TABLE OF EXHIBITS

WaterLegacy Objections to PolyMet Draft Permit to Mine

Attachment O

Memorandum from MPCA to DNR on Legacy

Document begins on pdf page 2931 of PolyMet PTM Application Dec. 2017
It is an attachment to the Appendix 15.1 Legacy Closure Plan for Ferrous LTVSMC Areas subject to Assignment from Cliffs Erie, L.L.C. Dec. 2017 (no author named)
Appendix 15 Financial Assurance

Legacy Permitting/Financial Assurance for Change in Assignment
Former LTV Steel Mining Company (LTVSMC) Tailings Basin and Plant Site
Ann Foss, Metallic Mining Sector Director
December 12, 2017

This memo addresses MPCA's views on the State's potential liability for closure of the Cliffs Erie/NorthMet ferrous tailings basin under a very specific scenario described in detail in section II below.

I. Background/Site History

I.A. LTV Steel Mining Company (LTVSMC)

LTVSMC owned a taconite processing facility and associated tailings basin near Hoyt Lakes, mining areas near Hoyt Lakes, Dunka mine, a railroad from Hoyt Lakes to Taconite Harbor, a dock and ship loading/unloading facility at Taconite Harbor, a power plant at Taconite Harbor, and real estate. LTV Corporation, the parent company to LTVSMC, filed for bankruptcy in 2000 and in January 2001 operations at the LTVSMC facilities ceased. As a result of subsequent bankruptcy proceedings, the State of Minnesota entered into a Master Agreement with the purchasers of the property (Cliffs Natural Resources, FKA Cleveland Cliffs, and Minnesota Power) and LTV. The Bankruptcy court approved the sale and closing occurred in October 2001. One goal of the Master Agreement was to preserve the assets for future use. In addition, under the 2001 Master Agreement, Cliffs Natural Resources provided a Corporate Guarantee as financial assurance under the DNR Ferrous Permit to Mine.

Cliffs Natural Resources has successfully transferred a portion of the property to Steel Dynamics, which owns the Mesabi Nugget plant and the neighboring mine area. MPCA and DNR permits covering this portion of the property were transferred/assigned to Steel Dynamics. As part of the Ferrous Permit to Mine, Steel Dynamics provided financial assurance to cover the associated ferrous responsibilities.

I.B. Cliffs Erie, LLC (CE)

Cliffs Erie, LLC (CE), a subsidiary of Cliffs Natural Resources, holds NPDES/SDS (WQ) permits for the remainder of the former LTVSMC property near Hoyt Lakes.

One of the WQ permits covers the taconite processing plant and the tailings basin ("Basin"). The Basin is also regulated by a 2010 Consent Decree between CE and MPCA, which resolves WQ permit compliance issues involving all WQ permits for the remaining portions of the former LTVSMC property, including the Basin. CE is currently in compliance with the Consent Decree. Neither the CE Basin WQ permit nor the Basin portion of the Consent Decree anticipates requiring a treatment facility for the foreseeable future.

I.C. Transfer/Assignment of legacy permits for the Basin

CE and Poly Met Mining, Inc. (PolyMet) have indicated that PolyMet intends to purchase the former LTVSMC processing plant, Basin, and other assets from CE. A condition to closing on that purchase is that the NPDES/SDS permit and Consent Decree obligations held by CE for the Basin be assigned to PolyMet or one of its affiliates (together, "PolyMet").

To facilitate transfer/assignments, proper requests/forms would need to be submitted to the MPCA by CE and PolyMet. MPCA would process the requests and determine whether to transfer the Basin WQ permit to PolyMet. As part of the transaction, obligations related to the Basin in the 2010 Consent Decree between CE and MPCA would be assigned to PolyMet using the process provided in that document.

The Basin is also currently regulated by the DNR under the CE Ferrous Permit to Mine (PTM) along with other remaining portions of the LTVSMC lands. DNR will handle this through their permit to mine process.

The Basin is regulated by a variety of other permits as well. All of these would go through a similar process to transfer or assign to PolyMet.

II. Question

DNR has the regulatory authority for establishing financial assurance related to closure of the ferrous Basin. DNR has asked for specific information from the MPCA to assist in its financial assurance decisions related to the ferrous Basin. MPCA has been asked to address the following:

What actions would the State need to take to close the ferrous Basin in a manner that ensures compliance with Minnesota's water quality requirements under applicable law for the following situation?

- PolyMet has obtained control of the property;
- Necessary ferrous permit transfers/assignments have been made to PolyMet.
- DNR has completed the permit to mine process related to the Basin and the associated financial assurance.
- The NorthMet project has not been fully constructed and is not operational (in particular, the seepage collection system and the wastewater treatment system). It is important to note that operation of the proposed NorthMet project resolves any legacy water quality issues at the ferrous Basin.
- The state becomes responsible for closure of the Basin.

This would occur sometime after DNR and MPCA permit decisions related to the NorthMet project. It is reasonable to assume that the soonest the events above would occur is one to two years after the NorthMet permit decisions. This puts the timeframe of the State's decision related to closure somewhere in the early 2020's or later. In the interim, the Basin will be operated in compliance with the Basin WQ permit and the Basin portion of the Consent Decree.

III. MPCA Response

The Basin will continue to be regulated under the CE Basin WQ Permit and the Basin portion of the CE Consent Decree while the NorthMet project permitting process continues.

The MPCA focus, in the closure scenario described above, would be protection of surface water quality and existing uses in the area of the Basin. Specifically, surface water quality in Mud Lake Creek, Unnamed Creek, Trimble Creek, and Second Creek would be the priority. Water quality data from existing monitoring points in these streams would be used in any assessments.

It is important to note that operation of the proposed NorthMet project resolves any legacy water quality issues at the ferrous Basin.

MPCA staff recommend the following activities in the near term. MPCA will work with CE and PolyMet to ensure these activities occur using the Consent Decree work plans or some other tool. If the property transfer from CE to PolyMet occurs, the portion of the Consent Decree assigned to PolyMet will include these activities:

1. Continuation of existing monitoring of surface and groundwater
2. Addition of a groundwater monitoring well near existing well GW006 with ongoing sampling for the same parameters, at the same frequency as the existing wells. Well installation completed.
3. Redevelopment and potential eventual replacement of GW010 to eliminate well construction materials as a potential contributor to groundwater pollutant levels.
4. Installation of a shallow piezometer in the wetland area adjacent to GW010. This will assist in determining the adjacent wetland influence on groundwater pollutant levels. Piezometer installation completed.

MPCA staff recommend the following be incorporated into DNR's PTM closure plan if the State becomes responsible for closure (the scenario in II. above):

1. The State needs to consider how long to continue to preserve the Basin asset before proceeding with final closure activities, including:
    - Commencement of dewatering of the Basin (pool water in cell 2E would be pumped to cell 1E in the Basin and then pumped to SD026 to remove the pools from the top of the Basin) as soon as reasonable following a decision to proceed with closure;
    - Discontinuation of current pump-backs from SD004, SD006 and SD026 as soon as reasonable following a decision to proceed with closure;
    - Grading at the Basin to allow for proper drainage; and
    - Construction of a permanent outlet structure to allow storm water to drain off the top of the Basin.
2. Regular evaluation of the monitoring data in the context of this memo and its conclusions. In particular, this should be done upon completion of any revision to the Class 3 and 4A standards and the wild rice sulfate numeric standard.
3. Additional sampling, biological testing and/or wild rice monitoring if deemed necessary by the MPCA.

No treatment/mitigation for alkalinity, hardness, total dissolved solids (TDS), specific conductance, sulfate, and mercury should be required.

IV. Basis for MPCA Response

MPCA reviewed the October 30, 2017, Barr technical memorandum titled "Tailings Basin Legacy Permitting/Financial Assurance for Title Transfer" (PolyMet's report).

MPCA's response considers the following:

1. Timing considerations
    a. As noted above, the facility has been closed since January 2001 and the current MPCA WQ permit for the Basin prohibits operation of the ferrous facility. No additional pollutants from processing have been added since January 2001 nor will they be added under the scenario discussed in this memo.

b. As noted above, the State Master Agreement had a goal of preserving assets for the future. This included the Basin. If the scenario above occurs, the State will need to consider how long to continue to preserve the Basin asset before proceeding with final closure.
c. The soonest this scenario will occur is the early 2020's.
d. If the State decides to proceed with final closure of the ferrous Basin, the MPCA will evaluate the environmental conditions at that time and the regulatory tools (see part V.C.4. of this document) available to the agency at that time to determine how to best resolve any remaining legacy water issues.

2. Groundwater
   a. Data shows groundwater quality is generally better than applicable groundwater standards at the property line. For aluminum, iron, manganese and pH, natural background exceeds the groundwater criteria. For arsenic and barium, an evaluation of tracer pollutants indicates these exceedances are not due to the Basin.
3. Mercury
   a. For mercury, in locations where surface water quality surrounding the Basin exceeds the standard, the higher concentrations are most likely due to influences from precipitation and background concentration, not from seepage from the existing Basin.

   MPCA concludes no treatment/mitigation is necessary in final closure for mercury.

4. Sulfate and wild rice
   a. Continuation of the current conditions associated with the Basin will likely not result in an exceedance of the calculated sulfate standard (or alternative sulfate standard in the proposed rule) if the MPCA's proposed rule revision goes into effect. Closure is not anticipated to change this conclusion, so no treatment/mitigation for sulfate would be required for protection of wild rice.
   b. If the wild rice rulemaking is not completed, another regulatory option available to the State would be to consider developing a site-specific standard based on the science at that time.

5. Class 3 and 4 pollutants
   a. As noted in V.C.1., MPCA is in the process of evaluating the existing water quality standards for alkalinity, hardness, TDS and specific conductance. MPCA has made this rulemaking a high priority and expects to propose revisions in 2018. Based on current information, MPCA expects that these standards will either remain unchanged or become less stringent. The rulemaking will provide clarity as to where the standards apply and how to determine whether the surface water meets the applicable standard. This clarity will be provided even in the event the numeric standards remain unchanged. This rulemaking should be complete prior to the early 2020's.
   b. Monitoring data indicates current compliance, future compliance, and uncertain compliance with the current standards using a protective compliance method.
   c. MPCA recommends regular evaluation of the monitoring data, especially upon completion of the revision to the Class 3 and 4A standards. In addition, based on evaluations, MPCA may recommend additional sampling or biological testing to support alternative regulatory approaches (see V.C.4).

   Considering the information above, MPCA concludes that if the scenario in part II. above occurred and the Basin had to be closed, no treatment/mitigation for alkalinity, hardness, TDS and specific conductance would be required.

V. Detailed Basis for Response based on Surface Water Quality

Surface water monitoring data was reviewed. The only parameters of concern identified were sulfate, mercury, alkalinity, hardness, total dissolved solids (TDS), and specific conductance. These will be discussed in the following order:

1. Mercury
2. Sulfate
3. Alkalinity, hardness, TDS and specific conductance

V.A. Mercury

- The applicable mercury standard is 1.3 ng/L.
- Monitoring data for Second Creek from 2010-2017 have been below the standard.
- Monitoring data for Mud Lake Creek, Unnamed Creek and Trimble Creek have fluctuated above and below the standard. The highest measured concentration was 6 ng/L.
- Data from four groundwater monitoring wells at the toe of the Basin indicate concentrations of mercury in Basin seepage are not increasing. Mercury levels in seepage to groundwater have generally been less than the surface water standard of 1.3 ng/L since 2013.
- Mercury levels in seepage are not expected to change (are not expected to increase). Final Basin closure will not change this.
- In addition, studies conducted by state agencies have found that taconite tailings appear to be a sink for mercury in northern Minnesota (e.g., Berndt (2003)). In particular, the sequestering of mercury through adsorption to solids in the tailings basin and subsequent burial in the sediments results in an overall permanent retention of mercury within the basin and decreases the mercury load released to receiving waters. The analysis in the NorthMet Final EIS demonstrates that mercury released to surface waters during taconite processing is insignificant with respect to mercury concentrations found in local precipitation and existing background surface waters. Surface water monitoring around the former LTVSMC tailings basin found mercury concentrations in surface water seepage around the tailings basin to be consistent with baseline levels, which confirms there is no significant addition of mercury to the environment from seepage from the existing Basin (FEIS, page 5-229, Table 4.2.2-4).
- It is important to note that, as indicated in Minnesota's Statewide Mercury TMDL, atmospheric deposition supplies almost all of the mercury reaching the environment (e.g., atmospheric deposition is the source of 99.5% of mercury in fish), and the great majority of mercury deposition in Minnesota (approximately 90%) originates from outside of the state. See https://www.pca.state.mn.us/water/statewide-mercury-reduction-plan. Concentrations of mercury in rainfall are around 10 ng/L.
- In locations where surface water quality surrounding the Basin is worse than the standard, the higher concentrations are most likely due to influences from precipitation and background influences, not from seepage from the existing Basin.

CONCLUSION: Considering all of the information above, MPCA concludes that if the scenario in II. above occurred and the Basin had to be closed, no treatment/mitigation for mercury would be required.

V.B. Wild Rice Surface Water Quality Standard

V.B.1. Background on the standard.

There is an existing surface water sulfate standard in state rule of 10 mg/L sulfate that applies to "water used for production of wild rice." The rule provides no further clarity on where the standard applies. Instead, it has been a case-by-case determination by the MPCA. In these case-by-case determinations, the MPCA staff review the available information to recommend whether the water in question was a wild rice *production* water (not simply if wild rice was present). In addition, the existing standard applies "when the rice is susceptible to damage from high sulfate levels," which is undefined. The MPCA has sometimes interpreted this to mean the wild rice growing season.

Data from groundwater monitoring wells (GW007, GW001, GW008 and GW0012) at the toe of the Basin indicate concentrations of sulfate in Basin seepage are not increasing. Following dewatering of the Basin in closure, seepage flow will decrease as the system stabilizes, so with stable concentrations in seepage, the impact on streams would not be expected to increase.

Due to issues related to implementing the existing standard and debate about the scientific details of the standard, MPCA is in the process of developing a revision to the wild rice rule. In addition, current state law prohibits MPCA from requiring expenditure of "money for design or implementation of sulfate treatment technologies or other forms of sulfate mitigation" until the current 10 mg/L sulfate wild rice rule is amended.

Recent scientific studies have found that sulfide in the sediment porewater where wild rice grows impacts wild rice; there is not a direct impact from sulfate in the surface water. Research has further shown that sulfide levels are largely controlled by three variables: surface water sulfate, sediment total carbon, and sediment total extractable iron levels. Based on this new information, the MPCA is currently pursuing a revised standard that would establish a protective sediment pore water sulfide level, then use the relationship between sediment sulfide, iron, and carbon to determine the numeric water column sulfate standard for a given wild rice water that maintains sediment pore water levels at or below the protective sulfide level. MPCA public noticed a revision to the standard in August 2017.

It is anticipated that the rule revision will be complete prior to the early 2020's.

V.B.2. Review of sulfate and sediment data

PolyMet collected sediment data from each of the waterbodies downstream of the Basin that MPCA included in the MPCA 2017 proposed rule.

In all but two instances, the calculated allowable sulfate concentrations using the proposed rule were higher than the corresponding measured surface water sulfate concentrations.

In Wynne Lake, of the nine sediment samples (4 grab samples and 5 composite) collected over three years, only one sample resulted in a calculated allowable sulfate concentration lower than the associated measured surface water sulfate concentration.

Regarding Second Creek, PolyMet's report states: "PolyMet's sampling in Second Creek downstream of the tailings basin relied on grab samples based on earlier proposed protocols rather than the composite samples required in MPCA's 2017 proposed rule." "Of the four grab sediment samples collected on Second Creek in 2015 and 2016, two of the samples had calculated allowable sulfate values higher than

the associated measured surface water sulfate concentrations. The two exceptions to this outcome are with grab samples SED-92 and SED-07, which had a calculated allowable sulfate concentration of 367 mg/L and 389 mg/L, with a corresponding measured surface water sulfate concentration of 380 mg/L and 451 mg/L, respectively."

The proposed rule allows for establishment of an alternate standard for sulfate "when the ambient sulfate concentration is above the calculated sulfate standard and data demonstrates that sulfide concentrations in pore water are 120 micrograms per liter or less." An alternate standard might be based on a proportional relationship between the maximum allowable increase in porewater sulfide concentrations and an increase in ambient sulfate. MPCA's sulfide sampling in Second Creek found pore water concentrations of less than 120 micrograms per liter, even where sulfate levels were higher than the MPCA's proposed equation-based standard would allow. The proposed rule proposes 120 micrograms per liter pore water sulfide as protective of wild rice.

Continuation of the current conditions associated with the Basin will likely not result in an exceedance of the calculated allowable sulfate concentrations or alternate sulfide standard if the MPCA's proposed rule goes into effect. Closure is not anticipated to change this conclusion.

This data is representative of all potential wild rice waters downstream of the Basin and upstream of the St. Louis River.

If the rulemaking is not completed, another regulatory option available to the State would be to consider developing a site-specific standard based on the science at that time.

CONCLUSION: As a result, MPCA concludes that if the scenario in II. above occurred and the Basin had to be closed, no treatment/mitigation for sulfate would be required for protection of wild rice.

V.C. Alkalinity, Hardness, TDS and Specific Conductance

V.C.1. Background on alkalinity, hardness, TDS and specific conductance standards.

Hardness is a Class 3 standard providing protection for industrial use. When this standard was developed in the 1960s, all waters were protected for this use, whether the use existed or not.

Alkalinity, TDS and specific conductance are Class 4A standards providing protection for irrigation use. These standards were developed in the same timeframe and apply to most waters whether the use exists or not.

At the point in time when the irrigation standards and the industrial use standards were developed, neither the standards nor the background supporting documents for the standards provided guidance on how to determine surface water compliance with the standards. The standards do not include a frequency or duration. For instance, is the standard a never-to-exceed value (an "instantaneous maximum"), a monthly average, an annual average, or some other duration? Minnesota adopted the Class 4A standards to protect irrigation uses, and a longer averaging time may be appropriate since a primary intent of the standards is to protect irrigated soil from the accumulation of salts over the long term. Hardness typically is not a significant concern for industrial water appropriators since surface water appropriated for such use is almost universally treated prior to use.

MPCA is in the process of evaluating these standards, has made them a high priority, and expects to propose revisions in 2018. Based on current information, MPCA expects that the standards will either

remain unchanged or become less stringent. The rulemaking will also provide clarity as to where the standards apply and how to determine surface water compliance. This clarity will be provided even in the event the numeric standards remain unchanged. This rulemaking should be complete prior to the early 2020's.

Neither irrigation nor industrial uses exist at or near the site today. The 7Q10 (low) flow in these headwater streams is zero and thus it seems unlikely someone would request to use these waters for irrigation or industrial use. The closest use for either industrial or irrigation purposes is an irrigation appropriation from Wynne Lake (located downstream in the Embarrass River) for a golf course. This is located over 10 miles downstream and there is significant watershed contribution to the river prior to reaching Wynne Lake that would result in dilution of any contributions from the Basin.

V.C.2. Review of monitoring data – Alkalinity, hardness, TDS and specific conductance

PolyMet's report evaluated the existing surface water monitoring data (2011-2016) using two statistical methods. One method uses the 95% confidence interval and one method uses the 95% prediction interval. The 95% prediction interval upper limit represents the 95% likelihood that all individual data points will be below that limit. Evaluating compliance by using the 95% prediction interval method is protective. As noted above, in V.C.1., neither the standards for these parameters nor the background supporting documents for the standards provide guidance on how to determine surface water compliance with the standards. The standards do not include a frequency or duration. For instance, is the standard a never-to-exceed value (an "instantaneous maximum"), a monthly average, an annual average, or some other duration? The current rulemaking will provide clarity as to how to determine surface water compliance. This clarity could result in a conclusion that these standards will be met.

The table below (from the PolyMet report) shows the approximate year surface water standards for these parameters will be met based on the 95% prediction interval upper limit.

Table 1 Approximate Year to Achieve Compliance with Water Quality Standards based on 95% Prediction Interval Upper Limit

Parameter	Water Quality Standard	Unnamed (Mud Lake) Creek	Trimble Creek	Unnamed Creek	Second Creek
Alkalinity, Bicarbonate as CaCO3	250 mg/L	Uncertain	Uncertain	2022	Uncertain
Hardness, as CaCO3	500 mg/L		Uncertain	2018	2024
Total Dissolved Solids	700 mg/L			2017(1)	
Specific Conductance	1,000 µmho/cm		Uncertain	2018	2018

■ - Prediction interval currently below standard

(1) Data used in calculations extend through December 2016; the upper limit of the 95% prediction interval reaches compliance in August 2017

- Using the 95% prediction interval upper limit, Mud Lake Creek, Unnamed Creek and Second Creek are in compliance with most of these standards or will be in compliance by the early 2020's. The exceptions are discussed below.

- Using the 95% prediction interval upper limit, it is uncertain when compliance with the alkalinity standard in Mud Lake Creek, Trimble Creek and Second Creek will occur.
- Using the 95% prediction interval upper limit, it is uncertain when compliance with the hardness and specific conductance standards will occur in Trimble Creek. However, it should be noted that individual monitoring results for hardness and specific conductance in Trimble Creek have been below the standard since 2015.
- Data from four groundwater monitoring wells (GW007, GW001, GW008 and GW0012) at the toe of the Basin indicate concentrations of alkalinity, hardness, TDS and specific conductance in Basin seepage are not increasing.
- It should be noted that data from a fifth groundwater monitoring well (GW006) is very different from the other wells. For purposes of this memo, MPCA is treating GW006 is atypical and not representative of Basin seepage. MPCA recommends that another monitoring well be placed in the same general area as GW006.
- As noted in V.C.1., the current rulemaking related to these standards will provide clarity on the numeric standards themselves, where the standards apply and how to determine whether a water complies with the applicable standard. This is expected to occur prior to the early 2020's.
- For Trimble Creek, it is uncertain whether alkalinity, hardness and specific conductance will be below the existing standard. More data and other regulatory tools may be necessary. This will be determined after the completion of the current rulemaking.

V.C.3. Expected conditions post-closure when the system has stabilized after dewatering (including removal of the pump-backs)

- Conditions will remain the same or improve in Trimble Creek and Mud Lake Creek.
- Current conditions and predictions above for Unnamed Creek and Second Creek are affected by the current operation of the Basin pump-back systems required by the existing Consent Decree.
- If closure of the ferrous Basin were required, the pump-back systems would be removed at some point to allow for dewatering of the Basin.
- PolyMet's report evaluated how the removal of the pump-backs may affect surface water quality in Unnamed Creek and Second Creek.
- PolyMet's report concludes that "continued decreases or stabilization of concentrations can be expected, even if pump-back activities are discontinued …"
- MPCA is uncertain whether the decreased impacts from dewatering the Basin will offset any increase due to cessation of the pump-backs. In particular, alkalinity could be above, below or at the existing standard following closure of the Basin. Therefore, more data and other regulatory tools may be necessary. This will be determined after the completion of the current rulemaking.

V.C.4. Other regulatory tools

At any point, the MPCA can consider other regulatory options such as site-specific standards (SSS), a use attainability analysis (UAA), a use and value demonstration (UVD), or a variance. These regulatory processes are available but are subject to various approvals including approvals by the MPCA and the United States Environmental Protection Agency (EPA). Factors that may be considered in a SSS include: consideration of specific ion concentrations as it relates to impacts to soil structure, the averaging period for determining compliance with the standards (monthly average, annual average, etc.) and the effects of seasonal applicability on the protection of designated uses. As noted above in V.C.1., there are not existing uses for industrial consumption or agricultural irrigation in the immediate vicinity of the Basin. Under these circumstances, one of these tools may be reasonable.

It is important to note that operation of the proposed NorthMet project resolves any legacy water quality issues at the Basin.

If early cessation of pump-backs has a negative effect on water quality, the pump-backs could be resumed and remain in place until standards are met and then be discontinued.

In considering all available regulatory tools, the MPCA would also need to consider the following:

1. The facility has been closed since January 2001 and the current MPCA WQ permit for the Basin prohibits operation of the ferrous facility.
2. MPCA would need to evaluate the environmental tradeoffs of all available approaches to determine the net environmental benefit. This evaluation would also consider environmental tradeoffs of the installation of a collection system to capture the Basin seepage, which could introduce additional environmental concerns (e.g., wetland impacts, hydrology impacts, etc.)

V.C.5. Conclusion

Considering all of the information above, MPCA concludes that if the scenario in II. above occurred and the Basin had to be closed, no treatment/mitigation for alkalinity, hardness, TDS and specific conductance would be required.

MPCA recommends regular evaluation of the monitoring data, especially upon completion of the revision to the Class 3 and 4A standards. In addition, based on evaluations, MPCA may recommend additional sampling or biological testing to support alternative regulatory approaches.

OAH 80-9003-34519
Revisor R-4324

STATE OF MINNESOTA
OFFICE OF ADMINISTRATIVE HEARINGS

In the Matter of the Proposed Rules of the Pollution Control Agency Amending the Sulfate Water Quality Standard Applicable to Wild Rice and Identification of Wild Rice Rivers, Minnesota Rules parts 7050.0130, 7050.0220, 7050.0224, 7050.0470, 7050.0471, 7053.0135, 7053.0205, and 7053.0406

REPORT OF THE CHIEF ADMINISTRATIVE LAW JUDGE

This matter came before the Chief Administrative Law Judge pursuant to the provisions of Minn. Stat. § 14.15, subd. 3 (2016), and Minn. R. 1400.2240, subp. 4 (2017). These authorities require that the Chief Administrative Law Judge review an Administrative Law Judge's findings that a proposed agency rule should not be approved.

Based upon a review of the record in this proceeding, the Chief Administrative Law Judge agrees with and hereby **CONCURS** with all disapprovals contained in the Report of the Administrative Law Judge dated January 9, 2018.

1. The Chief Administrative Law Judge **CONCURS** that the following proposed rules are **DISAPPROVED:**

a. Proposed **Minn. R. 7050.0220, subps. 3a, 4a, 5a, 6a**
b. Proposed **Minn. R. 7050.0224, subp. 2**
c. Proposed **Minn. R. 7050.0224, subp. 5, A**
d. Proposed **Minn. R. 7050.0224, subp. 5, B (1)**
e. Proposed **Minn. R. 7050.0224, subp. 5, C**
f. Proposed **Minn. R. 7050.0224, subp. 6**
g. Proposed **Minn. R. 7050.0471, subps. 3 through 9**

2. The following changes to rules as originally proposed are **DISAPPROVED:**

a. Proposed changes to **Minn. R. 7050.0224, subp. 5, B (1)**
b. Proposed changed to **Minn. R. 7050.0224, subps. 5, E, F**

c. Proposed changes to **Minn. R. 7050.0224, subp. 5, B (2)**

The changes or actions necessary for approval of the disapproved rules and repeals are as identified in the Administrative Law Judge's Report.

If the Department elects not to correct the defects associated with the repeal of the existing rules and the defects associated with the proposed rules, the Department must submit the proposed rules to the Legislative Coordinating Commission and the House of Representatives and Senate policy committees with primary jurisdiction over state governmental operations, for review under Minn. Stat. § 14.15, subd. 4 (2016).

Dated: January 11, 2018

TAMMY L. PUST
Chief Administrative Law Judge

OAH 80-9003-34519
Revisor R-4324

STATE OF MINNESOTA
OFFICE OF ADMINISTRATIVE HEARINGS

In the Matter of the Proposed Rules of the Pollution Control Agency Amending the Sulfate Water Quality Standard Applicable to Wild Rice and Identification of Wild Rice Rivers, Minnesota Rules parts 7050.0130, 7050.0220, 7050.0224, 7050.0470, 7050.0471, 7053.0135, 7053.0205, and 7053.0406

REPORT OF THE ADMINISTRATIVE LAW JUDGE

Administrative Law Judge LauraSue Schlatter conducted several public hearings on this rulemaking proceeding at various locations throughout the state. The hearings were held on the following dates at the following locations: the Harold Stassen Building in St. Paul, Minnesota, on October 23, 2017; the Mesabi Range College in Virginia, Minnesota, on October 24, 2017; Bemidji State University in Bemidji, Minnesota, on October 25, 2017; the Fond du Lac Tribal Community College in Cloquet, Minnesota, on October 26, 2017; and Central Lakes Community College in Brainerd, Minnesota, on October 30, 2017. Judge Schlatter held an additional hearing at the offices of the Minnesota Pollution Control Agency (MPCA or Agency) in St. Paul, Minnesota, on November 2, 2017. This hearing was also broadcast via interactive video conference to the MPCA's regional offices in Detroit Lakes, Duluth, Mankato, Marshall, and Rochester. All of the hearings continued until everyone present had an opportunity to be heard concerning the proposed rules.[1]

The MPCA proposes to amend the rules governing Minnesota's water quality standard to protect wild rice from excess sulfate. The existing standard limits sulfate to 10 milligrams per liter in water used for the production of wild rice. The proposed amendments would establish an equation to determine the protective level of sulfate in each "wild rice water" based on the concentration of iron and organic carbon in the sediment. When sulfate in the water interacts with iron and organic carbon in the sediment, they can form sulfide, which the MPCA has determined is toxic to wild rice.[2] The proposed rules would limit sulfide in the sediment of a wild rice water to 120 micrograms per liter; identify approximately 1,300 lakes, rivers, and streams as wild rice waters; establish a process for the future identification of wild rice waters; and describe

[1] Throughout this Report, the terms "rule" and "rules," as well as the terms "standard" and "standards," are used interchangeably and in a manner intended to reflect typical usage while encompassing the fact that the rulemaking proceeding addresses a proposed rule made up of various identified parts.
[2] Ex. D (SONAR) at 12.

the sampling and analytical methods to characterize sediment and determine porewater sulfide.[3]

The public hearings and this Report are part of a rulemaking process governed by the Minnesota Administrative Procedure Act.[4] The Minnesota Legislature designed the rulemaking process to ensure that state agencies meet all of the requirements that Minnesota law specifies for adopting rules.[5] The rulemaking process also includes a hearing when 25 or more persons request one or when ordered by the agency.[6]

The hearings were conducted to allow the Agency representatives and the Administrative Law Judge reviewing the proposed rules to hear public comment regarding the impact of the proposed rules and what changes might be appropriate.[7] Further, the hearing process provided the general public an opportunity to review, discuss, and critique the proposed rules.

The Agency must establish that the proposed rules are within the Agency's statutory authority; necessary and reasonable; follow from compliance with the required procedures; and that any modifications that the Agency made after the proposed rules were initially published in the *State Register* are within the scope of the matter that was originally announced.[8]

Adonis Neblett, General Counsel, represented the MPCA at the hearing. The members of the MPCA's hearing panel (Agency Panel) included Carol Nankivel, Rulemaking Coordinator; Shannon Lotthammer, Division Director for the Environmental Analysis and Outcomes Division; Ed Swain, Research Scientist with the Environmental Analysis and Outcomes Division; Catherine Neuschler, Water Assessment Section Manager; Gerald Blaha, Research Scientist with the Water Quality Standards Unit; Elizabeth Kaufenberg, Research Scientist with the Effluent Limits Unit; Phillip Monso, Research Scientist with the Water Quality Standards Unit; Scott Kyser, Engineer with the Effluent Limits Unit; and Debra Klooz, a Paralegal in the Legal Services unit.

