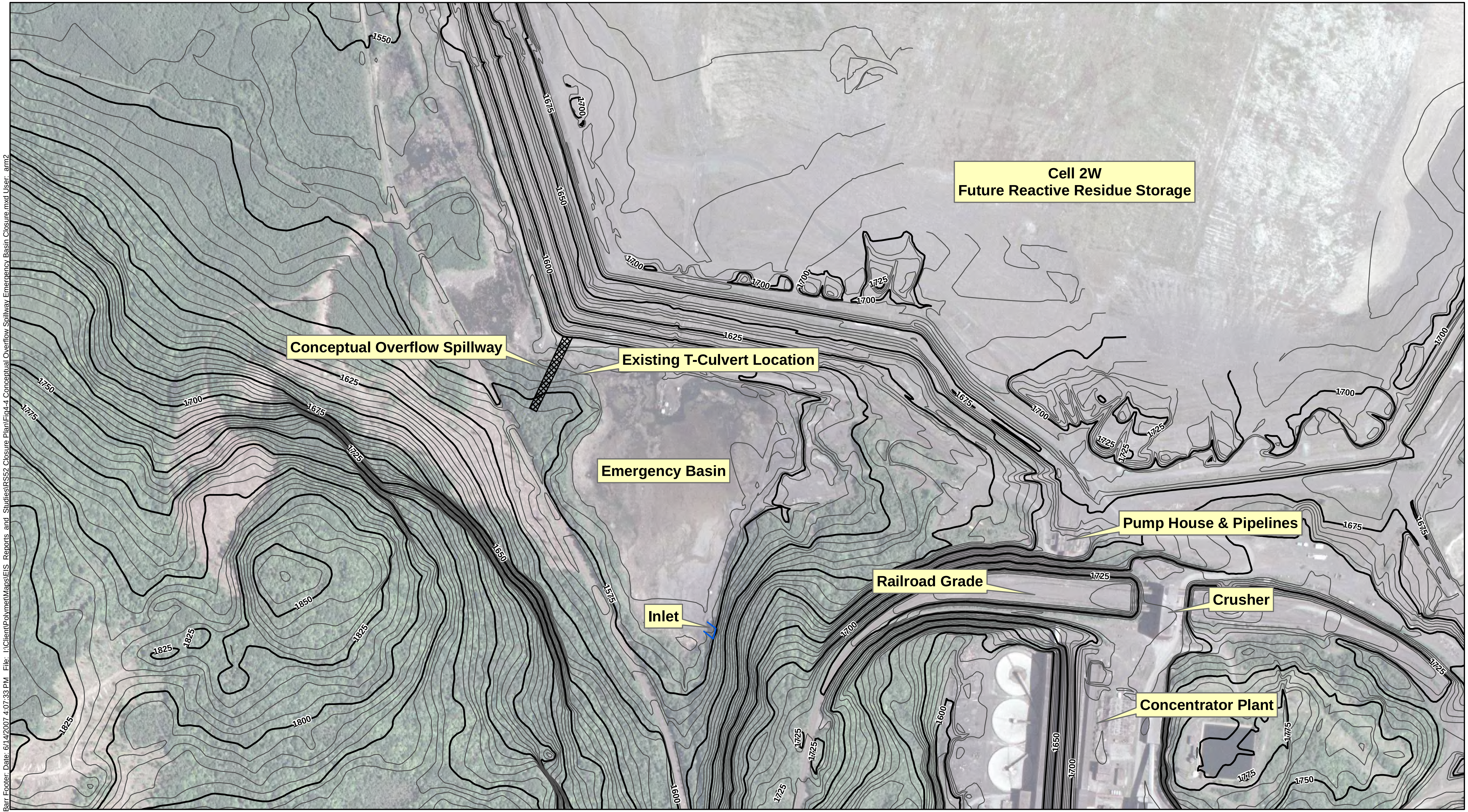
FINAL COVER (TYP.)

NOT TO SCALE

P:\23\69\862\Figures_Graphics\Proposed HRC Closure Approach.CDR RLG 06-14-07

Figure 4-3

PROPOSED
HYDROMETALLURGICAL RESIDUE CELL
CLOSURE APPROACH



Barr Footer: Date: 6/14/2007 4:07:33 PM File: I:\Client\Polymet\Maps\EIS_Reports and Studies\RS52 Closure Plan\Fig4-4 Conceptual Overflow Spillway Emergency Basin Closure.mxd User: arm2

DNR Mesabi Project 5' Contours
2003 FSA Aerial Photo

0 250 500 1,000
Feet

Figure 4-4
CONCEPTUAL OVERFLOW SPILLWAY
EMERGENCY BASIN CLOSURE
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, MN

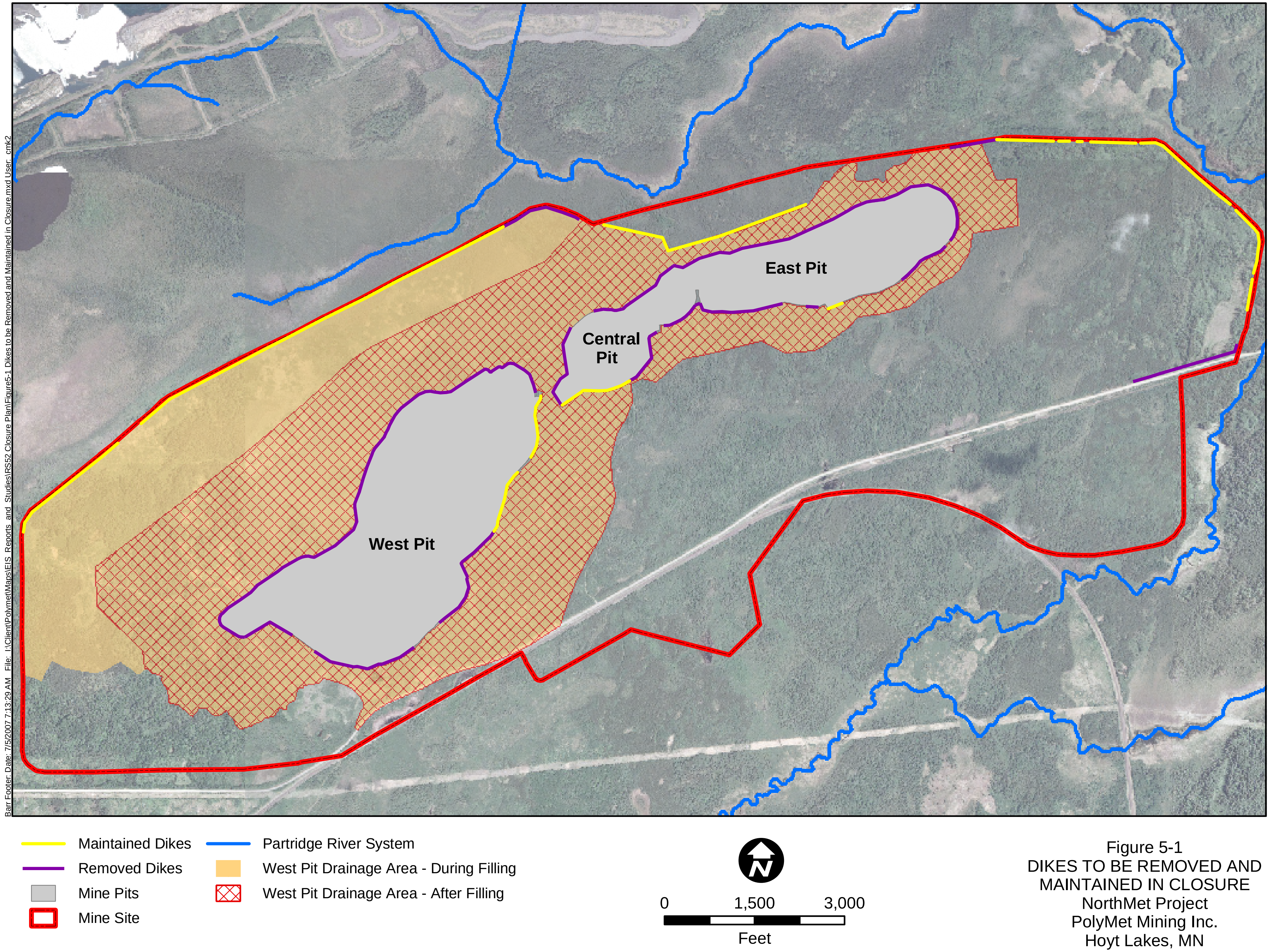


Figure 5-1
DIKES TO BE REMOVED AND MAINTAINED IN CLOSURE
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, MN

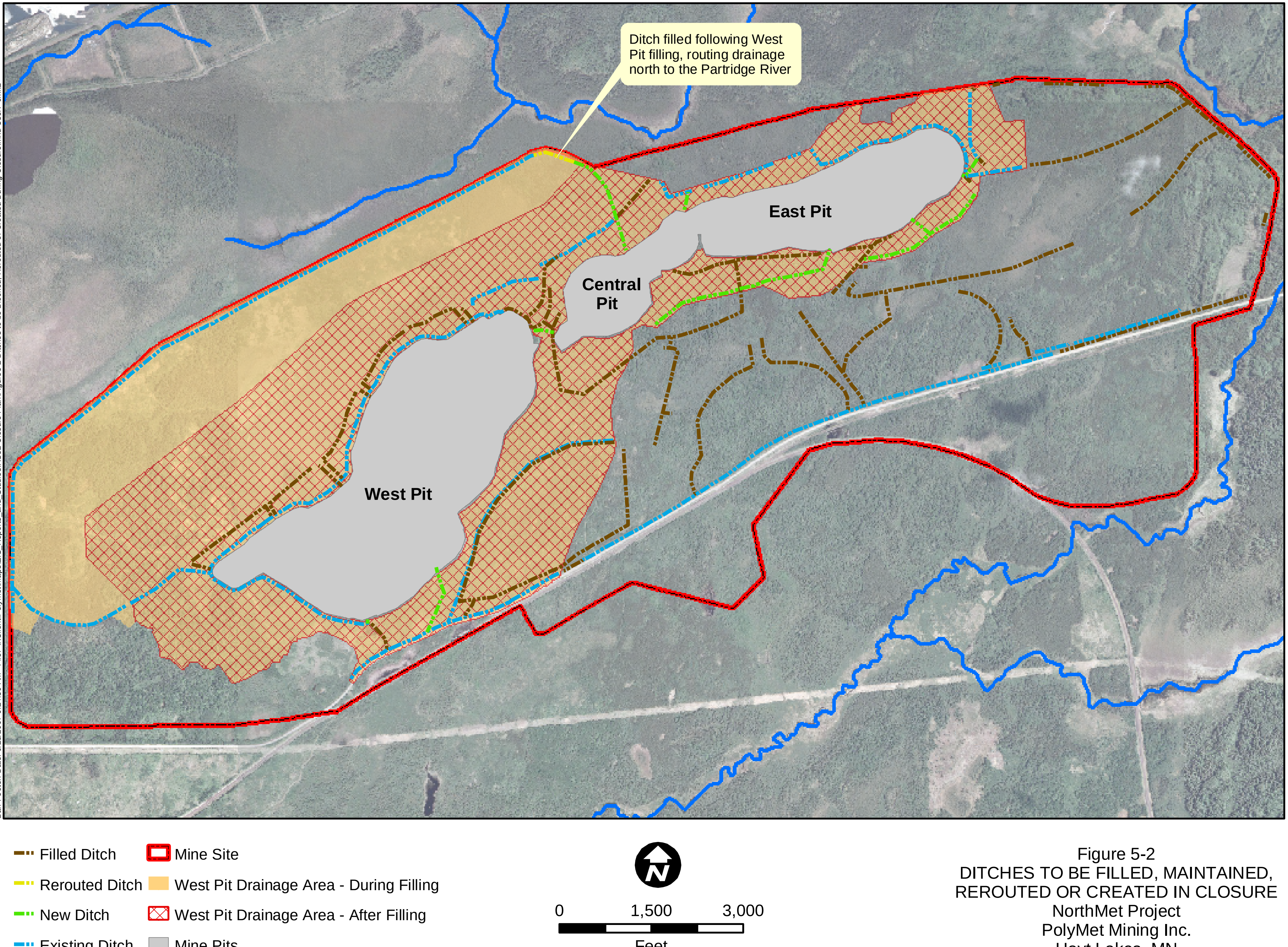


Figure 5-2
DITCHES TO BE FILLED, MAINTAINED, REROUTED OR CREATED IN CLOSURE
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, MN

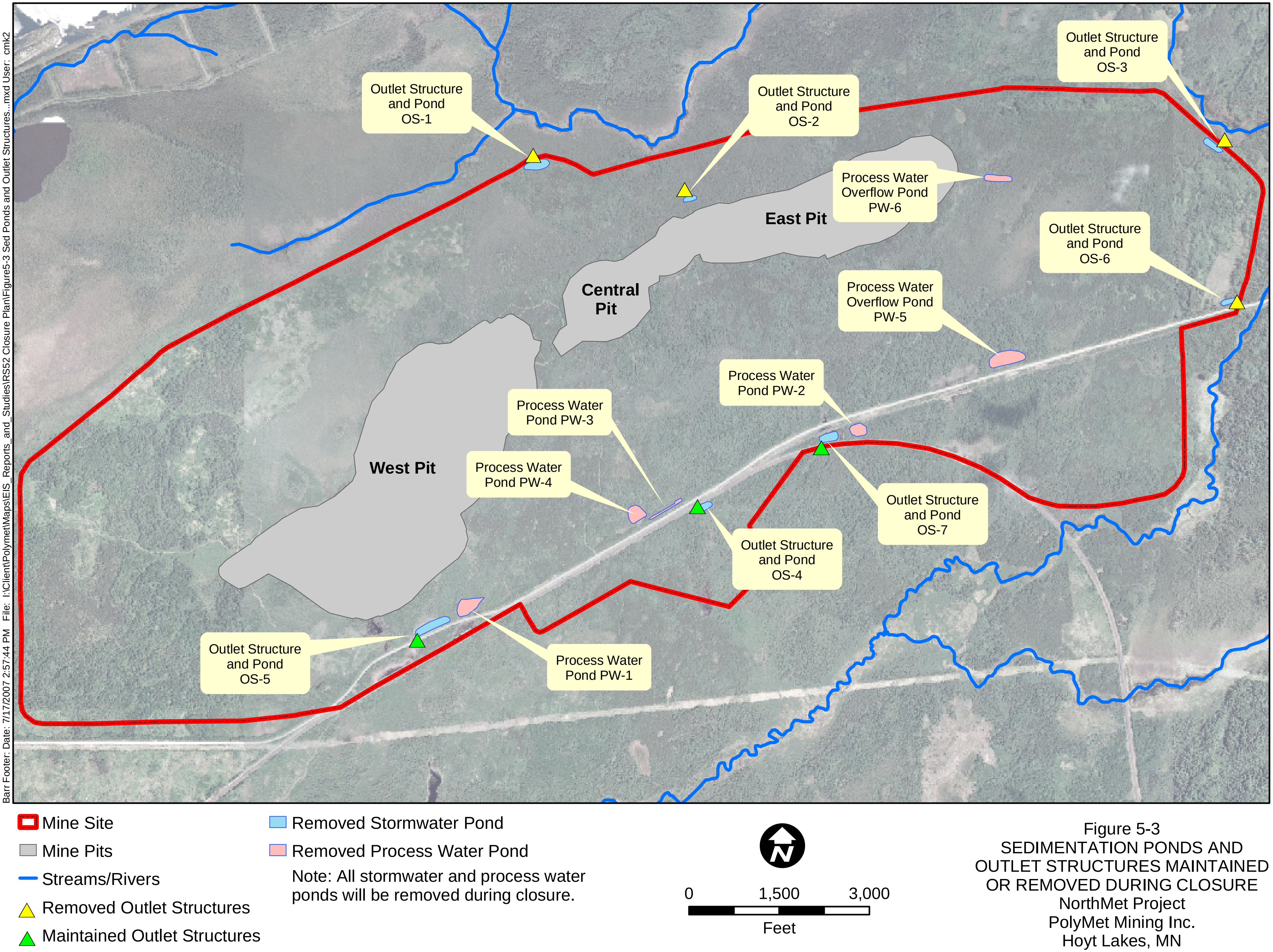


Figure 5-3
SEDIMENTATION PONDS AND OUTLET STRUCTURES MAINTAINED OR REMOVED DURING CLOSURE
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, MN

Figure 5-4 **Modeled Flows at SW-001, Near the Northern Boundary of the Mine Site, presented as percent reduction from Existing Conditions flows**

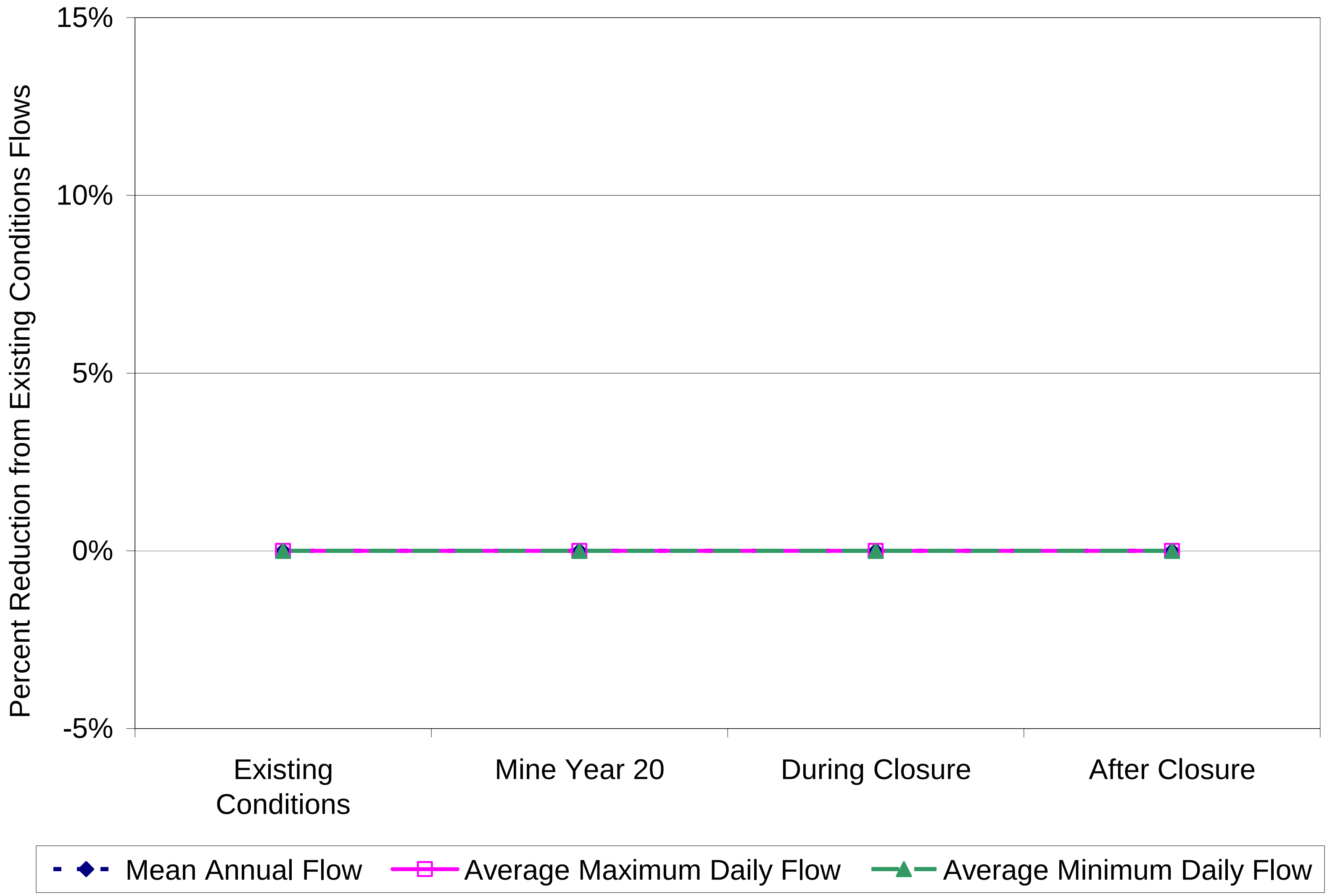


Figure 5-5 **Modeled Flows at SW-002, Near the Northeastern Boundary of the Mine Site, presented as percent reduction from Existing Conditions flows**

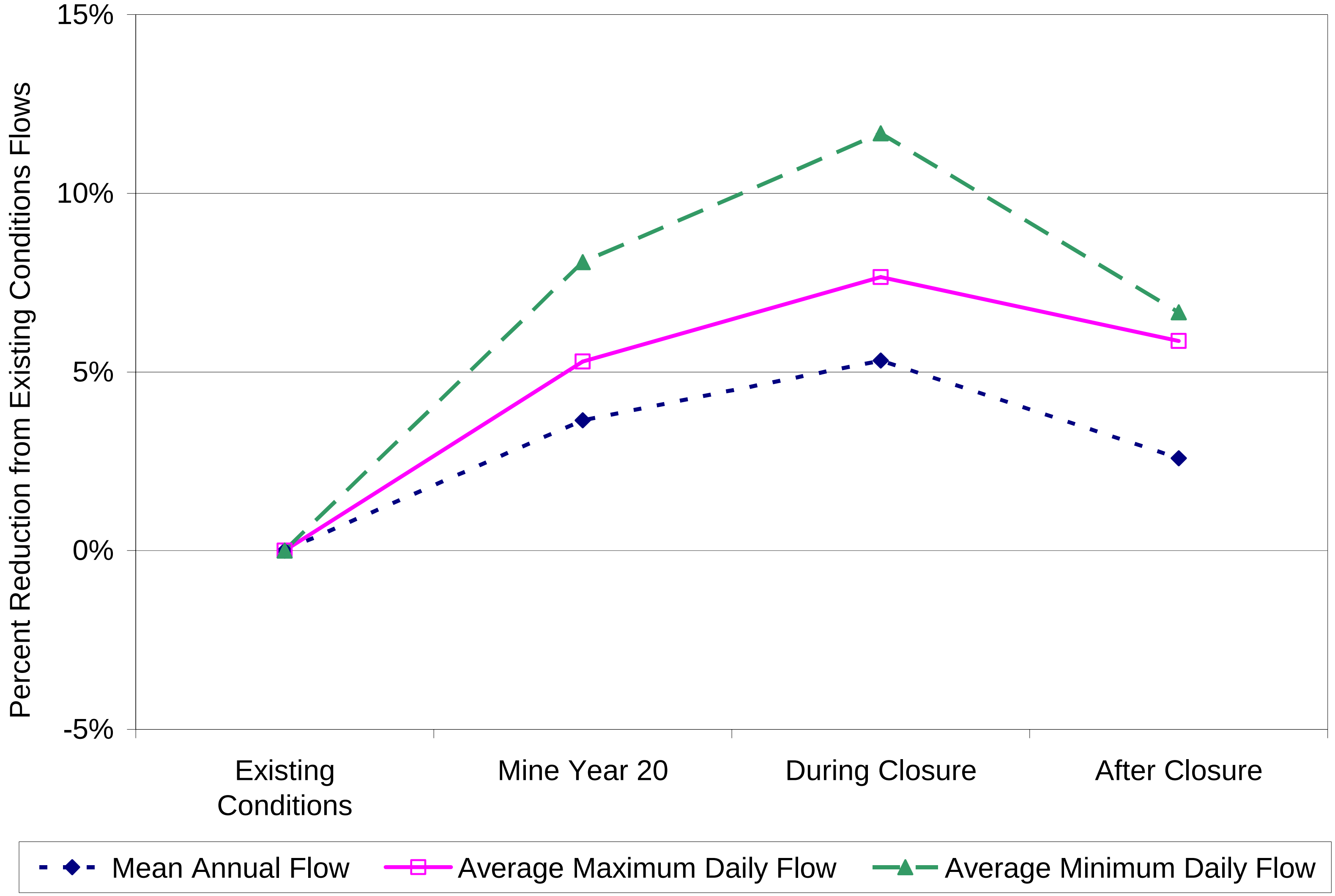


Figure 5-6 **Modeled Flows at SW-003, Near the Southeastern Boundary of the Mine Site, presented as percent reduction from Existing Conditions flows**

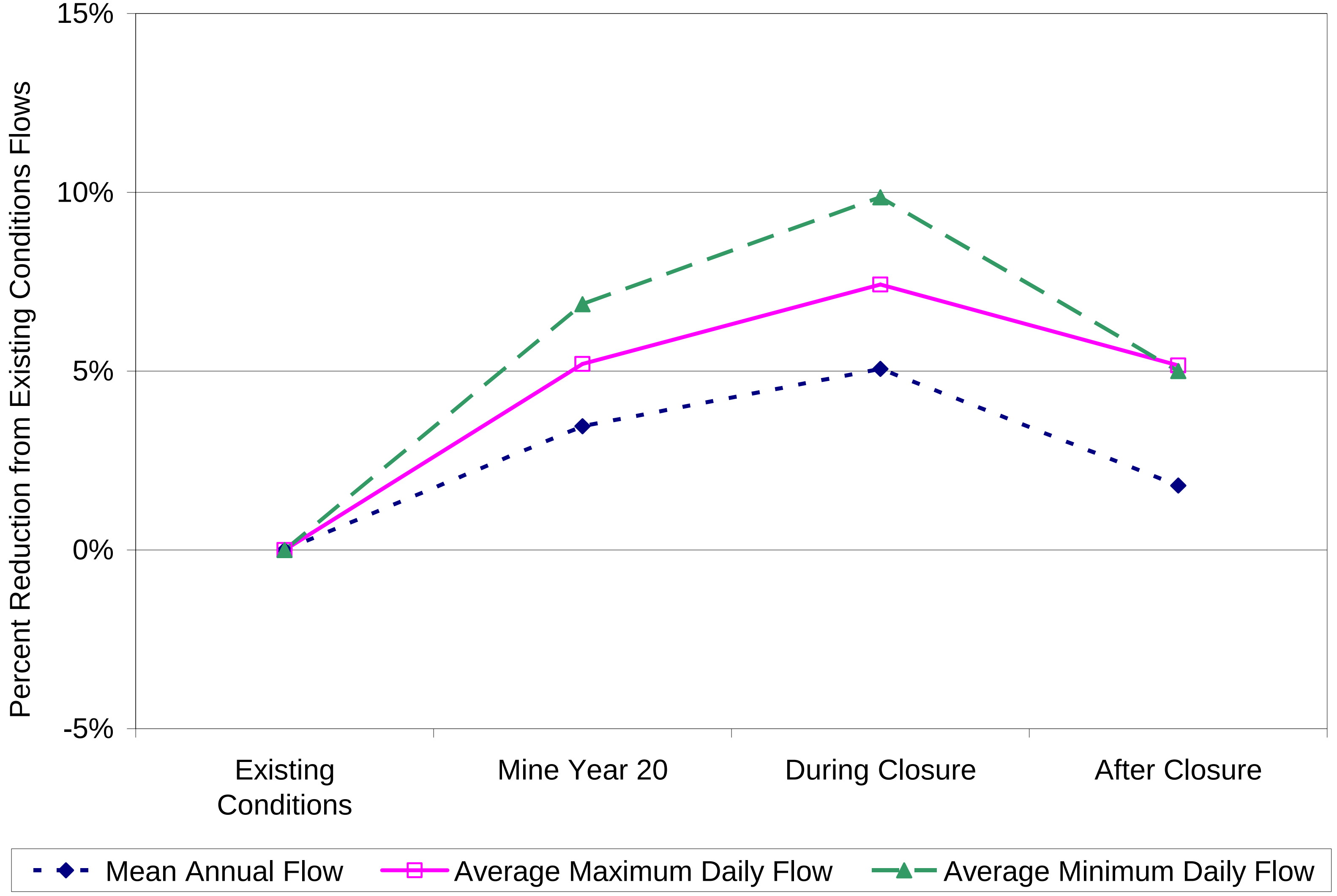


Figure 5-7 **Modeled Flows at SW-004, Upstream of the Confluence of the North and South Branches of the Partridge River, presented as percent reduction from Existing Conditions flows**