The MPCA received thousands of written comments on the proposed rules between August 21, 2017 and November 2, 2017. Approximately 57 people attended the first public hearing on October 23rd in St. Paul, Minnesota and signed the hearing register. Fourteen members of the public provided oral comments regarding the proposed rules during the October 23rd hearing and one public exhibit was received during that hearing.[9]

Approximately 88 people attended the October 24th hearing in Virginia, Minnesota and signed the hearing register. Twenty-five members of the public provided oral

[3] Porewater is the water present in saturated sediment between the solid particles of minerals and organic matter.
[4] Minn. Stat. §§ 14.131-.20 (2016).
[5] *See* Minn. Stat. §§ 14.05-.20 (2016); Minn. R. 1400.2000-.2240 (2017).
[6] See Minn. Stat. § 14.25 (2016).
[7] *See* Minn. Stat. § 14.14; Minn. R. 1400.2210-.2230.
[8] Minn. Stat. §§ 14.05, 14.23, 14.25, 14.50 (2016).
[9] Exhibit (Ex.) 1000.

comments regarding the proposed rules during the October 24th hearing. Twelve public exhibits[10] and two Agency exhibits[11] were received during the October 24th hearing.

Approximately 44 people attended the October 25th hearing in Bemidji, Minnesota, and signed the hearing register. Fourteen members of the public provided oral comments regarding the proposed rules during the October 25th hearing and two public exhibits were received during that hearing.[12]

Approximately 89 people attended the October 26th hearing in Cloquet, Minnesota, and signed the hearing register. Twenty-seven members of the public provided oral comments regarding the proposed rules during the October 26th hearing and nine written public exhibits were received during that hearing.[13]

Approximately 53 people attended the October 30th hearing in Brainerd, Minnesota, and signed the hearing register. Twenty members of the public provided oral comments regarding the proposed rules during the October 30th hearing and nine public exhibits were received during that hearing.[14]

Approximately 26 people attended the November 2nd hearing in St. Paul, Minnesota, or watched via interactive video conference at one of the MPCA's regional offices in Detroit Lakes, Duluth, Mankato, Marshall, and Rochester. Eight members of the public provided oral comments regarding the proposed rules during the November 2nd hearing and three public exhibits were received during that hearing.[15]

In total, 38 exhibits were received during the public hearings.[16]

After the close of the last of the hearings, the Administrative Law Judge kept the rulemaking record open for an additional 20 calendar days, until November 22, 2017, to allow interested persons and the Agency to submit written comments. Thereafter, the record remained open for an additional five business days, until December 1, 2017, to allow interested persons and the Agency to file written responses to any comments received during the initial comment period.[17]

Approximately 1,500 written comments were received from members of the public after the hearings, along with two responses from the Agency.[18] To aid the public in participating in this matter, all comments were posted at the Office of Administrative

[10] Exs. 1001-1012.
[11] Exs. 1013-1014.
[12] Exs. 1015-1016.
[13] Exs. 1017-1024A.
[14] Exs. 1025-1033.
[15] Exs. 1033-1036.
[16] Exs. 1000-1036, which includes Exs. 1024 and 1024A.
[17] *See* Minn. Stat. § 14.15, subd. 1.
[18] MPCA Response to Public Comments (Nov. 22, 2017) and MPCA Rebuttal Response to Public Comments (Dec. 1, 2017).

Hearings' Rulemaking eComments website. In total, the Administrative Law Judge received more than 4,500 written comments on the proposed rule amendments.[19]

The hearing record closed for all purposes on December 1, 2017.[20]

NOTICE

The Agency must make this Report available for review by anyone who wishes to review it for at least five working days before the Agency takes any further action to adopt final rules or to modify or withdraw the proposed rules. If the Agency makes changes in the rules other than those recommended in this report, it must submit the rules, along with the complete hearing record, to the Chief Administrative Law Judge for a review of those changes before it may adopt the rules in final form.

Because the Administrative Law Judge has determined that the proposed rules are defective in certain respects, state law requires that this Report be submitted to the Chief Administrative Law Judge for her approval. If the Chief Administrative Law Judge approves the adverse findings contained in this Report, she will advise the Agency of actions that will correct the defects, and the Agency may not adopt the rules until the Chief Administrative Law Judge determines that the defects have been corrected. However, if the Chief Administrative Law Judge identifies defects that relate to the issues of need or reasonableness, the Agency may either adopt the actions suggested by the Chief Administrative Law Judge to cure the defects or, in the alternative, submit the proposed rules to the Legislative Coordinating Commission for the Commission's advice and comment. The Agency may not adopt the rules until it has received and considered the advice of the Commission. However, the Agency is not required to wait for the Commission's advice for more than 60 days after the Commission has received the Agency's submission.

If the Agency elects to adopt the actions suggested by the Chief Administrative Law Judge and make no other changes; and the Chief Administrative Law Judge determines that the defects have been corrected, it may proceed to adopt the rules. If the Agency makes changes in the rules other than those suggested by the Administrative Law Judge and the Chief Administrative Law Judge, it must submit copies of the rules showing its changes, the rules as initially proposed, and the proposed order adopting the rules to the Chief Administrative Law Judge for a review of those changes before it may adopt the rules in final form.

After adopting the final version of the rules, the Agency must submit them to the Revisor of Statutes for a review of their form. If the Revisor of Statutes approves the form of the rules, the Revisor will submit certified copies to the Administrative Law Judge, who will then review them and file them with the Secretary of State. When they are filed with

[19] Of these comments, the vast majority were form letters, form postcards, or petitions. *See* https://minnesotaoah.granicusideas.com/discussions/minnesota-pollution-control-agency-environmental-assessment-and-outcomes-division.

[20] Pursuant to Minn. Stat. § 14.15, subd. 2, a one week extension was granted for the preparation of this Report. *See* Order Extending Deadline for Rule Report (Dec. 28, 2017).

the Secretary of State, the Administrative Law Judge will notify the Agency, and the Agency will notify those persons who requested to be informed of their filing.

SUMMARY OF CONCLUSIONS

The MPCA has established that it has the statutory authority to adopt the proposed rules and that it followed the legal requirements to promulgate the rules.

The Administrative Law Judge **DISAPPROVES** the proposed repeal of the 10 mg/L sulfate standard at **Minn. R. 7050.0220, subps. 3a, 4a, 5a, 6a** and **Minn. R. 7050.0224, subp. 2,** due to the Agency's failure to establish the reasonableness of the repeal, and because the repeal conflicts with the requirements 33 U.S.C. § 1313(c), 40 C.F.R. § 131.10(b) (2015) and Minn. R. 7050.0155 (2017).

The Administrative Law Judge **DISAPPROVES** the proposed equation-based sulfate standard at **Minn. R. 7050.0224, subp. 5, B (1)** because the proposed rule fails to meet the definition of a rule under Minn. Stat. § 14.38 (2016) and Minn. R. 1400.2100.G (2017). In addition, the proposed equation-based sulfate standard is not rationally related to the Agency's objective in this proceeding, and is unconstitutionally void for vagueness.

The Administrative Law Judge **DISAPPROVES** the proposed list of approximately 1,300 wild rice waters at **Minn. R. 7050.0471, subps. 3 through 9** because it violates 40 C.F.R. §§ 131.3 and .11(h)(1).

In addition, the Administrative Law Judge **DISAPPROVES** the following proposed rules because the Agency failed to demonstrate that the proposed rules meet the required legal standards:

a. Proposed **Minn. R. 7050.0224, subp. 5, A** – to the extent the language incorporates the standard in items B(1) and (2) the language violates Minn. Stat. § 14.38 and Minn. R. 1400.2100.B and G (2017).

b. Proposed **Minn. R. 7050.0224, subp. 5, A** – to the extent the language incorporates the standard in item C, the language violates Minn. R. 1400.2100.D (2017).

c. Proposed **Minn. R. 7050.0224, subp. 5, C** – violates Minn. R. 1400.2100D.

d. Proposed **Minn. R. 7050.0224, subp. 6** – fails to establish need or reasonableness for rule. No reason for distinguishing between [WR], which are provided additional protection of narrative standard, and other wild rice waters listed at Minn. R. 7050.0471 violates 1400.2100.B.

The Administrative Law Judge finds that the Agency failed to provide adequate regulatory analyses as required by Minn. Stat. § 14.131 (1), (5), (7), and (8). While the Agency made the cost determination required by Minn. Stat. § 14.127, the Administrative

Law Judge concludes that this determination is not adequately supported in the rulemaking record.[21]

Based upon all the testimony, exhibits, and written comments the Administrative Law Judge makes the following:

FINDINGS OF FACT

I. Background to the Proposed Rules

1. This rulemaking concerns amendments to Minnesota's water quality standard to protect wild rice from adverse impacts due to sulfate pollution. Wild rice is an important natural resource in Minnesota. In addition to providing food to people and waterfowl generally, it has spiritual, cultural, and nutritional significance to the Dakota and Ojibwe people.

2. Under the federal regulations implementing the Clean Water Act (CWA), the MPCA is responsible for establishing, reviewing, and revising water quality standards.[22]

3. Federal law defines "water quality standards" to "consist of a designated use or uses for the waters of the United States and water quality criteria for such waters based upon such uses. Water quality standards are intended to protect the public health or welfare, enhance the quality of water and serve the purposes of the Act."[23]

4. Water quality standards "must be based on sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use."[24]

5. Minnesota Rules, chapter 7050 (2017) establishes water quality standards for "all waters of the state, both surface and underground."[25] This chapter sets out a classification system for the beneficial uses of waters, establishes numeric and narrative water quality standards, and provides nondegradation provisions, and other provisions to protect the physical, chemical, and biological integrity of waters of the state.[26] Water use classifications, and their accompanying narrative and numeric standards and antidegradation provisions, make up the state's set of water quality standards.

6. In Minnesota, the wild rice resource is protected with a unique water quality standard. The existing wild rice standards, found at Minn. R. 7050.0224, consist of a narrative standard in subpart 1 applicable to selected wild rice waters specifically identified in rule, and a numeric standard in subpart 2 that establishes a sulfate standard

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[21] *See Builders Ass'n. of Twin Cities v. Minnesota Dept. of Labor and Industry*, 872 N.W. 2d 263 (Minn. Ct. App. 2015).
[22] 40 C.F.R. § 131.4(a) (2017). Under state and federal law, the MPCA is charged with the administration and enforcement of the CWA. *See* 33 U.S.C. §§ 1251-1387 (2016); 40 C.F.R. § 123.25(a) (2017); Minn. Stat. § 115.03, subds. 1, 5 (2016).
[23] 40 C.F.R. § 131.3(i) (2017).
[24] 40 C.F.R. § 131.11(a)(1) (2017); *see also* 40 C.F.R. § 131.5(a)(2) (2017).
[25] Minn. R. 7050.0110.
[26] *Id.*

applicable to "water used for production of wild rice." The purpose of a designated use of a water body to protect wild rice is described as "the harvest and use of grains from this plant serve as a food source for wildlife and humans."[27]

7. Minnesota first adopted a sulfate standard to protect wild rice in 1973.[28] The sulfate standard was based on research conducted in the 1930s and 1940s that found that higher levels of sulfate in water correlated with reduced presence of wild rice.[29] Based on this research, the MPCA set the numeric standard at 10 mg/L of sulfate applicable to "water used for production of wild rice during periods when the rice may be susceptible to damage by high sulfate levels."[30]

8. Over the years, the MPCA has received comments and questions about the appropriateness of the sulfate standard and the meaning of the phrase "waters used for production of wild rice."[31] In 2011, the Minnesota Legislature directed the MPCA to undertake further study of the wild rice sulfate water quality standard and to revise the standard as necessary.[32] This rulemaking proceeding is the result of that legislative directive.[33]

9. In 2011, the Minnesota Legislature provided the MPCA with a $1.5 million appropriation from the Clean Water Fund to conduct a Wild Rice Sulfate Study to gather additional information about the effects of sulfate and other substances on the growth of wild rice.[34] The Legislature also directed the MPCA to undertake rulemaking to identify wild rice waters and to make any other needed changes to the standards following completion of the study.[35] The rulemaking was to be completed by January 15, 2018.[36]

10. The Minnesota Legislature also directed the MPCA to create an advisory group comprised of tribal government representatives and a variety of other stakeholders to provide input on the research and the development of future rule amendments.[37] The legislation further directed the MPCA to establish criteria for waters containing natural beds of wild rice after consulting Minnesota tribes, the Minnesota Department of Natural Resources (DNR), and stakeholders.[38]

11. In 2017, the MPCA received $180,000 from the Legislative Citizens Commission on Minnesota Resources to analyze wastewater treatment alternatives to

[27] Minn. R. 7050.0224, subp. 1.
[28] Ex. D SONAR at 11-12, 33-34.
[29] Ex. D at 11.
[30] Minn. R. 7050.0224, subp. 2.
[31] Ex. D at 11-12.
[32] 2011 Minn. Laws 1st Spec. Sess. ch. 2, art. 4, § 32.
[33] Ex. D. at 13.
[34] Ex. D at 13; 2015 Minn. Laws 1st Spec. Sess. ch. 4, art. 4, § 136.
[35] Ex. D at 13.
[36] 2015 Minn. Laws 1st Spec. Sess. ch. 4, art. 4, § 136.
[37] 2011 Minn. Laws 1st Spec. Sess. ch. 2, art. 4, § 32.
[38] *Id.*

inform the development of the proposed rules. The analysis is expected to be completed by May of 2018.[39]

12. In 2017, the Minnesota Legislature extended the deadline for completing this rulemaking by one year to January 15, 2019.[40]

II. Rulemaking Authority

13. The MPCA relies upon its general rulemaking authority under Minn. Stat. § 115.03, subd. 1 (2016), as its statutory authority to adopt these proposed rules. This statute provides that the Agency is given and charged with the following powers and duties:

> (a) to administer and enforce all laws relating to the pollution of any of the waters of the state;
>
> (b) to investigate the extent, character, and effect of the pollution of the waters of this state and to gather data and information necessary or desirable in the administration or enforcement of pollution laws, and to make such classification of the waters of the state as it may deem necessary;
>
> (c) to establish and alter such reasonable pollution standards for any waters of the state in relation to the public use to which they are or may be put as it shall deem necessary for the purposes of this chapter and, with respect to the pollution of waters of the state, chapter 116;
>
> (d) to encourage waste treatment, including advanced waste treatment, instead of stream low-flow augmentation for dilution purposes to control and prevent pollution; and
>
> (e) to adopt, issue, reissue, modify, deny, or revoke, enter into, or enforce reasonable orders, permits, variances, standards, rules, schedules of compliance, and stipulation agreements, under such conditions as it may prescribe, in order to prevent, control, or abate water pollution, or for the installation or operation of disposal systems or parts thereof, or for other equipment and facilities.[41]

14. The MPCA also relies upon its general authority to "group the designated waters of the state into classes, and adopt classifications and standards of purity and quality" under Minn. Stat. § 115.44, subd. 2 (2016), as a source of statutory authority to adopt the proposed rules. Minn. Stat. § 115.44, subd. 2, provides in part:

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[39] Ex. 1015; Letter from Iron Range Legislative Delegation (Nov. 2, 2017); Testimony (Test.) of Rep. Matt Bliss at Tr. 85 (Oct. 25, 2017); Test. of Rep. Rob Ecklund at 69-72 (Oct. 30, 2017).
[40] 2017 Minn. Laws, ch. 93, art. 2, § 149.
[41] Minn. Stat. § 115.03, subd. 1.

> In order to attain the objectives of sections 115.41 to 115.53, the agency after proper study, and after conducting public hearing upon due notice, shall, as soon as practicable, group the designated waters of the state into classes, and adopt classifications and standards of purity and quality therefor.

15. Additionally, the MPCA cites the specific legislative authorities that require it to initiate a process to amend the state water quality standards in Minn. R. ch. 7050,[42] and that extended the deadline for completing the mandated rule revisions.[43]

16. The Administrative Law Judge concludes that the Agency has the statutory authority to adopt the proposed rules.

III. Procedural Requirements of Chapter 14 (2016)

A. Publications

17. On October 26, 2015, the Agency published a Request for Comments in the *State Register* seeking comments on "its planned changes to rules governing water quality standards, Minnesota Rules chapter 7050 (Waters of the State)."[44]

18. On August 3, 2017, the Agency requested review and approval of its Notice of Hearing and Additional Notice Plan.

19. On August 8, 2017, Administrative Law Judge Eric Lipman issued an Order on behalf of Administrative Law Judge LauraSue Schlatter approving the Additional Notice Plan and Hearing Notice.

20. On August 21, 2017, the Agency published a Notice of Hearing in the State Register stating its intention to adopt rules following the receipt of input from the public.[45] In the Notice, the Agency announced a series public hearings scheduled for October 23, 24, 25, 30, and November 2, 2017.[46]

21. On August 21, 2017, the Agency sent via electronic mail the Notice of Hearing to all persons and associations who had registered their names with the Agency for the purpose of receiving such notice.[47] The Agency also provided a copy of the Notice of Hearing to all persons and associations identified in the Agency's Additional Notice Plan.[48]

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[42] 2011 Minn. Laws 1st Spec. Sess, ch. 2, art. 4, § 32.
[43] 2017 Minn. Laws ch. 93, art. 2, § 149.
[44] Ex. A; 40 *State Register* 477-78 (Oct. 26, 2015).
[45] Ex. F; 42 *State Register* 171-172 (Aug. 21, 2017).
[46] *Id*.
[47] Ex. G.
[48] Ex. H1.

22. On September 18, 2017, the Agency sent via electronic mail the Notice of Additional Hearing to all persons and associations who had registered their names with the Agency for the purpose of receiving such notice and to all persons and associations identified in the Agency's Additional Notice Plan.[49] In the Notice, the Agency announced an additional public hearing to take place in Cloquet, Minnesota, on October 26, 2017.[50]

23. The Agency published the Notice of Additional Hearing in the *State Register* on September 18, 2017.[51]

24. At the hearing on October 23, 2017, the MPCA filed copies of the following documents as required by Minn. R. 1400.2220 (2017):

a. MPCA's Request for Comments as published in the *State Register* on October 26, 2015;[52]

b. A Petition for Rulemaking submitted by the Minnesota Chamber of Commerce on December 17, 2010, and a Memorandum in Support of the Minnesota Chamber of Commerce's Petition for Rulemaking dated December 6, 2010;[53]

c. Proposed rules dated July 24, 2017, including the Revisor's approval;[54]

d. The MPCA's Statement of Need and Reasonableness (SONAR);[55]

e. The Certificate of Mailing the SONAR to the Legislative Reference Library on August 21, 2017;[56]

f. The Notice of Hearing as mailed and as published in the *State Register* on August 21, 2017; and the Notice of Additional Hearing as mailed and as published in the *State Register* on September 18, 2017;[57]

g. Certificate of Mailing the Notice of Hearing to the rulemaking mailing list and Certificate of Accuracy of the Mailing List dated August 21, 2017, and Certificate of Mailing the Notice of Additional Hearing to the rulemaking list and Certificate of Accuracy of the Mailing List dated September 18, 2017;[58]

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[49] Ex. H2.
[50] *Id*.
[51] Ex. F; 42 *State Register* 369-370 (Sept. 18, 2017).
[52] Ex. A; 40 *State Register* 477-478 (Oct. 26, 2015).
[53] Ex. B.
[54] Ex. C.
[55] Ex. D.
[56] Ex. E.
[57] Ex. F.
[58] Ex. G.

h. Certificate of Providing Additional Notice of the August 21, 2017, Notice of Hearing[59] and Certificate of Providing Additional Notice of the September 18, 2017, Notice of Additional Hearings;[60]

i. Written comments received during the prehearing comment period and a link to the Minnesota Office of Administrative Hearings' rulemaking eComments website, where written comments on the proposed rules received by the Agency prior to the hearing were posted;[61]

j. Chief Judge's authorization to omit from the notice of hearing published in the *State Register* the text of the proposed rules (not applicable);

k. Other documents or evidence to show compliance with any other law or rule which the agency is required to follow in adopting this rule:

K1 – Certificate of Sending the Notice of Hearing and SONAR to legislators and the Legislative Coordinating Commission on August 21, 2017;[62]

K2 – Notice to Department of Agriculture of Agency's intent to adopt rules as required by Minn. Stat. § 14.111, dated July 19, 2017;[63]

K3 – Notice to the Minnesota Department of Management and Budget and a September 17, 2017, memorandum from the Minnesota Department of Management and Budget;[64]

K4 – Notices sent to affected municipalities as required by Minn. Stat. § 115.44, subd. 7 (2016).[65]

l. Additional documents submitted at the hearing:

Peer-reviewed articles on sulfur processes and sulfate treatment;[66] the MPCA's rule hearing presentation; errata correcting minor errors in the SONAR; and MPCA Changes to Specific Water Identification Numbers (WID). [67]

[59] Ex. H1.
[60] Ex. H2.
[61] Ex. I.
[62] Ex. K1.
[63] Ex. K2.
[64] Ex. K3.
[65] Ex. K4.
[66] Exs. L1–L5 and L8.
[67] Exs. L6, L7, and L9.

B. Additional Notice Requirements

25. Minn. Stat. §§ 14.131 and 14.23 require that an agency include in its SONAR a description of its efforts to provide additional notification to persons or classes of persons who may be affected by the proposed rule or, alternatively, the agency must detail why these notification efforts were not made.

26. The MPCA states that the proposed revisions have been in development for many years and that it has made extensive efforts to inform and engage specific stakeholders and the general public. In April of 2011, the MPCA created a webpage to provide background about the existing wild rice sulfate standard and its plan to evaluate the standard. Since 2011, the MPCA has also used the GovDelivery system to share information about the wild rice standard with subscribers. In addition, pursuant to a 2011 legislative directive, the MPCA established an advisory committee to provide input to the Commissioner on various topics related to the wild rice scientific study and proposed rulemaking. The MPCA also made a special effort to communicate and consult with Minnesota tribes, given their sovereign status and the great importance of wild rice to the Ojibwe and Dakota people.[68]

27. The MPCA also held numerous meetings over the course of developing the proposed revisions to engage interested persons and obtain feedback.[69] The MPCA released a draft proposal of the proposed wild rice water quality standard in March 2015, along with a draft list of waters where the standard would apply. The MPCA sent notice of the availability of the draft proposal to the MPCA's GovDelivery mailing list of people who had registered their interest in this topic and posted the draft proposal on its rulemaking webpage.[70] Before officially proposing the rules, the MPCA held a series of three open house meetings to provide an informal opportunity for the public to review the proposal and ask questions.[71]

28. Pursuant to the Additional Notice Plan approved by the Office of Administrative Hearings, on August 8, 2017, the Agency:

a. posted the Notice of Hearing, SONAR, SONAR attachments, proposed rule language, documents incorporated by reference, information about how to file comments, and the times and locations of hearings on an Agency webpage established to provide information about the proposed rule amendments;

b. Published the Notice of Hearing on the MPCA's Public Notice webpage;

c. issued a press release via the GovDelivery system to 534 news media contacts and more than 3,400 media contacts and persons

[68] Ex. D at 126-128.
[69] *Id*. at 128.
[70] *Id*. at 129.
[71] *Id*.

registered to be notified of news releases to provide information about the proposed rule amendments and how to comment;

d. provided an extended comment period to allow additional time for review of the proposed rule amendments;

e. held multiple public hearings in various locations throughout the state and provided daytime and evening opportunities for people to attend and comment;

f. provided notice to a series of nonprofit organizations that represent and serve Native American communities in Minnesota; trade associations that serve mining communities and mining companies; and municipalities that operate wastewater treatment facilities and associations that represent them;

g. provided an electronic copy of the Notice of Hearing to more than 2,600 interested parties as certified in the MPCA's Certificate of Mailing Notice;

h. provided an electronic copy of the Notice of Hearing to municipalities as required by Minn. Stat. § 115.44, subd. 7;

i. posted the Notice of Hearing with links to the SONAR and proposed rule language on the Agency's public notice website for the term of the public notice comment period; and

j. posted the Notice of Hearing, SONAR, and proposed rule language on an Agency webpage established to provide information about the proposed amendments.[72]

29. The Administrative Law Judge finds that the Agency has fulfilled its additional notice requirements.

C. Notice Practice

1. Notice to Stakeholders

30. On August 21, 2017, the Agency provided a copy of the Notice of Hearing to its official rulemaking list (maintained under Minn. Stat. § 14.14) and to stakeholders identified in its Additional Notice Plan.[73]

31. On September 18, 2017, the Agency provided a copy of the Notice of Additional Hearing to its official rulemaking list (maintained under Minn. Stat. § 14.14) and to stakeholders identified in its Additional Notice Plan.[74]

[72] Exs. H1 and G. *See also* Ex. D at 131-132.
[73] Exs. G and H1.
[74] Exs. G and H1.

32. Hearings on the proposed rules were held on October 23, 24, 25, 26, 30, and November 2, 2017.[75]

33. There are 62 days between August 21, 2017 and October 23, 2017, the date of the first hearing in this matter. There are 37 days between September 18, 2017 and October 26, 2017, which was the date of the additional hearing.

34. The Administrative Law Judge concludes that the Agency fulfilled its responsibility to mail the Notice of Hearing and Notice of Additional Hearing "at least 33 days before the . . . start of the hearing."[76]

2. Notice to Legislators

35. On August 21, 2017, the Agency sent a copy of the Notice of Hearing and the SONAR to legislators and the Legislative Coordinating Commission as required by Minn. Stat. § 14.116.[77]

36. Minn. Stat. § 14.116(b) requires the agency to send a copy of the Notice of Hearing and the SONAR to certain legislators on the same date that it mails its Notice of Hearing to persons on its rulemaking list and pursuant to its additional notice plan.

37. The Administrative Law Judge concludes that the MPCA fulfilled the requirements of Minn. Stat. § 14.116(b).[78]

3. Notice to the Legislative Reference Library

38. On August 21, 2017, the MPCA mailed a copy of the SONAR to the Legislative Reference Library.[79]

39. Minn. Stat. § 14.23 requires the agency to send a copy of the SONAR to the Legislative Reference Library when the Notice of Intent to Adopt is mailed.

40. The Administrative Law Judge concludes that the Agency met the requirement of Minn. Stat. § 14.23 that it send a copy of the SONAR to the Legislative Reference Library when the Notice of Intent is mailed.

D. Impact on Farming Operations

41. Minn. Stat. § 14.111 imposes additional notice requirements when the proposed rules affect farming operations. The statute requires that an agency provide a copy of any such changes to the Commissioner of Agriculture at least 30 days prior to publishing the proposed rules in the *State Register*.

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[75] Ex. G.
[76] Minn. R. 1400.2080, subp. 6.
[77] Ex. K1.
[78] Minn. R. 1400.2080, subp. 6.
[79] Ex. E.

42. The MPCA provided the Commissioner of Agriculture with a copy of the proposed rules and notice of its intent to adopt the rules. This notice was provided on July 19, 2017, 32 days prior to the publication of the Notice of Hearing in the State Register.[80]

43. The Administrative Law Judge concludes that the MPCA fulfilled its responsibilities under Minn. Stat. § 14.111.

E. Statutory Requirements for the SONAR

44. The Administrative Procedure Act obliges an agency adopting rules to address certain factors in its SONAR.[81] Those factors are:

> (1) a description of the classes of persons who probably will be affected by the proposed rule, including classes that will bear the costs of the proposed rule and classes that will benefit from the proposed rule;
>
> (2) the probable costs to the agency and to any other agency of the implementation and enforcement of the proposed rule and any anticipated effect on state revenues;
>
> (3) a determination of whether there are less costly methods or less intrusive methods for achieving the purpose of the proposed rule;
>
> (4) a description of any alternative methods for achieving the purpose of the proposed rule that were seriously considered by the agency and the reasons why they were rejected in favor of the proposed rule;
>
> (5) the probable costs of complying with the proposed rule, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals;
>
> (6) the probable costs or consequences of not adopting the proposed rule, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals;
>
> (7) an assessment of any differences between the proposed rule and existing federal regulations and a specific analysis of the need for and reasonableness of each difference; and

[80] Ex. K2.
[81] Minn. Stat. § 14.131.

(8) an assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

1. The Agency's Regulatory Analysis

(1) A description of the classes of persons who probably will be affected by the proposed rule, including classes that will bear the costs of the proposed rule and classes that will benefit from the proposed rule.

45. The MPCA's analysis focuses on regulated facilities that discharge wastewater to certain waters containing beds of natural wild rice, and on people interested in enjoying the beneficial uses that the water quality standards protect. The Agency states that the beneficial uses includes fishing, swimming, boating, and harvesting wild rice.

a. Classes that will bear costs.