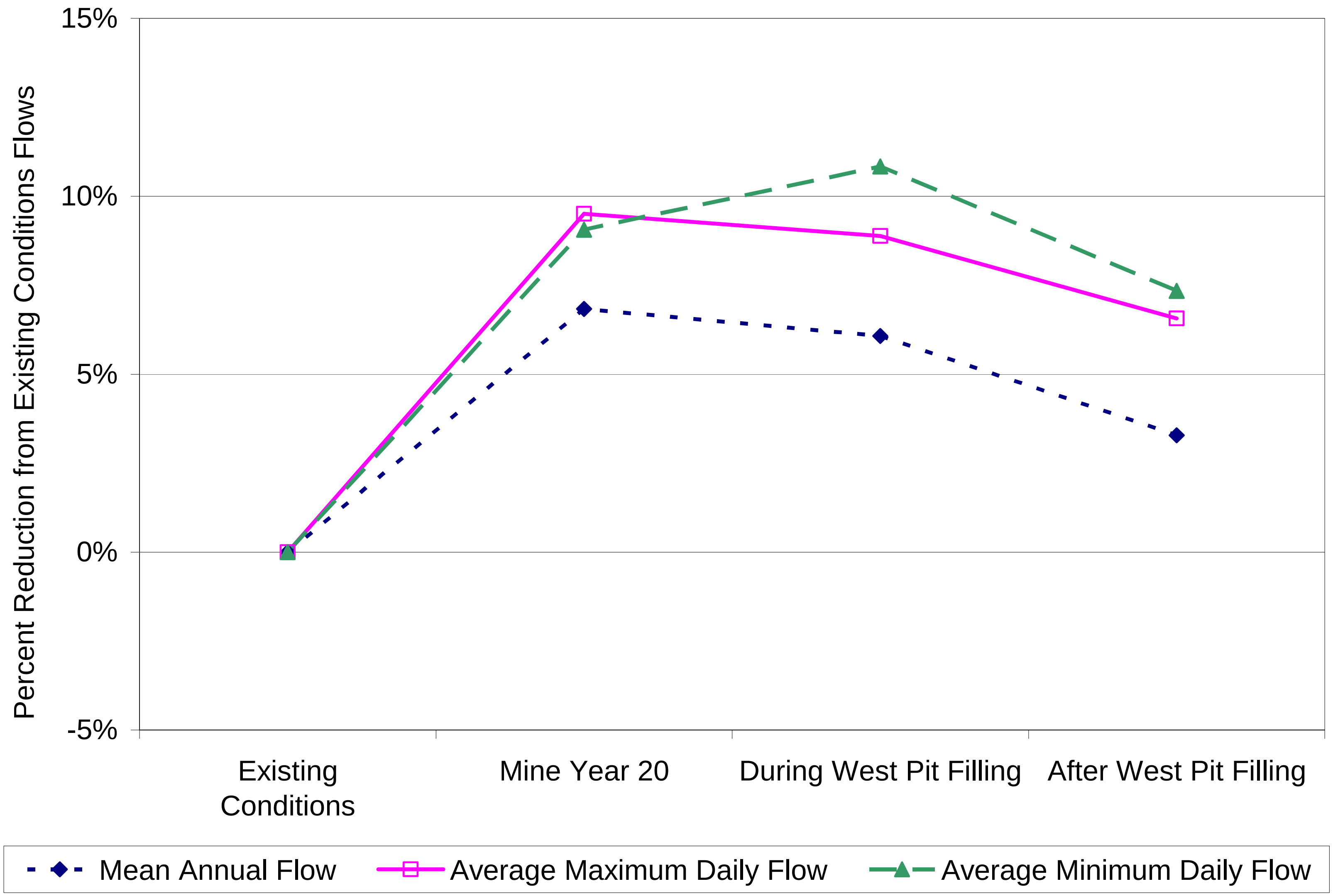


Figure 5-8 **Modeled flows at SW-004a, Downstream of the Confluence of the North and South Branches of the Partridge River, presented as percent reduction from Existing Conditions flows**

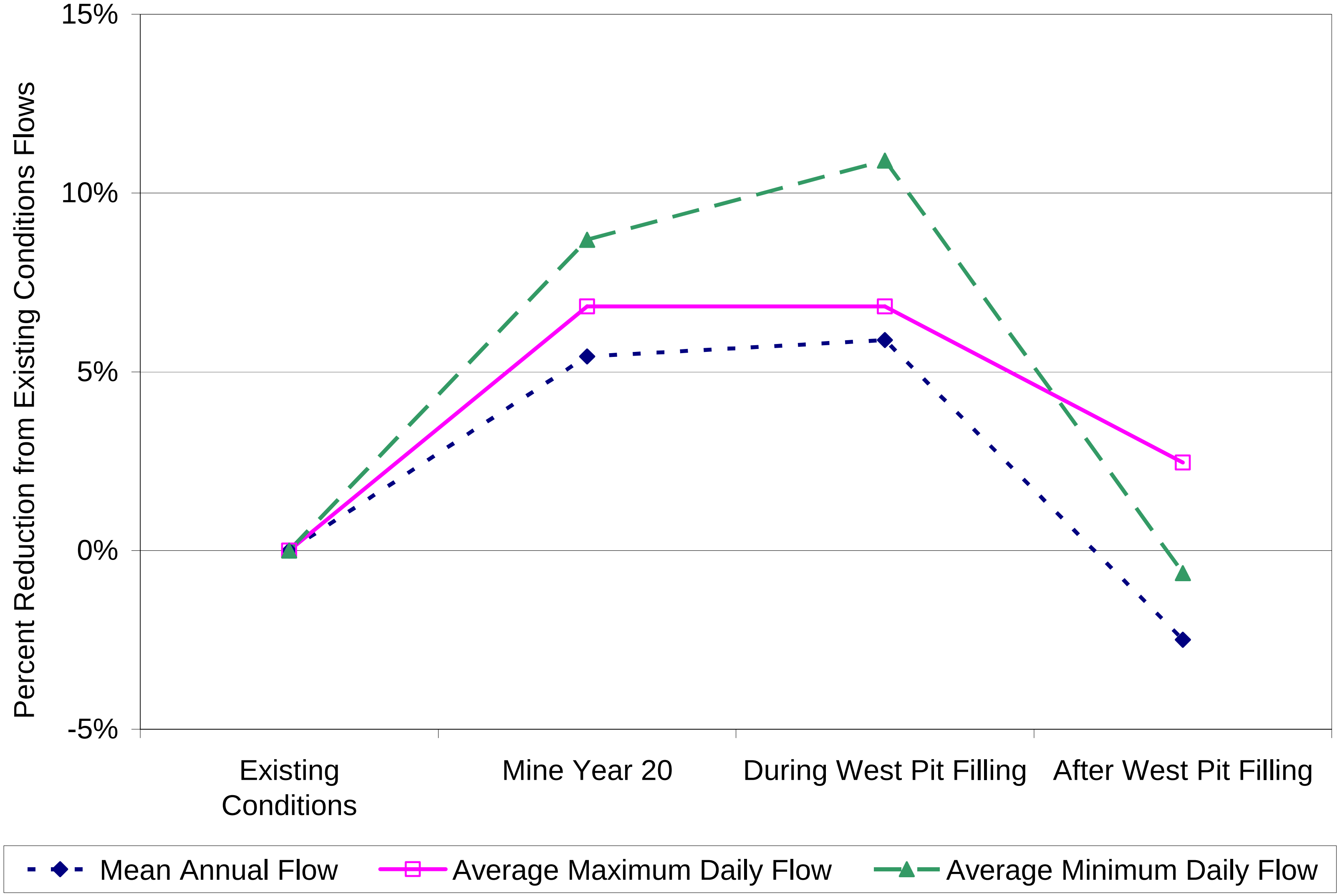


Figure 5-9 **Modeled flows at SW-005, at the Railroad Crossing Upstream of Colby Lake, presented as percent reduction from Existing Conditions flows**

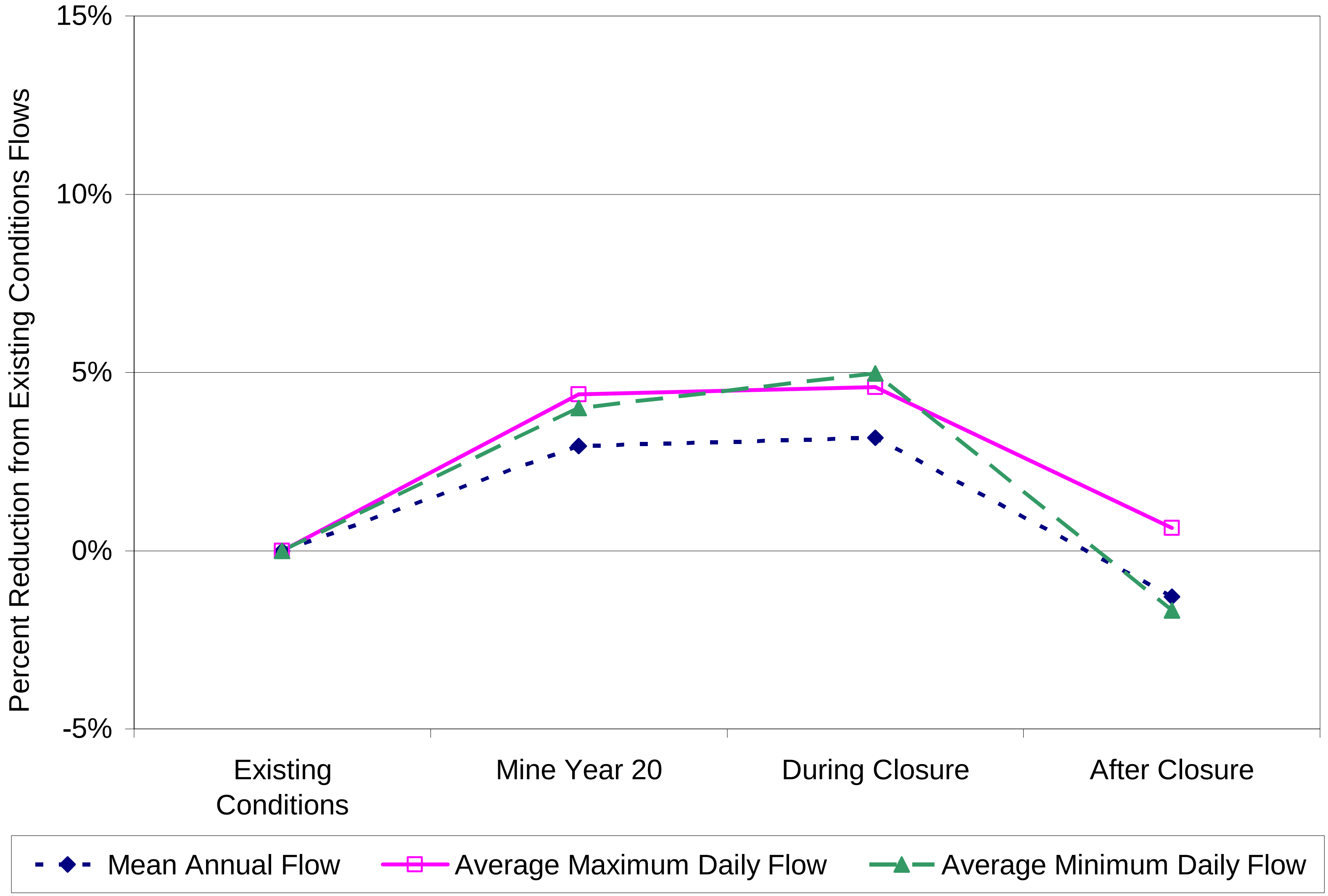
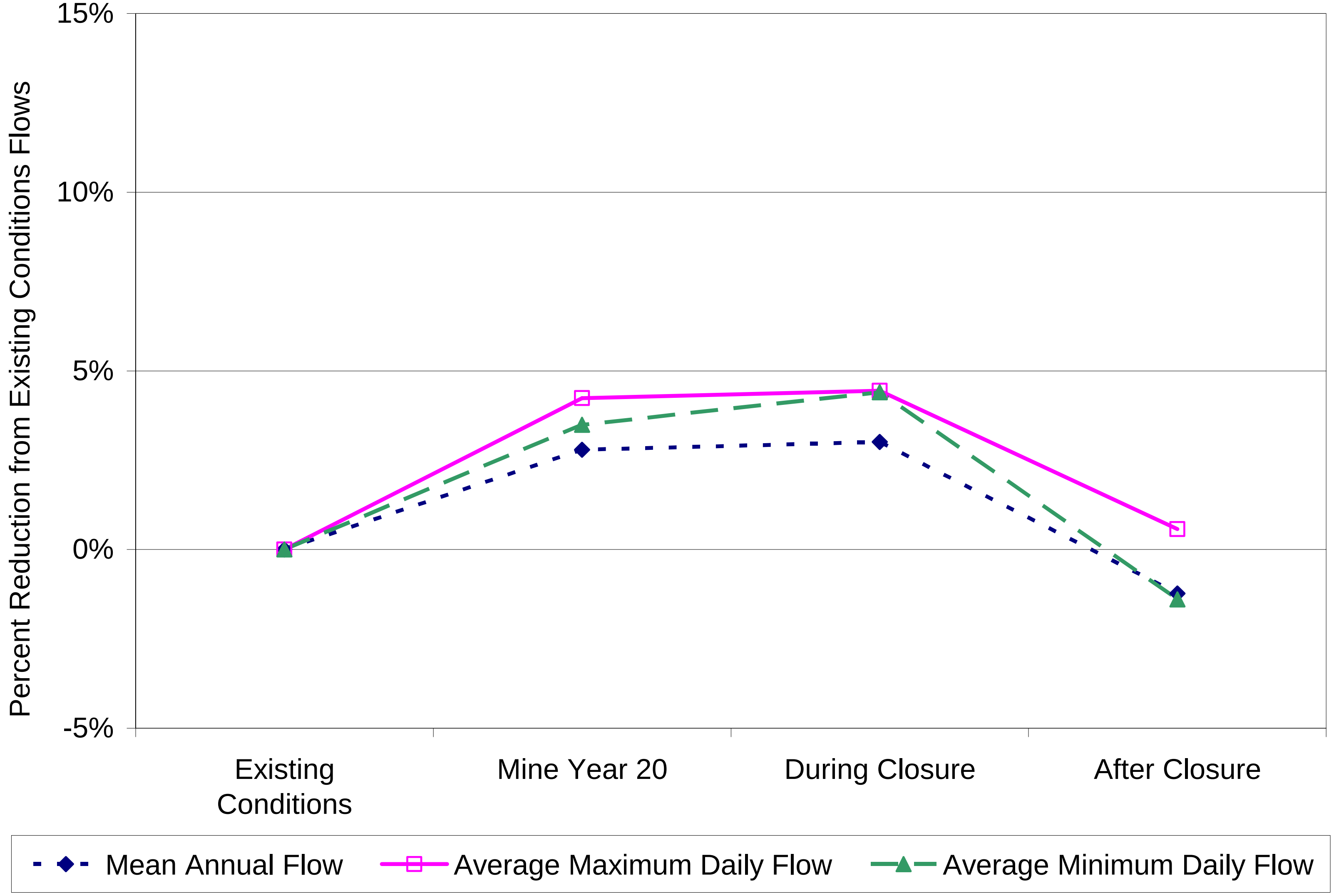


Figure 5-10 **Modeled flows at USGS gage 04015475, presented as percent reduction from Existing Conditions flows**