46. The Agency points out that effluent limits imposed on regulated facilities as a result of the proposed rules will be applied through National Pollutant Discharge Elimination System/State Disposal System (NPDES/SDS) permits. These permits are reviewed and re-issued every five years. Any facility that discharges sulfate directly to, or is located upstream of, a wild rice water governed by the rules has the potential to be affected by the proposed rules. These facilities are generally either industrial facilities, or municipal water or wastewater treatment plants.[82]

47. The MPCA describes the process for adopting the proposed equation-based water quality standards as follows:

> In the case of this wild rice sulfate standard, this implementation process will begin with data collection. As noted . . . , the data required will be sediment data to calculate the sulfate standard (or porewater sulfide data to establish an alternate standard), surface water sulfate data, and effluent sulfate data. The MPCA plans to collect the sediment data over time, largely in conjunction with its regular ten-year cycle of intensive watershed monitoring, focusing first on wild rice waters that are most likely to be impacted by high levels of sulfate. The exception would be that where a new or expanded discharge is proposed, the proposer may be required to collect the sediment data following the procedures proposed to be incorporated into the rule.[83]

48. The Agency notes that regulated facilities that are not already monitoring their sulfate effluent data will probably have to do so for their first five-year permit due to the fact that the permit will be reissued following adoption of the rule. Facilities will also be impacted by an effluent limit review, which involves analysis of site-specific variables

[82] Ex. D (SONAR) at 145-146.
[83] *Id.*

to determine whether the facility's permit must include a limit to ensure that the sulfate standard is not exceeded.[84]

49. The variables include specifics of the facility as well as the receiving water, including the level of the receiving water's sulfate pollutant The MPCA estimates that, for facilities that already monitor their effluent's sulfate discharge, the effluent limit review will likely occur in the first five-year permit reissuance after the rule is adopted. For facilities that do not, the effluent review will likely not occur until the second five-year permit reissuance after the rule is adopted.[85]

50. Another necessary variable for this analysis is a numeric sulfate standard for at least one wild rice water which is affected by the facility's discharge. To calculate the numeric sulfate standard in accordance with the proposed rule, certain data must be obtained, including the amount of organic carbon and extractable iron in the wild rice water sediment.[86]

51. By identifying the industrial and municipal waste water treatment plants (WWTPs) within a specified distance of a regulated wild rice water, the MPCA was able to estimate "the universe of affected dischargers."[87]

52. Based on an analysis of 2015 NPDES/SDS permit information, the Agency estimated that there are approximately 745 discharge stations upstream of at least one wild rice water to be regulated pursuant to the proposed rules, ranging in distance between one mile to 413 river miles from the nearest regulated wild rice water. About 319 of the stations are within 60 miles of a proposed regulated wild rice water, and about 135 are within 25 miles of a proposed regulated wild rice water. While noting that "25 miles is not a definite predictor for impact . . . ,"[88] the MPCA focuses on the 135 WWTPs as those most likely to be affected by the proposed rule. These facilities are most likely to require an effluent limit review and possibly to incur the treatment costs needed to meet an applicable water quality standard. But, the Agency notes, "[s]everal factors will affect a facility's potential to impact a wild rice water and those factors cannot be determined in advance of establishing the numeric sulfate standard and evaluating the specific circumstances associated with each discharge and each wild rice water."[89] The new standards could result in costs, if more treatment is needed to meet a standard that is more stringent than the current 10 mg/L standard, or in cost savings, if the standard is more relaxed than the current standard.[90]

53. The Agency states that industrial WWTPs are likely to pass along the costs of new treatment equipment or technologies to their customers and municipal WWTPs are likely to pass along similar costs to their residential, commercial, and industrial system

[84] Ex. D at 146.
[85] *Id.*
[86] Ex. C (proposed rule 7050.0224, subp. 5, B) at li. 7.25-8.12.
[87] *Id.* at 147.
[88] *Id*.
[89] *Id.*
[90] *Id.* at 148.

users. The Agency speculates that, to the extent the market will not support increased industrial costs, such costs may have to be absorbed, and will thus reduce profits, making the industry less competitive in the marketplace, negatively impacting shareholders and employees, and possibly resulting in a company ceasing operations rather than investing in the expensive technology needed to meet a new standard. The Agency acknowledges that employment is a particularly key issue for the mining economy of Minnesota's Iron Range, but it is unable to predict whether the consequences of adopting the proposed rule will be "as minor as a small increase in the price of the product, or may be as extensive as the consequences to an entire community when a company ceases operations."[91]

54. Adopting the standards through the MPCA's water assessment cycle will, in itself, take up to ten years:

> The MPCA's current Intensive Watershed Monitoring plan includes intensive data collection across the state following a 10-year cycle. The MPCA is working with field staff to incorporate data collection needs for the proposed sulfate wild rice standard into that effort. In most cases, the MPCA will integrate the collection of sediment data in wild rice waters into our regular monitoring work around the state. The agency will prioritize data collection for wild rice waters most likely to be affected by discharges, and some work may be prioritized outside the regular monitoring schedule.[92]

55. In its Rebuttal to Comments following the rule hearings, the Agency explains:

> [E]valuating the need for and (as needed) determining a water quality based effluent limit requires data specific to the discharge being evaluated and the receiving water(s) being discharged to. Data needs unique to the proposed rule revisions are the sediment iron and carbon (or porewater sulfide) data. Collecting all the data necessary to calculate all effluent limits statewide would take at least ten to fifteen years, even if the sediment data were not needed. Necessary steps such as gathering five years of effluent data to evaluate and set effluent limits combined with the 10-year surface water monitoring schedule to gather surface water data cumulatively add up to the necessary data not being available for some permitted discharges until at least ten to fifteen years after rule promulgation. The MPCA does plan to prioritize data collection based on factors such as those mentioned in the EPA comments, Appendix 2 – the likelihood of sulfate impacts (because of type and location of dischargers) and permitting schedules. It is unreasonable to delay this rulemaking for ten to fifteen years to provide total certainty regarding future effluent limits for specific facility discharges and the exact future costs. In addition, every facility is unique and detailed engineering is needed to estimate the costs of installing any treatment

[91] Ex. D. at 148.
[92] MPCA Response to Comments, Cover Memorandum at 10 (Nov. 22, 2017) (Response Cover Memo).

system. This is why the MPCA provided general effluent limit considerations and the range of costs detailed in the SONAR. A delay such as would be necessary to gather data and estimate the cost for all potentially affected facilities is particularly unreasonable given that while the rulemaking would be delayed the existing sulfate standard would remain in place and need to be addressed as required by the Clean Water Act and federal regulations. [93]

56. The Administrative Law Judge concludes that the Agency has correctly described the various types of WWTPs that discharge sulfate directly to, or that are located upstream of, wild rice waters governed by the proposed rules as classes that will bear the cost of the proposed rules. However, the Administrative Law Judge further concludes that the Agency omitted to include, in its discussion of the WWTPs' possible costs, the Agency's SONAR-based expectation, which is not set forth in the rule, that regulated parties will bear the cost of conducting sediment sampling for a new or expanded discharge.[94]

57. The Agency's predictions about the number of dischargers likely to be affected is unreliable because "[s]everal factors will affect a facility's potential to impact a wild rice water and those factors cannot be determined in advance of establishing the numeric sulfate standard and evaluating the specific circumstances associated with each discharge and each wild rice water."[95]

58. The Agency did not identify Minnesota Indian tribes or individual Native Americans as classes of persons who would bear a burden under the proposed rules because the Agency believes that the proposed new sulfate standards will be protective of wild rice.[96]

59. Wild rice is not only a food source for Native American communities, but a source of deep spiritual importance and, for some, a life-giving being.[97] Many in the Native American communities who submitted comments, testified at the public hearings, and worked with the MPCA during the development of this rule do not believe that the rule will be protective of wild rice. Among the reasons that some of the representatives of Native American communities presented as their concerns about the rule are:

a. A higher sulfate standard will be harmful to the rice because the higher levels of iron underlying the higher sulfate standard cause plaque to form on the roots of the wild rice plants, interfering with the ability of the plant to absorb nutrients and ultimately leading to barren seeds;[98]

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[93] MPCA Rebuttal Memo at 40-41.
[94] Ex. D at 146.
[95] *Id.* at 147.
[96] *Id.*at 145.
[97] Exs. 1000 and 1020; Tr. at 142-145 (Oct. 24, 2017); Comments from Fond du Lac Band of Lake Superior Chippewa (filed Nov. 22, 2017).
[98] Comments from 1854 Treaty Authority (filed Nov. 21, 2017); Comments from Fond du Lac Band of Lake Superior Chippewa (filed Nov. 22, 2017).

b. A higher sulfate standard will lead to higher levels of methylmercury in fish, which in turn leads to serious health concerns for Native American and other populations who rely heavily on fish for food;[99]

c. The list of wild rice waters excludes a number of waters identified by the 1854 Exclusionary Act Treaty as well as the Minnesota DNR's 2008 wild rice waters list;[100] and

d. The MPCA's inclusion, in the wild rice waters listed in the proposed rule, of waters that are within the boundaries of the Fond du Lac and Grand Portage reservations despite requests that those waters be excluded.[101]

60. While the MPCA had responses to each of these concerns, the volume and nature of the comments from the Native American community demonstrated that the Agency has not succeeded in building an atmosphere of trust regarding this proposed rule, or in making the Minnesota Native American community feel that it has been heard.

61. Implementation of the rule as proposed is a burden to the Minnesota Indian tribes, and many Native American individuals, whose testimony and written comments during the rulemaking process demonstrate that they are compelled to continue to challenge the rule because they believe that the long-term survival of wild rice is in peril and do not believe that the Agency understands the importance of wild rice in Native American culture and life.[102]

62. The Administrative Law Judge concludes that the Agency failed to recognize the proposed rule's burden on the Native American community in its discussion of classes of people who will be burdened by adoption of the proposed rule.

b. Classes that will benefit from the new standard.

63. The MPCA states generally that any person who uses Minnesota waters for drinking, swimming, boating, fishing, commerce, scientific, educational, or cultural purposes, or general aesthetic enjoyment will benefit from the proposed rules. Specifically, the Agency states that any person who harvests wild rice for food or who eats wild rice will benefit. The Agency emphasizes that many Native Americans, especially members of the Ojibwe and Dakota tribes, will benefit from the proposed rule. The Agency states that tribal rights to harvest wild rice are protected in treaties and that harvesting, preparing, sharing, and selling wild rice is important culturally, spiritually, and socially to Native American Minnesotans.[103]

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[99] Tr. at 65-68 (Oct. 25, 2017).
[100] Exs. 1000 and 1020; Comments from 1854 Treaty Authority (filed Nov. 21, 2017); Comments from Fond du Lac Band of Lake Superior Chippewa (filed Nov. 22, 2017).
[101] Ex. 1020; Comments from 1854 Treaty Authority (filed Nov. 21, 2017); Comments from Fond du Lac Band of Lake Superior Chippewa (filed Nov. 22, 2017).
[102] Exs. 1000 and 1020; Comments from Fond du Lac Band of Lake Superior Chippewa (filed Nov.22, 2017); eComments Nicolette Slagle on behalf of Honor the Earth (Nov. 22, 2017); eComments from George Crocker on behalf of North American Water Office (Nov. 22, 2017).
[103] Ex. D at 149.

64. The Agency asserts that the varied benefits of wild rice include the following:

> Transactions and activities associated with the wild rice harvest benefit individuals and local economies. Some tribal members have shared stories about how money from ricing paid for each year's school supplies. Many people place a high value on wild rice as food, especially for its availability, flavor, and health benefits. For persons who have limited incomes or a cultural connection, wild rice can be an important subsistence food.[104]

65. In addition, the MPCA states that wildlife, especially the migratory waterfowl that depend on wild rice as a food source, along with the people who hunt waterfowl, engage in bird watching and other wildlife-related activities, plus businesses that support those activities, will benefit from the proposed rules. The Agency adds that businesses that benefit from tourism and people who derive a value from ecosystem services generally will also benefit from the proposed rules.[105]

66. The Agency explains that, where the proposed rule will require ambient sulfate levels to be less than 10 mg/L, the equation-based standard will be more protective of the wild rice than the current standard and thus provide a benefit to those who use and value wild rice.[106]

67. To the contrary according to the MPCA, where the proposed rule will permit ambient sulfate levels to be higher than 10 mg/L while still maintaining a protective level of sulfide to the wild rice, the equation-based standard will potentially reduce treatment costs. In addition, the proposed alternate standard, which can be used in certain cases where the equation is not appropriate, could also allow sulfate levels to be higher than that calculated by the equation-based standard.[107]

68. The proposed rules may thus allow some municipal or industrial dischargers to reduce or eliminate sulfate treatment, or the need for a variance, to operate at a lower level of sulfate treatment. This could permit dischargers to avoid paying for a higher level of wastewater treatment, or applying for, and justifying, a variance request. In addition to the monetary costs of wastewater treatment, the MPCA notes that wastewater treatment for sulfate involves energy use and the generation of by-products, both of which could be lessened or avoided through application of the proposed rules. [108]

69. The Agency does not analyze how less-protective standards of wild rice waters that neighbor wild rice waters on tribal lands will affect waters on tribal lands. Nor does the Agency explain how it will insure that increased sulfate levels will not add to mercury methylation.

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[104] *Id.* at 150.
[105] *Id.*
[106] *Id.* at 151.
[107] *Id.* In its Rebuttal, the Agency proposes to change the way in which the Alternate Standard is established from the rule as originally proposed. MPCA Rebuttal Response to Public Comments (MPCA Rebuttal) at 6-7 (Dec. 1, 2017). *See* Ex. C. (proposed rule 7050.0224, subp. 5, B (2)) at li. 8.18-8.25.
[108] Ex. D at 151.

70. The Administrative Law Judge concludes that, to the extent the proposed rule fails to maintain a level of water quality that provides for the attainment and maintenance of the water quality standards of downstream waters, including waters on tribal lands, the proposed rule will not benefit wildlife, or the Objibwe, Dakota or other people who harvest or depend on wild rice for food, spiritual or cultural nourishment, or as a means of earning money.

c. Classes that will benefit from clarity regarding how and where the standard applies.

71. The MPCA states that the proposed rule may benefit dischargers "in the form of the benefit of regulatory certainty, prompt permit renewal, and protection from litigation."[109] By "regulatory certainty," the MPCA means "the general ability of permittees to know and anticipate environmental regulations and reasonably plan for compliance. . . ." [110]

72. The MPCA identifies two areas of difficulty for dischargers of sulfate: (1) a lack of duration or averaging time in the current sulfate rule, leading to uncertainty regarding whether the standard applies at all times or is to be averaged over some period of time; and (2) a lack of clear criteria for determining whether a given water is used for production for wild rice, resulting in case-by-case decisions regarding the applicability of the sulfate standards.[111]

73. According to the MPCA, it is this lack of clarity concerning waters used for the production of wild rice that has resulted in delayed issuance of new or renewed NPDES/SDS permits. Because the proposed rule specifically identifies wild rice waters and provides more details about the standard, the proposed rule provides dischargers with more certainty regarding "whether their effluent may impact a wild rice water and whether they will need to take actions because of the standard – from monitoring their effluent to undergoing an effluent limit review to installing treatment."[112]

74. The MPCA predicts that the proposed rule will speed permitting, reduce permitting backlogs, and reduce the risk of litigation. In addition, the Agency states that the proposed rule will "allow existing facilities to implement improvements and innovations that are currently stalled."[113] According to the Agency, industries and taxpayers will benefit because dischargers will be able to obtain and update their permits more effectively under the proposed rule.[114]

75. Finally, the MPCA envisages that greater clarity about how and where the wild rice sulfate standard applies will also allow the development of a clear process of

[109] *Id.*
[110] *Id*. at 151, n.24.
[111] *Id*. at 151-152.
[112] Ex. D at 152.
[113] *Id.*
[114] *Id.*

assessing wild rice waters to determine attainment of the standard. This is important both for assessment and identifying impaired waters and for developing point source permit limits to ensure compliance with the standard. In this way, a clearer, more effective standard will also benefit those concerned about the effective protection of wild rice waters.[115]

76. The tribal representatives and the WaterLegacy and other environmental organizations disagreed strongly with the exclusion of water bodies where wild rice is an existing use under the CWA as demonstrated by their inclusion on the 1854 Treaty list and the Minnesota Department of Natural Resources' (MDNR) 2008 list of Minnesota wild rice waters.[116] While not identifying specific reasons for excluding individual water bodies, the Agency acknowledges that it excluded from the proposed rule some water bodies where wild rice has been an existing use.[117]

77. The Administrative Law Judge concludes that because the proposed rule listing wild rice waters is not in compliance with the CWA it will not improve the permitting process by providing certainty as to the water bodies which are identified. Therefore, the proposed rule will not provide the benefit of clarity regarding identification of wild rice waters to WTTP owners and operators.

78. Because the Agency has not sampled the affected waters before proposing the rules, it cannot state what the standard will be for any given discharger, or whether that discharger's effluent will exceed a new standard, and what treatment may be needed to meet the standard, once it is ascertained.[118]

79. Regulated parties predict extremely large costs for wastewater sulfate treatment and express frustration at the lack of specific information which would allow them to accurately predict and plan for water treatment requirements or variance requests.[119]

80. The Administrative Law Judge concludes that the Agency's decision to promulgate this rule without defining a standard applicable to each regulated wild rice water undermines many of the potential benefits the rule could provide to WWTP owners and operators, including improvements in their ability to plan, certainty about regulated waters, and efficiency in the regulated environment.

81. The Administrative Law Judge concludes that the proposed rule may continue to give rise to litigation regarding the identification of wild rice waters subject to the sulfate standard. In addition, the rule as proposed is more likely to give rise to litigation

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[115] *Id.*

[116] Comments from 1854 Treaty Authority (filed Nov. 21, 2017); Comments from WaterLegacy (filed Nov. 22, 2017).

[117] Ex D at 58.

[118] *Id*. at 145-149, 165, 182-186.

[119] See, e.g., Exs. 1009, 1029, U.S. Steel Corporation comments (filed Nov. 22, 2017); Comments from Hibbing Chamber of Commerce (filed Nov. 2, 2017); Comments from Alexandria Lake Area Sanitary District (filed Nov. 20, 2017).

regarding the standard itself.[120] Therefore, the Administrative Law Judge concludes that the Agency incorrectly determined that the proposed rule will lead to less litigation concerning the water quality standards for wild rice waters.

82. The Administrative Law Judge finds that the Agency performed an analysis of classes of persons who probably will be affected by the proposed rule, including classes that will bear the costs of the proposed rule and classes that will benefit from the proposed rule as required by Minn. Stat. § 14.131(1). However, the Administrative Law Judge finds that the Agency's determinations as a result of that analysis are not supported by the record.

(2) The probable costs to the Agency and to any other agency of the implementation and enforcement of the proposed rule and any anticipated effect on state revenues.

83. The MPCA implements water quality standards primarily through permitting and assessment. The Agency states that it will continue its activities related to permit applications, variance requests, assessments, impaired water identification, and compliance enforcement using the revised standard instead of the previous standard.[121]

84. The MPCA predicts that it will incur the following additional costs if the proposed rules are adopted:

a. Updating the list of wild rice waters (data gathering and rulemaking);

b. Conducting sediment and surface water sampling and analysis;

c. Processing permit applications;

d. Reviewing variance requests; and

e. Responding to possible litigation.[122]

85. In this rulemaking, the Agency is proposing to identify approximately 1,300 waters as wild rice waters. While the Agency expects that these waters make up most of the wild rice waters in Minnesota, it expects it will be need to amend the rule within three years to add newly identified wild rice waters.[123]

86. The MPCA presumes that it will be able to gather information leading to the identification of additional wild rice waters through its existing triennial standards review process and its routine water assessment activities. Therefore, the MPCA does not expect to incur additional costs to obtain wild rice information.[124]

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[120] *See* discussion in this Report at 55-58.
[121] Ex. D SONAR at 152.
[122] Ex. D at 152-153.
[123] Ex. D at 153.
[124] *Id.*

87. The MPCA estimates the cost of a rulemaking including a hearing in three years will be approximately $129,000. The Agency projects that future amendments may not be controversial and may either be adopted without the need for a hearing, making them less costly, or may be combined with other rulemaking projects at no additional cost.[125]

88. Another cost of implementing the proposed rule will be calculating the new sulfate standard pursuant to the proposed equation-based standard or the alternative standard at each of the approximately 1,300 identified regulated wild rice waters. The MPCA plans to conduct analyses of the sediment of wild rice waters as part of its permitting process for new or expanding discharge sources, and its regular 10-year cycle of intensive watershed monitoring. The MPCA plans to initially focus its efforts to calculate the sulfate standard on wild rice waters associated with existing permitted dischargers.[126]

89. According to the MPCA, between 1,050 and 1,100 of the wild rice waters identified in the proposed rule are not currently impacted by a discharge, leaving approximately 200-250 waters for the MPCA to prioritize. The MPCA's plan to collect and sample the sediment, in order to calculate the standard under the proposed rule, is spelled out in the SONAR but not in the rule:

> [D]uring the existing process of preparation for each year's lake and stream monitoring, the MPCA will review how many wild rice waters are in the watershed, and the resources to collect and sample sediment. Waters to be sampled, if there are more than resources allow, will be prioritized based on factors such as the distance from dischargers, type of discharger, and timeline for permit reissuance.[127]

90. Using procedures for collection and analysis of the sediment according to the methods prescribed in its document entitled "Sampling and Analytical Methods for Wild Rice Waters,"[128] the MPCA determined that an average cost to conduct the necessary sampling analysis of a wild rice water in order to calculate the numeric sulfate standard will be approximately $1,200 per regulated wild rice water, including laboratory services.[129]

91. The MPCA separately calculated that the costs for porewater sampling and analysis to establish an alternate sulfate standard will be approximately $1,050 per

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[125] *Id.*

[126] As stated above, the MPCA expects that, for new or expanded discharge sites, the permittee will be responsible for the cost of characterizing sediment total extractable iron and sediment total organic carbon. Ex. D at 154. This expectation is not stated in the rule.

[127] Ex. D at 154.

[128] The MPCA incorporated the Sampling and Analytical Methods for Wild Rice Waters by reference into the proposed rule. Ex. C. at lines 9.8-9.12 (part 7050.0224, subp. 5, E). However, as discussed later in this Report, the MPCA's December 1, 2017 Rebuttal comments include a proposal to allow people to use methods consistent with its methods, rather than strictly conforming to the methods as written. In addition, the MPCA mentions that it may make changes to the Sampling and Analytical Methods document. MPCA Rebuttal at 6-7.

[129] Ex. D at 154.

regulated wild rice water, including laboratory analysis of 10 porewater samples. For the alternate standard, the $1,050 is in addition to the initial $1,200 for calculating the numeric sulfate standard, resulting in a total of $2,250.[130]

92. The MPCA was unable to estimate the costs for establishing a site-specific standard, except to state that they will be highly variable:

> In addition to the cost of sediment sampling, and possibly porewater sampling, there will be other costs unique to the situation. It is likely that more extensive sampling and analysis will be needed and additional costs will be incurred to determine the factors affecting the wild rice beneficial use in that water body.[131]

93. The MPCA predicts that, while the complexity of the proposed wild rice sulfate standard will require increased staff time and costs to review permit applications, that increase will be balanced by a decrease in time required to resolve questions about whether the sulfate standard applies to a particular receiving water. Only those waters listed as wild rice waters in the proposed rule will be subject to the rule's sulfate standard. The MPCA states that the determination of "whether a water is a 'water used for production of wild rice' has been a significant obstacle to efficiently applying the existing sulfate standard, requiring time from multiple staff to make a determination."[132]

94. Because such determinations will no longer be required under the proposed rule, the MPCA anticipates that the proposed rule will not result in significant changes to the Agency's current administrative costs to review permit applications.[133]

95. Similarly, the Agency states it does not believe that it will incur significant increases in costs to process variance requests as a result of the proposed rule. The Agency acknowledges that a revised standard will likely result in requests for variances from the new standard, but states "it is difficult to predict how many, when they will be received, and the degree of complexity of those requests."[134] Nonetheless, the MPCA concludes that, as with permitting costs, it "does not expect that the costs associated with increased variance reviews will exceed the costs associated with the complicated and time consuming process required to implement the current rules."[135]

96. The MPCA recognizes that the portion of the proposed rule allowing for an exemption from the fees for municipal WWTPs seeking a variance from a wild rice standard or effluent limit will entail a cost to the MPCA.[136] The MPCA forecasts that the fee waiver will not have a significant impact on its resources because it is developing a streamlined variance application and review process specifically for the sulfate standard.

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[130] *Id*. at 154-155.
[131] *Id*. at 154.
[132] *Id*. at 155.
[133] *Id.*
[134] Ex. D at 156.
[135] *Id.*
[136] *Id.* Ex. C. at 67.20-67.21 (proposed rule 7053.0406, subp. 2, C).

The Agency expects that the streamlined process will result in a reduced level of staff effort required to review applications for variances from the proposed sulfate standards.[137]

97. The Agency stated frequently during public hearings that it expects WWTPs that are required to meet higher sulfate standards to apply for variances from those standards.[138] The cost analysis does not reflect an anticipated increase in variance requests, or a discussion of whether the Agency expects variance requests to increase as a result of expected higher standards for some dischargers under the proposed rules.

98. The MPCA anticipates litigation costs regardless of whether the proposed rules are adopted. It is not able to estimate what the costs will be, but surmises that the costs will be higher if the new standard is not adopted than if it is adopted. This is based on the MPCA's assumption that legal challenges under the existing standard will have to do with the identification of waters used for the production of wild rice, and that legal challenges under the proposed standard will be to permits issued under the revised standard.[139]

99. The MPCA does not include in its litigation estimate any possible challenges from one or more of the many groups that have vigorously opposed this rule. Those groups include Native American communities, environmental groups, mining companies, power companies, municipal WWTPs, and a variety of governmental entities. The Administrative Law Judge concludes the MPCA may have underestimated litigation costs that could follow if the rule is adopted.

100. Explaining that other state agencies incur costs if they have permitted projects or operations required to comply with water quality standards, the MPCA states that other agencies, especially the Minnesota Department of Transportation (MnDOT), and the Minnesota Department of Natural Resources (MDNR) may incur additional costs under the proposed rules. MnDOT operates highway rest areas and MDNR operates campgrounds and fish hatcheries, all of which generate wastewater. The wastewater treatment systems associated with these activities are often subsurface sewage treatment systems that do not discharge. However, the MPCA has determined that eight MnDOT or MDNR facilities operate WWTPs that discharge to proposed wild rice waters.[140]

101. Another situation that could result in costs to MnDOT will arise if MnDOT conducts road construction in an area of high sulfate rock, resulting in increased sulfate storm water runoff to nearby regulated wild rice waters. The MPCA explains that state agency costs "in these situations will vary based on the treatment facility and receiving water characteristics and may be incurred regardless of the adoption of the proposed

[137] Ex. D at 109, 156.
[138] *See* Tr. at 51-54 (Oct. 23, 2017); Tr. at 47-48 (Oct. 24, 2017); Tr. at 59-60 (Oct. 30, 2017).
[139] Ex. D at 156.
[140] Ex. D at 157.

rules."[141] The MPCA concludes that it is unable to provide a reasonable estimate of possible costs without considering the site-specific factors.[142]

102. The MPCA predicts that the proposed sulfate rule's greater protection for regulated wild rice will increase the value provided by the wild rice, including tourism dollars related to increased wild rice harvesting and related activities, and sales tax on more abundant marketed wild rice. The MPCA predicts that if the proposed rules are not adopted these benefits to state revenue will be lost.[143]

103. The MPCA theorizes that the proposed rule, if adopted, may inhibit industrial growth or expansion due to the added costs of complying with more stringent sulfate standards. This could result in lost jobs and reduced state tax revenue. Conversely, the MPCA posits that, to the extent that the new standard requires less treatment of wastewater, there could be additional investment in new and existing industrial facilities, with added jobs and financial benefits to the state. The MPCA also points out that where additional treatment is required at existing facilities, the costs of new treatment systems, and the installation and operation of those systems, could provide additional employment, increased income, and equipment purchases with resulting increases in income and sales tax revenue for the state.[144]

104. Ultimately, the Agency concludes that, while the proposed rule change will likely affect state revenues, it cannot predict the direction or magnitude of the impact on revenues.[145]

105. The Administrative Law Judge concludes that the Agency performed the analysis required regarding probable costs to itself, and to any other agency, of the implementation and enforcement of the proposed rule and any anticipated effect on state revenues to the extent that it was able to do so with incomplete information.

(3) The determination of whether there are less costly methods or less intrusive methods for achieving the purpose of the proposed rule.

106. The Agency combined its response to this statutory requirement with its response to statutory requirement (4) below.

[141] *Id.*
[142] *Id.*
[143] *Id.*
[144] Ex. D at 157-158.
[145] *Id*. at 158.

(4) A description of any alternative methods for achieving the purpose of the proposed rule that were seriously considered by the agency and the reasons why they were rejected in favor of the proposed rule.

107. The MPCA notes that the determination of whether there are less costly or less intrusive methods to protect wild rice waters depends on what level of protection is desired. A less protective sulfate standard may result in lower treatment costs for some dischargers, but may be less beneficial for the groups who value wild rice. Similarly, a more narrow definition of what constitutes a wild rice water may be deemed a benefit to some, but overly restrictive to others.[146]

108. The MPCA considered a number of possible alternatives to the proposed rule including: (1) adopting a narrative standard; (2) adopting a higher protective sulfide value; (3) maintaining the existing 10 mg/L sulfate standard or adopting a different fixed numeric standard instead of the proposed equation; and (4) adopting an alternative equation standard other than the proposed equation.[147]

109. After reviewing the possible alternatives, the MPCA concluded that its proposed equation standard, which tailors the sulfate standard to the naturally variable environmental conditions, represents the best current scientific understanding of the effect of sulfate and sulfide on wild rice and provides the most precise protection of wild rice water's beneficial use.[148] The MPCA concluded that a narrative standard would not represent a significant improvement over the current fixed standard and could not be effectively implemented through permitting or assessment.[149] The MPCA also maintains that fixed numeric standards ignore current scientific information correlating wild rice viability with sulfide resulting from the interaction of sulfate with other compounds in the sediment.[150] According to the MPCA, the most accurate fixed standard is still much less accurate than the proposed equation-based standard.[151] The MPCA states that it considered other equation standards but ultimately concluded that its proposed equation standard is appreciably more accurate (misclassification rate of 16 to 19 percent) than the other modeling it analyzed.[152]

110. The MPCA also considered applying the current 10 mg/L standard or adopting an interim standard for all wild rice waters where no equation-based sulfate value has been calculated. Commenters expressed concern that it will take the MPCA many years to calculate a standard for the 1,300 wild rice waters identified in this rulemaking.[153] The MPCA acknowledges the validity of the concern about the length of time it will take to characterize 1,300 wild rice waters it proposes to list in the rule.

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[146] Ex. D at 159.
[147] *Id*. at 160-161.
[148] Ex. D at 159-163; MPCA's Response to Public Comments Attachment 1 at 3 (Nov. 22, 2017).
[149] Ex. D at 160.
[150] *Id*. at 161.
[151] *Id*.
[152] *Id*.
[153] Ex. D at 162.

However, it maintains it plans to prioritize those wild rice waters that receive or may receive a discharge from a permitted facility.[154] According to the MPCA, approximately 250-350 of the identified wild rice waters receive a discharge and it has developed an implementation plan to prioritize the sampling needed to calculate a numeric sulfate standard for those waters.[155]

111. The MPCA considered applying a "no net increase" in sulfate discharges to wild rice waters until a numeric standard is determined. But this proved to be difficult to create in rule and the Agency concluded it was unnecessary as no new discharges will be permitted without a sulfate standard being first calculated.[156]

112. The Agency also considered a number of alternatives to its criteria for identifying wild rice waters. The MPCA proposes to identify a wild rice water using the unique numeric identification it assigns to streams, rivers, and lakes.[157] This numeric identification is referred to as a water ID or WID.[158] Commenters expressed concern that identifying an entire large body of water as a wild rice water would not be reasonable if wild rice was only located in a small portion of the water body.[159] In response to these concerns, the MPCA considered identifying as a wild rice water only the specific area within a water where wild rice beds are found.[160] The MPCA concluded, however, that such an approach would be unreasonable because: (1) it would create a completely new system to identify a water, and (2) wild rice beds are known to move within a stream reach from one year to the next depending on hydrology and other factors.[161] According to the MPCA, a new form of identification would be inconsistent with the MPCA's many other data collection uses and would result in information that could not be effectively or efficiently compared and shared.[162]

113. The MPCA also received comments that its process of identifying wild rice waters was based on consideration of either too little or too much wild rice.[163] The MPCA maintains that the process it uses to identify wild rice waters reasonably characterizes them in regard to both the beneficial use of a Class 4D water (use of the grain as a food source by wildlife and humans) and the statutory mandate to consider the acreage and density of wild rice.[164] Under the proposed rules, the Commissioner is required to consider information about wild rice waters in the regular triennial water quality standards review process, which includes a public notice and comment period.[165]

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[154] *Id.*
[155] *Id.*
[156] *Id.*
[157] Ex. D at 40.
[158] *Id*. at 39.
[159] *Id*. at 162.
[160] *Id*. at 40.
[161] *Id*. at 40,162.
[162] *Id*. at 40-41.
[163] *Id*. at 162.
[164] *Id*.
[165] Ex. D at 163.