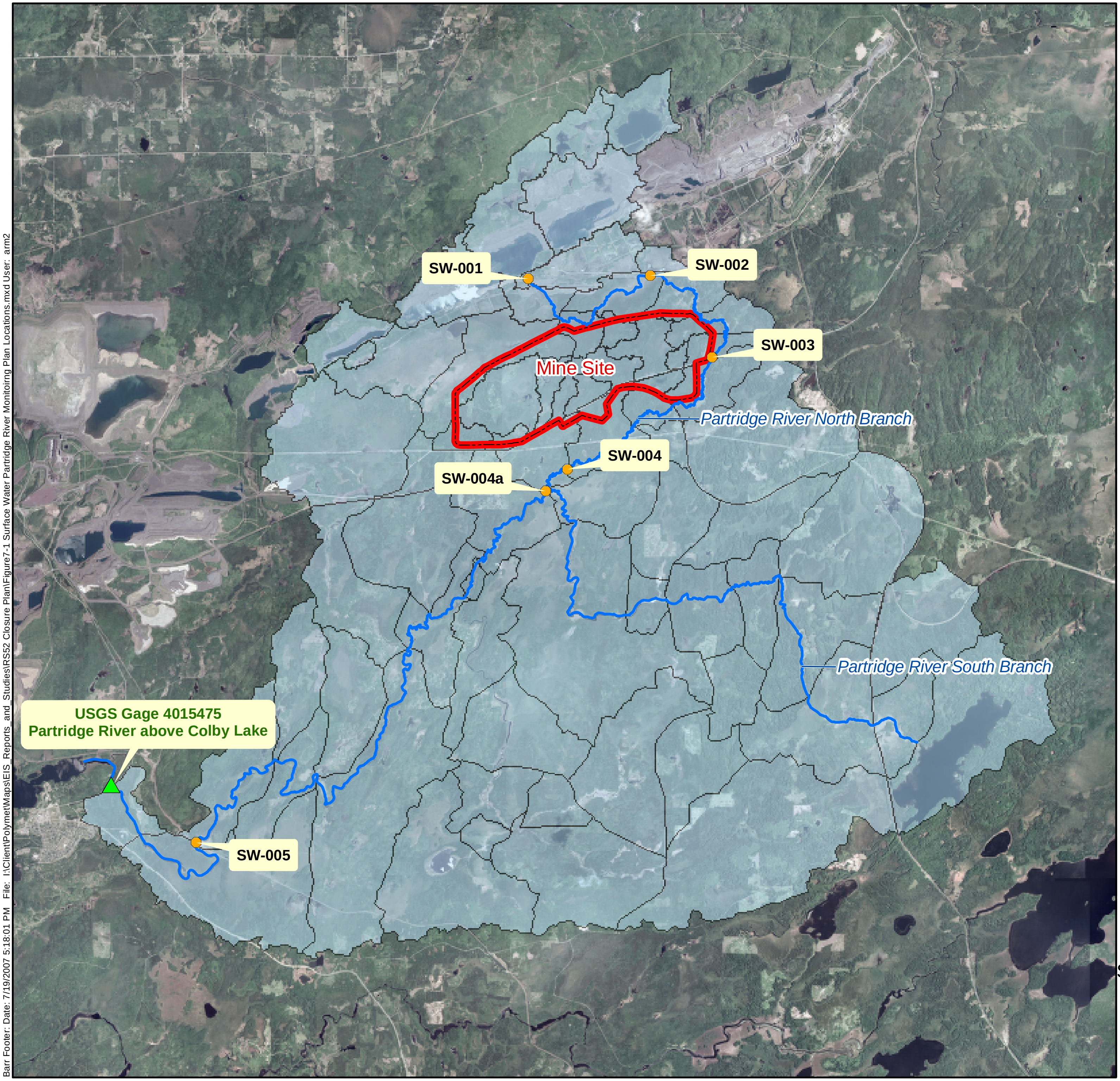
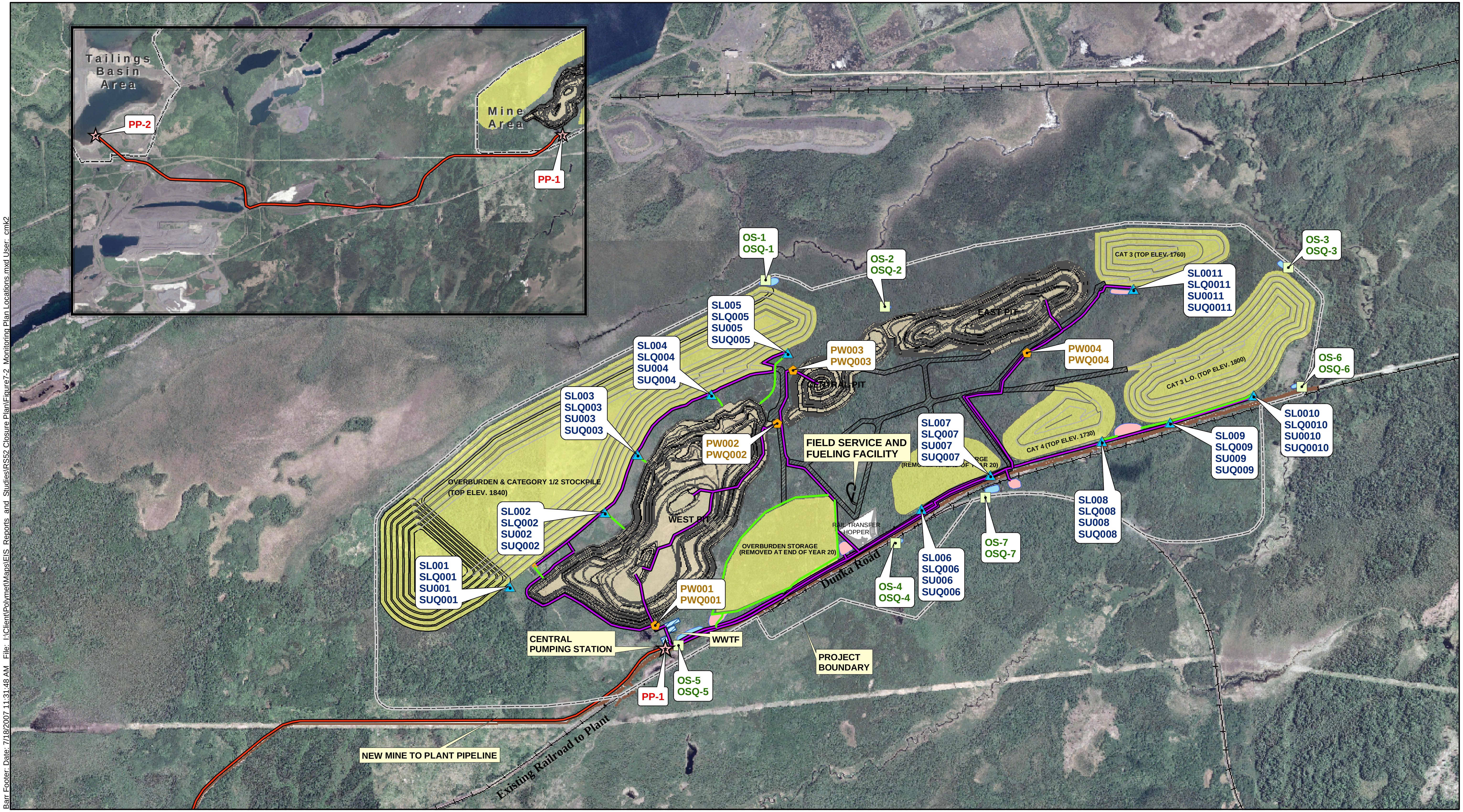


Figure 7-1
SURFACE WATER MONITORING PLAN
LOCATIONS - PARTRIDGE RIVER
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, MN



Barr Footer: Date: 7/18/2007 11:31:48 AM File: I:\Client\Polymet\Maps\EIS Reports and Studies\RS52 Closure Plan\Figure7-2 Monitoring Plan Locations.mxd User: cmk2

Monitoring Locations

- Pit Water
- Pumping Station Flows
- Stockpile Seepage
- Stormwater

See Tables 3.1.5.13-B through 3.15.13-H for Sampling Location Nomenclature

Mine Site

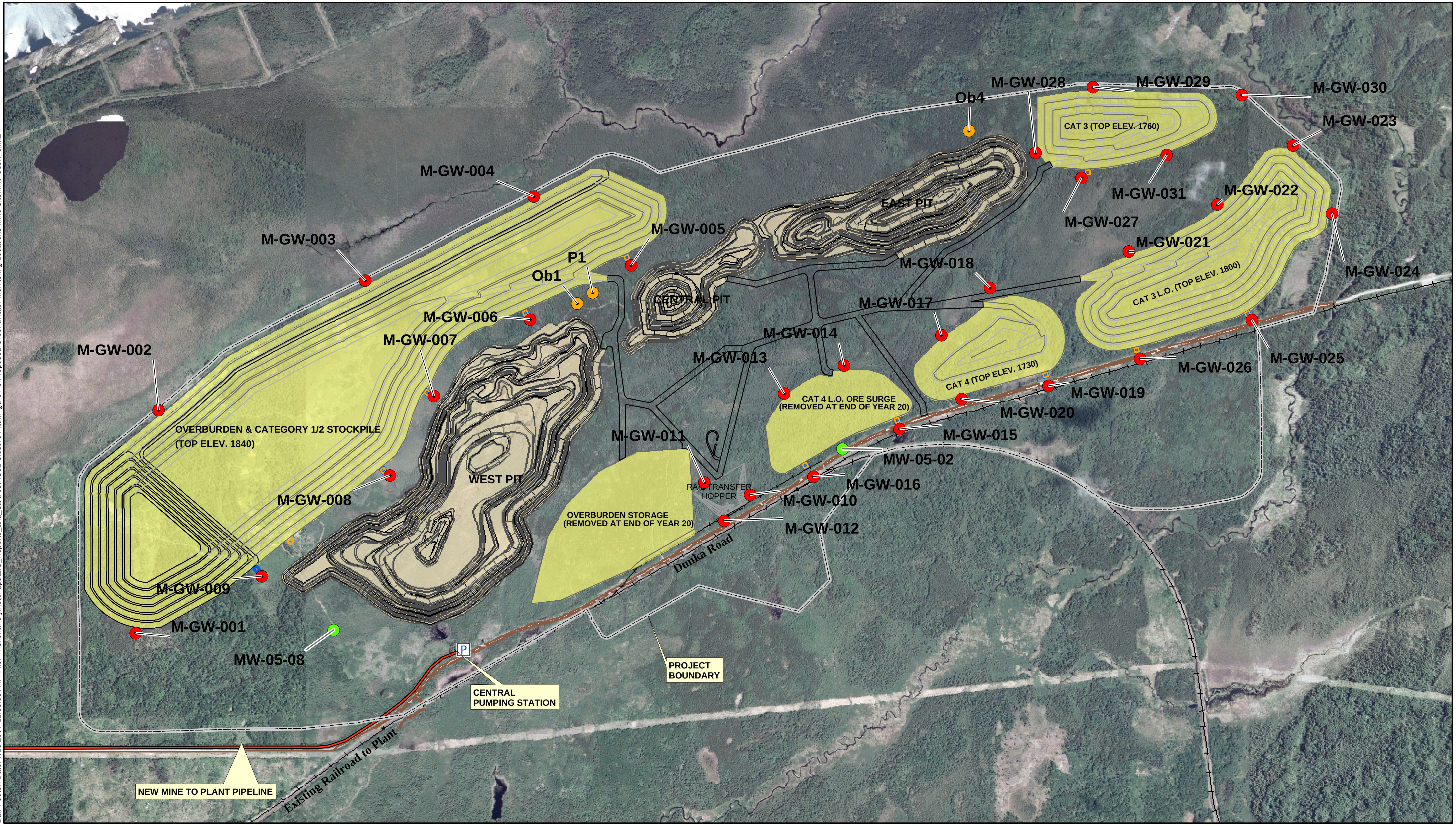
Year 20 Process Water

- Ditches
- Pipes

- Mine to Plant Pipeline
- Stockpiles
- Pits
- Stormwater Sedimentation Ponds
- Process Water Ponds

0 1,000 2,000 4,000 6,000
Feet

Figure 7-2
MONITORING PLAN LOCATIONS
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, MN



Project Area
Monitoring Well Existing
Monitoring Well Proposed
Bedrock Well Existing
Stockpiles
Pits
Stockpile Sumps

0 750 1,500 3,000
Feet

Figure 7-3
PROPOSED GROUNDWATER
MONITORING LOCATIONS -- MINESITE
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, MN

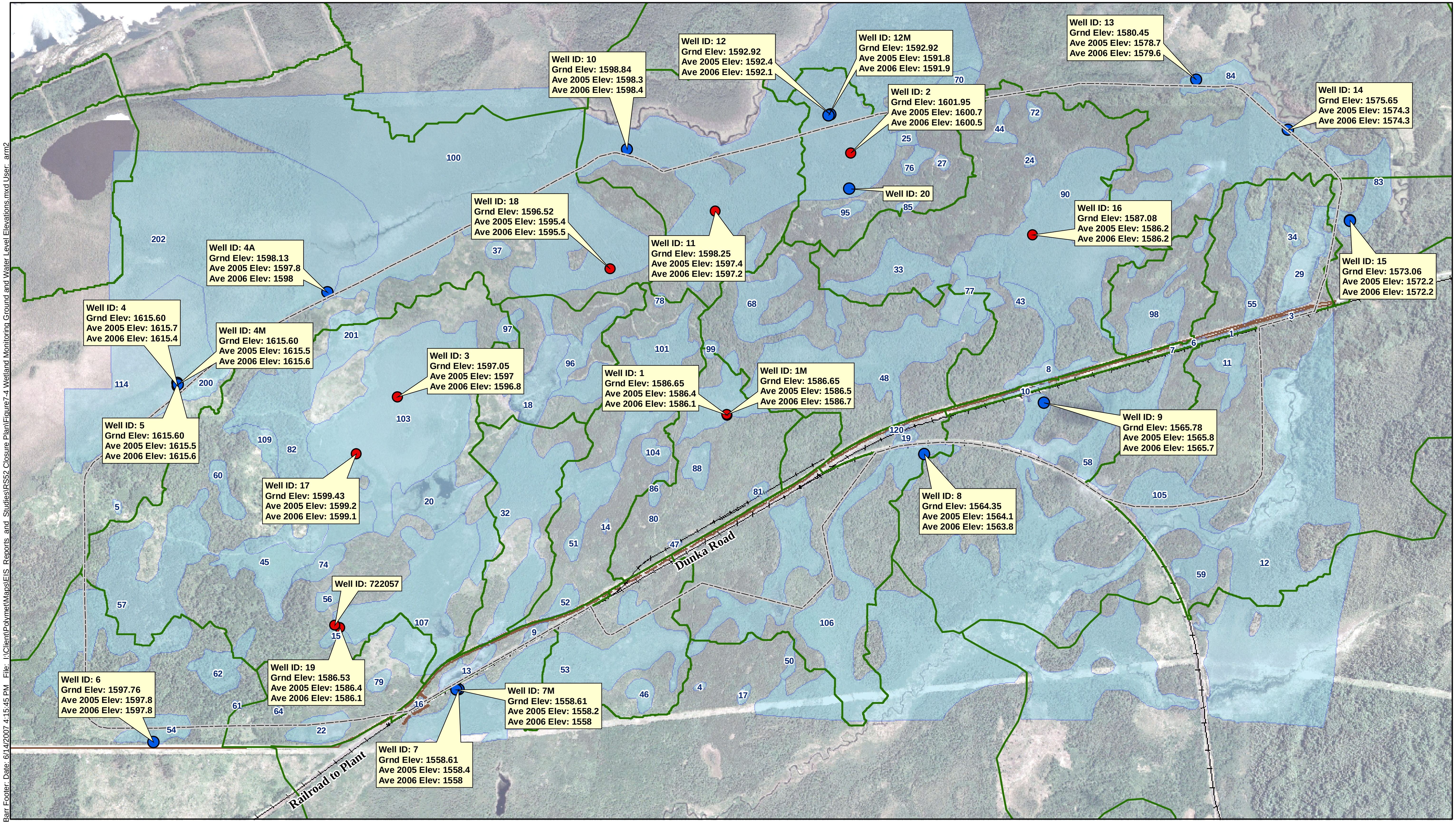
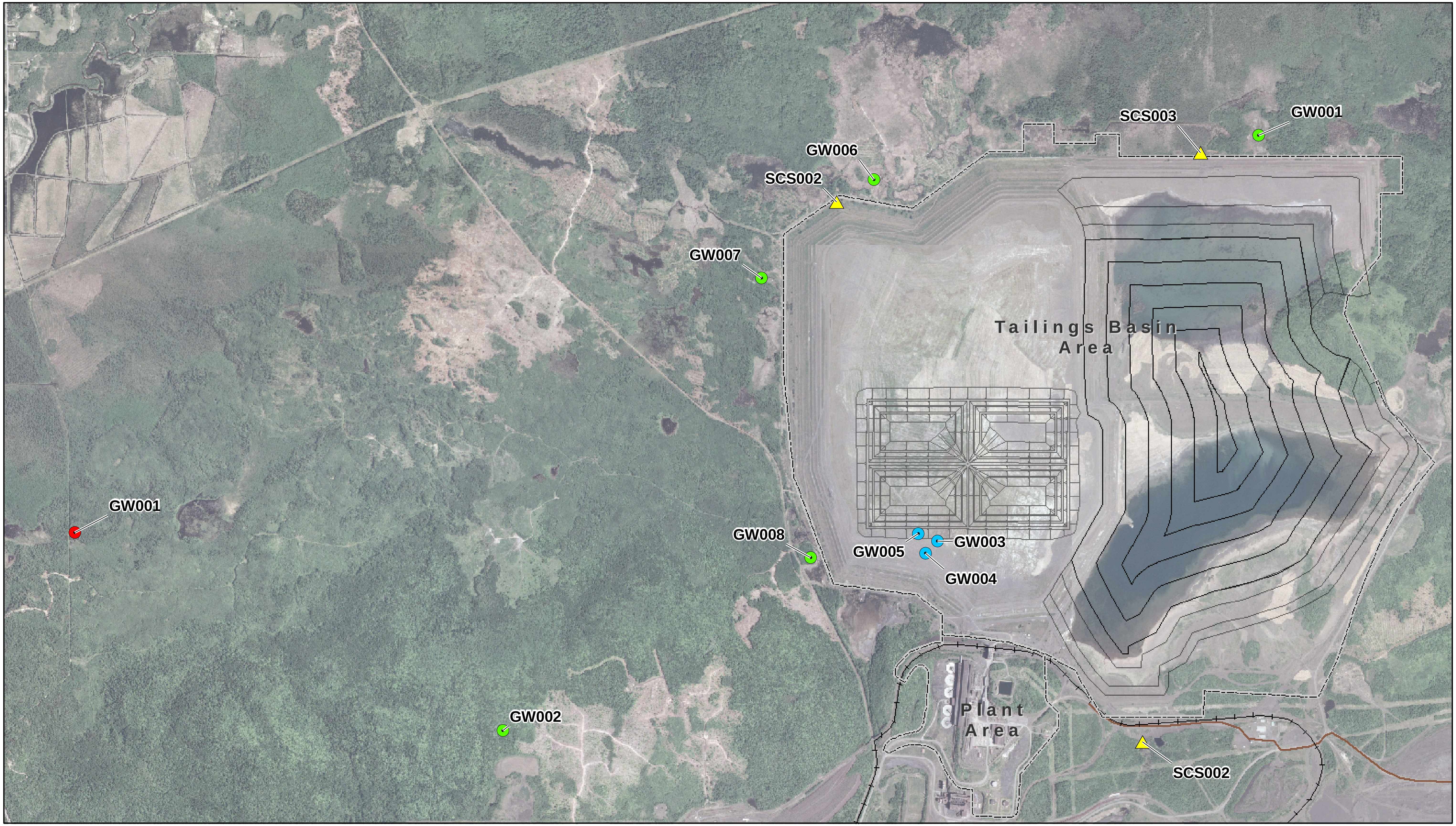


Figure 7-4
WETLAND MONITORING GROUND AND WATER LEVEL ELEVATIONS
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, MN



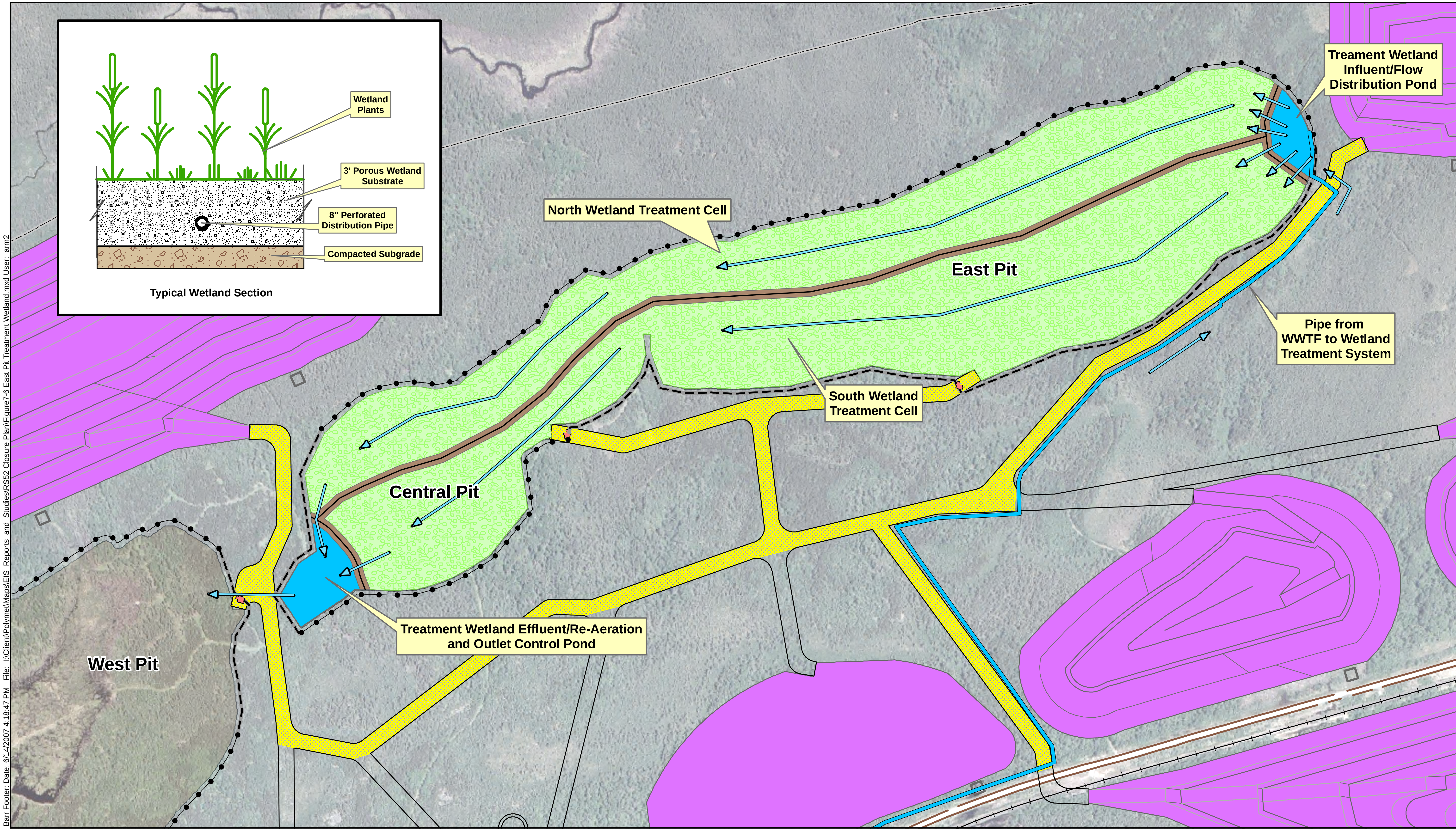
Monitoring Locations

- Groundwater Well - Existing
- Groundwater Well - Proposed
- Groundwater Well - Hornfels
- Seepage Collection Sump

Project Areas

0 1,000 2,000 4,000
Feet

Figure 7-5
GROUNDWATER AND SEEPAGE COLLECTION
SUMP MONITORING LOCATIONS--TAIILNGS BASIN
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, MN



Barr Footer: Date: 6/14/2007 4:18:47 PM File: I:\Client\Polymet\Maps\EIS Reports and Studies\RS52 Closure Plan\Figure7-6 East Pit Treatment Wetland.mxd User: arm2

East Pit Treatment Wetland Features

- Ponds
- Wetland Treatment Cells
- Pipes
- Flow Direction Arrows
- Haul Roads to Remain
- Reclaimed Stockpile
- Barbed Wire Fencing
- Fencing Gates
- Non-Climbable Fencing

0 300 600 1,200
Feet

Figure 7-6
EAST PIT TREATMENT WETLAND
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, MN

Appendix A

Detailed Outline – Closure Plan – RS52

Name: Closure Plan **Due Date:** 12/23/05
Comments PE 1-27-06
Timeline Reference: RS52

Objective:

Develop a draft Closure Plan. The plan will include sections on structure demolition/equipment removal, mine/plant site reclamation, site remediation and monitoring/maintenance. The Closure Plan will include an estimate for all closure costs (initial closure and ongoing). The Closure Plan will address closure at the proposed end of mine life. As part of the Permit to Mine, a Contingency Closure Plan must be prepared annually to reflect potential closure the following year while accounting for changes in closure design and associated costs. The closure plan detailed in this report will form the basis for the Contingency Closure Plan.

The Closure Plan will be consistent with Minnesota laws and regulations and overseen by the Minnesota Pollution Control Agency (the "MPCA") and the Minnesota Department of Natural Resources (the "MDNR").

Activities described in the Closure Plan will have the objective of achieving and maintaining compliance with MDNR Nonferrous Metallic Mineral Mineland Reclamation Rules (MR 6132) and MPCA Water Quality Standards (MR 7050, 7052 and 7060).

The Closure Plan and details at implementation will be developed in cooperation with the MDNR, MPCA, St Louis County Mine Inspector and other local government units and agencies as appropriate. In general, all environmental hazards will be remediated, inactive pit areas closed, all buildings and structures will be demolished, and all associated sites reclaimed and vegetated.

Several alternatives that may impact closure will be studied in the EIS. Some are included in the following scope. The impact on closure for those alternatives listed below will be discussed in the evaluation of the alternative and included in the final Closure Plan if the specific alternative is determined to have significant positive environmental impact and can be implemented:

- Chemical addition to stockpiles
- Subaqueous disposal of reactive and non-reactive waste rock
- Off site disposal of non-reactive waste rock
- Subaqueous disposal of tailings in existing taconite pit
- Co-disposal of reactive rock in lined tailings basin

NorthMet Project – Detailed Outline – DRAFT
November 28, 2005

Scope:

The draft Closure Plan for the EIS will address closure at the end of the projected 20-year mine life.

The draft Closure Plan will address the methods, sequence, and schedule of reclamation, for all components of the operation.

1. Structure Demolition/Equipment Removal
   a. Building Demolition
      i. List of Buildings to be Demolished
      ii. Disposal of demolition waste
      iii. Disposal of Asbestos Containing Materials
      iv. Disposal of mercury containing devices, PCB containing devices and nuclear devices
      v. Disposal of opened reagents, additives, paint, solvent, petroleum products, etc.
   b. Closure of Sanitary Systems and Wells
   c. Removal of ASTs and USTs
   d. Removal of Culverts
   e. Equipment Removal
   f. Pipeline Removal
   g. Power line Removal

2. Mine Site Reclamation
   a. Mine Pit (closure plans for two alternatives will be developed – single pit and two open pit mines sequentially)
      i. Water Balance will be provided by other studies – information required:
         - Time to fill (average and wet conditions)
         - Surface discharge (average and wet conditions)
         - Static level
         - All input and output components to be considered
         i. Includes possibility of rerouting surface drainage into pit
      ii. Natural and accelerated filling of the pit will be considered
      iii. Overflow channel location and design (average and maximum flows)
      iv. Mine wall sloping and re-vegetation
      v. Access to pit lake
      vi. Fencing pit perimeter
   b. Mine Stockpiles (closure plans for proposed action [reactive waste encapsulated in non reactive waste] and the alternative of segregated stockpiles will be developed)
      i. Water Balance will be provided by other studies – information required:
         - Surface runoff and seepage flows (average and wet conditions)
         - All input and output components considered
      ii. Stockpile cover and design will be provided by other studies and incorporated into closure plan document by reference.
      iii. Routing water from stockpiles (surface runoff and seepage), channel design and discharge location (average and maximum flows)
   c. Cover and re-vegetate Mine Site Building Area, roads and parking lots

   d. Rail lines

3. Plant site Reclamation
   a. Tailings Basin (closure plans for proposed action (lined basin atop Cell 2W and use of Cells 1E and 2E as is if tailings determined non reactive) and alternative of lined basin atop Cell 2W and lining of Cells 1E and 2E if tailings determined reactive) will be developed
      i. Design provided by other studies and will be incorporated into closure plan
      ii. Water Balance will be provided by other studies – required information:
         - Surface runoff and seepage flows (average and wet conditions)
         - All input and output components considered
      iii. Surface discharge channel location and design (average and maximum flows)
      iv. Re-vegetation
         - Information on tailings characterization, fertility, fertilizer and amendment recommendations will come from the closure plan
      v. Wet vs dry closure
   b. Reactive Residue Cells
      i. Design provided by other studies and will be incorporated into closure plan
      ii. Cover and re-vegetation
   c. Cover and re-vegetate Plant site Area, Area 1 Shops Area, roads and parking lots
   d. Rail lines

4. Site Remediation
   a. Fuel handling areas
   b. Reagent/additive receiving and storage areas
   c. Solid waste cleanup/disposal
   d. Contaminated railroad ballast

5. Monitoring and Maintenance
   a. Landfill inspection and maintenance
   b. Monitoring/recovery wells associated with remediation sites and solid waste disposal sites
   c. Water quality monitoring
   d. Water Treatment
      i. Water quality models (mine pit, mine stockpiles, tailings basin) that model water quality as a function of time will be provided by other studies. The results of the models will be incorporated into the closure plan.
      ii. Water treatment system design and projected water quality after treatment as a function of time for mine pit, stockpiles, tailings basin provided by other studies. This information will be incorporated into the closure plan. Planned modifications to wastewater treatment methods, systems or strategies to incorporate passive/low maintenance treatment approaches in post closure will be described in the closure plan. The effectiveness of the passive/low maintenance treatment approaches will also be described in the closure plan.
   e. Stormwater inspections
   f. Monitoring and maintenance on all reclamation re-vegetation and drainage systems and treatment systems, both active and passive

  g. Dam safety monitoring and maintenance

6. Timetable – list of activities 1 through 5 above by estimated year of implementation

7. Closure Estimate – Will reference the Contingency Closure plan cost estimate that will be included in the Permit to Mine application and a 20-year cost estimate that will be included in the Detailed Project Description.
8. should closure plan include case studies, or would this be captured in other reports, the documentation of successful closure of other sulfide mines would be helpful, we should contact Wisconsin since they were looking for case studies under their 10/10 law

Appendix B

Minnesota Department of Natural Resources Rules, Section 6132.3200 Closure and Post Closure Maintenance

(3) revoke the permit to mine under part 6132.4600; or
(4) modify the permit to mine under part 6132.4300.