114. The MPCA considered alternatives for future identification of wild rice waters based on water bodies meeting specific stem densities or observation of wild rice over several growing seasons.[166] Ultimately, the MPCA decided that a specific threshold for determining wild rice waters was too limiting.[167] The MPCA maintains it is better to evaluate adding water bodies based on their unique factors as they relate to the beneficial use, which is the process the MPCA employed to identify the 1,300 wild rice waters being proposed.[168] The MPCA notes that, because each addition to the list of wild rice waters will be required to go through rulemaking, the specific factors demonstrating the beneficial use necessary to establish the water as a wild rice water will be considered in the SONAR and can be evaluated in that rulemaking.[169]

115. The MPCA also considered alternatives to the application of the proposed equation-based sulfate standard.[170] The MPCA contemplated applying averaging periods other than the annual average proposed. Some commenters suggested that a monthly average would be more protective of wild rice during critical growth periods.[171] Ultimately, the MPCA rejected shorter averaging periods. The MPCA maintains that its research supports the conclusion that porewater sulfide is a function of long-term (at least one year) average concentrations of sulfate, rather than short-term changes in surface water sulfate.[172]

116. The MPCA also considered alternatives for sediment sampling and analytical results in the equation-based standard.[173] The proposed rule establishes how many sediment samples must be taken and analyzed for iron and carbon and how the resulting values are used in the equation.[174] The MPCA proposes that the sediment of a wild rice water can be adequately characterized by a composite of five sediment cores from each of five different areas within the water body.[175] The MPCA proposes to designate the lowest of the five calculated sulfate concentrations as the sulfate standard for that wild rice water.[176]

117. Some commenters suggested taking the average value of the five sulfate concentrations, rather than the lowest.[177] Others suggested calculating the 10th or 20th percentile concentration from the data.[178] The MPCA considered these alternatives and concluded that taking the lower value would be the best approach. The MPCA contends that an average value would not be protective of the entire wild rice population and is susceptible to biasing high if the analysis yields one unusually high value that is

[166] *Id*.
[167] *Id*.
[168] *Id*.
[169] *Id*.
[170] Ex. D at 164.
[171] *Id*.
[172] *Id*.
[173] *Id.*
[174] *Id*.
[175] *Id*.
[176] Ex. D at 165.
[177] *Id*.
[178] *Id.*

incorporated into the average.[179] Using the lowest value is also easier to implement than calculating a percentile value. The MPCA maintains that using the lowest value from the set of calculated sulfate concentrations is a reasonable method to produce a protective sulfate concentration for a wild rice water.[180]

118. Both Representative Rob Ecklund (Minnesota House District 3A) and Representative Matt Bliss (Minnesota House District 5A) noted that the MPCA had received $180,000 from the Legislative Citizens Commission on Minnesota Resources to analyze wastewater treatment alternatives to inform the development and analysis of wild rice, sulfate, and other water quality standards.[181] That analysis will be completed in May of 2018.[182] Both Representatives Ecklund and Bliss were critical of the MPCA for proposing the new sulfate standard before the analysis of wastewater treatment alternatives was completed. Representative Bliss stated that the legislature moved the deadline for completing this rulemaking to January of 2019 specifically so the MPCA could use the results of the study to further inform its new wild rice standard.[183]

119. The Iron Range Legislative Delegation[184] commented in a joint letter pointing out that, during the 2017 Legislative Session, the legislature provided the MPCA with an additional year, until January, 2019, to adopt a new wild rice water quality standard. The letter states that "[t]he proposed rules are premature . . ." because the sulfate treatment cost analysis is not complete. The letter also expressed concerns about the relative untested nature of the science underlying the proposed standard, and supported eliminating the 10 mg/L standard.[185]

120. WaterLegacy opposes the MPCA's proposed equation standard.[186] It contends that the MPCA's assumption that iron protects wild rice from the harmful effects of sulfate loading is premature and inconsistent with both laboratory experiments and field experience.[187] According to WaterLegacy, the proposed equation standard will neither provide effective protection of wild rice nor clarify implementation.[188]

121. WaterLegacy also opposes the MPCA's proposed identification of wild rice waters.[189] According to WaterLegacy, the MPCA's proposal to restrict the water bodies in which any wild rice sulfate standard would apply is arbitrary and would remove a

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[179] *Id*.
[180] *Id*.
[181] Tr. at 87 (Oct. 25, 2017); Tr. at 69-72 (Oct. 30, 2017); Ex. 1015.
[182] Ex. 1015.
[183] *Id.*
[184] Letter from Iron Range Legislative Delegation (Senators David Tomassoni, Thomas Bakk, and Justin Eichorn, and Representatives Jason Metsa, Rob Ecklund, Julie Sandstede, Dale Lueck, and Sandy Layman) (Nov. 2, 2017).
[185] *Id.* at 1.
[186] WaterLegacy comments (filed Nov. 22, 2017).
[187] *Id*. at 18.
[188] *Id*.
[189] WaterLegacy comments (filed Nov. 22, 2017) at 30.

designated use and de-list wild rice waters identified by Minnesota state agencies, including waters downstream of existing and potential mining discharge.[190]

122. Similarly, both the Friends of the Boundary Waters and the Fond du Lac Band complained that the MPCA was removing a designated use when it failed to identify certain waters as wild rice waters.[191] The comments referred to all waters listed in Appendix B of the MDNR's 2008 *Natural Wild Rice in Minnesota* report and the 1854 Treaty Authority's 2016 and 2017 lists of wild rice waters.[192]

123. The MPCA maintains that not all surface waters in the state are class 4A waters used for the production of wild rice. The MPCA points out that the existing sulfate standard is applicable only to "water used in the production of wild rice" and that this modifying language clearly demonstrates that not all Class 4A waters are wild rice waters.[193] The MPCA also contends that the presence of a waterbody in the MDNR's 2008 inventory[194] is not sufficient to demonstrate beneficial use.[195]

124. Other commenters, like Mining Minnesota, complained that the MPCA was over-designating waters as wild rice waters.[196]

125. The Administrative Law Judge concludes that the MPCA provided the analysis required by Minn. Stat. § 14.131(4).

> **(5) The probable costs of complying with the proposed rules, including the portion of the total costs that will be borne by identifiable categories of affected parties, such as separate classes of governmental units, businesses, or individuals.**

126. The MPCA states that, because many of the variables affecting costs cannot be determined until the standard is actually implemented at a specific location it has limited information about the probable costs of complying with the proposed rules.[197]

127. The MPCA acknowledges that if a facility needs to treat its wastewater discharge to comply with the revised water quality standard, the design, construction, installation, and operation of the treatment system will be a major cost.[198]

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[190] *Id*.
[191] *See* MPCA's Rebuttal Response to Public Comments Submitted during the Post-Hearing Public Comment Period at 12 (filed Dec. 1, 2017).
[192] *Id*.
[193] *Id*.
[194] MDNR's 2008 *Natural Wild Rice in Minnesota – A Wild Rice Report Study Report to the Legislature* (2008), Appendix B.
[195] *Id*.
[196] *See* Comments from Mining Minnesota (filed Nov. 22, 2017) and MPCA's Rebuttal Response to Public Comments Submitted during the Post-Hearing Public Comment Period at 13 (filed Dec. 1, 2017).
[197] *Id*.
[198] Ex. D at 166.

128. In addition to municipal WWTPs, the MPCA permits nearly 520 industrial wastewater discharges under its NPDES/SDS permitting program.[199] The MPCA permits a variety of types of industrial wastewater discharge, including discharges from non-contact cooling water systems, ethanol producers, manufacturing facilities, food processors, paper mills, and power plants. Industrial wastewater dischargers also include sand/gravel/stone mining, peat mining, and taconite mining operations.[200]

129. The MPCA acknowledges that treatment for sulfate can be extremely expensive.[201] According to the MPCA, reverse osmosis (RO) membrane filtration is the most practical sulfate treatment technology currently available for removing sulfate from wastewater discharges.[202] However, the MPCA states that there are significant design uncertainties that make it difficult to estimate costs for RO treatment of sulfate.[203] According to the MPCA, a design engineer would need to perform extensive site-specific analysis and engineering testing in order to get the correct parameters to design and cost a full-scale plant capable of removing sulfate and meeting all potential permit limits.[204] The MPCA states that, if bench or pilot testing of operations is required to obtain design parameters, it will add well over a year to the full-scale plant design time and hundreds of thousands of dollars to the design costs.[205]

130. The MPCA states that treating municipal wastewater using RO followed by evaporation and crystallization is likely to have high capital costs associated with sulfate-polishing costs that are above the costs of conventional WWTPs.[206] There will also be high operation and maintenance costs associated with concentrate management.[207] Energy and disposal costs are the primary drivers of concentrate management operations and maintenance costs.[208] The MPCA notes that RO is an energy intensive process but evaporation with crystallization is much more so.[209] In addition, the crystalized salts must be disposed of at a landfill and the tipping and hauling fees will add cost.[210] The MPCA cites to the Barr report that found five to ten percent of operations and maintenance costs were associated with disposal fees.[211]

131. RO membrane treatment with evaporation and crystallization also has significant secondary costs such as high carbon emissions, advanced operator training requirements, and an increased need for operator labor hours.[212] According to the MPCA, when evaporators and crystalizers are operated in conjunction with a RO plant,

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[199] Ex. D at 169.
[200] *Id*.
[201] Ex. D at 182.
[202] *Id*. at 181-182.
[203] *Id*. at 181.
[204] *Id.*
[205] *Id.*
[206] Ex. D at 183.
[207] *Id*.
[208] *Id*.
[209] *Id*.
[210] Ex. D at 184.
[211] *Id*. citing SONAR Ex. 42.
[212] Ex. D at 184.

four to eight additional labor hours per eight-hour shift are normally required.[213] The MPCA acknowledges that the combination of these secondary considerations could prove prohibitively burdensome for affected communities.[214]

132. The MPCA notes that, with respect to municipal dischargers, there are some state programs available to mitigate the cost of activities necessary to comply with the proposed sulfate standard.[215]

133. With respect to taconite mine dischargers, the MPCA states that it is impossible to estimate the costs for treatment of taconite mine wastewater with a high degree of certainty as it will vary depending on the volume, concentration, level of treatment, and process used.[216] A mining company's 2012 estimate of costs associated with mining wastewater treatment to achieve the current wild rice sulfate standard of 10 mg/L identified total capital costs at over $20 million and annual operation and maintenance costs at nearly $3 million.[217]

134. The MPCA notes that the identification of 1,300 wild rice waters in the proposed rule will expand the number of permittees required to address sulfate treatment in their discharges.[218] This requirement will likely increase the cost of preparing a permit application for these permittees and the fees associated with the review of the application.[219]

135. In addition, the MPCA includes approximately $1,200 per body of wild rice water for taking samples to characterize the sediment and collecting and analyzing porewater for sulfide in order to develop the numeric standard.[220]

136. The record indicates that some industries and cities will incur substantial costs in complying with the proposed rules.

137. Many commenters expressed concern about the potential significant costs to municipal and industrial dischargers associated with achieving a revised sulfate standard. For example, the Duluth Area Chamber of Commerce indicated its opposition to the proposed rule revisions citing the prohibitively expensive treatment options.[221] Likewise, Nancy McReady with Conservationists with Common Sense (CWCS) predicted the proposed rules could bankrupt cities and businesses and result in large increases to residential sewer and water bills.[222]

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[213] *Id.*
[214] *Id.*
[215] Ex. D at 188.
[216] *Id*. at 184.
[217] Ex. D at 185, Table 18.
[218] Ex. D at 186.
[219] *Id*.
[220] *Id.*
[221] Rulemaking eComment from David Ross (filed Nov. 6, 2017).
[222] Rulemaking eComment from Nancy McReady (filed Nov. 4, 2017).

138. State Representative Mike Sundin (Minnesota House District 11A) echoed the Western Lake Superior Sanitary District's concern that implementation of RO treatment could require a $500 million investment, resulting in residential sewer bills increasing upwards of five times.[223] Gerard Bettendorf, mayor of the city of Foley, commented that the proposed rule could have a devastating economic impact on Foley and other cities throughout Minnesota.[224]

139. In its Response to Public Comments, the MPCA states that the conclusions made by some commenters regarding the extensive costs of implementing the proposed standard are premature.[225] The MPCA asserts that it intends to make use of available tools and "pursue creative strategies" to avoid impacts to municipalities and industries that would affect jobs, affordability of municipal services, and economic vitality.[226] According to the MPCA, economic and environmental health are not mutually exclusive.[227]

140. The Administrative Law Judge concludes that the MPCA has attempted to engage in the analysis required by Minn. Stat. § 14.131 but that the record does not support an adequate analysis.

(6) The probable costs or consequences of not adopting the proposed rule, including those costs borne by individual categories of affected parties, such as separate classes of governmental units, businesses, or individuals.

141. The MPCA asserts that there are two primary problems with the existing standard that would not be resolved if the proposed revisions are not adopted.[228] The first problem is the difficulty of determining how the standard applies and defining the waters to which the existing standard applies.[229] The existing standard has no clear information about duration and frequency and implementing the current standard requires a detailed case-by-case analysis to determine whether the wild rice beneficial use exists.[230]

142. According to the MPCA, failing to adopt the proposed revisions will result in continued uncertainty and the attendant need for case-by-case interpretation as to whether or not a water used for the production of wild rice is downstream of a discharge.[231] This confusion results in delays in the permitting process and increased costs of permit design and review.[232]

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[223] Rulemaking eComment from Rep. Mike Sundin (filed Nov. 21, 2017).
[224] Ex. 1029.
[225] MPCA's Response to Public Comments at 11 (filed Nov. 22, 2017).
[226] *Id*.
[227] *Id*.
[228] Ex. D at 189.
[229] *Id*.
[230] *Id*.
[231] *Id*.
[232] *Id*.

143. The MPCA states that the second problem is the existing numeric sulfate standard's lack of accuracy in protecting wild rice beneficial use.[233] The MPCA maintains that current scientific understanding of sulfate toxicity means that the existing standard may be, depending on the circumstances, either over-protective or under-protective.[234] By retaining the existing standard and not adopting the proposed equation-based approach, the MPCA believes there will be higher misclassification rates and less accurate and effective protection of wild rice.[235]

144. The MPCA also contends that failing to adopt the proposed equation-based standard will result in less effective protection of wild rice, negatively impacting the economic, ecological, and cultural benefits provided by wild rice waters.[236]

145. Many commenters urged the MPCA to not adopt the proposed rule and to instead retain the existing 10 mg/L standard.[237] These commenters noted that keeping the existing 10 mg/L standard would be easier to enforce and more cost effective than trying to implement the proposed equation.[238]

146. Many commenters also agreed that the sulfate standard should be enforced year-round as proposed in the rule, rather than just during the wild rice growing season as required by the existing rule.[239]

147. The Administrative Law Judge concludes that the Agency conducted the analysis required by Minn. Stat. § 14.131(6).

(7) An assessment of any differences between the proposed rules and existing federal regulation and a specific analysis of the need for and reasonableness of each difference.

148. The MPCA states that there is no federal counterpart to the equation-based sulfate standard for wild rice waters or the process for identifying wild rice waters.[240] Therefore, it is not possible to assess any differences between the proposed rule revisions and existing federal regulations. The MPCA maintains, however, that the proposed revisions are consistent with the intent of the CWA as well as reasonable interpretations of federal guidance and the federal expectation that states develop state-specific water quality standards.[241]

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[233] Ex. D at 190.
[234] *Id*.
[235] *Id*.
[236] Ex. D at 193.
[237] *See, e.g.,* Rulemaking eComment from Kris Wegerson (filed Nov. 21, 2017).
[238] *Id*.
[239] Ex. 1020.
[240] Ex. D at 197.
[241] *Id.*

149. No other state has established a beneficial use class for wild rice or established a sulfate standard applicable to wild rice.[242]

150. The Grand Portage and Fond du Lac Bands of the Minnesota Chippewa Tribe have each established a water quality standard for wild rice.[243] The water quality standards for both tribes generally define wild rice areas as bodies of water that "presently has or historically had the potential to sustain the growth of wild rice." Both also establish a numeric sulfate standard of 10 mg/L.[244]

151. The MPCA's current wild rice sulfate standard and proposed revisions to the wild rice sulfate standard differ from the tribal standards as follows:

a. The proposed revisions clarify the existing beneficial use to "the use of the grain of wild rice as a food source for wildlife and humans."

b. The proposed rule revisions apply the standard to identified wild rice waters based on supporting the beneficial use. The tribal standards apply the standards more broadly to waters on the basis of past, present, or future potential to sustain growth of wild rice.

c. The existing state rules apply the sulfate standard "during periods when the rice may be susceptible to damage by high sulfate levels." The proposed revisions apply the sulfate standard as an annual average that can be exceeded once in ten years. The Grand Portage tribal standards do not specify when the standard applies. The Fond du Lac sulfate standard is an instantaneous maximum limit.

d. The proposed revisions to the state sulfate standard establish the protective sulfate value through an equation rather than a fixed 10 mg/L standard. Both tribal sulfate standards are fixed numeric standards of 10mg/L.[245]

152. The Administrative Law Judge finds that the Agency failed to discuss the definition of "existing use" under the CWA, and how its decision to exclude certain waters previously identified as wild rice waters corresponds with the CWA's definition of "existing use." Therefore, the Administrative Law Judge determines that the Agency has not met its obligation under Minn. Stat. § 14.131(7) to assess the differences between the proposed rule and federal regulations and the reasonableness of each difference.

153. The Administrative Law Judge notes that the Agency failed to address the potential conflict between the 10 mg/L sulfate standard on the Fond du Lac and Grand Portage Indian Reservations and the proposed equation-based sulfate standard. While this failure may not technically violate the requirements of Minn. Stat. § 116.07, subd. 2(f) (2016), the Administrative Law Judge views this as a violation of the underlying purpose of this statutory requirement.

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[242] *Id.*
[243] Id.; SONAR Exs. 45 and 46.
[244] Ex. D at 197; SONAR Exs. 45 and 46.
[245] Ex. D at 197-198; SONAR Exs. 45 and 46.

154. The Administrative Law Judge finds that the Agency has met its special obligations under Minn. Stat. § 116.07, subd. 2(f), to assess the impact of the proposed rule and the approaches taken by neighboring states.

(8) Assessment of the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the rule.

155. "Cumulative effect" means the incremental impact of the proposed rule in addition to other rules, regardless of what state or federal agency has adopted the other rules. Cumulative effects can result from individually minor, but collectively significant, rules adopted over a period of time.[246]

156. As noted above, there is no federal counterpart to the wild rice sulfate standard. Therefore, there is no cumulative effect to assess with respect to other federal regulations.

157. The MPCA maintains that, because it is replacing the existing water quality standard and not proposing an additional standard, the revised standard does not create cumulative impacts.[247] According to the MPCA, an assessment of whether a regulation has a cumulative effect is "whether the proposed revisions duplicate an existing rule that achieves the same purpose."[248]

158. The Administrative Law Judge disagrees that this is the proper analysis for the question of cumulative effect. The Administrative Law Judge looks first to the plain language of the word "cumulative." The first dictionary definition of "cumulative" is "increasing by successive additions."[249] "Duplicative," in contrast, means "consisting of or existing in two corresponding or identical parts or examples."[250]

159. The legislative history of Minn. Stat. § 14.131(8) demonstrates that Minnesota legislators were not concerned with agencies promulgating rules that were duplicative. They were concerned with regulations that have an increasing effect on regulated parties. At a hearing before the Senate Committee on Finance when the "cumulative effect" language was under consideration, the MPCA's legislative director spoke to the committee:[251]

> One example [is] our agency deals with hazardous waste, medical waste. As we deal on the disposal side of it, once it gets to a landfill. However, up the chain of control of that issue that is handled by a number of additional

[246] Minn. Stat. § 14.131.
[247] Ex. D at 199.
[248] *Id.*
[249] Merriam-Webster online dictionary, https://www.merriam-webster.com/dictionary/cumulative.
[250] Merriam-Webster online dictionary, https://www.merriam-webster.com/dictionary/duplicative.
[251] Testimony of Kirk Koudelka, legislative director, MPCA before Senate Comm. On Finance, S.F. 1922 (Mar. 29, 2012).

> agencies that could have an impact on that. Us then having to do a cumulative effect on how a hospital handles their medical waste or how MnDOT regulates how they transport medical waste before it gets to the landfill.

160. In response to the Committee Chair Robling's concern that the MPCA was not considering the cumulative effect of regulations, and that legislators were hearing from constituents that the cumulative effect was overwhelming,[252] Mr. Koudelka replied:[253]

> For instance, right now we are working on some mercury rules for facilities and their mercury emissions. We do look at what other requirements are on the federal level on that. . . . . The way this is written, all other rules that affect that waste, through its chain of command, even though we may not personally have any authority over it, would have to be looked at. There is some concern on what that does to the scope from a number of agencies . . . .

161. The Administrative Law Judge finds that the MPCA has not met its obligation to assess the cumulative effect of the rule with other federal and state regulations related to the specific purpose of the proposed rule.

2. Performance-Based Regulation

162. The Administrative Procedure Act[254] also requires an agency to describe how it has considered and implemented the legislative policy supporting performance based regulatory systems. A performance-based rule is one that emphasizes superior achievement in meeting the agency's regulatory objectives and maximum flexibility for the regulated party and the agency in meeting those goals.[255]

163. The Agency asserts that the proposed rules meet the state's objectives for flexible, performance-based standards. It maintains that the existing WQS are a performance-based regulatory system. The WQS identify, using the best-available science, the conditions that must exist in Minnesota's water bodies to support each waters' designated uses. Because the proposed rules do not dictate how a regulated party must achieve the wild rice beneficial use or prescribe how they must operate to ensure compliance with the WQS, the Agency maintains they allow regulated parties maximum flexibility in meeting the standard. The Agency concedes, however, that, in the case of sulfate treatment, there are limited alternatives and options available to meet the standard. Nonetheless, the Agency contends that, by not dictating a single course of action and by allowing for variances, the proposed rules meet the requirement of emphasizing maximum flexibility for the regulated parties.[256]

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[252] Chair Claire A. Robling, Senate Comm. On Finance, S.F. 1922 (Mar. 29, 2012).
[253] Testimony of Kirk Koudelka, legislative director, MPCA before Senate Comm. On Finance, S.F. 1922 (Mar. 29, 2012).
[254] Minn. Stat. § 14.131.
[255] Minn. Stat. § 14.002.
[256] Ex. D at 201.

164. The Administrative Law Judge finds that the Agency has met the requirements set forth in Minn. Stat. § 14.131 for consideration and implementation of the legislative policy supporting performance-based regulatory systems.

3. Consultation with the Commissioner of Minnesota Management and Budget (MMB)

165. By memorandum dated September 7, 2017, Sean Fahnhorst, an Executive Budget Officer with MMB, responded to the MPCA's request to evaluate the fiscal impact and benefit of the proposed rules on local units of government, as required by Minn. Stat. § 14.131.[257] The MPCA estimates that the 62 municipal wastewater treatment plants that discharge into or within 25 miles upstream of identified wild rice waters are most likely to incur major costs to upgrade their treatment processes to comply with these revised standards.[258] The MPCA provided a "preliminary analysis of the costs" in its SONAR and indicated that it expects to complete further analysis of the costs and alternatives of sulfate treatment by May 2018.[259]

166. MMB reviewed the proposed rules and the Agency's SONAR. MMB noted that municipal wastewater treatment plants are generally not designed to remove sulfate and that upgrades to existing facilities will be non-standard and require site-specific analysis and engineering testing. MMB noted further that few options exist for removing sulfate from wastewater, and the methods available can be very expensive. MMB concluded that cost estimates for upgrades are only possible with detailed wastewater treatment plant design information.[260]

167. MMB also noted that the MPCA expects to grant variances to some municipal wastewater treatment facilities, which would exempt them from discharge limits related to this standard if they demonstrate that economic or technological factors prevent their compliance. Local governments would incur administrative costs applying for the variance, but the MPCA proposes to reduce some of these expenses by waiving the variance application fee and assisting municipalities with the application process.[261]

168. Finally, MMB noted that, in terms of fiscal impacts, the proposed rules may benefit some local governments by identifying nearby wild rice waters, clarifying wastewater regulations and standards, and attracting tourists.[262]

169. The purpose of the consultation with MMB required by Minn. Stat. § 14.131 is "to help evaluate the fiscal impact and fiscal benefits of the proposed rule on units of local government." [263] In this case, given the scarcity of information available about the

[257] Ex. K3.
[258] *Id.*
[259] *Id.*
[260] *Id*.
[261] Ex. K3.
[262] *Id*.
[263] Minn. Stat. § 14.131.

actual costs and benefits that are likely to accrue to local governments, the MMB memorandum reaches no conclusions regarding the adequacy of the information and analysis provided by the Agency. Nor is MMB provided with enough information to engage in its own evaluation of the fiscal impacts and benefits of the proposed rule on units of local government.

170. The Administrative Law Judge finds that the Agency consulted with MMB as required under Minn. Stat. § 14.131, but failed to provide adequate information to help MMB evaluate the fiscal impacts and benefits of the proposed rule on units of local government.

4. Cost to Small Businesses and Cities under Minn. Stat. § 14.127

171. Minn. Stat. § 14.127 requires the Agency to "determine if the cost of complying with a proposed rule in the first year after the rule takes effect will exceed $25,000 for: (1) any one business that has less than 50 full-time employees; or (2) any one statutory or home rule charter city that has less than ten full-time employees." The Agency must make this determination before the close of the hearing record, and the Administrative Law Judge must review the determination and approve or disapprove it.[264]

172. The Agency concludes that a small business or city within the definition of Minn. Stat. § 14.127 may incur expenses in excess of $25,000 to comply with the proposed rule in the first year after the rule takes effect. However, the Agency believes that such a circumstance is unlikely to occur within a year after the rule takes effect.[265]

173. The Agency discusses the criteria it developed that are necessary to determine which small businesses and cities could potentially be included in an analysis pursuant to Minn. Stat. § 14.127. The criteria identified by the Agency are as follows:

a. The business or city must discharge to a surface water.

b. The surface water receiving the discharge must be a wild rice water or within a certain range of a wild rice water. For purposes of this evaluation, the MPCA selected a range of 25 miles.

c. The discharge must contain sulfate.

d. The affected business must have fewer than 50 full-time employees. Affected cities must have fewer than 10 full time employees.

e. The business or city must need to obtain a new or re-issued permit within the first year after the rules are adopted.

f. The MPCA must have sufficient information available to develop an effluent limit – including sediment data to set the numeric standard

[264] Minn. Stat. § 14.127, subds. 1 and 2.
[265] Ex. D at 202.

for the receiving wild rice water, sulfate levels in the receiving water, and data on sulfate concentrations in the business or city's effluent.

g. The application of the adopted sulfate standard must result in effluent limits that are more stringent.

h. The business or city must incur costs of more than $25,000 in the first year following adoption of the proposed revisions for planning, installation, or operation activities specifically to meet the revised standard.[266]

174. Using these criteria, the Agency calculates that, of the 135 dischargers within 25 miles of a regulated wild rice water, there are approximately 75 small businesses and cities that may be affected by the proposed revisions and currently have permits. Because the MPCA issues permits to dischargers on a five-year schedule, fewer than 75 will be required apply for a permit under the new standard in the first year. Nonetheless, assuming the rule is adopted in mid-2018,[267] the MPCA estimates that more than 60 dischargers will at least begin the process of updating their existing permits in 2018.[268]

175. According to the Agency, permit issuance or renewal involves "setting effluent limits, developing and reviewing plans and specifications, permit notice and approval, and construction activities."[269] In addition, the Agency recognizes that "dischargers may have to make a significant initial investment in planning and preliminary design work in advance of receiving the permit."[270]

176. The Agency explains that the cost driver for dischargers is the implementation of a sulfate effluent limit in a permit, which requires the discharger to take action to either limit the sulfate in its discharge or to request a variance. Before a discharger can be assigned an effluent limit, the MPCA must know the numeric sulfate standard applicable to the receiving wild rice water. In addition, the discharger's sulfate effluent concentrations must be available.[271]

177. The Agency states that a majority of dischargers do not have current effluent monitoring for sulfate. For these dischargers, the Agency estimates that sulfate limits could not be implemented before 2023.[272]

178. According to the Agency, only if a small business or city receives a more stringent effluent limit than was required under the existing standard will it have higher treatment costs than it would have had under the 10 mg/L standard, or incur the costs of applying for a variance.[273] However, a facility will not know whether its effluent limit is

[266] Ex. D at 204.
[267] *Id*. at 202.
[268] *Id*. at 206.
[269] *Id.*
[270] *Id.*
[271] *Id*. at 207.
[272] *Id.*
[273] *Id.*

more or less than it would be under the existing standard until the new standard has been set for the receiving wild rice water.[274]

179. The Agency does not explain why it estimates that it will take dischargers five years to monitor their own sulfate discharges.

180. Furthermore, the Agency states that it expects to take up to ten years to sample the 1,300 regulated wild rice waters identified in the proposed rule for the purpose of setting new standards.[275]

181. Nonetheless, for purposes of the rulemaking evaluation, the MPCA assumes that all the identified dischargers will have to either meet more stringent sulfate discharge limits or apply for variances. The cost to treat wastewater to remove sulfate is extremely high. The MPCA recognizes that the most effective treatment option at this time to remove sulfate from wastewater is an RO membrane treatment system.[276] The cost of designing, building and operating an RO system will certainly exceed $25,000. However, the MPCA expects permittees will not incur the full cost of treatment or design/build in the first year after adoption of the proposed rules.[277]

182. The MPCA expects that WWTPs that meet the above criteria may incur costs in the first year after the rules are adopted. Costs could include retaining a contractor or designer to begin the process of evaluating discharge and treatment options, among other items. The WTTP could also begin the process of bench-scale studies and facility design, although the MPCA believes a variance application is more likely. The MPCA notes that the cost of a variance alone could exceed $25,000, especially for an industrial facility for which there is no variance fee waiver in the rule. However, the MPCA does not presume that the cost of a variance for a municipality would necessarily be less than $25,000.[278]

183. The MPCA cannot estimate the cost of these activities "because of the extent of the variables,"[279] but the Agency concludes that such costs will "be significant" and "may exceed $25,000"[280] for some small businesses and cities in the first year after adoption of the proposed revisions.[281]

184. While the MPCA's analysis pursuant to Minn. Stat. § 14.127 discusses the question of whether small businesses and cities will spend more than $25,000 to comply with the proposed rule within one year after the rule is adopted, the statutory language

[274] Ex. D at 207.
[275] Response Cover Memo at 10.
[276] Ex. D at 207.
[277] *Id.*
[278] Ex. D at 208.
[279] *Id.*
[280] *Id.*
[281] *Id.*

requires this analysis to focus on the "cost of complying with a proposed rule in the first year after the rule takes effect . . . ."[282]

185. Because MPCA predicts that it will likely take five to ten years to sample the regulated wild rice waters identified in the proposed rule for the purpose of setting new standards that will provide the basis for new effluent limits, the Administrative Law Judge finds that the rule cannot take effect for purposes of the Agency's analysis under Minn. Stat. § 14.127 until the necessary sediment and porewater sampling have been completed and new sulfate standards calculated pursuant to the equation standard in the proposed rule.