STAT AUTH: MS s 93.44 to 93.51; 103G.222

HIST: 17 SR 2207
Current as of 12/09/02

6132.3200 CLOSURE AND POSTCLOSURE MAINTENANCE.

Subpart 1. **Goal.** The mining area shall be closed so that it is stable, free of hazards, minimizes hydrologic impacts, minimizes the release of substances that adversely impact other natural resources, and is maintenance free.

Subp. 2. **Requirements.** Closure and postclosure maintenance must meet the requirements in items A to E.

A. When the permittee is aware of a temporary or permanent shutdown, the permittee shall immediately notify the commissioner.

B. For a temporary shutdown, the permittee shall:

(1) document the reason for temporary shutdown;
(2) project when the temporary shutdown will end;
(3) submit a maintenance plan for the temporary shutdown period to ensure that the facility will remain stable and hazard free;
(4) document how all permit standards will be complied with during the shutdown;
(5) maintain full financial assurance;
(6) complete all corrective action requirements as scheduled; and
(7) comply with all reporting requirements.

C. The commissioner, after review of the requirements in item B, may either:

(1) approve the temporary shutdown;
(2) request more information to make a decision; or
(3) deny the temporary shutdown and direct the permittee to implement a contingency reclamation plan under part 6132.1300.

D. In evaluating a request for an extension of a temporary shutdown, the commissioner shall:

(1) evaluate compliance with all state and federal permits;
(2) evaluate safety and stability of all mining facilities; and
(3) evaluate the need to implement corrective action procedures.

E. For a permanent shutdown, the permittee must implement the contingency reclamation plan under part 6132.1300 and comply with subitems (1) to (7).

(1) Accesses to underground mines shall be promptly sealed as approved by the commissioner and the county mine inspector.

(2) Within six months after closure of a mine begins, the permittee shall:

(a) provide at least one safe access to the bottom of an open pit; and
(b) construct fences or other access barriers for safety under Minnesota Statutes, chapter 180.

(3) Within one year after closure begins, or within a longer period if approved by the commissioner, debris and mobile equipment that will not be used for reclamation shall be removed from the area being closed.

(4) Within three years after closure begins, or within a longer period if approved by the commissioner, the following shall be accomplished:

(a) roads, parking areas, and storage pads except those the commissioner considers necessary for access shall be removed;
(b) permittee-owned power plants and associated facilities except public utilities, transmission lines, pipelines, docks and associated facilities, and railroads except common carrier transportation facilities shall be removed or provisions made for continued subsequent use; and
(c) all other equipment, facilities, and structures shall be removed and foundations razed and covered with a minimum of two feet of surface overburden.

(5) Within three years after the start of the closure of basins constructed for the purpose of mining or processing, or within a longer period if approved by the commissioner, the permittee shall provide for drainage of the basins and reintegrate the area into the natural watershed.

(6) If, following closure, continued compliance with parts 6132.2000 to 6132.3200 cannot be achieved without continued maintenance of the facilities, the permittee shall:

(a) implement postclosure maintenance techniques designed to ensure that the requirements of parts 6132.2000 to 6132.3200 will continue to be met following closure;
(b) identify specifically how, when, and by whom the active techniques will be conducted or managed;
(c) identify performance levels or limitations that would have to be achieved before the techniques could be considered successful; and
(d) provide for financial assurance under part 6132.1200, subpart 1, item A.

(7) No release from the permit to mine under part 6132.4800 shall be granted for those portions of the mining area that require postclosure maintenance until the necessity for maintenance ceases.

STAT AUTH: MS s 93.44 to 93.51; 103G.222

HIST: 17 SR 2207
Current as of 12/09/02

6132.4000 PROCEDURES FOR OBTAINING A PERMIT TO MINE.

Subpart 1. **Application and publication.** The process for requesting a permit to mine begins with a preapplication conference and site visit under part 6132.1100, subpart 1, followed by the submission of an application to the commissioner under parts 6132.1000 to 6132.1400. After the commissioner determines the application is complete, the commissioner shall publish a notice in the State Register and the EQB Monitor stating the department has received an application for a permit to mine. The applicant shall also publish an advertisement

B. Financial assurance in the amount equal to the contingency reclamation cost estimate under subpart 2 shall be:

(1) submitted to the commissioner for approval before issuance of a permit to mine and before granting an amendment to the permit;

(2) continuously maintained by the permittee; and

(3) annually adjusted as follows:

(a) if the new cost estimate approved by the commissioner is greater than the amount of the existing financial assurance, the permittee shall provide additional financial assurance in an amount equal to the increase; or

(b) if the new cost estimate approved by the commissioner is less than the amount of existing financial assurance, the permittee shall be released from maintaining financial assurance in an amount equal to the decrease.

C. Financial assurance in the amount equal to the corrective action cost estimate under subpart 3 shall be:

(1) submitted to the commissioner for approval as part of the corrective action cost estimate under subpart 3;

(2) continuously maintained by the permittee until the commissioner determines it is no longer necessary; and

(3) annually adjusted as follows:

(a) if the new cost estimate approved by the commissioner is greater than the amount of the existing financial assurance, the permittee shall provide additional financial assurance in an amount equal to the increase; or

(b) if the new cost estimate approved by the commissioner is less than the amount of existing financial assurance, the permittee shall be released from maintaining financial assurance in an amount equal to the decrease.

D. Financial assurances may be canceled by the permittee, on approval by the commissioner, only after it is replaced by an alternate mechanism or after the permittee is released from financial assurance according to item H.

E. The permittee must ensure that the provider of financial assurance gives the commissioner 120 days' notice prior to cancellation of the financial assurance mechanism. Upon receipt of this notice, the commissioner shall initiate a proceeding to access the financial assurance according to part 6132.1200, subpart 6.

F. If the permit to mine is assigned under part 6132.4700, the new permittee must be in compliance with requirements of this part before the commissioner approves the assignment. On the assignee's demonstration of compliance with this part, the former permittee shall be released from the requirements of this part.

G. Financial assurance must meet the criteria of subpart 5.

H. The commissioner shall release the permittee from the responsibility to maintain financial assurance when the commissioner determines, through inspection of the mining area, that:

(1) all reclamation activities have been completed according to this part and the permit to mine;

(2) conditions necessitating postclosure maintenance no longer exist and are not likely to recur; and

(3) corrective actions have been successfully accomplished.

Subp. 5. **Criteria for financial assurance.** Financial assurance for reclamation and for corrective action must meet the following criteria:

A. assurance of funds sufficient to cover the costs estimated under subparts 2 and 3;

B. assurance that the funds will be available and made payable to the commissioner when needed;

C. assurance that the funds will be fully valid, binding, and enforceable under state and federal law;

D. assurance that the funds will not be dischargeable through bankruptcy; and

E. all terms and conditions of the financial assurance must be approved by the commissioner. The commissioner, in evaluating financial assurance, shall use individuals with documented experience in the analysis. The reasonable cost of the evaluation shall be paid by the applicant.

Subp. 6. **Forfeiture of financial assurance.** Financial assurance must be made available to the commissioner under items A to C when the operator is not in compliance with either the contingency reclamation plan or the corrective action plan.

A. A proceeding to access financial assurance shall be commenced by:

(1) serving an order to forfeit the financial assurance on the person, institution, or trustee holding the financial assurance; and

(2) serving a notice of measures required to correct the situation and the time available for correction on the permittee.

B. If conditions that provided grounds for the order are corrected within a period established by the commissioner and if measures approved by the commissioner are taken to ensure that the conditions do not recur, the order shall be canceled.

C. If the conditions that provided grounds for the order are not corrected, the commissioner shall proceed with accessing and expending the funds provided by this part to implement the contingency reclamation or corrective action plans.

Subp. 7. **Failure to comply.** The commissioner may take one or more of the following actions if failure to comply with any portion of this part occurs:

A. deny the permit to mine;

B. suspend the permit to mine under part 6132.4500;

C. assess civil penalties under part 6132.5100;

D. revoke the permit to mine under part 6132.4600; or

E. modify the permit to mine under part 6132.4300.

STAT AUTH: MS s 93.44 to 93.51; 103G.222

HIST: 17 SR 2207
Current as of 12/09/02

6132.1300 ANNUAL REPORT.

Subpart 1. **Purpose.** The purpose of the annual report is to describe actual mining and reclamation completed during the past year, the mining and reclamation activities planned for the upcoming year, and a contingency reclamation plan to be implemented if operations cease in the upcoming year. The permittee shall submit an annual report, in duplicate, to the commissioner by March 31 of each year.

Subp. 2. **Preceding calendar year.** For the preceding calendar year, the report must include:

A. a description of actual mining activities, including:

(1) the types, amounts, sequence, and schedule of mining the ore body and storage piling materials, including the distinction among ore, lean ore, and waste rock; and

(2) changes in the beneficiating process, including a discussion of the type and amount of chemicals added and their effect, if any, on the types, amount, and means of waste disposal;

B. a description of actual reclamation activities and corrective actions;

C. a description of the status of ongoing postclosure maintenance activities;

D. a discussion of items A to C differ in scope and schedule from the approved mining and reclamation plan under part 6132.1100, subpart 6;

E. a characterization of new rock types or formations encountered during mining that have not been previously characterized under part 6132.1000, subpart 2;

F. a discussion of changes in ownership or organizational structure of the permittee; and

G. a description of actual wetland replacement activities, in the manner prescribed by the monitoring section of the "Standards and Procedures for Evaluating Wetland Replacement Plans" pursuant to chapter 8420, wetland rules.

Subp. 3. **Upcoming calendar year.** For the upcoming calendar year, the report must include:

A. the anticipated rate of mining;

B. the anticipated mining activities, including:

(1) the types, amounts, sequence, and schedule of mining the ore body and storage piling materials, including the distinctions among ore, lean ore, and waste rock; and

(2) changes in the beneficiating process, including a discussion of the type and amount of chemicals to be added and their effect, if any, on the types, amount, and means of waste disposal;

C. the anticipated reclamation including methods, schedules, and research;

D. notification of intent to close a mining area or portion of an area;

E. a discussion of how anticipated activities will differ in scope and schedule from the approved mining and reclamation plan under part 6132.1100, subpart 6;

F. evidence that the liability insurance policy submitted with the permit application under part 6132.1100, subpart 3, item C, is in force, or that self-insurance requirements are being met;

G. a discussion of anticipated changes in ownership and organizational structure of the permittee; and

H. a wetland replacement plan approved pursuant to part 6132.5300.

Subp. 4. **Contingency reclamation plan.** A contingency reclamation plan including closure and postclosure maintenance shall be submitted with the annual report to identify reclamation activities that would be implemented by the permittee if operations cease in the upcoming calendar year. The plan shall include the following:

A. methods, sequence, and schedule of reclamation that address the goals and meet the requirements of parts 6132.2000 to 6132.3200;

B. maps and cross sections at a scale approved by the commissioner that depict the construction, including shape, extent, and content, and reclamation, including contouring, covering, vegetation, closure, and postclosure maintenance, of each area affected by mining; and

C. cost estimates and financial mechanisms under part 6132.1200 necessary to implement the contingency reclamation plan if operations cease in the upcoming calendar year.

Subp. 5. **Corrective action for upcoming calendar year.** When a corrective action plan has been required under part 6132.3100, subpart 2, the report shall include:

A. a description of actual corrective action conducted in the preceding calendar year;

B. a description of anticipated corrective action for the upcoming calendar year; and

C. a corrective action cost estimate for the upcoming year under part 6132.1200, subpart 3.

Subp. 6. **Maps.** For the preceding and upcoming year, the report shall contain a map in the form prescribed by part 6132.1100, subpart 7, that shows the status of mining, construction, reclamation including closure and postclosure maintenance, and watershed modifications.

STAT AUTH: MS s 93.44 to 93.51; 103G.222

HIST: 17 SR 2207
Current as of 12/09/02

6132.1400 REQUEST FOR RELEASE FROM PERMIT.

Subpart 1. **Purpose.** The purpose of the request for release is to provide the commissioner with information on the final reclamation status of the mining area or a specific portion of the area. The request shall be submitted by the permittee when the permittee has concluded that all reclamation has been satisfactorily accomplished and that release from the permit or portion of it should be granted.

Subp. 2. **Contents.** The request for release shall include the following:

A. a declaration by the permittee of how each portion of the mining area for which a release is requested has been made to comply with the requirements of parts 6132.2000 to 6132.3200 and the permit to mine;

B. identification of:

(1) the ownership of the mining area;

Appendix C

PolyMet Mining Company, Standard Procedure, Specifications for Seeding and Mulching

Hoyt Lakes, Minnesota
STANDARD PROCEDURE

SPECIFICATIONS FOR SEEDING AND MULCHING		
General Manager's Approval ____________________ Manager's Approval __________________________ Initiator __________________________	Date Effective 2/14/07	SP Number ER08B
History: 2/15/07 – ER08B - preliminary version to support Detailed Project Description		

Description

This work shall consist of the operations of establishing herbaceous ground cover on designated areas within the PolyMet Mining, Inc. properties. It shall include seeding, mulching, fertilizing, and any other work specified in conjunction therewith.

Construction Requirements

A. General

If any of the work provided for herein is performed under unfavorable conditions or contrary to the restrictions and requirements set forth, the Contractor shall assume full responsibility for the results by repairing any damages and replacing unacceptable work as PolyMet directs.

The Contractor will provide seed, fertilizer, topsoil (for sodding areas) mulch and any other materials necessary to complete the job.

Contracted equipment and/or substitutions from that listed herein or in the Vegetative Specifications must be approved by PolyMet before the substitution can be made.

B. Placing and Working in Fertilizer

Fertilizers shall be applied at the rates indicated in the Vegetative Specifications, using mechanical spreading devices to the fullest extent practicable, and providing uniform distribution of the material over the designated areas.

Unless otherwise specified, immediately prior to sowing the seed, the fertilizer shall be worked into a depth of approximately eight inches on the level and four inches on all slopes, using rotovators, klodbusters, discs, harrows, etc., or as specified on the Vegetative Specifications. On slopes, the cultivating equipment shall be operated in a general direction at right angles to the direction of surface drainage wherever practical.

C. Sowing Seed

The season of planting (dates approximate) for the various seed mixtures shall be as follows:

Season of Planting

Winter: March

Spring: Fertilization will commence as soon as the ground is workable, and planting will commence as soon after May 1st as is practicable and will be completed by June 10th.

Summer: August 15 - September 15

Fall:October

On areas to be mulched after seeding, no more seed shall be sown on any day than can be mulched on the same day. In any event, the lag time between seeding and mulching shall not exceed 24 hours where the mulch is placed after seeding. Should the mulch application be delayed more than 24 hours, PolyMet may order the area reseeded at the Contractor's expense.

Seed shall be sown by means of mechanical or hydrospreading of the seeds at the specified rate of application. The use of hand operated mechanical spreaders will be permitted only on areas which are inaccessible to, or too small for the other equipment approved herein, all as determined by PolyMet. During windy weather, no seeding shall be done with cyclone type broadcasting devices.

All legume seed used must be pre-inoculated. If a hydroseeder will be used to distribute seed, double the appropriate bacteria culture will be added to the hydroseeder tank immediately before planting commences. The inoculant will be supplied by the Contractor and must be kept cool by the Contractor until the time of its use.

If a seed drill of the agricultural type is used, the drill shall be operated in a general direction at right angles to the direction of surface drainage, wherever practical, and the seed shall not be sown to a depth greater than 1/2 inch. Small seed species such as timothy, alfalfa, white clover, red top, red clover, etc., shall be sown through the grass seed attachment or by other approved means.

Broadcast seeders shall be used in wet areas where drill seeders tend to clog-up and will be followed by a cultipacker or equivalent.

If a hydroseeder is used, it shall have continuous agitation action that keeps the seed mixed in uniform distribution in the water slurry until pumped from the tank. The pump pressure shall be such that a continuous, nonfluctuating stream is maintained.

All seeded areas having slopes 3 horizontally to 1 vertically or flatter shall have the seedbed firmed or the seed worked in after seeding and prior to mulching. The soil firming shall be done with a corrugated cultipacker or other approved soil firming equipment. On slopes steeper than 3 horizontally to 1 vertically, the seed shall be covered by hand raking or other approved means prior to mulching. Soil firming or seed covering shall be accomplished within twenty-four hours after seeding.

D. Mulch Classification

Mulch material shall conform to the requirements for one of the following types, as specified in the Contract:

Type 1 - Mulch shall consist of grain straw, hay, cutting of agricultural grasses and legumes. The material shall be relatively free of seed bearing stalks of noxious grasses or weeds, as defined by the rules and regulations of the Minnesota Department of Agriculture.

Type 2 - Type 2 mulch shall consist of a mixture of Type 1 (straw, hay, etc.) and asphalt emulsion mulch materials.

Type 3 - Type 3 mulch shall consist of Type 1 (straw, hay, etc.) spread on the ground and anchored using an Imco disc or comparable equipment.

Type 4 - Type 4 mulch shall consist of approved chemical application.

Type 5 - Type 5 mulch shall consist of wood fiber, newsprint, chopped straw, cotton fiber or any combination of the four listed materials.

Type 6 - Type 6 mulch shall consist of an initial application of Type 1 mulch held in place with Type 5 mulch.

E. Applying Mulch

Type 1 - Wherever possible, Type 1 mulch shall be placed with blower equipment. The rate of application shall be 2 tons/acre. Where so specified and provided for in the Vegetative Specifications, the mulch shall be anchored the same day it is placed, unless otherwise authorized by PolyMet.

Type 2 - Type 2 mulch materials shall be applied by blowing, with asphalt emulsion being sprayed into the Type 1 material as it leaves the blower. Disc anchoring will not be required. The rates of application shall be 2 tons of Type 1 and 250 gallons of asphalt per acre.

Type 3 - Type 3 mulch materials shall be applied by blowing or spreading. Application rates shall be 2 tons of Type 1 mulch per acre (or other approved rate). The mulch shall be anchored with an Imco disc or other approved equipment the same day it is placed.

Type 4 - Type 4 mulch shall be applied with hydraulic spray equipment at the rate of 650 gallons per acre (four parts water to one part TREX), or 1,300 gallons per acre (9 parts water to one part Coherex) or another rate and chemicals as designated by PolyMet. The slurry mixture shall be uniformly sprayed on the prepared seed bed. The Engineer will verify, by inspection of tank loading and spray application, that materials applied correspond with the per acre requirements within reasonable limitations.

Type 5 - Type 5 mulch shall be applied with hydraulic spray equipment at the rate of 1,500 to 2,000 lbs./acre (or other approved rate). The slurry mixture shall be uniformly sprayed on the prepared seed bed.

Type 6 - Type 6 mulch materials shall be applied by:

1) Blowing on 2 tons/acre of Type 1 mulch material.
2) Application over the Type 1 mulch of 1000 lbs./acre Type 5 mulch.

F. Sodding

Sod used shall be field-run, consisting of good quality grasses and/or legumes. It shall be laid at right angles to the slope contours and satisfactorily staked to prevent creep and erosion.

G. Litter Reduction

Litter reduction will be a spring treatment used on interior areas displaying an excessive amount of organic material from previous year's growth. A brush hog, weed chopper or other equipment approved by PolyMet shall be used to chop and scatter the existing vegetative material. This treatment will normally be used alone.

H. Plowing

Plowing will be a fall treatment used on interior areas choked with root-bound vegetation or containing excessive amounts of litter. Unless otherwise specified, this treatment shall be done immediately prior to placing and working in fertilizer. Approximate depth of cut shall be eight (8) inches.

Method of Measurement

A. Basin Seeding (Areas)

Basin seeding will be measured by the area seeded, regardless of the seed mixture or quantity of seed used, and regardless of whether the seed was furnished by the Contractor or PolyMet. Areas reseeded by order of PolyMet, after the original seeding of the area was accepted, will be measured and added to the area originally seeded.

B. Mulch (Mulch - Tons)
(Oil - Gallons)
(Non-Petro Binder - Pounds or Gallons)
(Dust Retarding Chemicals - Gallons)

Mulch material of Type 1 will be measured by the weight furnished and applied acceptably.

C. Disc Anchoring (Acres)

Disc anchoring of Type 1 mulch will be measured by the area in acres of mulch disced acceptably.

D. Sodding (Square Yards)

Sodding will be measured by the area in square yards of sod laid and staked acceptably.

E. Plowing (Acres)

Plowing will be measured by the area in acres treated acceptably.

VEGETATIVE SPECIFICATIONS

I. Treatment A - Fertilizing and Planting Flat Areas on the Tailings Basin -

This treatment, described below, will be done mainly on the flat, fine tailings found on the basin interior area. Some may be done on coarse tailing with slopes flatter than 3:1.

Treatment

A. Fertilization

1. Application will be made using a mechanical spreader, hydro-seeder, or other equivalent device approved by PolyMet.

2. Fertilizer will be 400 pounds of 20-20-0 per acre (or equivalent) applied at a uniform rate, or any other rate designated by PolyMet.

3. After application, the fertilizer will be worked and thoroughly mixed with the tailing using a disc (or equivalent) to an approximate depth of six (6) inches.

B. Sowing of Seed

1. Seed Mixtures

Mixture No.	Species	Rate (Lbs./Acre)	Total (Lbs./Acre)	Acres
1	Rye	20		
	Sweet Clover	5	35	30
	Redtop	5		
	Alsike Clover	5		

2. Any substitute mixture or individual species designated by PolyMet.

2. The individual species or mixtures will be sown in one application in areas clearly designated by PolyMet.

3. Method of Application If the seed is not premixed, it will be mixed by the contractor in the proper proportions and sown using a hydroseeder, broadcast seeder or equivalent.

4. Soil firming using a cultipacker or equivalent will be required for all Treatment "A" acres and will follow seeding as soon as possible. In all cases, packing will be complete within 24 hours of seeding.

I. Treatment A - Fertilizing and Planting Flat Areas on the Tailings Basin - (Continued)

C. Mulching – Type 3

II. Treatment B - Fertilizing and Planting Tailing Slopes

This treatment, described below, will be done mainly on the 2:1 sloped tailing dams, but some may be done on natural ground.

Treatment

A. Fertilization

1. Application will be made using a mechanical spreader, hydroseeder, or another equivalent device approved by PolyMet.

2. Fertilizer will be 600 pounds of 11-55-0 per acre and 100 pounds of 0-46-0 per acre (or equivalent) applied at a uniform rate, or any other rate designated by PolyMet.

3. After application, the fertilizer will be worked and thoroughly mixed into the tailing or topsoil with a klodbuster or equivalent to an approximate depth of 4 inches (6 passes over a given area).

B. Sowing of Seed

1. Seed Mixtures

Mixture No.	Species	Rate (Lbs./Acre)	Total (Lbs./Acre)	Acres
1	Canada Bluegrass	10		
	Redtop	5	65	10
	Cicer Milkvetch	10		
	Birdsfoot Trefoil	20		
	Perennial Ryegrass	10		
	Alsike Clover	10		
2	Brome	10		
	Red Fescue	10		
	Perennial Ryegrass	10		
	Cicer Milkvetch	10	70	10
	Birdsfoot Trefoil	20		
	White Clover	10		
3	Any substitute mixture or individual species designated by PolyMet.			

2. The individual mixtures will be sown in one application in areas clearly designated by PolyMet.

II. **Treatment B - Fertilizing and Planting Tailing Slopes** (Continued)

B. Sowing of Seed (Continued)

3. Method of Application - if seed is not premixed, it will be mixed by the Contractor in the proper proportions and sown using a hydroseeder or similar equipment approved by PolyMet.

4. The seed will be covered by dragging a light chain over the surface, one (1) pass of the klodbuster or covering by a similar method approved by PolyMet.

5. All legume seed will be pre-inoculated and supplemented in hydroseeder tank.

III. **Treatment C - Fertilizing and Planting Stockpiles and Minewall**

This treatment, described below, will be done in the Spring or fall on stockpile and minewall areas.

Treatment

A. Fertilization and Seeding

1. Application will be made using a hydroseeder, mechanical spreader or another equivalent device approved by PolyMet.

2. Fertilizer will be 400 pounds of 19-19-19 per acre (or equivalent) applied at a uniform rate, or any other rate designated by PolyMet.

3. Seed Mixture:

Species	Rate** (Lbs./Acre Bulk)		Total** (Rate/Acre)	Acres
Creeping Red Fescue	10	}		
Smooth Brome	10	}		
Timothy	5	}		
Oats (Grain)	15	}	65	10
Sweetclover (White Blossom)*	5	}		
Birdsfoot Trefoil*	15	}		
White Dutch Clover*	5	}		

* Pre-inoculated and supplemented in hydroseeder tank.
** Rates may be increased for dormant plantings.

4. Method of Application - The fertilizer and seed may be mixed and applied in one application by the contractor using a hydroseeder, spreader or other similar equipment approved by PolyMet.

III. **Treatment C - Fertilizing and Planting Stockpiles and Minewall** (Continued)

B. Mulching - Types 5 and 6 specified in Part IV (Treatment D)

IV. **Treatment D - Mulching Only**

A. Explanation

These are fertilized and seeded areas which require mulching or areas mulched for dust control.

B. Mulching

1. Type 6 (straw or hay held in place with Type 5 mulch) mulch will be distributed at a rate provided in Part II of the general specifications and uniformly spread to provide the most adequate vegetative protection on all Treatment "B" acres and approximately 8 acres of Treatment "C".

2. Type 5 mulch will be distributed at a rate provided in Part II of the general specifications and uniformly spread to provide the most adequate vegetative protection on all but 8 acres of Treatment "C" sites.

Appendix D

PolyMet Mining Company, Standard Procedure, Mine Site and Plant Site Fugitive Emission Control Plans

Hoyt Lakes, Minnesota **STANDARD PROCEDURE**		
MINE SITE FUGITIVE EMISSION CONTROL (FEC) PLAN		
General Manager's Approval ____________________ Manager's Approval _________________________ Initiator _________________________	Date Effective 2/14/07	SP Number ER09
History: 2/15/07 – ER09 - preliminary version to support Detailed Project Description		

1.0 Introduction

PolyMet Mining Company (PolyMet) expects to be issued an Air Emissions Operating Permit upon completion of environmental review and processing of an Air Emissions Permit Application for its NorthMet project. The project proposes to operate a base and precious metals mine and processing plant located at Hoyt Lakes, Minnesota. This Fugitive Emission Control (FEC) Plan covers activities at the mine. **Note that this preliminary document is written to apply to the operating and fully staffed facility not the current non-operating situation and that all referenced procedures and manuals do not yet exist.**

2.0 Objectives

The objectives of the FEC Plan are to outline the basic procedures to prevent or minimize the release of fugitive emissions as required by the anticipated air emission permit. The plan outlines the practices followed to control emissions, how it will be determined when emissions require corrective action, the procedures that will be employed to manage the emissions, and the record keeping that will be used to demonstrate fugitive emission control.

The fugitive emission sources outlined in the permit application are discussed in the next section including a general description of each process involved and associated fugitive emission control procedures

3.0 Fugitive Emission Sources

The following offers a detailed overview of the operation of the fugitive emission sources and the factors relied upon to control fugitive emissions.

3.1 Drilling and Blasting

Blasting activity is conducted based on safety, noise reduction, and emission control. Several steps are taken to comply with the Minnesota Rules 6130.3800 and .3900, including:

1. Weather data obtained from Universal Weather and Aviation.

2. Aircraft fly-in service employed to monitor for proper meteorological conditions. The aircraft conducts safety surveillance and records temperatures aloft to approximately 6700 feet. PolyMet will not blast when temperature inversions and wind conditions create air overpressure beyond state and federal limits.

3. A test blast is also conducted a half-hour before each blast. Decibel readings are taken in the nearby communities to determine if it is safe, a maximum reading of 130db is allowed.