186. Any attempt to perform the analysis required by Minn. Stat. § 14.127 is based on conjecture regarding whether and to what extent any given small business or city that meets the criteria outlined by the MPCA will be subject to a more stringent effluent limit once a new standard is determined for receiving waters subject to the wild rice sulfate rules.

187. The legislature's purpose in enacting Minn. Stat. § 14.127 was to better understand the impact of its regulatory delegations. For example, in its 1993 review of Minnesota's rulemaking process, the State Commission on Reform and Efficiency observed that the legislature is often "not aware of the specific costs of preparing and adopting the rules it authorizes or requires" and "lacks cost information when considering bills authorizing rulemaking."[283] In this context, the provisions of Minn. Stat. § 14.127 operate as a check against the legislature misjudging the cost of regulatory programs when it delegates rulemaking authority.

188. The structure and text of the exemptions in Minn. Stat. § 14.127, subd. 4, confirm this conclusion. Subdivision 4 provides that there is no safe harbor from regulatory compliance for small cities and small businesses when:

a. the legislature has appropriated sufficient funds for the costs of complying with the proposed rule;

b. the proposed rule follows from "a specific federal statutory or regulatory mandate";

c. the rules were promulgated under the limited exemption of the "good cause exempt" rulemaking procedure;

d. the legislature exempted the proposed rules from compliance with Chapter 14 rulemaking procedures;

e. the rules were promulgated by the Public Utilities Commission; or

[282] Minn. Stat. § 14.127 (emphasis added).
[283] *See* Finding 6, *Reforming Minnesota's Administrative Rulemaking System* (State Commission on Reform and Efficiency, 1993.).

f. the Governor waives the safe-harbor provisions by filing a notice with both houses of the legislature and publishing the same in the *State Register*.

189. These exemptions reflect an underlying legislative assumption that delegated rulemaking authority will not result in compliance costs of more than $25,000 for a small city or small business during the first year. If that cost assumption is not generally true for a particular agency (such as the Public Utilities Commission), or untrue with respect to a particular program (such that appropriation accompanies the rulemaking delegation), one of the listed exemptions will apply. In all other cases, the legislature offers the affected stakeholders the opportunity to revisit the question of compliance costs with the legislature and the agency.[284]

190. The Agency's application of the statute significantly narrows the protections for small businesses and small cities. Under Minn. Stat. § 14.127, a qualifying small city or small business may opt out of costly regulatory programs by filing "a written statement with the agency claiming a temporary exemption from the rules"[285] until "the rules are approved by a law enacted after the agency determination or administrative law judge disapproval."[286] Because, according to the MPCA, the small businesses and cities it has identified as potentially affected by $25,000 limitation in Minn. Stat. § 14.127 will not know for certain whether their effluent limits will be more or less stringent until the new sulfate standards are calculated, it is not technically possible for any small city or business to claim that it must spend $25,000 in order to comply with the new sulfate standards. Thus, the Agency's attempt to implement a rule without definite standards runs afoul of the statutory language of Minn. Stat. § 14.127, despite the Agency's finding that some small businesses and cities may spend $25,000 within a year after the proposed rule is adopted.

191. The Administrative Law Judge finds that the Agency has made a determination required by Minn. Stat. § 14.127, but that determination is not adequately supported in the rulemaking record. The hearing record does not establish that the compliance costs for any one qualifying small city or small business will be more than $25,000 in the first year following the adoption of the proposed rule because the hearing record does not establish that the compliance costs for any one qualifying small city or small business will be known within one year of adoption of the proposed rule.

192. The cost determination under Minn. Stat. § 14.127 is disapproved.

193. The result of this cost determination disapproval would usually be that any small business or city that must spend more than $25,000 to comply with this rule can file a statement with the Agency pursuant to Minn. Stat. § 14.127, subd. 3, claiming a temporary exemption pending further action by the legislature. Because the basis for the disapproval is that the Agency has failed to provide the information required to make a

[284] Minn. Stat. § 14.127, subd. 3.
[285] *Id.*
[286] *Id.*

finding under Minn. Stat. § 14.127, it is not possible for a small city or business to claim a temporary exemption at this time without further action by the Agency.

5. Adoption or Amendment of Local Ordinances

194. Under Minn. Stat. § 14.128 (2016) the Agency must determine if a local government will be required to adopt or amend an ordinance or other regulation to comply with a proposed agency rule. The Agency must make this determination before the close of the hearing record, and the Administrative Law Judge must review the determination and approve or disapprove it.[287]

195. The Agency states that, because state water quality standards are not implemented at the local level, no changes will be required to local ordinances or regulations in response to the proposed rule revisions. The Agency notes, however, that local units of government that own or operate a WWTP may be subject to additional conditions on discharges due to the proposed revisions. For example, a city may require pre-treatment of high sulfate wastewater or charge a higher fee for discharge of sulfate to the municipal WWTP. These conditions may be in the form of an ordinance or regulation, but they are not specifically required by the proposed rules.[288]

196. The Administrative Law Judge finds that the Agency has made the determination required by Minn. Stat. § 14.128 and approves that determination.

6. Economic Analysis and Identification of Cost-Effective Permitting

197. Pursuant to a 2015 Minnesota Session Law,[289] the MPCA is required to consider the effect the proposed revisions will have on MPCA's permit process for industrial and municipal dischargers.[290]

198. The MPCA states that it considered the effects its proposed revisions will have on the permit process and it recognizes that, for some dischargers, the proposed rules may result in substantial costs.[291]

199. The MPCA expects that, in most cases, dischargers can only meet the proposed sulfate standard by using membrane treatment. The MPCA recognizes that the current options for treating sulfate are costly and complex.[292]

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[287] Minn. Stat. § 14.128, subd. 1. Moreover, a determination that the proposed rules require adoption or amendment of an ordinance may modify the effective date of the rule, subject to some exceptions. Minn. Stat. § 14.128, subds. 2 and 3.
[288] Ex. D at 201.
[289] 2015 Minn. Laws 1st Spec. Sess. ch. 4, art. 3, § 2, subd. 2 (authorizing funds for "enhanced economic analysis in the water quality standards rulemaking process, including more specific analysis and identification of cost-effective permitting.").
[290] Ex. D at 209-213.
[291] *Id*. at 209.
[292] *Id*.

200. The MPCA states that industrial dischargers could encounter substantial treatment costs if sulfate effluent limits are included in NPDES/SDS permits. The industries most likely to be affected include ethanol producers, food processors, power plants, ferrous (taconite) mining and processing, and any potential non-ferrous mining. The taconite industry on the Mesabi Iron Range is likely to be the most affected of the industrial categories because of the prevalence of wild rice in that region, the amount of sulfate generated by mining and processing, the aggregate volume of water discharged, and the elevated sulfate concentrations from legacy mining.[293]

201. The MPCA notes that variances from water quality standards are a permitting tool that may be used to temporarily address uncertain or costly treatment alternatives.[294] The MPCA expects variances to become an increasingly necessary component of the permit process as more stringent water quality-based effluent limits are implemented.[295] In considering a variance, the MCPA must determine the point at which costs would result in substantial and widespread negative economic and social impact such that compliance with the standard is not feasible.[296] All variances from a water quality standard are subject to final approval by the United States Environmental Protection Agency (EPA).[297]

202. Because the proposed sulfate effluent limits may prompt an increase in variance requests, the MPCA is considering implementing a streamlined variance process. According to the MPCA, the streamlined process will define the information required for obtaining final approval from the EPA and allow ample time for a discharger to consider its permitting options. The MPCA maintains that the streamlined process will reduce permitting uncertainty and application review time and result in more cost-effective permitting.[298]

203. The Administrative Law Judge concludes the Agency has made the analysis required under 2015 Minn. Laws 1st Spec. Sess. ch. 4, art. 3, § 2, subd. 2, given the limited information available.

7. External Review Panel

204. The Agency is required to convene an external review panel during the promulgation or amendment of a water quality standard, or state in the SONAR why such a panel was not convened.[299]

205. The MPCA conducted an external peer review on the state-sponsored wild rice study in 2014.[300] The report of the peer review panel was released in September

[293] *Id*. at 209-210.
[294] Ex. D at 210.
[295] *Id*.
[296] *Id*.
[297] *Id*.
[298] Ex. D at 216.
[299] *See* Minn. Stat. § 115.035 (2016).
[300] Ex. D at 217.

2014.[301] The names and affiliations of the peer reviewers are provided in Table 19 of the SONAR.[302] The MPCA states that the report of the peer review panel informed its analysis and interpretation of data regarding the effect of sulfate on wild rice and that analysis is reflected in its March 2015 draft proposal.[303]

206. The Administrative Law Judge finds that the Agency met the requirement of Minn. Stat. § 115.035 regarding external review panels.

IV. Rulemaking Legal Standards

207. The Administrative Law Judge must make the following inquiries: whether the agency has statutory authority to adopt the rule; whether the rule is unconstitutional or otherwise illegal; whether the agency has complied with the rule adoption procedures; whether the proposed rule grants undue discretion to government officials; whether the rule constitutes an undue delegation of authority to another entity; and whether the proposed language meets the definition of a rule.[304]

208. Under Minn. Stat. § 14.14, subd. 2 and Minn. R. 1400.2100 (2017), the agency must establish the need for, and reasonableness of, a proposed rule by an affirmative presentation of facts. In support of a rule, the agency may rely upon materials developed for the hearing record,[305] "legislative facts" (namely, general and well-established principles that are not related to the specifics of a particular case but which guide the development of law and policy),[306] and the agency's interpretation of related statutes.[307]

209. A proposed rule is reasonable if the agency can "explain on what evidence it is relying and how the evidence connects rationally with the agency's choice of action to be taken."[308] By contrast, a proposed rule will be deemed arbitrary and capricious where the agency's choice is based upon whim, devoid of articulated reasons or "represents its will and not its judgment."[309]

210. An important corollary to these standards is that when proposing new rules an agency is entitled to make choices between different possible regulatory approaches, so long as the alternative that is selected by the agency is a rational one.[310] Thus, while reasonable minds might differ as to whether one or another particular approach

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[301] *Id*.; SONAR Ex. 9.
[302] Ex. D at 217.
[303] *Id*; SONAR Ex. 10.
[304] *See* Minn. R. 1400.2100.
[305] *See Manufactured Housing Institute v. Pettersen*, 347 N.W.2d 238, 240 (Minn. 1984); *Minnesota Chamber of Commerce v. Minnesota Pollution Control Agency*, 469 N.W.2d 100, 103 (Minn. Ct. App. 1991).
[306] *Compare generally United States* v. *Gould,* 536 F.2d 216, 220 (8th Cir. 1976).
[307] *See Mammenga v. Agency of Human Services*, 442 N.W.2d 786, 789-92 (Minn. 1989); *Manufactured Manufactured Hous. Inst.*, 347 N.W.2d at 244.
[308] *Manufactured Hous. Inst.*, 347 N.W.2d at 244.
[309] *See Mammenga*, 442 N.W.2d at 789; *St. Paul Area Chamber of Commerce v. Minn. Pub. Serv. Comm'n,* 251 N.W.2d 350, 357-58 (Minn. 1977).
[310] *Peterson v. Minn. Dep't of Labor & Indus*., 591 N.W.2d 76, 78 (Minn. Ct. App. 1999).

represents "the best alternative," the agency's selection will be approved if it is one that a rational person could have made.[311]

211. Because both the Agency and the Administrative Law Judge suggested changes to the proposed rule language after the date it was originally published in the *State Register*, it is also necessary for the Administrative Law Judge to determine if this new language is substantially different from that which was originally proposed.

212. The standards to determine whether any changes to proposed rules create a substantially different rule are found in Minn. Stat. § 14.05, subd. 2(b). The statute specifies that a modification does not make a proposed rule substantially different if:

> (1) the differences are within the scope of the matter announced . . . in the notice of hearing and are in character with the issues raised in that notice;
>
> (2) the differences are a logical outgrowth of the contents of the . . . notice of hearing, and the comments submitted in response to the notice; and
>
> (3) the . . . notice of hearing provided fair warning that the outcome of that rulemaking proceeding could be the rule in question.

213. In reaching a determination regarding whether modifications result in a rule that is substantially different, the Administrative Law Judge must consider whether:

> (1) persons who will be affected by the rule should have understood that the rulemaking proceeding . . . could affect their interests;
>
> (2) the subject matter of the rule or issues determined by the rule are different from the subject matter or issues contained in the . . . notice of hearing; and
>
> (3) the effects of the rule differ from the effects of the proposed rule contained in the . . . notice of hearing.[312]

V. Analysis of the Proposed Rule

214. There were few sections of the proposed rule that were not opposed by any member of the public. This Report will first address the three portions of the rule that are central to its function and design: Minn. R. 7050.0224, subp. 2, which proposes to repeal the 10 mg/L sulfate standard; Minn. R. 7050.0224, subp. 5, B (1), which proposes to replace the 10 mg/L standard with the equation-based sulfate standard; and Minn. R. 7050.0471, subps. 3-9, which proposes the list of waters to be included as class 4D waters to be protected by the wild rice sulfate standard.

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[311] *Minnesota Chamber of Commerce*, 469 N.W.2d at 103.

[312] *See* Minn. Stat. § 14.05, subd. 2.

A. Repeal of the 10 mg/L Sulfate Standard

215. Minn. R. 7050.0224, subp. 2, proposes to repeal the 10 mg/L sulfate standard applicable to wild rice waters, which are currently classified as Class 4A waters.[313]

216. Minn. R. 7050.0220, subps. 3a, 4a, 5a, and 6a, propose to delete references to the 10 mg/L sulfate wild rice water standard.[314]

217. A number of commenters support repeal of the 10 mg/L sulfate standard as it applies to wild rice waters, without regard to whether they are re-classified as Class 4D waters or remain classified as Class 4A waters.[315]

218. The MPCA responded that the decision to repeal the 10 mg/L standard "is not separate from moving forward with the proposed equation."[316] Because the MPCA has determined that sulfate negatively affects wild rice, albeit indirectly rather than directly, the MPCA determined that "[i]t is not scientifically defensible to conclude that simply eliminating the existing sulfate standard would protect" wild rice.[317]

219. The 1854 Treaty Authority, the Fond du Lac Band of Lake Superior Chippewa, the Grand Portage Band of Chippewa, WaterLegacy, and numerous individuals oppose repeal of the 10 mg/L sulfate standard.[318] These commenters and others express concerns that increases in sulfate could lead to increases in methyl mercury, which bio-accumulates in fish, has long-term serious health effects on humans, and is especially dangerous to developing fetuses.[319] Some commenters also question

[313] Ex. C at 7.16, proposed Minn. R. 7050.0224, subp. 5.
[314] Ex. C at 3.16, 4.11, 5.7, 5.23, proposed Minn. R. 7050.0220, subps. 3a, 4a, 5a, and 6a.
[315] Test. of Rob Beranek, Oct. 23 Tr. at 91; eComment from Kurt Anderson on behalf of Minnesota Power at 7 (Minnesota Power comment) (Nov. 21, 2017); eComment from Elizabeth Wefel on behalf of Coalition of Greater Minnesota Cities at 1-2 (Coalition of Greater MN Cities comment) (Nov. 22, 2017); Test. of Chrissy Bartovich, Oct. 24, 2017 Tr. at 82; Test. of Jason Metsa, Oct. 24, 2017 Tr. at 104; Letter from Iron Range Mayors (Hoyt Lakes, Ely, Virginia, Nashwauk, Aurora, Biwakbik, Grand Rapids, Hibbing, Babbitt, Mountain Iron) at 1 (Nov. 6, 2017); Letter from Iron Range Legislative Delegation (Senators David Tomassoni, Thomas Bakk, and Justin Eichorn, and Representatives Jason Metsa, Rob Ecklund, Julie Sandstede, Dale Lueck, and Sandy Layman) (Nov. 2, 2017).
[316] MPCA Response, Att. 1 at 24.
[317] MPCA Response at 3.
[318] eComment from Paula Maccabee on behalf of WaterLegacy at 11-12, 55-56 (WaterLegacy comment), (eComment filed Nov. 22, 2017); Letter from Darren Vogt at 5 (Nov. 21, 2017); eComment from Nancy Schuldt at 25 (Nov. 22, 2017); Test. of Dennis Scymialis, Oct. 26, 2017, Tr. at 70; Test. of Tom Thompson, Oct. 26, 2017, Tr. at 75. Some commenters objected to the Agency's classification of wild rice waters as class 4 waters rather than class 2 waters. Test. of Margaret Watkins, Oct. 26, 2017, Tr. at 89-90, Hearing Ex. 1020 (Letter from Dennis Morrison on behalf of Grand Portage Tribal Reservation Council at 8 and Letter from Robert L. Larsen on behalf of Minnesota Indian Affairs Council at 2).
[319] Test. of Dave Zentner, Oct. 26 Tr. at 117; Test. of Dr. Emily Onello, Oct. 26, 2017, Tr. at 68; Test. of Margaret Watkins, Oct. 26, 2017, Tr. at 89-90, Hearing Ex. 1020 (Letter from Dennis Morrison on behalf of Grand Portage Tribal Reservation Council at 8 and Letter from Robert L. Larsen on behalf of Minnesota Indian Affairs Council at 2).

whether the extraordinary nutritional value – and health benefits – of wild rice will be degraded by increased surface water sulfate levels.[320]

220. In response to the concerns raised about the effect of increased sulfate concentrations on the methylation of mercury, the MPCA acknowledges that "increased concentrations of sulfate have been shown to increase the methylation of mercury in aquatic systems where organic carbon is available and especially where background sulfate concentrations are low." The MPCA agrees that "enhanced production of methylmercury is a significant concern."[321]

221. Despite these concerns, and while acknowledging that it is "very concerned about actions that might increase the mercury content of fish," the Agency notes that "in a formal sense," the scope of this rulemaking does not encompass the effects of sulfate on the methylation of mercury.[322] The MPCA reports that it is "conducting a significant separate study concerning the factors that control mercury in fish."[323] At this time, the Agency states that it has determined

> that the relationship between sulfate and mercury methylation is significantly more complicated than the relationship between sulfate and sulfide on which the proposed wild rice rule is based. Therefore, it would be even more challenging to develop a proposed sulfate standard that addresses the role of sulfate in the potential for production of methylmercury.[324]

For these reasons, the Agency states, it is not making "any decisions as how to proceed on the question of enhanced mercury methylation until the results of the ongoing major study are available."[325]

222. Both the Fond du Lac Band and the Grand Portage Band of Lake Superior Chippewa have wild rice water quality standards that limit sulfates to 10 mg/L. Each Band has authority to set water quality standards on its reservation, and the EPA has approved the standard for each Band.[326]

223. The CWA requires that, any time a state revises or adopts a new water quality standard, the standard "shall be such as to protect the public health or welfare, enhance the quality of water and serve the purposes of" the CWA.[327] Standards "shall

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[320] Test. of Dr. Emily Onello, Oct. 26, 2017, Tr. at 68-69; Test. of Dr. Debby Allert, Oct. 26, 2017, Tr. at 107-112, Hearing Ex. 1024 (Materials submitted by Dr. Allert on behalf of Minnesota Academy of Family Physicians).
[321] MPCA Response Att. 1 at 21 (Nov. 22, 2017).
[322] *Id.*
[323] *Id.*
[324] *Id.*
[325] *Id.*
[326] Hearing Ex. 1020 (Letter from Dennis Morrison on behalf of Grand Portage Tribal Reservation Council at 11; Test. of Nancy Schuldt at 96 (Oct. 26, 2017); eComment from Paula Maccabee on behalf of WaterLegacy at 15 (eComment filed Nov. 22, 2017).
[327] 33 U.S.C. § 1313 (c).

be established taking into consideration their use and value for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial, and other purposes . . . ."[328] The federal regulations also require the state to "take into consideration the water quality standards of downstream waters and . . . ensure that its water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters."[329]

224. Minn. R. 7050.0155 requires that "[a]ll waters must maintain a level of water quality that provides for the attainment and maintenance of the water quality standards of downstream waters, including the waters of another state."

225. The MPCA has proposed that the maximum value of sulfate which could result in application of the proposed equation-based standard would be 838 mg/L,[330] a standard more than 80 times the current standard of 10 mg/L.

226. In the face of challenges raised by the public concerning increased mercury methylation, further harm to wild rice, and degradation of waters due to algae blooms as a result of elevated sulfate standards, the MPCA has failed to make an affirmative presentation of facts which demonstrate that, in establishing standards which would allow increased levels of sulfate in wild rice waters, it is protecting the public health or welfare, enhancing the quality of water, and ensuring that the proposed water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters, as required by federal and state law.[331] Therefore, the Administrative Law Judge concludes that the proposed repeal of the 10 mg/L wild rice sulfate standard violates Minn. R. 1400.2100.D, prohibiting a rule that conflicts with other applicable law.

227. For the reasons set forth in the following section regarding the equation-based standard, the Administrative Law Judge further concludes that the MPCA has not presented facts adequate to support the reasonableness of the proposed repeal of the 10 mg/L sulfate standard without a replacement standard that is equally or more protective of wild rice waters. Therefore, the proposed rule repealing the 10 mg/L sulfate standard is defective because it violates Minn. R. 1400.2100.B.

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[328] 33 U.S.C. § 1313 (c)

[329] 40 C.F.R. § 131.10(b) (2015).

[330] MPCA Rebuttal at 4.

[331] The Fond du Lac Band of the Minnesota Chippewa Tribe asserts that the Chippewa retain usufructuary rights to gather wild rice under the Treaties of 1837 and 1854. *Minnesota v. Mille Lacs Band of Chippewa Indians*, 526 U.S. 172, 196 (1999). The Fond du Lac Band, along with the entire Minnesota Indian Affairs Council, believes that equation-based sulfate standard is not proven to be protective of wild rice waters. Hearing Ex. 1020 (Letter from Dennis Morrison on behalf of Grand Portage Tribal Reservation Council at 8 and Letter from Robert L. Larsen on behalf of Minnesota Indian Affairs Council at 2). Therefore, the Fond du Lac Band argues, the State has an obligation under the 1837 and 1854 Treaties to insure that wild rice is not degraded or contaminated. The Fond du Lac Band contends that the proposed equation-based standard will not adequately protect wild rice or, by extension, the Band's Tribal treaty rights. eComment from Nancy Schuldt at 1,4-5 (Nov. 22, 2017). Because the Administrative Law Judge finds that repeal of the 10 mg/L violates federal and state law, this Report need not reach the treaty-rights arguments.

228. Should the Agency proceed with this rulemaking, it may cure the defect by retaining the 10 mg/L wild rice sulfate standard either by returning to the current wild rice classification as 4A waters, or by applying the 10 mg/L wild rice sulfate standard to wild rice in the 4D classification.

229. The Administrative Law Judge finds that the suggested changes would be needed and reasonable and would not constitute a substantially different rule under Minn. Stat. § 14.05, subd. 2(b).

B. Equation-based Sulfate Standard

230. **Part 7050.0224, subp. 5, B (1).** As stated above, the MPCA proposed the equation-based sulfate standard to replace the 10 mg/L sulfate standard.

231. Because the Administrative Law Judge has determined that the proposed repeal of the 10 mg/L sulfate standard is not needed or reasonable, the equation-based standard cannot be implemented as part of this rulemaking. Nonetheless, for purposes of the Agency's consideration in future rulemaking procedures, the Administrative Law Judge provides a review of the equation-based standard.

232. **Part 7050.0224, subp. 5, B (1)** contains the equation for the calculated sulfate standard as proposed by the Department. The standard is expressed as milligrams of sulfate ion per liter, as follows:[332]

$$\text{Calculated sulfated standard} = 0.0000121 \times \frac{\text{Iron}^{1.923}}{\text{Organic carbon}^{1.197}}$$

Where:

(a) organic carbon is the amount of organic matter in dry sediment. The concentration is expressed as percentage of carbon, as determined ~~using~~ consistent with the method for organic carbon analysis in Sampling and Analytical Methods for Wild Rice Waters, which is incorporated by reference in item E;

(b) iron is the amount of extractable iron in dry sediment. The concentration is expressed as micrograms of iron per gram of dry sediment, as determined ~~using~~ consistent with the method for extractable iron in Sampling and Analytical Methods for Wild Rice Waters, which is incorporated by reference in item E;

(c) sediment samples are collected ~~using~~ consistent with the procedures established in Sampling and Analytical Methods for Wild Rice Waters; and

[332] Ex. C at lines 7.25-7.26 and 8.1-8.17.

(d) the calculated sulfate standard is the lowest sulfate value resulting from the application of the equation to each pair of organic carbon and iron values collected and analyzed in accordance with units (a) to (c).[333]

233. Many of the commenters rejected the proposed equation-based standard. Concerns about the equation-based standard focused on the implementation of the standard and on the science underlying the equation.

1. Implementation of the Equation-based Standard

234. The equation will require measurements of iron and carbon to be taken from the sediment in each of the 1,300 or more identified wild rice waters. The data will then be inserted into the equation to calculate the equation-based sulfate standard for that particular water.[334] As stated above, the Agency estimates that it will take approximately ten years for agency staff to calculate the standards for the approximately 1,300 waters identified in the proposed rule.[335]

235. A number of commenters express concerns that it will take approximately ten years for the Agency to establish the standards under the proposed rule. Some of the concerns are that the Agency's delayed ability to implement the new standards will create confusion, and will defer enforcement of the water quality standards for wild rice waters.[336] Regulated parties assert that they lack the information they need to properly plan for compliance with the standards once they are implemented.[337] Others observe that the Agency has not enforced the 10 mg/L standard for most of the years the existing standard has been in place, and that the Agency, with its limited resources, has not shown that it will have the means to develop the 1,300 individual standards which must be calculated before they can be enforced.[338]

236. Cleveland Cliffs, which owns and operates United Taconite and Northshore Mining Company and partially owns and operates Hibbing Taconite, is a major employer on Minnesota's Iron Range. Cleveland Cliffs employs over 1,700 individuals and claims it has a total economic impact to the region of nearly $900 million.[339] In its post-hearing comments, Cleveland Cliffs asserts that the MPCA's implementation plan for the equation-based standard is unreasonable. Cleveland Cliffs contends that it is unreasonable that the MPCA cannot notify any potentially affected WWTP what revised standard will apply to it because the MPCA has not calculated sulfate standards in

[333] Ex. C at 8.5-8.17; MPCA Rebuttal Response to Public Comments at 5.
[334] MPCA Rebuttal at 44.
[335] Ex. D at 153-154; MPCA's Response to Public Comments at 10-11 (Nov. 22, 2017).
[336] Comments of Lea Foushee, Oct. 23 Hearing Tr. at 93; (MCEA eComment) at 6-8 (Nov. 22, 2017).
[337] Comments of Chrissy Bartovich, Oct. 24 Hearing Tr. at 82.
[338] Comments of Matt Tuchel, Oct. 24 Hearing Tr. at 151-152; Paula Maccabee letter at 7-11 (Nov. 22, 2017); Dorie Reisenweber, Oct. 26 Hearing Tr. at 106; Dave Zentner, Oct 26 Hearing Tr. at 114; Allen Richardson, Oct. 26 Hearing Tr. at 129; Barbara Cournyea, Oct. 30 Hearing Tr. at 88; Sydney Evans (eComment) (Oct. 23, 2017); Jeff Williams (eComment) (Nov. 2, 2017).
[339] Letter from Rob Beranek at 1 (Nov. 22, 2017) (Beranek Letter).

individual wild rice waters under the proposed rule.[340] To demonstrate the inadequacy of the MPCA's regulatory cost analysis,[341] Cleveland Cliffs cites the MPCA's statements in the SONAR that "sulfate treatment is prohibitively expensive for many dischargers"[342] and that "companies might choose to stop operations rather than invest in the treatment needed to meet a revised standard."[343]

237. The Agency's response to comments regarding implementation of the equation-based standard is that this water quality rule is not unique:

> With any standard, resources are required to collect a sufficient amount of data for implementation. In fact, the MPCA is not convinced that the resources needed to implement the proposed standard revision exceed those needed to implement the existing 10 mg/L sulfate standard if this rulemaking were not to proceed.[344]

238. In response to commenters' concerns regarding the time needed to develop the individual sulfate limits, the Agency states: "[i]t is not uncommon for data gathering to be necessary before a standard can be fully implemented in permits."[345]

239. The Agency explains that implementing the current 10 mg/L standard takes time, both because wild rice waters have to be identified and because surface waters have to be analyzed to see whether the 10 mg/L standard is being met.[346]

240. The Agency plans to make efficient use of its resources by collecting sediment iron and carbon data to develop the new sulfate standards using its existing 10-year intensive watershed monitoring program.[347]

241. The MPCA acknowledges that, because it does not have the data available to calculate the proposed equation-based standard, it does not know "how many dischargers will be required to install additional treatment"[348] or "how many wild rice waters need a standard more stringent than the existing 10 mg/L."[349] Similarly, the Agency states in the SONAR, "[b]ecause the number of dischargers who must meet a different limit (either more or less stringent) is not known, it is difficult to quantify the change in environmental costs or benefits based on this rule revision."[350]

242. In its rebuttal comments, the MPCA states:

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[340] Beranek Letter at 25-26.
[341] Beranek Letter at 23.
[342] Ex. D at 107.
[343] Ex. D at 148.
[344] MPCA Response at 10 (Nov. 22, 2017).
[345] MPCA Response, Att. 2 at 39.
[346] MPCA Response at 10-11 (Nov. 22, 2017).
[347] MPCA Response at 10 (Nov. 22, 2017).
[348] Ex. D at 144.
[349] Ex. D at 143.
[350] *Id.*

> [T]he MPCA understands that dischargers want clarity about how the standard will affect them, and we are sensitive to comments that the MPCA should strive to fully understand and articulate the implementation details of a rule prior to adopting the rule. In the case of water quality standards, the impact on permitted facilities comes through development of an effluent limit specific to a facility that ensures the permitted facility will not cause or contribute to a violation of the water quality standard. Effluent limit setting requires evaluating multiple factors as described beginning on page 96 of the SONAR.
>
> There are approximately 1000 facilities in Minnesota that hold water discharge permits. Site-specific data is required to evaluate the need for an effluent limit at each facility, and these issues are addressed in an individualized permitting process. This data is not immediately available for all facilities and it takes time to gather this data.
>
> This time and data need is inherent to the difference between water quality standards and effluent limits, and is not unique to the proposed revisions to the wild rice sulfate standard. As explained in Part 6G, pp. 96-99 of the SONAR, evaluating the need for and (as needed) determining a water quality based effluent limit requires data specific to the discharge being evaluated and the receiving water(s) being discharged to. Data needs unique to the proposed rule revisions are the sediment iron and carbon (or porewater sulfide) data.
>
> Collecting all the data necessary to calculate all effluent limits statewide would take at least ten to fifteen years, even if the sediment data were not needed. Necessary steps such as gathering five years of effluent data to evaluate and set effluent limits combined with the 10-year surface water monitoring schedule to gather surface water data cumulatively add up to the necessary data not being available for some permitted discharges until at least ten to fifteen years after rule promulgation. The MPCA does plan to prioritize data collection based on factors such as those mentioned in the EPA comments, Appendix 2 – the likelihood of sulfate impacts (because of type and location of dischargers) and permitting schedules.[351]

243. The rule, as proposed, gives regulated parties no notice of the numeric sulfate standard they will be expected to comply with, because it repeals the existing 10mg/L standard and replaces it with an equation based on variables that lack values. WWTPs will not know, until there is a final decision regarding the new water quality standards applicable to their discharge facilities, whether and to what extent they will have to treat their wastewater discharge for sulfate.

244. During the public hearings, MPCA staff distinguished between the process of setting standards and the permitting process. In her introductory remarks, Shannon Lotthammer, Division Director for the MPCA's Environmental Analysis and Outcomes

[351] MPCA Rebuttal Memo at 40.

Division, stated, “So one thing I want to point out is that the permitting process is not the same thing as establishing a water quality standard.”[352] Ms. Lotthammer made similar comments during her introductory remarks at each public hearing.[353]

245. To the extent that the Agency claims that the delay in setting standards does not disadvantage the WWTPs because the permitting process can also take years, that claim is undermined by the Agency’s own statements that setting water quality standards and permitting are two completely separate processes. The additional step of establishing a water quality standard before effluent limits can be established will prevent the WWTPs from planning, with any certainty, how to approach what will, at that point, be unknown compliance obligations.

246. The Administrative Law Judge finds that Part 7040.0224, subp. 5, B (1) violates Minn. R. 1400.2100.B. The equation-based sulfate standard is not rationally related to the Agency's objective. The Agency states that its objective in this proceeding is "[t]o amend the state water quality standards and the rules implementing those standards to protect wild rice from the impact of sulfate, so that wild rice can continue to be used as a food source by humans and wildlife.”[354] The equation-based sulfate standard does not update the standards because, while the rule repeals the existing sulfate standard of 10 mg/L,[355] it fails to provide the values necessary to insert into the proposed equation to calculate individualized standards for each wild rice water body. Therefore, if the rule is enacted as proposed, there will be no standards when the rule becomes effective. Regulated parties will not know what standards will apply to them, or even whether any sulfate standard applies to them. Therefore, the rule as proposed will not protect wild rice from the impact of sulfate, and is not rationally related to the Agency’s objective.

247. The Administrative Law Judge finds that Part 7040.0224, subp. 5, B (1) violates Minn. R. 1400.2100.E because it is unconstitutionally void for vagueness. “A rule, like a statute, is void for vagueness, if it fails to give a person of ordinary intelligence a reasonable opportunity to know what is prohibited or fails to provide sufficient standards for enforcement.”[356]

248. The Administrative Law Judge finds that Part 7040.0224, subp. 5, B (1) violates 1400.2100.G. By its own terms, the equation-based sulfate standard cannot have the force and effect of law. The equation lacks values to insert in the place of the iron and organic carbon variables, and thus cannot be calculated. Therefore, the proposed equation-based sulfate standard will not have the force and effect of law within five working days after notice of its adoption and violates the requirements of Minn. Stat. § 14.38.

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[352] Comments of Shannon Lotthammer, Tr.at 49 (Oct. 23, 2017).
[353] Comments of Shannon Lotthammer, Tr.at 44-45 (Oct. 24, 2017); Tr. at 44 (Oct. 25, 2017); Tr. at 58 (Oct. 26, 2017); Tr. at 57 (Oct. 30, 2017); Tr. at 47-48 (Nov. 2, 2017).
[354] Ex. D at 1.
[355] Ex. C. at lines 7.8-7.10 (proposed Minn. R. 7050.0224, subp. 2).
[356] *In re N.P.*, 361 N.W. 2d 386, 394 (Minn. 1985), *citing Grayned v. City of Rockford*, 408 U.S. 104, 108-09, 92 S. Ct. 2294, 2298-99 (1972).

249. The Agency could cure the defects identified in this section only by conducting the sampling process necessary to provide the values for the equation proposed in the rule for each water identified in the rule, before proposing the rule. However, because the Agency cannot repeal the 10 mg/L sulfate standard for the reasons explained in section V. A., above, the Agency cannot implement the equation-based sulfate standard.

2. Science-based Objections to the Equation

250. The basis for many of the objections were disagreements with the scientific underpinnings of the equation. The science-based objections fall primarily into the following categories:

a. Disagreement with the MPCA's conclusion that sulfate harms wild rice.[357]

b. Disagreement with the MPCA's conclusion that the proposed sulfide standard will be protective of wild rice.[358]

c. Concerns that permitting higher sulfate levels will result in increased methyl mercury in fish.[359]

d. Criticisms of MPCA's research based on its decision to exclude from consideration stressors on wild rice growth other than sulfate or sulfide.[360]

e. Disagreement with the MPCA's conclusion that a level as low as 120 micrograms per liter of sulfide is the maximum level that is protective of wild rice. [361]

f. Criticisms of the MPCA's research on porewater sulfide.[362]

g. Criticisms of the MPCA's use of field data.[363]

h. Criticisms of the MPCA's choice of data sets.[364]

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[357] eComment from Tom Scott (Nov. 22, 2017); Kurt Anderson, Tr. at 116 (Oct. 23, 2017); Sen. David Tomassoni Tr. at 53-55 (Oct. 24, 2017); Larry Sutherland, Tr. at 73 (Oct. 24, 2017).
[358] eComment from John Coleman on behalf of Great Lakes Indian Fish and Wildlife Commission at 3-7 (Nov. 22, 2017); eComment from Nancy Schuldt on behalf of Fond du Lac Band of Chippewa at 26-88 (Nov. 22, 2017).
[359] Jennifer Lang, Tr. at 61 (Oct. 23, 2017); Ex. 1000, Letter from Lea Foushee on behalf of North American Water Office at 1; eComment from Nancy Schuldt on behalf of Fond du Lac Band of Chippewa at 33 (Nov. 22, 2017); Test. of Dave Zentner on behalf of Izaak Walton League, Tr. at 116-117 (Oct. 26, 2017); E- comment from Kristin Blann on behalf of The Nature Conservancy (Nov. 22, 2017).
[360] Test. of O'Neill Tedrow, Tr. at 89-95 (Oct. 24, 2017) and Ex. 1008; Test. of Chrissy Bartovich, Tr. at 80 (Oct. 24, 2017).
[361] Test. of Kurt Anderson, Tr. at 113-116 (Oct. 23, 2017); Test. of Mike Bock, Tr. at 76-80 (Oct. 23, 2017); Test. of Mike Hansel, Tr. at 82 (Oct. 23, 2017); Test. of Rob Beranek, Tr. at 90 (Oct. 23, 2017); Tom Rukavina, Tr. at 134-148 (Oct. 24, 2017); Sen. Justin Eichorn, Tr. at 59-60 (Oct. 24, 2017).
[362] Test. of Mike Hansel, Tr. at 83 (Oct. 23, 2017).
[363] Test. of Mike Bock, Tr. at 79 (Oct. 23, 2017); eComment from John Coleman on behalf of Great Lakes Indian Fish and Wildlife Commission at 3-7 (Nov. 22, 2017).
[364] Test. of Rob Beranek, Tr. at 90 (Oct. 23, 2017); eComment from John Coleman on behalf of Great Lakes Indian Fish and Wildlife Commission at 4-5 (Nov. 22, 2017).

i. Concerns that the equation assumes steady state in a water body.[365]

j. Questions about upwelling of ground water.[366]

k. Questions about the long-term effectiveness of the calculated sulfide levels.[367]

l. Concerns about error rates in the equation.[368]

m. Disagreement about the use of EC_{10} concentration standard.[369]

n. Effect of sulfate on different parts of the wild rice plant.[370]

o. Challenges to the MPCA's analysis of its research and data.[371]

p. Concerns about response to peer review criticisms.[372]

q. Issues with the structural equation model (SEM).

251. The Administrative Law Judge finds that the MPCA presented sufficient evidence to demonstrate that there is an adequate scientific basis to conclude that the proposed equation-based sulfate standard is supported by peer-reviewed science and is needed and reasonable.

252. With one notable exception, the MPCA responded to each of the arguments raised by the commenters with arguments that were supported by peer-reviewed research.[373]

253. The exception, for which the MPCA did not offer a convincing response, was raised by several parties, most notably Dr. John Pastor, one of the scientists on whose foundational research the MPCA relied for its conclusions that sulfide, rather than sulfate, is the direct cause of damage to naturally-occurring wild rice.[374] Dr. Pastor's continuing mecocosm research has indicated that, while increased iron may counter the toxicity of sulfide to wild rice seedlings in the springtime, iron sulfide plaques form and

[365] John Pastor, PhD., Technical Review Comments on MPCA's Proposed Flexible Standard for Sulfate in Wild Rice Beds (Nov. 2017), submitted as attachment to WaterLegacy eComments (Nov. 22, 2017); eComment from Nancy Schuldt on behalf of Fond du Lac Band of Chippewa (Nov. 22, 2017); eComment from Miya Evans on behalf of Mesabi Nugget (Nov. 22, 2017).
[366] Test. of Meaghan Blair, Tr. at 117-119 (Oct. 24, 2017).
[367] John Pastor, PhD., Technical Review Comments on MPCA's Proposed Flexible Standard for Sulfate in Wild Rice Beds (Nov. 2017), submitted as attachment to WaterLegacy eComments (Nov. 22, 2017);
[368] Test. of Rob Beranek, Tr. at 91 (Oct. 23, 2017); Test. of Sen. David Tomassoni, Tr. at 55 (Oct. 24, 2017); Test. of Jack Croswell, Tr. at 99 (Oct. 24, 2017); Test. of Rep. Jason Metsa, Tr. at 102 (Oct. 24, 2017); Test. of Sen. Justin Eichorn, Tr. at 54, 61 (Oct. 25, 2017).
[369] eComment from Nancy Schuldt on behalf of Fond du Lac Band of Chippewa at 28-31 (Nov. 22, 2017); eComment from Rob Beranek at 12-13 (Nov. 22, 2017); eComment from John Coleman on behalf of Great Lakes Indian Fish and Wildlife Commission at 4-5 (Nov. 22, 2017).
[370] eComment from Rob Beranek at 6-8 (Nov. 22, 2017); Test. of Kurt Anderson, Tr. at 69-70 (Oct. 23, 2017).
[371] Test. of Mike Bock, Tr. at 78-79 (Oct. 23, 2017); Test. of Kurt Anderson, Tr. at 114 (Oct. 23, 2017).
[372] Test. of Kelsey Johnson, Tr. at 69 (Oct. 24, 2017).
[373] *See* MPCA Response Memorandum (Nov. 22, 2017) and Rebuttal Memorandum (Dec. 1, 2017).
[374] Ex. D at Ex. S-19.

precipitate on the plants' roots during the flowering and seed production phases of the wild rice life cycle. These plaques result in fewer and smaller seeds, with reduced nitrogen content, leading to extinction of the wild rice plant within 4 or 5 years at about 300 mg/L of sulfate, and greatly reducing wild rice plant population viability at lower concentrations of sulfate. Dr. Pastor hypothesizes that this occurs because the increased plaque appears to block uptake by the plant of nitrogen during the critical flowering and seed production portion of its life cycle.[375]

254. The MPCA's response to Dr. Pastor's reports about the plaque formation is, first, that "the only information the MPCA has on this issue is a four-page non-peer reviewed progress report . . . ." The MPCA also states that Dr. Pastor only presents evidence of nutrient uptake inhibition at 300 mg/L, asserting that this is "much higher than would be allowed using the MPCA's proposed equation."[376]

255. The Administrative Law Judge notes that the MPCA failed to mention the discussion of plaque formation in the peer-reviewed article which Dr. Pastor co-authored with MPCA staff, among others. The MPCA relies on this article, among others, to support the theory that increased iron in the porewater is protective against sulfide, permitting increased sulfate in the surface water.[377] This theory underlies, and is essential to, its equation-based sulfate standard. Furthermore, as discussed above, Dr. Pastor considered the effect of lower amounts of sulfate, as reported in his June 2017 article, concluding that, even at lower levels, sulfate greatly reduced plant viability when combined with increased iron.[378]

256. Nonetheless, Dr. Pastor's continued research regarding the harmful effects of increased sulfate with increased iron are not yet the subject of peer-reviewed publication. Therefore, the Administrative Law Judge finds that the MPCA demonstrated by an affirmative presentation of facts that it could rationally choose to proceed with the equation-based sulfate standard from a scientific standpoint.

257. The Administrative Law Judge finds that the MPCA's demonstration that the science underlying the equation-based standard is reasonable in that it describes a manner of calculating a sulfate level resulting in a level of sulfide in porewater protective of wild rice.

258. Nonetheless, because the MPCA failed to make an affirmative presentation of facts that implementation of the equation-based standard, or the alternate standard, would provide "for the attainment and maintenance of the water quality standards of downstream waters," the new proposed sulfate standards, even if based on science that a rational decision-maker could conclude is protective of wild rice, must be disapproved.

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[375] MPCA Response, Att. 5, N-34 at 3 (Pastor, Progress Report on Experiments on Effects of Sulfate and Sulfide on Wild Rice. June 28, 2017); eComment from John Coleman on behalf of Great Lakes Indian Fish and Wildlife Commission at 6 (Nov. 22, 2017).
[376] MPCA Rebuttal at 25.
[377] Ex. D at Ex. S-19.
[378] MPCA Response, Att. 5, N-34 at 3 (Pastor, Progress Report on Experiments on Effects of Sulfate and Sulfide on Wild Rice. June 28, 2017).

C. List at Minn. R. 7050.0471 of Proposed 4D (Naturally Occurring) Wild Rice Waters

259. **Part 7050.0471, subparts 3-9,** proposes to list the waters that will be protected as Class 4D wild rice waters. There are approximately 1,300 Minnesota water bodies in the list as proposed by the MPCA.[379]

260. In the SONAR, the MPCA explains that the current rules "apply the wild rice beneficial use to 'water used for production of wild rice,'" without identifying the waters to which the use applies.[380] The MPCA states that the case-by-case process of evaluating potential wild rice waters has posed a significant challenge to the implementation of the existing standard.[381]

261. The proposed rule is a response to a legislative mandate first passed in 2011:[382]

> (a) Upon completion of the research referenced in paragraph (d), the commissioner of the Pollution Control Agency shall initiate a process to amend Minnesota Rules, chapter 7050. The amended rule shall:
>
> (1) address water quality standards for waters containing natural beds of wild rice, as well as for irrigation waters used for the production of wild rice;
>
> (2) designate each body of water, or specific portion thereof, to which wild rice water quality standards apply; and
>
> (3) designate the specific times of year during which the standard applies.
>
> Nothing in this paragraph shall prevent the Pollution Control Agency from applying the narrative standard for all class 2 waters established in Minnesota Rules, part 7050.0150, subpart 3.
>
> (b) "Waters containing natural beds of wild rice" means waters where wild rice occurs naturally. Before designating waters containing natural beds of wild rice as waters subject to a standard, the commissioner of the Pollution Control Agency shall establish criteria for the waters after consultation with the Department of Natural Resources, Minnesota Indian tribes, and other interested parties and after public notice and comment.

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[379] Ex. C at 11.16-11.17 and 12.7-66.8 (proposed Minn. R. 7050.0471, subps. 1 and 3-9). The original proposed list is slightly longer than the list as finally proposed by the MPCA, because the MPCA initially included waters within the boundaries of the Grand Portage and Fond du Lac reservations. The two tribes objected to inclusion of the waters within their reservations' boundaries, and the MPCA proposed to remove those waters from the proposed list. MPCA Response at 13.

[380] Ex. D at 38.

[381] *Id.*

[382] 2011 Minn. Laws, 1st Sp. Sess. ch. 2, art. 4, § 32(a)-(d).

The criteria shall include, but not be limited to, history of wild rice harvests, minimum acreage, and wild rice density.

(c) Within 30 days of the effective date of this section, the commissioner of the Pollution Control Agency must create an advisory group to provide input to the commissioner on a protocol for scientific research to assess the impacts of sulfates and other substances on the growth of wild rice, review research results, and provide other advice on the development of future rule amendments to protect wild rice. The group must include representatives of tribal governments, municipal wastewater treatment facilities, industrial dischargers, wild rice harvesters, wild rice research experts, and citizen organizations.

(d) After receiving the advice of the advisory group under paragraph (c), consultation with the commissioner of natural resources, and review of all reasonably available and applicable scientific research on water quality and other environmental impacts on the growth of wild rice, the commissioner of the Pollution Control Agency shall adopt and implement a wild rice research plan using the money appropriated to contract with appropriate scientific experts. The commissioner shall periodically review the results of the research with the commissioner of natural resources and the advisory group.

262. The proposed rule applies the sulfate standard only to waters specifically identified as Class 4D wild rice waters, which are listed in proposed Minn. R. 7050.0471.[383] Waters which are not listed in the rule are not subject to the sulfate standard.[384]

263. In determining which waters to include in the proposed rule, the MPCA relied on a number of sources, including:[385]

a. *Natural Wild Rice in Minnesota*) – A Wild Rice Study Report to the Legislature (2008) (Minnesota DNR) – MDNR Wild Rice Harvester Survey Report (2007);

b. Minnesota Wild Rice Management Workgroup List of 350 Important Wild Rice Waters (2010);

c. 1854 Treaty Authority List of wild rice waters (through March 2016 plus three additional waters since March 2016);

d. MDNR Aquatic Plant Management Database;

e. MPCA Biomonitoring Field Sites;

f. University of Minnesota/MPCA Wild Rice Study Field Survey Sites;

[383] Ex. C at li. 12.7-66.8 (proposed Minn. R. 7050.0471, subps. 3-9); Ex. D at 38.
[384] Test. of S. Lotthammer, Nov. 2, 2017 Tr. at 92.
[385] Ex. D at 42.

g. Minnesota Biological Survey Database;

h. MPCA Call for Data;

i. Permittee Monitoring Reports;

j. WR Waters (7050.0470);

k. Waters identified by MDNR in 2015 as wild rice waters; and

l. Waters Identified through MPCA Review of Various Water Surveys.

264. The MPCA found that it could not determine that certain waters were Class 4D wild rice waters based solely on the information it received from these sources. In some cases, the MPCA could not identify the location of the water from the information provided. In other cases, the MPCA could not correlate the location of a river or stream with a specific WID.[386]

265. The MPCA acknowledges that the MDNR's 2008 report "is widely considered the most comprehensive source of information regarding where rice may be found in Minnesota, and [the DNR report] was extensively reviewed."[387] The MDNR report represents the work of experts in the field from state, tribal, and federal governments, along with academia and the private sector.[388] However, the MPCA found the MDNR list insufficient on its face because it consolidated certain information on the location of natural wild rice stands, making it difficult for the MPCA to define the density or acreage of some rice stands. In addition, according to the MPCA, the MDNR report contains limited information about streams with wild rice.[389]

266. As part of this rulemaking, at proposed Minn. R. 7050.0471, subp. 2, the MPCA is proposing "[a]cceptable types of evidence"[390] that can be used in future rulemakings to add wild rice water bodies. The evidence must

> support a demonstration that the wild rice beneficial use exists or has existed on or after November 28, 1975, in the water body, such as by showing a history of human harvest or use of the grain as food for wildlife or by showing that a cumulative total of at least two acres of wild rice are present.[391]

267. The evidence the MPCA lists as acceptable evidence in its proposed Minn. R. 7050.0471, subp. 2, includes:

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[386] Ex. D at 45.
[387] *Id.*
[388] *Id.*
[389] Ex. D at 46.
[390] Ex. C at line11.24 (proposed Minn. R. 7050.0471, subp. 2).
[391] Ex. C at lines11.21-11.24 (proposed Minn. R. 7050.0471, subp. 2) and MPCA Rebuttal at 8. The reference to the Rebuttal reflects some fairly minor proposed changes to the language in subpart 2 which the MPCA set forth in its December 1, 2017 Rebuttal Memorandum.

A. written or oral histories that meet the criteria of validity, reliability, and consistency;

B. written records, such as harvest records;

C. photographs, aerial surveys, or field surveys; or

D. other quantitative or qualitative information that provides a reasonable basis to conclude that the wild rice beneficial use exists.[392]

268. The MPCA found the MDNR report sufficiently reliable to presume that water bodies included in the report "with wild rice acreage estimates of two acres or more meet the beneficial use."[393] For waters in the MDNR report with fewer than two acre estimates, the MPCA looked to other sources to identify "high quality, harvestable wild rice waters."[394]

269. Several commenters maintained that, in rejecting waters listed in MNDR's 2008 report and in the 1854 Treaty Authority's list, the MPCA is removing a designated use from waters that already had wild rice as an "existing use" under federal law.[395] Under federal law, states are delegated authority to establish "designated uses" of waters and to set water quality standards to protect the designated uses.[396] According to these commenters, this action by the MPCA violates the CWA's prohibition against removing a designated use if the designated use is an "existing use[], as defined in [40 C.F.R.] § 131.3, unless a use requiring more stringent criteria is added . . . ."[397]

270. A number of commenters object to the MPCA's proposed list of Class 4D wild rice waters.[398] WaterLegacy and others assert that the MPCA's use of the term "beneficial use" with regard to the classification of wild rice waters is an imprecise and confusing use of a term that is not defined in either existing or proposed rules.[399]

271. WaterLegacy argues that the MPCA's proposed list of Class 4D waters is "arbitrary and exclusive" and will "de-list wild rice waters identified by Minnesota state agencies, including waters downstream of existing and potential mining discharge."[400]

272. WaterLegacy points out that the existing rules, at Minn. R. 7050.0220, subps. 3a, 4a, 5a, and 6a, apply the current 10 mg/L sulfate standard where wild rice is

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[392] Ex. C at lines 12.1-12.6 (proposed Minn. R. 7050.0471, subp. 2).
[393] Ex. D at 46.
[394] Ex. D at 46.
[395] WaterLegacy eComment at 30. Hearing Ex. 1020, Written Comments of Dennis Morrison on behalf of Grand Portage Band of Chippewa (Grand Portage Comments) at 8 (Oct. 24, 2017). *See* eComment from Nancy Schuldt on behalf of Fond du Lac Band at 21-23 (Nov. 22, 2017).
[396] WaterLegacy eComment at 31. 40 C.F.R. § 131.3.
[397] 40 C.F.R. § 131.11(h)(1).
[398] eComment of Nancy Schuldt on behalf of Fond du Lac Band at 8-25 (Nov. 22, 2017), WaterLegacy eComment at 30-40; Hearing Ex. 1020, Grand Portage Comments at 4-8 (Oct. 24, 2017). eComment of Minnesota Center for Environmental Advocacy (MCEA eComment) at 2-5 (Nov. 22, 2017).
[399] WaterLegacy eComment at 30. Fond du Lac eComment at 20-21.
[400] WaterLegacy eComment at 30.

"present." Minn. R. 7050.0224, subp. 1, protects wild rice as a Class 4 water, "for wildlife designated public uses and benefits," recognizing it as a "food source for wildlife and humans." In addition, WaterLegacy cites Minn. R. 7050.0224, subp. 2, which limits sulfate to 10 mg/L in "water used for production of wild rice . . . ."[401]

273. WaterLegacy maintains that, while rescinding existing Minnesota rules that protect waters used for the production of wild rice and where wild rice is present, the proposed rules create a list of protected waters that excludes "many known and previously designated wild rice waters."[402]

274. WaterLegacy claims that the MPCA proposes to delist designated wild rice waters previously identified in consultation with the MDNR and Minnesota tribes. WaterLegacy contends that this delisting violates the CWA's prohibition on removing existing uses that have been attained at any time since November 28, 1975. In addition, according to WaterLegacy, the MPCA's proposed list fails to protect wild rice waters generally, and particularly fails to protect wild rice waters downstream of existing and proposed WWTPs.[403]

275. Other commenters disagree with the MPCA's proposed list of Class 4D waters for distinctly different reasons. Cleveland Cliffs focuses on the 2011 legislative requirement that the MPCA must consult "with the Department of Natural Resources, the Minnesota Indian tribes, and other interested parties and after public notice and comment"[404] to establish criteria for wild rice waters before the Agency designates such waters.[405] Cleveland Cliffs argues that this legislative language required the MPCA to engage in rulemaking to establish criteria for designating wild rice waters before it could designate such waters.[406]

276. In addition, Cleveland Cliffs contends that MPCA violated the language in the 2011 law requiring that "[t]he criteria shall include, but not be limited to, history of wild rice harvests, minimum acreage, and wild rice density" when it included waters in the Class 4D wild rice waters list, without regard to their failure to meet the MPCA's stated minimum acreage requirement or a known density of wild rice.[407]

277. U.S. Steel Corporation asserts the MPCA's listing of waters violates the 2011 legislation because the list does not contain information about wild rice density.[408]

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[401] WaterLegacy eComment at 31.
[402] WaterLegacy eComment at 31. eComment of Nancy Schuldt on behalf of Fond du Lac Band at 8-25 (Nov. 22, 2017), Hearing Ex. 1020, Grand Portage Comments at 4-8 (Oct. 24, 2017).
[403] WaterLegacy eComment at 31.
[404] 2011 Minn. Laws, First Sp. Sess., Ch. 2, Art. 4(b).
[405] eComment from Rob Beranek on behalf of Cleveland Cliffs (Cleveland Cliffs eComment) at 16 (Nov. 22, 2017).
[406] Cleveland Cliffs eComment at 16.
[407] Cleveland Cliffs eComment at 17.
[408] Letter from Lawrence Sutherland on behalf of U.S. Steel (U.S. Steel letter) at 37-38 (Nov. 22, 2017).

278. The MPCA maintains that, for this rulemaking, it used a "weight-of-evidence approach as it reviewed the corroborating evidence from sources to determine if the wild rice beneficial use exists or has existed in a water." Further, the MPCA states:[409]

> Many of the supporting documents used in the MPCA's review do not contain complete information about the density or acreage of wild rice. Therefore, MPCA scientists used their best professional judgement to determine if the available information provided reasonable evidence that the water demonstrated the wild rice beneficial use (or had done so since November 28, 1975).
>
> For example, where a corroborating source qualitatively identified a water as having "lush" stands of wild rice, the MPCA considered that it met the beneficial use as a wild rice water. Because no single source provided comprehensive or consistent data about the presence of wild rice, the MPCA was not able to apply a strict criterion for what information did or did not reasonably characterize a wild rice water. The MPCA reasonably made the best use of the information from all sources as a basis for professional judgement.

279. In considering possible wild rice waters for inclusion in the list at 7050.0442, subp. 2, the MPCA did not explicitly apply the evidentiary expectations it proposes in Minn. R. 7050.0471, subp. 2. Nor did the MPCA explain why it rejected each proposed specific water that the MPCA excluded from the list in the proposed rule.

280. The MPCA acknowledges that it may not have included all of the waters where the wild rice use has existed since November 28, 1975 in the list proposed at Minn. R. 7050.0471.[410]

281. In the SONAR, the MPCA addresses the questions of whether it has included all wild rice waters with an existing use, stating that the Agency

> acknowledges that the wild rice waters in this rulemaking may not include every water in Minnesota where the wild rice beneficial use has existed since November 28, 1975. Although the MPCA has made reasonable use of the information available to develop and justify the proposed list of Class 4D wild rice waters, there are additional waters that may be wild rice waters but for which there is not yet sufficient information to determine that the beneficial use is demonstrated.[411]

282. In response to the commenters who believe that the list of wild rice waters is under-inclusive, the MPCA responds that "it is likely that not all wild rice waters have

[409] Ex. D at 47.
[410] Ex. D at 58.
[411] *Id.*

been identified and is proposing a specific process for future identification of wild rice waters" at proposed Minn. R. 7050.0471, subp. 2.[412]

283. In its December 1, 2017 Rebuttal memorandum, the MPCA states that it "does not agree that the presence (or evidence of past presence) of any amount of wild rice is indicative that the Class 4D wild rice beneficial use is an existing use in that water body."[413] In the same document, the MPCA states, with no affirmative presentation of facts to support the statement, that it "has identified those waters where wild rice is an existing use as wild rice waters. Some of those waters may not have wild rice today, but under the CWA must be protected if the use has existed since November 28, 1975."[414]

284. The 2011 legislature required the MPCA to engage in rulemaking only after completing significant research on "water quality and other environmental impacts on the growth of wild rice . . . ."[415] The amended rule was required to:

> (1) address water quality standards for waters containing natural beds of wild rice, as well as for irrigation waters used for the production of wild rice;
>
> (2) designate each body of water, or specific portion thereof, to which wild rice water quality standards apply; and
>
> (3) designate the specific times of year during which the standard applies.[416]

285. The MPCA was not authorized to engage in separate preliminary rulemaking to establish criteria for designating wild rice water bodies.[417]

286. The Administrative Law Judge concludes that the plain language in 2011 Minn. Laws 1st Spec. Sess. ch. 2, art. 4, § 32(b), requires the MPCA to consider the criteria listed in the 2011 Session Law, but does not require that any one of the criteria be determinative. Therefore, the Administrative Law Judge concludes that there is no minimum wild rice acreage or density required for the MPCA to determine that a water body is included in the listing of wild rice water bodies.

287. The Administrative Law Judge concludes that the MPCA's proposed list of wild rice waters at Minn. R. 7050.0471, subps. 3 through 9 is defective because it fails to include all waters previously identified by the MDNR and federally recognized Indian tribes as waters where wild rice was an existing use since November 28, 1975. The MPCA's approach, in using a "weight-of-evidence" standard to identify waters such as those with "lush stands of wild rice" that would meet its criteria for "the beneficial use as a wild rice water" violates federal law, which prohibits removing an existing use for wildlife

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[412] MPCA Response Memo at 13.
[413] MPCA Rebuttal Memo at 12.
[414] MPCA Rebuttal Memo at 13.
[415] 2011 Minn. Laws 1st Spec. Sess. ch. 2, art. 4(d).
[416] 2011 Minn. Laws 1st Spec. Sess. ch. 2, art. 4(a).
[417] 2011 Minn. Laws 1st Spec. Sess. ch. 2, art. 4.

unless more stringent criteria are applied.[418] Because Minn. R. 7050.0471 violates federal law, it fails to meet the requirements of Minn. R. 1400.2100.D and is defective.