4. Proper blast agent loading and blast hole stemming alleviates noise and emissions by directing the blast energy outward, into the rock, instead of into the atmosphere.

5. Reliance on natural conditions.

The only actual fugitive emission abatements relied upon are the natural conditions of the environment, such as relative humidity, precipitation, and moisture content of the surface and refusal (waste rock and ore). The typical hygroscopic moisture content of the refusal is highly variable in a region where wet bottom mining is common.

3.2 Loading and Unloading Material

Several of the fugitive emission sources for material loading and unloading in the permit application are listed below:

FS001, FS014, FS019, FS002, FS017, FS045, FS048 and FS018	Surface overburden truck loading and unloading
FS007, FS009 and FS020	Ore truck loading and unloading
FS004 and FS005	Waste rock truck loading and unloading
FS010	Ore railcar loading

The amount of fugitive emissions generated by truck loading and unloading and railcar loading is influenced by a number of factors:

1. The type of materials (surface, waste rock, ore, etc.)
2. The nominal size of the material
3. The dumping procedure (direct or dump and push)
4. The drop distance
5. The natural conditions of the environment

The drop distance from the shovel to the truck will be adjusted to minimize fugitive emissions during surface overburden truck loading (FS001, 019, 017, 048), ore truck loading (FS007) and waste rock truck loading (FS004). The drop distance at the Rail Transfer Hopper is also minimized to control fugitive emissions during ore rail loading (FS010). Fugitive emission control for material loading and dumping is contingent upon the natural conditions of the environment as mentioned previously. The fugitive emissions that may be created are minimized because of the material's large size, its natural moisture content, and the minimization of drop distances.

3.3 Haulage Roads

The emissions from transport on haulage roads and unpaved roads (FS011, FS012, and FS049) are the transport emission sources identified in the permit application. Natural conditions in the environment control fugitive emissions during material transport.

Controlling fugitive emissions from haulage and unpaved roads is important for safety as well as the environment. Standard operating procedures are in place to control these emissions, including:

1. If visible emissions are observed or reported by an equipment operator, PolyMet will investigate the condition and dispatch water trucks or other action to decrease the fugitive emissions.

2. Fugitive emission control is achieved with the application of water and/or several different MPCA approved commercial dust suppressants.

3. During the winter months, salts ($NaCl/CaCl_2$) and sand mixtures are used to enhance safety and control fugitive emissions from the roads.

4. The haulage roads are surfaced with crushed rock having low silt content, thus affording proper traction, vehicle support, minimizes tire wear, and reduces fugitive emissions.

PolyMet maintains adequate watering and/or dust suppressant application capacity to control emissions during typical summer months. PolyMet continues to evaluate new technologies in emission abatement for their effectiveness and economic feasibility.

3.4 Surface Overburden, Ore and Waste Rock (Including Lean Ore) Stockpiles

The surface overburden (FS043, FS044), ore (FS042) and waste rock (FS013, FS022, FS041, FS040) including lean ore stockpiles may release minimal fugitive emissions during construction depending on:

1. Nominal size of the material
2. Dumping procedures
3. Drop distance
4. Natural conditions of the environment

Fugitive emission control during the construction is primarily dependent on natural conditions of the environment, while minimizing drop distances and the relatively large size of most of the surface and rock formation are used as control practices. Once construction is completed, PolyMet follows the Mineland Reclamation Rules set forth in Minnesota Rules. PolyMet benches and slopes the stockpile as needed, surface material and/or glacial till is normally spread over the stockpile and benches, and then vegetated. Vegetation provides structural support, erosion control, wildlife habitat, and aesthetic value.

3.5 Other Sources

Other sources of fugitive emissions include portable crushers on site and small truck traffic around the property. PolyMet will ensure that contractors control their fugitive emissions.

Dust from small truck traffic is controlled when the trucks travel on the main haul roads. Water and or dust suppressants are occasionally applied to the service roads in and around the mine area when traffic and weather conditions require.

4.0 Operating Practices and Control Measures

The operating practices and control measures that will be implemented and recorded for the significant fugitive emission sources are described/summarized below.

4.1 Truck Loading and Unloading,(FS001, FS014, FS019, FS002, FS017, FS045, FS048, FS018, FS007, FS009, FS020, FS004 and FS005) & Storage Piles (FS043, FS044, FS042, FS040, FS013, FS022 and FS041)

Primary Control: Natural moisture content
Rock size
Environmental conditions

Contingent Control: None

Practices: Minimized the drop distance
Dumping procedure

Records: Fugitive emissions exception reporting

4.2 Haulage and Service Roads (FS011, FS012 and FS049) – haulage roads are subject to frequent haul truck traffic – service roads are subject to occasional haul truck traffic as haul trucks access fueling or maintenance facilities

Primary Control: Water and/or dust suppressant application
Rain during non-freezing conditions
Snow during freezing conditions
Road maintenance including crushed rock surfacing and grading

Contingent Control: Other dust suppressant application

Practices: Employees notify shift manager or appropriate personnel of fugitive emissions
Road maintenance
Water trucks

Records: Fugitive emissions exception reporting

4.3 Railcar Loading (FS010)

Primary Control: Environmental conditions

Contingent Control: None

Practices: Minimize drop distances
One daily observation/check

Records: Number of railcar loads
Daily checks and corrective actions

4.4 Drilling and Blasting

Primary Control: Natural conditions (i.e. humidity, precipitation, and moisture content)

Contingent Control: None

Practices: Blast under safe meteorological conditions
Direct blast into rock rather than vertically into atmosphere

Test blast conducted

Records: Weather data from Universal Weather and Aviation
Decibel readings
Time and location of blast

5.0 Training

An integral part of the implementation of the FEC Plan is training the personnel involved. Specific training will be give to each person as it pertains to their job. Records of their names, dates, durations, and subjects of each training exercise will be kept. Each training exercise will cover the basics including:

1. Employee responsibilities
2. Reporting
3. Record keeping
4. Corrective actions
5. Maintenance
6. Work orders
7. Dust observation
8. Weather observations

These basic principles are taught to each employee and are addressed in the annual training log.

6.0 Records

The following records regarding fugitive emission controls will be maintained at PolyMet as required:

1. Commercial dust suppressant information (applications, permits, etc.)
2. Winter emission control activities
3. Water truck inspection and maintenance logs
4. Visible emissions exception reports
5. Work order numbers
6. Corrective action reports
7. Training records
8. MPCA Fugitive Emission Control Plan approval letter
9. Shift Coordinator's report
10. Air Emission Inventory Reports
11. Daily checks records
12. Water and haulage truck Global Positioning System (GPS) tracking records
13. Records of truck loading and unloading

7.0 Notifications

PolyMet will comply with the MPCA notification rules as outlined in Minnesota Rules 7019.0100, for shutdowns and/or breakdowns.

Hoyt Lakes, Minnesota **STANDARD PROCEDURE**		
PLANT SITE FUGITIVE EMISSION CONTROL (FEC) PLAN		
General Manager's Approval ____________________ Manager's Approval ________________________ Initiator ________________________	Date Effective 2/14/07	SP Number ER08
History: 2/15/07 – ER08 - preliminary version to support Detailed Project Description		

1.0 Introduction

PolyMet Mining Company (PolyMet) expects to be issued Federal; Part 70 Air Emissions Operating Permit (Title V) upon completion of environmental review and processing of an Air Emissions Permit Application for its NorthMet project. The project proposes to operate a base and precious metals mine and processing plant located at Hoyt Lakes, Minnesota. This Fugitive Emission Control (FEC) Plan covers activities at the Plant Site. **Note that this preliminary document is written to apply to the operating and fully staffed facility not the current non-operating situation and that all referenced procedures and manuals do not yet exist.**

2.0 Objectives

The objectives of the FEC Plan are to outline the basic procedures to prevent or minimize the release of fugitive emissions as required by the anticipated Title V permit. The plan outlines the practices followed to control emissions, how it will be determined when emissions require corrective action, the procedures that will be employed to manage the emissions, and the record keeping that will be used to demonstrate fugitive emission control.

The fugitive emission sources outlined in the Title V permit application are discussed in the next section including a general description of each process involved and associated fugitive emission control procedures.

3.0 Fugitive Emission Sources

The following is a detailed overview of the operation of the fugitive emission sources and the procedures used to control fugitive emissions.

3.1 Tailings Basin Roads

Controlling fugitive emissions from Tailings Basin roads (FS016) is important for safety as well as the environment. Standard operating procedures are in place to control these emissions, including:

1. If visible emissions are observed or reported by an equipment operator, the condition will be investigated. If it is determined that corrective action is needed, fugitive emission control measures will be initiated.
2. Fugitive emission control is achieved with the application of water and/or MPCA approved dust suppressants.
3. During the winter months, salts ($NaCl/CaCl_2$) and sand mixtures are used to enhance safety and control fugitive emissions from the roads.

Adequate watering and/or dust suppressant application capacity will be maintained to control emissions during typical summer months. New technologies for emission abatement will be evaluated for effectiveness and economic feasibility.

3.3 Limestone Unloading, Storage, Reclaim

Initially limestone will be delivered by truck (FS038) directly to a grizzly over a storage bin feed conveyor in an enclosed area (FS035, FS036 and FS037). Ultimately limestone will be delivered to the limestone storage yard where the limestone is inventoried before being added to the process. Transport to the yard is by railroad (enclosed dumping serviced by baghouse system). Transport from the yard to the process is by front end loader to a reclaim hopper. In addition to weather conditions and moisture content of the limestone, procedures to reduce fugitive emissions include:

1. Water may be applied to the storage piles via water monitors. Water is also applied to conveyors via spray bars and racks. Water sprays may be used during limestone handling as a contingent measure for dust control. The purpose of water application is to reduce emissions.

2. Positioning of the stacker to minimize drop distance.

3. Application of dust suppressants that can be safely and feasibly be used and not adversely affect the environment or the process.

4. Construction of a shed around the truck unloading area. (for initial period of truck delivery)

5. Sweeping of paved roads. (for initial period of truck delivery)

6. Installation of a partial enclosure around the reclaim hopper.

3.4 Tailings Basin

Wind erosion is a primary factor in fugitive emissions from the Tailings Basin (FS032). Tailings are spigotted from the outside edges of the basin across the beach area to the pond. The medium and coarse tailings are generally retained on the beach area, with the finest tailings generally being deposited in the pond. Standard operating procedures for the control of fugitive emissions are as follows:

1. Exterior slopes and beaches are contoured and compacted as construction is completed.

2. Seeding for permanent cover is performed during the planting seasons (Spring and Fall). Seeding is completed by June 15th in the Spring and October 30th in the Fall.

3. During the freezing months, freshly deposited tailings freeze and are covered with snowfall. Snow cover, road plowing, and general traffic are limited to active areas during the cold weather months.

4. Water elevation is maintained to provide maximum inundated safe level coverage for interior slopes and beaches. A minimum of beach is maintained between the crest of the perimeter dam and the waters edge, with a minimum free board from the top of the perimeter dam and the water line. Those minimums are determined by dam safety requirements.

5. The uncontrolled areas of beaches are seeded if inactive for eight (8) months or longer, mulched if inactive for two (2) to eight (8) months, and dust suppressant is applied if inactive for less than two (2) months. The time periods above may be altered by seasonal/climatic conditions.

6. The active tailings basin work area is kept wet by moisture from the wet tailings deposition, natural conditions (i.e. precipitation), and by capillary action (near the pond). The beach area can be accessed at any time by maintenance vehicles as required to conduct additional emission control procedures, such as seeding, mulching, or applying water and/or dust suppressant on any eroding areas.

Dust suppressants approved by the MPCA, such as Lignosulfonate, Lignosulfonate-magnesium chloride mix, and Coherex, are also applied, as needed, for fugitive emission abatement. The natural conditions of the environment also provide emission control and determine when other forms of control need to be implemented. Tailing basin airborne fugitive lift-off procedures are included as Appendix A.

3.5 Other Sources

Other sources of fugitive emissions include small truck traffic around the property. Dust from small truck traffic is controlled when the trucks travel on the tailings basin roads. Water and or dust suppressants are occasionally applied to the service roads in and around the plant area when traffic and weather conditions require.

4.0 Operating Practices and Control Measures

The operating practices and control measures that will be implemented and recorded for the significant fugitive emission sources described/summarized below.

4.1 Tailings Basin Roads (FS016)

Primary Control: Water and/or dust suppressant application
Rain during non-freezing conditions
Snow during freezing conditions
Road maintenance including grading

Contingent Control: Other dust suppressant application

Practices: Employees notify shift manager or appropriate personnel of fugitive emissions
Road maintenance
Water trucks

Records: Fugitive emissions exception reporting

4.2 Limestone Unloading, Storage, Reclaim (FS024, FS025, FS033, and FS034)

Primary Control: Water application via water monitors during non-freezing months
Environmental conditions

Contingent Control: Water application via additional portable equipment

Practices: Minimize drop distances
One daily observation/check

Records: Number of railcar loads
Daily checks and corrective actions

4.3 Tailings Basin (FS032)

Primary Control: Water and/or dust suppressant application
Seeding and mulching

	Environmental conditions
Contingent Control:	Other dust suppressant application Beach area reduction
Practices:	Minimize exposed areas Grading, compacting, seeding and mulching
Records:	Seeding and mulching (location and application date) Basin growth and/or reduction Fugitive emissions exception reporting

4.4 Small Truck Traffic

Primary Control:	Water and/or dust suppressant application Environmental conditions
Contingent Control:	Water application via additional portable equipment
Practices:	Employees notify shift manager or appropriate personnel of fugitive emissions Road maintenance Water trucks
Records:	Fugitive emissions exception reporting

5.0 Training

An integral part of the implementation of the FEC Plan is training the personnel involved. Specific training will be give to each person as it pertains to their job. Records of their names, dates, durations, and subjects of each training exercise will be kept. Each training exercise will cover the basics including:

1. Employee responsibilities
2. Reporting
3. Record keeping
4. Corrective actions
5. Maintenance
6. Work orders
7. Dust observation
8. Weather observations

These basic principles are taught to each employee and are addressed in the annual training log.

6.0 Records

The following records regarding fugitive emission controls will be maintained:

1. Commercial dust suppressant information (applications, permits, etc.)
2. Winter emission control activities
3. Water truck inspection and maintenance logs
4. Visible emissions exception reports
5. Work order numbers
6. Corrective action reports
7. Tailings basin records
8. Training records
9. MPCA Fugitive Emission Control Plan approval letter
10. Shift Coordinator’s report (limestone delivery records, road watering records, dust suppressant application, sweeping of paved roads, etc.)
11. Air Emission Inventory Reports
12. Daily checks records
13. Weekly road dust condition observation records

7.0 Notifications

PolyMet will comply with the MPCA notification rules as outlined in Minnesota Rules 7019.0100, for shutdowns and/or breakdowns.