288. The MPCA could cure the defect at Minn. R. 7050.0471 by amending the listed waters to include all waters previously identified by the MDNR and federally recognized Indian tribes as waters where wild rice was an existing use since November 28, 1975. The Administrative Law Judge concludes that adding the wild rice waters as described in this paragraph would not constitute modification that makes the rule substantially different than the rule as originally proposed based on the standards set forth at Minn. Stat. § 14.05, subd. 2.

D. Other Rule Parts Not Approved

287. In addition to the disapproved proposed rules and proposed changes to the proposed rules discussed above, there are several other rule parts which the Administrative Law Judge finds do not meet the legal requirements for rulemaking. Because of the significant underlying problems with these proposed rules overall, the following rules, and the standards they violate, are listed without additional discussion for the purpose of putting the Agency on notice should it reconsider this rulemaking in the future:

a. Minn. R. 7050.0224, 5, C. Site-specific sulfate standard. The proposed rule is disapproved based on a violation of Minn. R. 1400.2100.D. No process is provided for the commissioner to determine that "the beneficial use is not harmed." The criteria included in the rule, "reliable and representative data characterizing the health and viability of the wild rice . . . ," are vague and grant the commissioner discretion in excess of statutory authority to determine whether to substitute the existing standard.

b. Minn. R. 7050.0224, subp. 6. This proposed rule concerns the existing narrative standard for Class 4D [WR] waters currently at Minn. R. 7050.0224, subp. 1. The narrative standard applied to the only other wild rice waters previously identified in rule. The proposed rule moves the narrative standard to Minn. R. 7050.0224, subp. 6, and explicitly restricts application of the narrative standard to the wild rice waters originally identified in the rule, at Minn. R. 7050.0470, excluding the wild rice waters listed at 7050.0471 from the scope of its protections.[419] The Administrative Law Judge disapproves Minn. R. 7050.0224, subp. 6, to the extent that it does not apply to all wild rice waters. The MPCA provided no basis to distinguish between protections needed for the waters listed at Minn. R. 7050.0470 and those listed at Minn. R. 7050.0471. Therefore, to apply the narrative standard only to those listed at 7050.0470 violates Minn.

[418] 40 C.F.R. § 131.11(h)(1).
[419] Test. of Nancy Schuldt, Oct. 26, 2017 Tr. at 95-96.

R. 1400.2100.B because the record does not demonstrate the reasonableness of the rule.

E. Technical Errors

288. The language included in the following proposed rules appears to amend version of subparts which are no longer in effect. These are technical errors rather than legal defects. The Agency may cure the errors by amending the proposed language to propose changes to the current versions of the rule:

a. Minn. R. 7050.0220, subp. 5a

b. Minn. R. 7050.0470, subps. 1 through 9

F. Changes to the Proposed Rule

289. Following the public hearings, in its Response and Rebuttal Comments, the MPCA makes a number of proposed changes to the proposed rule. Because the Agency suggested changes to the proposed rule language after the date it was originally published in the *State Register*, it is necessary for the Administrative Law Judge to determine if this new language is substantially different from that which was originally proposed.

290. The standards to determine whether any changes to proposed rules create a substantially different rule are found in Minn. Stat. § 14.05, subd. 2(b). The statute specifies that a modification does not make a proposed rule substantially different if:

> (1) the differences are within the scope of the matter announced . . . in the notice of hearing and are in character with the issues raised in that notice;
>
> (2) the differences are a logical outgrowth of the contents of the . . . notice of hearing, and the comments submitted in response to the notice; and
>
> (3) the notice of hearing provided fair warning that the outcome of that rulemaking proceeding could be the rule in question.

291. In reaching a determination regarding whether modifications result in a rule that is substantially different, the Administrative Law Judge is to consider whether:

> (1) persons who will be affected by the rule should have understood that the rulemaking proceeding . . . could affect their interests;
>
> (2) the subject matter of the rule or issues determined by the rule are different from the subject matter or issues contained in the . . . notice of hearing; and

> (3) the effects of the rule differ from the effects of the proposed rule contained in the . . . notice of hearing.[420]

292. To the extent that they are not approved, the MPCA's suggested language changes are described in the following paragraphs.

1. Changes That Are Not Approved

(1) Minn. R. 7050.0224, subp. 5, B (1)

293. The EPA comments that "it is not possible to say with certainty," regarding the equation-based sulfate standard set forth at Minn. R. 7050.0224, subp. 5, B (1), "that the relationships between sediment pore water sulfide and total organic carbon and total extractable iron used to calculate protective water column sulfate concentrations remain valid outside the range of the data used to develop the criterion."[421]

294. Commenter Nathan Johnson similarly observes:

> It is possible that a limitation on the model predictions could be imposed . . . which would not allow high sulfate concentrations to be calculated by the model if the statistical strength of the model's predictive abilities towards the edge of the domains is limited. Using the proposed equation to extrapolate to very high surface water sulfate concentrations (higher than those observed commonly in the observational dataset) represents a potential instance of applying the model beyond an appropriate domain of applicability. The same could be said for sediment carbon and iron.[422]

295. In response to these concerns, the Agency proposes to amend the equation for the numeric sulfate standard, "by setting constraints on the implementation of the equation that would ensure that the equation is protective."[423] The MPCA proposes to set these constraints so "that input values of carbon cannot be lower than the minimum value in the range of data used to develop the equation, because carbon enhances sulfide production." Similarly, under the MPCA's proposal the "input values of iron cannot be higher than the maximum value in the range of data used to develop the equation because iron removes sulfide from porewater."[424] The MPCA provides no specific values for its minimum carbon or maximum iron values.

296. As part of its response to the concerns raised by Mr. Johnson and the EPA about setting constraints consistent with the models, the MPCA proposes "that output

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[420] *See* Minn. Stat. § 14.05, subd. 2.
[421] EPA Comments at 6.
[422] Nathan Johnson Comment at 1-2 (eComment Nov. 22, 2017).
[423] MPCA Rebuttal Memo at 3.
[424] *Id.*

values of sulfate cannot be higher than the maximum value in the range of data used to develop the equation, 838 mg/L."[425]

297. The MPCA asserts that the constraint on sulfate is appropriate "because observed sulfate levels were an input to the development of the equation, and the equation is of unknown validity outside the range used to develop it."[426] The Agency believes that this approach "will help assuage commenter concerns about exceedingly high sulfate levels that may result from the equation." However, the Agency realizes that imposing these limits may also raise concerns for other commenters.[427]

298. The Administrative Law Judge finds that, to the extent the equation-based standard remains a viable part of this rule, the sulfate cap is needed and reasonable and would not constitute a modification that makes the rule substantially different than the rule as originally proposed based on the standards set forth at Minn. Stat. § 14.05, subd. 2.

299. The Administrative Law Judge finds that, to the extent the equation-based standard remains a viable part of this rule, unspecified minimum carbon or maximum iron input values for the equation-based standard are not reasonable. They are unconstitutionally vague and violate the standards of Minn. R. 1400.2100.E.

(2) Minn. R. 7050.0224, subps. 5.E and F

300. In Minn. R. 7050.0224, subp. 5, E, the MPCA proposes to incorporate Sampling and Analytical Methods for Wild Rice Methods. As the name indicates, this document sets out methods for collecting and analyzing wild rice water sediment samples.

301. The MPCA explains that a "primary goal of incorporating the sampling methodology into the rule was to provide clarity so that others can conduct sampling and to ensure that the sampling, which is foundational to the developing of a numeric sulfate standard, is completed consistently and accurately." Because this goal is important to the MPCA, it plans to incorporate any changes to the methods incorporated by reference through rulemaking.[428]

302. Commenter Norman Miranda notes:

> The dilemma I see for utility managers regardless of whatever protective limit is adopted is to convince their respective City Council and rate payers that a very limited number of samples and sample locations yielded adequate and conclusive data to justify a significant capital investment. … I believe MPCA is on the right track offering a consistent sampling regime of a fixed number of samples at a prescribed location array. … I believe at least two sampling events conducted in appropriate but separate locations

[425] MPCA Rebuttal Memo at 4.
[426] *Id.*
[427] *Id.*
[428] MPCA Rebuttal at 5.

need to be conducted by the MPCA. I realize the MPCA has limited financial resources to conduct extensive sampling and analysis in multiple locations for every discharger. However, to offer some flexibility, I think the Rule should include a provision that municipalities/permitted facilities be given the opportunity to conduct additional sampling/testing beyond two events that would be required under the Rule. The ground rules for this additional sampling could include:

- Regulated party must submit a plan for MPCA approval showing proposed alternative sample locations.
- Sampling must follow MPCA "Sampling and Analytical Methods" and be conducted by approved lab/consultant.
- Sampling/testing to be done before or concurrent with MPCA sampling as not to delay MPCA's schedule.
- Cost of additional sampling events to be the responsibility of the Regulated Party.

In return I believe there should be language where the MPCA will give the Regulated Party's data set the same weight if all conditions are followed.[429]

303. The MPCA agrees that some flexibility may be needed as more sampling occurs, and appreciates that many permittees want to do more sampling, and perhaps sooner, than the MPCA plans to undertake. While the MPCA plans to do most sampling with its own resources, it plans to allow the use of data submitted by other parties (whether regulated parties or others) if the data was collected in accordance with the MPCA's requirements.[430]

304. The MPCA is proposing to amend Minn. R. 7050.0224, subp. 5, B (1) (a) - (c) at lines 8.6, 8.11, and 8.13, to require that analysis and sampling happen consistent with the methods that are incorporated by reference, rather than requiring exact adherence to the methods. This will allow some flexibility if, for example, an analytical method is slightly updated. The MPCA is also proposing to add language that the sediment samples are collected in areas where wild rice is growing or may grow within the wild rice water. The proposed rule language would read:[431]

Where:

(a) organic carbon is the amount of organic matter in dry sediment. The concentration is expressed as percentage of carbon, as determined ~~using~~ consistent with the method for organic carbon analysis in Sampling and Analytical Methods for Wild Rice Waters, which is incorporated by reference in item E;

[429] eComment of Norman Miranda (Nov. 15, 2017).
[430] MPCA Rebuttal at 4-5.
[431] MPCA Rebuttal at 5.

(b) iron is the amount of extractable iron in dry sediment. The 8.10 concentration is expressed as micrograms of iron per gram of dry sediment, as determined ~~using~~ consistent with the method for extractable iron in Sampling and Analytical Methods for Wild Rice Waters;

(c) sediment samples are collected ~~using~~ consistent with the procedures established in 8.14 Sampling and Analytical Methods for Wild Rice Waters;

305. The MPCA is proposing additional related changes, likely to be codified as rule part 7050.0224, subp. 5, E, which would read as follows:[432]

For each wild rice water identified in 7050.0471, the methods for selecting sediment sampling sites and for collecting, processing and analyzing sediment samples must be documented, including all QA/QC. Where methods are used that are consistent with but different from those specified in Sampling and Analytical Methods for Wild Rice Waters, the intended methods and how they will be used to calculate the numeric sulfate standard must be submitted to and approved by the Commissioner prior to sample collection.

306. The MPCA believes these changes will allow parties wishing to undertake sampling of wild rice waters needed to calculate a protective sulfate value the flexibility to do so, while ensuring necessary consistency. The MPCA intends that sampling by non-Agency personnel could occur at any time, even if MPCA sampling has already occurred. In those cases, the MPCA states, "the intended methods should describe how both the MPCA gathered data and any additional data will be used in concert." The MPCA intends that, in all cases, all sampling be documented.[433]

307. The Administrative Law Judge disapproves the MPCA's proposed language requiring prior approval of data collection methods to plan for allowing non-Agency personnel to engage in sampling and data collection of wild rice waters because the MPCA provides no criteria for approving alternate sampling plans. This delegates discretion to the Agency beyond what is allowed by law, in violation of Minn. R. 1400.2100.D.[434]

308. The MPCA states in its Rebuttal memorandum, but nowhere in the rule, that the MPCA will make the final determination about the numeric sulfate standard for any given water body.[435]

309. The MPCA includes no process and no criteria in the proposed rule language for the Agency to determine which of possible competing numeric sulfate

[432] MPCA Rebuttal at 5. The incorporation by reference would then be renumbered as Subp. 5, F. MPCA Rebuttal at 5.
[433] MPCA Rebuttal at 5.
[434] *See Lee v. Delmont*, 228 Minn. 101, 113, 36 N.W.2d 530, 538 (1949); *accord Anderson v. Commissioner of Highways*, 126 N.W.2d 778, 780 (Minn. 1964).
[435] MPCA Rebuttal at 5.

standards will apply in a given wild rice water. While the Administrative Law Judge does not disapprove incorporating by reference into the rule the Sampling and Analytical Methods for Wild Rice Waters, the Agency's larger scheme of permitting multiple players to propose standards with no written, transparent process or criteria for choosing among those standards exceeds the Agency's authority.

310. The Administrative Law Judge disapproves the MPCA's proposed language because, by granting the Agency authority to choose which standard to apply with no criteria in rule, the rule grants the Agency discretion beyond what is allowed by law in violation of Minn. R. 1400.2100.D.[436]

(3) Minn. R. 7050.0224, subp. 5, B (2)

311. The MPCA received several comments about the Alternate Standard set forth at Minn. R. 7050.0224, subp. 5, B (2). This alternate standard procedure develops a replicable approach to developing an alternate standard for areas where the equation does not fit – where there is high sulfate but low porewater sulfide. A number of commenters objected to the standard for a variety of reasons. [437]

312. In its Rebuttal, the MPCA proposes to revise Minn. R. 7050.0224, subp. 5, B (2), as follows:[438]

> The commissioner may establish an alternate sulfate standard for a wild rice water when the ~~ambient~~ surface water sulfate concentration is above the calculated sulfate standard and data demonstrates that sulfide concentrations in pore water are 120 micrograms per liter or less. Data must be gathered ~~using~~ consistent with the procedures specified in Sampling and Analytical Methods for Wild Rice Waters, which is incorporated by reference in item E. The alternate sulfate standard ~~established must be either the annual average sulfate concentration in the ambient water or a level of sulfate the commissioner has determined will maintain the sulfide concentrations in pore water at or below 120 micrograms per liter.~~ is determined by calculating the ratio of measured sulfide, in micrograms per liter, to 120 micrograms per liter and applying that ratio to the surface water sulfate as follows $\frac{120}{porewater\ sulfate} * surface\ water\ sulfate$.

313. The Administrative Law Judge disapproves of Minn. R. 7050.0224, subp. 5, B (2), because, as with the repeal of the 10 mg/L sulfate standard, the MPCA has failed to make an affirmative presentation of facts demonstrating that, in establishing an Alternative Standard which would allow increased levels of sulfate in wild rice waters, it

[436] *See Lee v. Delmont*, 228 Minn. 101, 113, 36 N.W.2d 530, 538 (1949); *accord Anderson v. Commissioner of Highways*, 126 N.W.2d 778, 780 (Minn. 1964).
[437] Test. of P. Maccabee, Oct. 23, 2017 Tr. at 104; eComment of Kurt Anderson on behalf of Minnesota Power (Minnesota Power eComment) at 18-19 (Nov. 21, 2017); eComment of Chrissy Bartovich and Lawrence Sutherland on behalf of U.S. Steel (U.S. Steel eComment) at 34 (Nov. 22, 2017).
[438] MPCA Rebuttal at 7.

is protecting the public health or welfare, enhancing the quality of water, and ensuring the proposed water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters, as required by federal and state law. Therefore, the Administrative Law Judge concludes that the proposed Alternative Standard violates Minn. R. 1400.2100.D, because it conflicts with other applicable law.

(4) Part 7050.0130, subp. 6a

314. **Part 7050.0130, subp. 6a** defines a "water identification number" or "WID" as a unique identifier used by the agency to identify a surface water.[439] Mining Minnesota objects to the MPCA's use of WIDs to describe the identified wild rice waters at proposed Minn. R. 7050.0471.[440] The basis for Mining Minnesota's objection is that the WIDs fail to describe the areas where wild rice beds are located with sufficient specificity, resulting in a list that designates waters with no wild rice, or no history of wild rice presence, as wild rice waters.[441] The result of the MPCA's use of what is essentially an administrative convenience, according to Mining Minnesota, is an overbroad regulation that "will inflict significant hardship on industry, companies, and private citizens across the state in a manner that is contrary to legislative intent."[442]

315. The MPCA disagrees with this criticism, stating that "WIDs are an important component of the MPCA's water programs."[443] The MPCA notes that the EPA agrees with the MPCA's assessment that rulemaking is required to make changes to a WID number that would entirely remove the WID from a particular water, or from a subpart of the water already identified as a wild rice water.[444] The MPCA contends that it is logical to apply the standard to the entire WID for lakes, wetlands, and reservoirs, because in these situations, the water generally "moves and mixes throughout the waterbody."[445] The MPCA notes that, in those cases where part of a lake or reservoir, such as a bay, is hydrologically isolated, the MPCA has a mechanism for assigning a separate WID to the hydrologically separate part of the waterbody.[446]

316. While the MPCA recognizes "that there may [be] cases where the presence of wild rice within a large or very diverse WID does not justify the application of the standard to the entire WID" the MPCA suggests that, in those cases, it "can split the WID and conduct a use and value determination . . . to remove the wild rice beneficial use from the WID that does not support the beneficial use."

317. The Administrative Law Judge concludes that the MPCA's proposal to "split the WID and conduct a use and value determination . . . to remove the wild rice beneficial

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[439] Ex. C at lines 1.16-1.22.
[440] Letter from Frank Ongaro on behalf of Mining Minnesota (Mining Minnesota letter) at 3 (Nov. 22, 2017).
[441] Mining Minnesota letter at 3-4.
[442] Mining Minnesota letter at 7.
[443] MPCA Rebuttal at 14.
[444] *Id.*
[445] *Id.*
[446] *Id.*

use from the WID that does not support the beneficial use" at some time in the future would violate the federal prohibition on removing an existing use.[447] This proposal is not currently in the proposed rule and the Administrative Law Judge does not approve including it.

2. Changes That Are Approved

318. The MPCA proposes changes to a number of proposed rules in its Response and Rebuttal memoranda. Should the MPCA proceed with revisions to the overall rule, the Administrative Law Judge concludes that the MPCA's proposed changes to the rule parts listed below would be needed and reasonable and would not constitute modifications that make the rule substantially different than the rule as originally proposed based on the standards set forth at Minn. Stat. § 14.05, subd. 2:

a. Minn. R. 7050.0130, subp. 2b[448]

b. Minn. R. 7050.0130, subp. 6c[449]

c. Minn. R. 7050.0220, subps. 1, B (1-4), 3a, 4a, 5a and 6a[450]

d. Minn. R. 7050.0220, subp. 3a[451]

e. Minn. R. 7050.0224, subp. 5, B[452]

f. Minn. R. 7050.0471, subp. 3[453]

g. Minn. R. 7050.0471, subps. 6 and 8[454]

h. Minn. R. 7050.0471, subp. 8[455]

i. Minn. R. 7053.0406, subp. 1[456]

j. Minn. R. 7053.0406, subp. 2[457]

k. Minn. R. 7053.0406, subp. 2, B[458]

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[447] 40 C.F.R. § 131.3 (e).
[448] MPCA Rebuttal at 2.
[449] MPCA Rebuttal at 3. The MPCA Rebuttal mistakenly refers to the rule part in question as part 7050.0220, subp. 6c.
[450] MPCA Rebuttal at 2.
[451] MPCA Rebuttal at 2-3.
[452] Rebuttal at 7. EPA Comments at 5.
[453] MPCA Response to Comments at 13.
[454] MPCA Response to Comments at 14.
[455] This WID location tool is intended to be supplementary to the Tableau interactive mapping tool presently available on the MPCA wild rice web page http://www.pca.state.mn.us/water/protectingwild-rice-waters. MPCA Response to Comments at 14.
[456] MPCA Response to Comments at 14-15.
[457] MPCA Response at 15. Minn. R. 7050.0190 contains provides that a variances from a water quality standard includes a variances for its related WQBEL. Environmental Protection Agency Comments (EPA Comments) at 15 (Nov. 22, 2017).
[458] MPCA Response at 15.

G. Additional Findings

319. The Administrative Law Judge finds that the Agency has demonstrated by an affirmative presentation of facts the need for and reasonableness of all rule provisions that are not specifically addressed in this Report.

320. Further, the Administrative Law Judge finds that all provisions that are not specifically addressed in this Report are authorized by statute, and that, to the extent they are severable from the defective rules, there are no other defects that would bar the adoption of those rules.

321. Because some of the defects in the rule are defects in foundational portions of the proposed rules, the Administrative Law Judge advises the Agency against resubmitting the rule for approval of changes unless it addresses the defects in the wild rice water sulfate standard and the list of wild rice waters. However, the list of wild rice waters proposed at Minn. R. 7050.0471 is severable from the wild rice water sulfate standard. Therefore, the Administrative Law Judge finds that the Agency could choose to resubmit the proposed list of wild rice waters separately from the wild rice water sulfate standard.

Based upon the Findings of Fact and the contents of the rulemaking record, the Administrative Law Judge makes the following:

CONCLUSIONS OF LAW

1. The Agency gave proper notice of the hearing in this matter, pursuant to Minn. Stat. §14.14, subd. 1(a).

2. The Agency has failed to fulfill the procedural requirements of Minn. Stat. §§ 14.127 and 14.131, paragraphs 1, 5, 7, and 8. All other procedural requirements of rule and law have been satisfied for both the proposed repeal of the 10 mg/L sulfate standard and the adoption of the proposed rules.

3. The following proposed rules are **DISAPPROVED:**

   a. Proposed **Minn. R. 7050.0220, subps. 3a, 4a, 5a, 6a**: deleting reference to 10mg/L sulfate wild rice water standard violates Minn. R. 1400.2100 B and D.

   b. Proposed **Minn. R. 7050.0224, subp. 2**: repealing 10mg/L sulfate wild rice water standard violates Minn. R. 1400.2100.B and D.

   c. Proposed **Minn. R. 7050.0224, subp. 5, A**: to the extent the language incorporates the standard in items B (1) and (2) the language violates Minn. Stat. § 14.38 and Minn. R. 1400.2100.B and G.

d. Proposed **Minn. R. 7050.0224, subp. 5, A**: to the extent the language incorporates the standard in item C, the language violates Minn. R. 1400.2100.D.

e. Proposed **Minn. R. 7050.0224, subp. 5, B (1)**: violates Minn. R. 14.38 and Minn. R. 1400.2100.B, G, and E.

f. Proposed **Minn. R. 7050.0224, subp. 5, C**: violates Minn. R. 1400.2100.D.

g. Proposed **Minn. R. 7050.0224, subp. 6**: need or reasonableness for rule not established. Failure to distinguish between [WR], which are provided the additional protection of the narrative standard, and other wild rice waters listed at Minn. R. 7050.0471 violates 1400.2100.B.

h. Proposed **Minn. R. 7050.0471, subps. 3 through 9**: violates Minn. R. 1400.2100.D and E.

4. The following changes to rules as originally proposed are **DISAPPROVED:**

a. Proposed changes to **Minn. R. 7050.0224, subp. 5, B (1):** violates Minn. R. 1400.2100.E.

b. Proposed changed to **Minn. R. 7050.0224, subps. 5, E and F:** violate Minn. R. 1400.2100.D.

c. Proposed changes to **Minn. R. 7050.0224, subp. 5, B (2):** violates Minn. R. 1400.2100.D.

5. The Administrative Law Judge has suggested actions to correct some of the defects cited herein and to improve the clarity of the proposed rules should they be resubmitted for approval in the future.

6. Due to the disapproval of the proposed rules and the repeal of the existing rules, this Report has been submitted to the Chief Administrative Law Judge for her approval pursuant to Minn. Stat. § 14.15, subd. 3.

7. Any Findings that might properly be termed Conclusions, and any Conclusions that might properly be termed Findings, are hereby adopted as such.

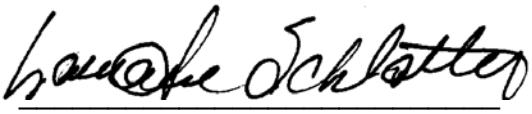
8. A Finding or Conclusion of need and reasonableness with regard to any particular rule subsection does not preclude and should not discourage the Agency from further modification of the proposed rules based upon this Report and an examination of the public comments, provided that the rule finally adopted is based on facts appearing in this rule hearing record and is not substantially different from the proposed rule.

Based upon the foregoing Conclusions, the Administrative Law Judge makes the following:

RECOMMENDATION

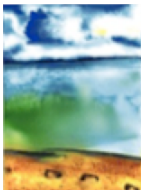
IT IS HEREBY RECOMMENDED that the proposed rules be **DISAPPROVED.**

Dated: January 9, 2018



LAURASUE SCHLATTER
Administrative Law Judge

Reported:
Marcia L. Menth, Kirby Kennedy & Associates, St. Paul – 10/23
Calvin J. Everson, Danielson Court Reporting, Virginia – 10/24
Lorna D. Jacobson, Jacobson Reporting & Video Services, Bemidji – 10/25
Nathan D. Engen, Cloquet – 10/26
Nathan D. Engen, Brainerd – 10/30
Kelly L. Brede, Kirby Kennedy & Associates, St. Paul – 11/2



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February 9, 2018

SENT ELECTRONICALLY
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RE: Comments on MPCA 2017 Triennial Standards Review

Dear Ms. Neuschler, Ms. O'Dell,

Thank you for the opportunity to provide comments on the Minnesota Pollution Control Agency (MPCA) 2017 Triennial Standards Review scope and schedule for changes in water quality standards. The following comments and attached references are submitted on behalf of WaterLegacy, the Sierra Club North Star Chapter, Northeastern Minnesotans for Wilderness, Friends of the Cloquet Valley State Forest and the Wisconsin Resources Protection Council.

We believe that the Minnesota Pollution Control Agency (MPCA) should take the following actions to protect aquatic life and human health and to comply with the federal Clean Water Act:

1. The MPCA must postpone its proposed changes to eliminate, weaken or convert to a narrative various Minnesota Class 3 (Industrial) and Class 4 (Agricultural and Wildlife) water standards in order to avoid impairments of fish and other aquatic biota in violation of the federal Clean Water Act and its implementing regulations.

2. The MPCA must prioritize setting a Class 2 (Aquatic Life and Recreation) water quality standard for specific conductivity to protect fish and other aquatic biota. MPCA data and detailed analysis by the U.S. Environmental Protection Agency (EPA) are sufficient to proceed with rulemaking and to set specific conductivity limits to protect aquatic life in Minnesota.

3. The MPCA must prioritize setting a Class 2 (Aquatic Life and Recreation) water quality standard for sulfate to prevent methylation of mercury and bioaccumulation of methylmercury in the aquatic food chain. Discharge of sulfate contributes to violations of numeric criteria for mercury and threatens the developing brains of human fetuses, infants and children as well as wildlife that consume fish.

The need for these actions is discussed in more detail below.

1. The MPCA Must Postpone Proposed Changes to Class 3 and Class 4 Standards.

In its 2017 timeline for Triennial Review,[1] the MPCA proposes to revise standards for waters designated for Class 3 (Industrial) and Class 4 (Agricultural and Wildlife) uses as a Group 1A project. Proposed changes to Class 3 and Class 4 water quality standards are highly significant for fish and other aquatic biota, since most Minnesota waters are classified and protected for multiple beneficial uses.[2] Thus, a Class 2 (Aquatic Life and Recreation) lake or stream will also be classified as a Class 3 and Class 4 water, and water quality standards applicable to the Class 3 or Class 4 beneficial uses will also protect the use of waters for aquatic life and recreation.

The MPCA's proposal to revise Class 3(Industrial) and Class 4 (Agricultural and Wildlife) standards is, in large part, a set of recommendations for deregulation on the grounds that industry and agriculture do not require the level of protections reflected in existing rules. Class 3 numeric limits on chlorides, hardness and pH would be replaced with a narrative standard. Class 4 limits on salinity would be removed and limits for total dissolved salts would be removed for irrigation waters and made less protective for waters used for livestock. The water quality standard for specific conductivity, which is an efficient test of ionic pollution resulting from various salts, would also be weakened under the proposed Class 3 and Class 4 provisions.

The Technical Support Document Summary from the University of Minnesota posted by the MPCA implies that, if Class 3 and Class 4 standards were eliminated, weakened or replaced with an indefinite narrative standard, Class 2 standards would protect aquatic life. The TSD Summary states, "Another option available is to modify the current water quality standards such that they directly relate back to current Class 2 aquatic life-recreational use water quality standards. This option would remove current Class 3 water chemistry parameters (pH, total hardness, and chloride) and substitutes a narrative standards citing back to the Class 2 standards."[3]

The expectation or assumption that Class 2 standards would protect aquatic-life and recreation if water quality standards for industrial, agricultural and wildlife beneficial uses were removed is incorrect.

Comparisons between existing Class 2 (Aquatic Life and Recreation) water quality standards and both existing and proposed Class 3 (Industrial) and Class 4 (Agricultural and Wildlife) standards are provided in the Water Quality Standards Comparison worksheet attached to these comments.

Class 2 standards for chloride are far less protective than those for Class 3 industrial waters.[4] According to the MPCA, the Class 2 aquatic life standard for chloride has been slated for revision. There is new information that water softeners in wastewater and road salt in urban runoff impair aquatic life and that Minnesota's current chloride standard is based on "potentially

[1] MPCA's proposed water quality standards work plan, 2018 – 2020, https://www.pca.state.mn.us/water/mpca%E2%80%99s-proposed-water-quality-standards-work-plan-2018-2020
[2] Minn. R. 7050.0220, Subp. 1.
[3] Technical Support Document Summary: University of Minnesota Class 3 and Class 4 Water Quality Standards Review Minnesota Surface Water Quality Investigation - Industrial Supply, Irrigation and Livestock Uses, June 29, 2010, p. 115, see also p. 2. Report available at https://www.pca.state.mn.us/water/amendments-water-quality-standards-%E2%80%94-use-classifications-3-and-4
[4] See Minn. R. 7050.0220, Subp. 3a(5); Subp. 4a(5); Supb. 5a(3).

outdated science."[5] Removing Class 3 and Class 4 chloride standards prior to determining the limits needed to protect aquatic life from chloride would fail to meet the minimum requirements for changes in water quality standards under the Clean Water Act.[6]

In addition, although Class 3 industrial water quality standards limit total hardness from calcium and magnesium, Class 2 aquatic life standards do not regulate hardness or calcium.[7] Recent scientific evidence indicates that there is a calcium threshold for zebra mussel invasive species.[8] Unimpacted waters in the Lake Superior Basin and north of the Laurentian divide may have low enough calcium under natural conditions to protect many Minnesota waters against invasion by zebra mussels. The appropriate criteria for calcium needed to protect aquatic life from zebra mussel invasive species must be determined before hardness standards are removed from waters with Class 2 beneficial uses.

Several changes proposed for Class 4 (Agricultural and Wildlife) standards[9] pertain to deregulation of controls on salinity. Although a water quality standard for sulfate of 500 to 2,000 milligrams per liter (mg/L) is proposed for Class 4B waters for livestock drinking, the MPCA proposes to eliminate the 1,000 mg/L standard limiting total salinity, remove the 700 mg/L standard for total dissolved salts in Class 4A waters, substantially weaken the standard for total dissolved salts in Class 4B waters (a standard of 3,000 – 5,000 mg/L has been proposed), eliminate the 1,000 µS/cm[10] standard for specific conductance in Class 4B waters and weaken the specific conductivity standard in Class 4A waters (a standard of 1,200 -1,700 µS/cm has been proposed).

There is a wealth of scientific evidence developed during the past decade by the U.S. Environmental Protection Agency (EPA) Office of Research and Development and published in peer-reviewed literature demonstrating that removing controls on salts and ionic pollution would impair aquatic life beneficial uses. EPA's research establishes that dissolved salts, whether measured in milligrams per liter of specific ions or measured in microSiemens of conductivity, extirpate sensitive aquatic insects and adversely impact freshwater fish.[11]

As detailed in the next section of these comments, Minnesota's existing Class 4 standards for salts and ionic pollution are already insufficiently stringent to protect aquatic life throughout all ecoregions of the State. Eliminating or weakening these existing Class 4 standards in Class 2 (Aquatic Life and Recreation) waters prior to determining what standards are needed to protect

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[5] MPCA's proposed water quality standards work plan, 2018 – 2020, *supra*, Chloride- aquatic life.
[6] 40 C.F.R. §131.6(a) and (c); 33 U.S.C. §1251(a)(2).
[7] *See* Minn. R. 7050.0223 and Minn. R. 7050.0220.
[8] *See e.g.* A.N. Cohen, A. Weinstein, Zebra Mussel's Calcium Threshold and Implications for its Potential Distribution in North America, San Francisco Estuary Institute, June 2001; S.S. Hinks, G.L Mackie, Effects of pH, calcium, alkalinity, hardness, and chlorophyll on the survival, growth and reproductive success of zebra mussel (Dreissena polymorpha) in Ontario Lakes, *Can. J. Fish, Aquatic Sci*., 54:2049-2057 (1977). References attached.
[9] *See* Minn. R. 7050.0224 for existing Minnesota Class 4 water quality standards.
[10] Minnesota's measurement of conductivity in micromhos per centimeter at 25° C is equivalent to measurement of conductivity in microSiemens per centimeter at 25° C (µS/cm), the measurement used by EPA and in the published literature.
[11] See M.B. Griffith, L. Zheing, S.M. Cormier, Using Extirpation to Evaluate the Ionic Tolerance of Freshwater Fish, *Env. Tox. & Chem*., Vol. 9999, Number 9999, pp. 1013, 2017 (accepted for publication Oct. 2017) and G. Suter, U.S. EPA ORD, Micro Siemens or Milligrams: Measured of Ionic Mixtures, PowerPoint presentation Jan. 11, 2017. References attached.

sensitive benthic macroinvertebrates and freshwater fish species from excessive salts and ionic pollution would violate the Clean Water Act and its implementing regulations.[12]

The undersigned organizations express no opinion as to whether the MPCA's proposed changes to alter or deregulate water quality standards for Class 3 (Industrial) and Class 4 (Agricultural and Wildlife) are appropriate for industrial and agricultural users of Minnesota waters. However, it is clear to us that these Class 3 and Class 4 rule changes cannot proceed under the Clean Water Act unless and until the following actions have been taken:

1) MPCA must conduct a thorough scientific analysis to evaluate the effects of every proposed change that will make Class 3 and Class 4 standards less stringent or that will eliminate numeric criteria on fish and other aquatic biota.

2) MPCA must adopt Class 2 (Aquatic Life and Recreation) water quality standards consistent with current science to protect aquatic life from chlorides, calcium and hardness, salts and ionic pollution prior to proceeding with changes to Class 3 and Class 4 standards for these parameters.

The Clean Water Act thus requires that the MPCA alter the priority and schedule for proposed rule changes that will weaken or deregulate numeric criteria for Class 3 or Class 4 waters. Until the above analysis and rulemaking have been completed, proposed changes to Class 3 and Class 4 standards are untimely and fail to meet minimum requirements for rulemaking under the Clean Water Act.

2. The MPCA Should Prioritize Adoption of a Class 2 Standard for Specific Conductivity and Apply Hazardous Concentration Values Developed by EPA.

MPCA currently identifies as a "possible revision" the development of a specific conductivity standard that would protect aquatic life. This "possible revision" doesn't even make MPCA's Group 2B list of priorities.

We believe that the MPCA has sufficient data and analysis from its own research, as well as that of the EPA, to promulgate as a Group 1A priority a rule limiting specific conductivity and to apply hazardous concentration values for specific conductivity to protect aquatic life, particularly in northeastern Minnesota.

A field-based method of determining aquatic life numeric criteria for specific conductivity was finalized by the EPA in 2011.[13] Since 2011, environmental and other stakeholders have requested that the MPCA both protect aquatic life from toxic wastewater discharge by limiting specific conductivity in wastewater discharge permits and that the MPCA also conduct rulemaking to set numeric criteria for specific conductivity to protect aquatic life.

In 2015, retired Minnesota regulators Bruce Johnson and Maureen Johnson undertook a review

[12] 40 C.F.R. §131.6(a) and (c); 33 U.S.C. §1251(a)(2).
[13] EPA, A Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams, Final Report, EPA/600/R-10/023F, March 2011 ("EPA 2011 Conductivity Benchmark Report"), available at https://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=233809 or on request.

of background levels of specific conductivity in a portion of Northeastern Minnesota's Ecoregion 50, along with data pertaining to benthic invertebrates (aquatic insects) in both impacted and unimpacted waters in the ecoregion.[14] They concluded that the EPA protocols for field-based specific conductivity criteria were applicable to Northeast Minnesota surface waters. In addition, they recommended adoption of a numeric criterion of 300 µS/cm as a chronic value of year-round application in order to protect benthic macroinvertebrates according to the criteria (prevent 5% extirpation of invertebrate genera/protect 95% of genera) set by the EPA.[15]

The EPA's Office of Research and Development reviewed the Johnson & Johnson Specific Conductance Evaluation and concluded in a memorandum dated February 4, 2016, that the weight of evidence supported the inference that effluents that increase specific conductivity to more than 300 µS/cm are likely to extirpate more than 5% of genera common to both Minnesota and Appalachia, the ecoregion EPA initially studied, and have adverse effects in northeast Minnesota waters.[16]

The EPA secured a broader set of data on benthic invertebrates and water quality from the MPCA to independently validate the conclusions reached in the Johnson & Johnson Evaluation. The EPA concluded as follows:

> [T]he inference that 5% extirpation of benthic invertebrates would occur at similar conductivity levels in central Appalachia and Ecoregion 50 in Minnesota was supported by analysis of an independent data set of paired benthic invertebrate and SC data from Ecoregion 50 in Minnesota. We estimated that more than 5% of genera would be extirpated in streams greater than 320 µS/cm. [17]

In December 2016, after extensive peer-review, the EPA released for public review its field-based methods for States (and Tribes with Treatment as a State authority) to use in developing aquatic life criteria for specific conductivity in regions outside central Appalachia.[18] Appendix D to the EPA's 2016 Field-Based Methods report detailed the method that should be used by states to develop a numeric criterion for specific conductance where there is sufficient water chemistry and biological data to calculate extirpation concentrations and hazardous concentrations.

The EPA reviewed biological and specific conductivity for 62 Level III Ecoregions, including four ecoregions in Minnesota: Ecoregion 47 (Western Corn Belt Plains), Ecoregion 50 (Northern Lakes and Forests), Ecoregion 51 (North Central Hardwood Forests) and Ecoregion 52 (Driftless Area). The EPA map below shows these Minnesota ecoregions, along with paired biological and

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[14] B.L. Johnson & M.K. Johnson, An Evaluation of a Field-Based Aquatic Life Benchmark for Specific Conductance in Northeastern Minnesota, November 2015. Reference attached with Table 1.
[15] *Id*., p. 42.
[16] S. M. Cormier, Ph.D., Review Memorandum for "An Evaluation of a Field-Based Aquatic Benchmark for Specific Conductance in Northeast Minnesota" (November 2015) Prepared by B. L. Johnson and M. K. Johnson for WaterLegacy, Feb. 4, 2016, ("EPA Review Memo"), p. 2. Reference attached.
[17] *Id*., p. 10.
[18] EPA, Field-Based Methods for Developing Aquatic Life Criteria for Specific Conductivity, Public Review Draft, EPA-822-R-07-010 December 2016. This "EPA 2016 Field-Based Methods" document, along with its Appendices A through G and the 2014 and 2015 Peer Review Reports and EPA Responses pertinent to the Field-Based Methods are available at https://www.epa.gov/wqc/draft-field-based-methods-developing-aquatic-life-criteria-specific-conductivity or on request.

water quality sampling sites.[19]

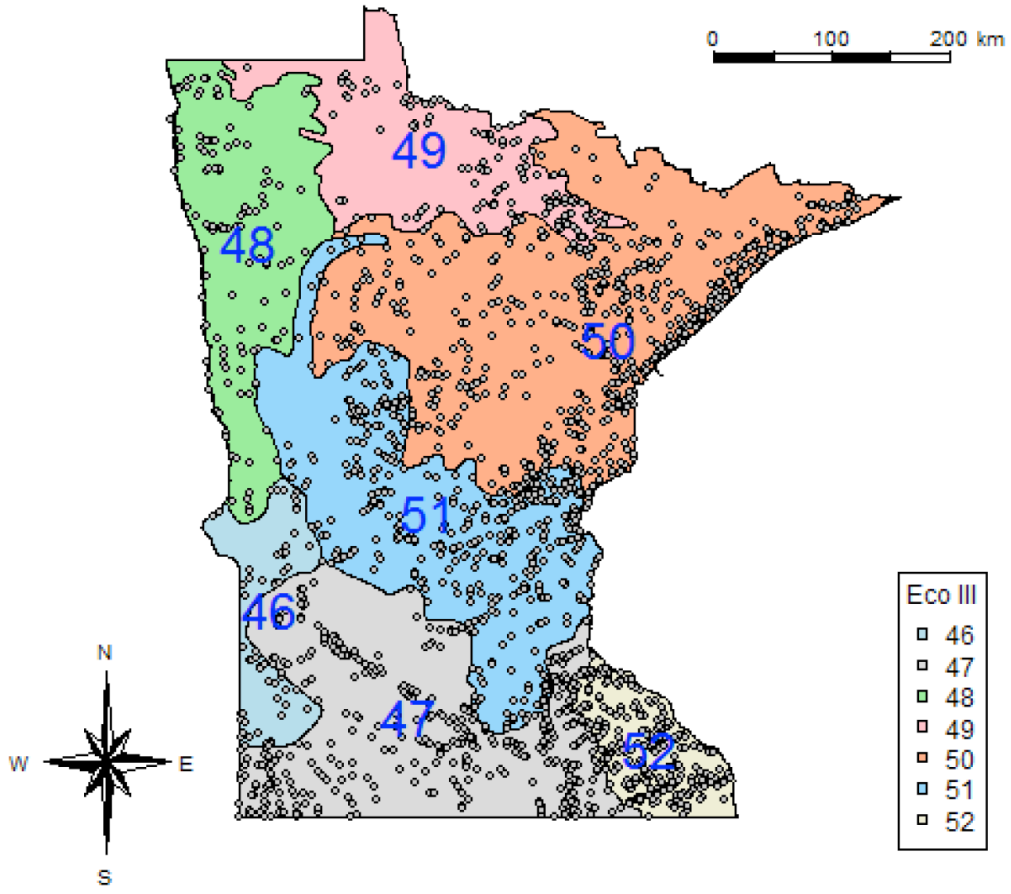

Figure 2. Ecoregion 50 is contained in the orange area in the northeast portion of Minnesota. Circles represent paired biological and water quality sampling sites. There are fewer samples in the area bordering Canada, often referred to as the boundary waters, which are less accessible for sampling.

The EPA noted that for Minnesota regions other than Ecoregion 50 in northeastern Minnesota the data had some discrepancies between State and EPA surveys of background levels of specific conductance that required further analysis. EPA developed examples for a specific conductivity hazardous concentration value in Ecoregions 47 and 51, a provisional specific conductivity value of 603 µS/cm for Ecoregion 52 in southeast Minnesota, and a provisional specific conductivity value of 320 µS/cm for Ecoregion 50, the Northern Lakes and Forests region in northeast Minnesota to protect aquatic life.[20]

[19] EPA Review Memo, *supra*, p. 7.
[20] EPA 2016 Field-Based Methods, *supra*, Appendix D. Development of a Background-to-Criterion Regression Model, at D-4, D-23, D-27. As noted at D-29, the EPA concluded that the number of samples completed in the Northern Minnesota Wetlands Ecoregion 49 was insufficient to calculate a hazardous concentration of specific conductivity for this region.

Minnesota Level III Ecoregion		Number of MPCA		EPA Hazardous Concentration Specific Conductivity (µS/cm)	
Number	Name	Samples	Sites	Example	Provisional
47	Western Corn Belt Plains	473	404	688	
50	***Northern Lakes and Forests***	*734*	*596*		***320***
51	Northern Central Hardwood Forests	583	437	494	
52	***Driftless Area***	344	277		***603***

Since December 2016, the EPA has published in peer-reviewed journals the scientific basis for establishing the proposed specific conductivity hazardous concentrations based on the weight-of-evidence process, the use of extirpation to evaluate tolerance of specific conductivity, and the step-by-step calculation to predict specific conductivity levels that extirpate freshwater aquatic benthic invertebrates. The EPA has also developed spreadsheet tools to conduct this analysis and predict stressor levels that extirpate genera and species.[21]

Adoption of a water quality standard to protect aquatic life from hazardous concentrations of specific conductivity is a compelling priority in Minnesota, particularly in the Lake Superior Basin. The MPCA's St. Louis River Watershed Stressor Identification Report identified specific conductivity as a potential stressor in multiple water bodies.[22] The Stressor Identification Report recommended that state water quality standards for conductivity and sulfate be established both to improve confidence in stressor diagnosis and to support the development of TMDL limits when waters have been identified as impaired as a result of assessments for fish or benthic invertebrates.[23]

Proposed changes in land use to develop Minnesota's first copper-nickel mines in northeast Minnesota and to undertake frac sand mining in southwest Minnesota also underscore the priority for recognizing the impact of specific conductivity on aquatic life.

Section 303 of the Clean Water Act requires that State water quality standards enhance the quality of water, serve the purposes of the Act, and protect the propagation of fish and wildlife.[24] Federal regulations implementing the Clean Water Act require that effluent limitations in permits achieve water quality standards adopted under the Act, including State narrative criteria for water

[21] G. Suter, S.M. Cormier, M. Barron, A Weight of Evidence Framework for Environmental Assessments: Inferring Qualities, *Int. Env. Assess. & Mgt.,* Vol. 13: 6, pp. 1038–1044; G. Suter, S.M. Cormier, M. Barron, A Weight of Evidence Framework for Environmental Assessments: Inferring Quantities, *Int. Env. Assess. & Mgt.* Vol. 13:6, pp. 1045–1051; M.B. Griffith, L. Zheing, S.M Cormier, Using Extirpation to Evaluate Ionic Tolerance of Freshwater Fish, *Env. Tox. & Chem.,* Vol. 9999: 9999, pp. 1–13, 2017 (accepted for publication Oct., 2017); S.M. Cormier, L. Zheing, E.W. Leppo, A. Hamilton, Step-by-step calculation and spreadsheet tools for predicting stressor levels that extirpate genera and species, *Int. Env. Assess. & Mgt*., Vol. 9999: 9999, pp. 1–7 (accepted for publication Oct., 2017). Published references attached; spreadsheet tools available on request.

[22] MPCA, St. Louis River Watershed Stressor Identification Report, wq-ws5-04010201a, Dec. 2016, available at https://www.pca.state.mn.us/sites/default/files/wq-ws5-04010201a.pdf. *See e.g*. pp. 7-8, 22, 32-36, 289-292, 299-305, 343-347, 379-386, 398, 400, 408-412, 419, 447.427-434.

[23] *Id*., p. 8.

[24] 33 U.S.C. §1313(c)(2)(A).

quality. They also require that NPDES permits control all pollutants that may be discharged at a level that has the reasonable potential to cause or contribute to an exceedance of State narrative criteria.[25]

Minnesota's water quality standards contain narrative criteria requiring protection of aquatic life from the toxic effects of pollutants through site-specific numeric criteria in the absence of broadly applicable numeric standards in order to "protect class 2 waters for the propagation and maintenance of aquatic biota."[26] Minnesota's rules define "protection of the aquatic community from the toxic effects of pollutants" to mean "the protection of no less than 95 percent of all of the species in any aquatic community."[27] This is the same extirpation standard used by the EPA to develop the hazardous concentrations of specific conductivity detailed in its 2016 Field-Based Methods report and peer-reviewed publications.

For the reasons discussed above, the MPCA should take the following actions to protect aquatic life from specific conductivity, particularly in Minnesota's Ecoregion 50, the Northern Lakes and Forests ecoregion, where there is sufficient and consistent data to determine the hazardous concentration of specific conductivity that would result in toxicity to benthic invertebrates:

1) MPCA must make adoption of a Class 2 (Aquatic Life and Recreation) water quality standard for specific conductivity a Group 1A rulemaking priority, consistent with current science, MPCA data, and EPA analysis of hazardous concentration values that would protect 95% of benthic invertebrate genera.

2) MPCA must interpret its narrative criteria and provide site-specific water quality criteria for specific conductivity to protect 95% of benthic invertebrate genera in any NPDES permit in Ecoregion 50 where proposed discharge to surface waters has a reasonable potential to exceed 320 µS/cm.

3) The MPCA Must Prioritize Rulemaking and Limit Sulfate Loading to Prevent Exceedance of Mercury Criteria and to Protect Wildlife and Human Health.

In its 2017 timeline for Triennial Review, the MPCA proposes to develop Class 2 (Aquatic Life and Recreation) standards for sulfate some time in the indefinite future (will not move into the next phase before 2020) as a Group 2B priority.[28] The MPCA has identified sulfate, in some cases in combination with specific conductivity and other parameters, as a stressor leading to extirpation of benthic invertebrates and impairment of waters to support diverse and abundant fish species.[29]

There is evidence that background sulfate levels in northeastern Minnesota, like background specific conductivity levels, are far below the levels discharged by mining facilities and that

[25] 40 C.F.R. §122.44(d)(1), specifically (d)(1)(i) and (d)(1)(vi); 40 C.F.R. §123.25(a)(15).
[26] Minn. R. 7050.0217, Subp. 1.
[27] Minn. R. 7050.0217, Subp. 2.
[28] MPCA's proposed water quality standards work plan, 2018 – 2020, available at https://www.pca.state.mn.us/water/mpca%E2%80%99s-proposed-water-quality-standards-work-plan-2018-2020
[29] See e.g. MPCA, St. Louis River Watershed Stressor Identification Report, *supra*, pp. 7-8, 36-40, and multiple references in evaluation of individual impaired water bodies.

levels of sulfate downstream of mining discharges may be toxic to sensitive benthic invertebrates.[30] However, as distinguished from specific conductivity, there is no definitive authority already developed that is sufficient to set specific numeric criteria to protect fish and benthic invertebrates from sulfate toxicity. Particularly if specific conductivity water quality standards are implemented in site-specific standards in Ecoregion 50 and prioritized for rulemaking, the MPCA's time frame proposed to set sulfate standards to protect sensitive fish and benthic invertebrate taxa may be reasonable.

However, the MPCA must not take a similar temporizing approach to establish Class 2 water quality standards for sulfate to prevent release of mercury, methylation of mercury, and increased bioaccumulation of toxic methylmercury in aquatic biota and fish.

The MPCA first acknowledged more than 11 years ago the need to develop specific sulfate concentration limits or other regulatory responses to the scientific evidence that sulfate loading can increase methylmercury production. In 2006, the MPCA committed to a "multi-year data collection effort combined with ongoing data analysis" so that "sensitive areas of the state will be identified and appropriate controls on sulfate discharge will be developed if necessary."[31] Yet, it appears from MPCA's Triennial Review timeline and work plan that MPCA has yet made no progress controlling sulfate discharge, and that no progress is contemplated by the Agency in the foreseeable future.

Recent peer-reviewed research authored by Amy Myrbo, Ph.D., in conjunction with the MPCA's wild rice sulfate standards studies, has demonstrated that increased sulfide production resulting from sulfate loading both increases release of inorganic mercury from sediments into the water and increases the proportion of mercury that is converted to toxic methylmercury.[32]

Dr. Myrbo found that sulfate loading to mesocosms of either 100 mg/L or 300 mg/L increased methylmercury by a factor of 5.9 as compared to the control experiment where no sulfate was added.[33] Sulfate loading also increased release of inorganic mercury from sediments to the water, with a maximum increase of 2.2 times over the experimental control under conditions of sulfate loading of 300 mg/L.[34]

Both the increased release of mercury from sediments and wetlands and the increased production of methylmercury are significant concerns. Bioaccumulation of methylmercury in fish tissue and excessive mercury in the water column are major causes of water quality impairments in Minnesota.

According to the MPCA's draft 2018 Impaired Waters List, there are 1,662 water bodies or stream segments that have been identified as impaired for Aquatic Consumption as a result of

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[30] *See* EPA 2011 Conductivity Benchmark Study, *supra*, Appendix A; Johnson & Johnson, Specific Conductivity Report, *supra*, pp. 12-13, 28-29, Attachment A Table 1.
[31] MPCA Strategy to Address Indirect Effects of Elevated Sulfate on Methylmercury Production and Phosphorus Availability, Final, Oct. 19, 2006. Reference attached.
[32] Myrbo, et al., Increase in nutrients, mercury, and methylmercury as a consequence of elevated sulfate reduction to sulfide in experimental wetland mesocosms (2017*), J. Geophys. Research: Biogeosciences*, 122, 2769-2785.
[33] *Id*., Table 1, p. 2775.
[34] *Id*. Dr. Myrbo also concluded at p. 2771 that local inhibitory effects of sulfide on mercury methylation would only apply where sulfide concentrations exceeded 300-3000 μg/L.

mercury in the water column or mercury in fish tissue.[35] Mercury in fish tissue is the single largest category of impairments in Minnesota's draft 2018 inventory, representing 31% of the total inventory of impaired waters.[36] Although 111 water bodies are identified in the draft 2018 Impaired Waters List as delisted in compliance with water quality standards, there is not a single mercury-impaired Minnesota water body that has been delisted or proposed for delisting.[37]

Bioaccumulation of methylmercury in the aquatic food chain harms piscivorous (fish-eating) mammals and birds and insectivorous bats.[38] Vulnerable wildlife may include species protected by the Endangered Species Act and as well as under state law.

The harmful effects of methylmercury contamination of fish to human health are well-known. Dr. Margaret Saracino, a Duluth child and adolescent psychiatrist has explained the particular vulnerability of fetuses, infants and children to morbidity resulting from methylmercury exposure:

> When pregnant women eat fish high in methylmercury, the fetus is then exposed to this lipophilic heavy metal. The placenta is not protective and the blood brain barrier is not well formed until after age two years, which makes fetuses, infants and young children most vulnerable to methylmercury's neurotoxic effects. Neurons in the developing brain multiply at a rapid rate and are particularly vulnerable to toxic effects of heavy metals, hence brain damage is more likely to occur during this vulnerable time. Neurotoxicity is also transferred to the infant through breast milk.
>
> The adverse effects of methylmercury depend on timing and amount of exposure. Methylmercury is a strong toxin that influences enzymes, cell membrane function, causes oxidative stress, lipid peroxidation and mitochondria dysfunction, affects amino acid transport and cellular migration in the developing brain. Exposure in utero can cause motor disturbances, impaired vision, dysesthesia, and tremors. Even lower level exposure can result in lower intelligence, poor concentration, poor memory, speech and language disorders, and decrease in visual spatial skills in children exposed to methylmercury in utero. Fetuses, infants, and young children are four to five times more sensitive to the adverse effects of methylmercury exposure than adults.[39]

From 2007-2011, the Minnesota Department of Health (MDH) conducted a study of "Mercury in Newborns in the Lake Superior Basin."[40] This was a large study testing a total of 1,465 babies in

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[35] MPCA, Draft Impaired Waters Excerpts (2018), including three worksheets "2018 Mercury Impaired Waters " "2018 List Summary" and "Delisted" is provided in attached references. Data sorted from MPCA 2018 Draft Impaired Waters List available at https://www.pca.state.mn.us/water/minnesotas-impaired-waters-list.
[36] *Id*., 2018 List Summary worksheet.
[37] *Id*., Delisted worksheet.
[38] *See e.g*. M.F. Wolfe, et al., Effects of Mercury on Wildlife: A Comprehensive Review, *Env. Tox. & Chem.*, Vol.17: 2, pp. 146-160, 1998; D.E. Yates et al., Mercury in bats from the northeastern United States, *Ecotoxicology* 23:45-55 (2014); K. Syaripuddin et al, Mercury accumulation in bats near hydroelectric reservoirs in Peninsular Malaysia, *Ecotoxicology*, 23:1164-1171 (2014). References attached.
[39] M. Saracino, Summary Opinion regarding Morbidity Associated with Methylmercury Exposure and other Neurotoxic Chemicals Potentially Released by the PolyMet NorthMet Copper-nickel Mine Project, Dec. 7, 2015, p. 2. Reference attached.
[40] MDH, Mercury in Newborns in the Lake Superior Basin summary in attached references. The full report is available at http://www.health.state.mn.us/divs/eh/hazardous/topics/studies/newbornhglsp.html.

Minnesota, Wisconsin and Michigan. About 30% of the Minnesota babies born in the study area were tested. In this study, 10% of the newborns in Minnesota's Lake Superior region had mercury levels above the EPA mercury dose limit, 3% of the Wisconsin newborns were above the mercury dose limit, and none of the Michigan samples exceeded the mercury limit. Babies born during the summer months were more likely to have an elevated mercury level, which, the MDH explained, suggests that increased consumption of locally caught fish during the warm months is an important source of pregnant women's mercury exposure in this region.[41]

The Clean Water Act and its implementing regulations require that NPDES permits comply with State water quality standards, including both numeric criteria and narrative standards.[42] Minnesota rules set numeric criteria for both mercury in the water column and mercury in edible fish tissue.[43] The scientific evidence shows that sulfate loading increases both release of mercury from sediments to the water column and mercury methylation that results in bioaccumulation. This means that the MPCA lacks discretion to permit sulfate loading to Class 2 waters without evaluating the reasonable potential of sulfate loading to cause or contribute to exceedance of numeric criteria for mercury.

Minnesota's water quality standards also contain narrative standards requiring protection of Class 2 waters for "the consumption of fish and edible aquatic life by humans."[44] Under Minnesota rules, "Protection of human consumers of fish, other edible aquatic organisms and water for drinking from surface waters means that exposure from noncarcinogenic chemicals . . . must be below levels expected to produce known adverse effects."[45] Given the Minnesota Department of Health study of mercury in newborns in Minnesota's Lake Superior region, the MPCA similarly must ensure that any NPDES/SDS or air quality permit affecting waters impaired for mercury, particularly in the Lake Superior basin,[46] affirmatively determines that the proposed sulfate loading will not cause or contribute to an increase exposure from methylmercury consumption.

The MPCA has clear evidence of the relationship of sulfate discharge to mercury releases from sediments to the water column and to mercury methylation. The Agency also has clear evidence of the threat that methylmercury bioaccumulation in the food chain poses to human health as well as to wildlife. MPCA should take the following actions:

1) MPCA must make adoption of a Class 2 (Aquatic Life and Recreation) water quality standard for sulfate to protect wildlife and human health from toxic effects of mercury release and mercury methylation its highest priority for rulemaking.

2) MPCA must, in permitting, ensure that no sources of sulfate loading to surface waters cause or contribute to exceedances of numeric or narrative criteria, increase impairments of water bodies due to mercury in the water column or in fish tissue, or cause or

[41] *Id*., all facts in this paragraph are referenced in the MDH summary.
[42] See 33 U.S.C. §1313(c)(2)(A); 40 C.F.R. §122.44(d); 40 C.F.R. §123.25(a)(15).
[43] Minn. R. 7050.0220, Subp. 3a (B)(16) and (17); Subp. 4a (B)(16) and (17), Subp. 5a (B)(11) and (12).
[44] Minn. R. 7050.0217, Subp. 1.
[45] Minn. R. 7050.0217, Subp. 2 (B).
[46] Note that under Minn. R. 7052.0110, Subp. 4(A) human health standards for mercury in the Lake Superior basin are specifically based on the human consumption of fish in Minnesota.

contribute to human exposures expected to produce adverse affects.

Thank you for the opportunity to comment regarding Minnesota rulemaking and protection of aquatic life and the protection of human consumers of fish from adverse health effects. We would welcome the opportunity to discuss the scientific evidence or the legal bases for our comments and concerns.

Respectfully submitted,

/s/ Paula Maccabee, Advocacy Director/Counsel
WaterLegacy

Sierra Club North Star Chapter

Northeastern Minnesotans for Wilderness

Friends of the Cloquet Valley State Forest

Wisconsin Resources Protection Council

Attachments:
Water Quality Standards Comparison worksheet
References.

cc: U.S. EPA Region 5

Comparison --- Class 3 (Industrial) and Class 4 (Agriculture & Wildlife) Water Quality Standards and Proposals with Class 2 (Aquatic Life & Recreation) Standards

Class 3 - Industrial Class 2 - Aquatic Life	**Chlorides mg/L**	**Total Hardness (Ca + Mg as $CaCO_3$) mg/L**	**pH minimum**	**pH maximum**
C				
3A	50	50	6.5	8.5
3B	100	250	6	9
3C	250	500	6	9
3D	Maintain Background	Maintain Background	Maintain Background	Maintain Background
3A- 3D (industrial) proposed	narrative	narrative	narrative	narrative
AQUATIC LIFE				
Class 2A chronic	230	NA	6.5	8.5
Class 2A max	860	NA	NA	NA
Class 2Bd chronic	230	NA	6.5	9
Class 2Bd max	860	NA	NA	NA
Class 2B chronic	230	NA	6.5	9
Class 2B max	860	NA	NA	NA

Class 4 - Agricultural Class 2 - Aquatic Life	**Bicarbonates (HCO3)**	**Boron (B)**	**pH minimum**	**pH maximum**	**Specific conductance**	**Total dissolved salts**	**Sodium (Na)**	**Total Salinity**	**Nitrite**	**Sulfate**
AGRICULTURE & WILDLIFE										
4A (irrigation)	5 millieq. per liter	0.5 mg/L	6.0	8.5	1,000 µS/cm	700 mg/L	60% total cations as millieq. per liter	NA	NA	10 mg/L Wild Rice
4A (irrigation) proposed	5 millieq. per liter	0.75 - 2mg/L	6.0	8.5	1,200 - 1,700 µS/cm	Remove	60% total cations as millieq. per liter	NA	NA	10 mg/L Wild Rice
4B (livestock & wildlife drinking)	NA	NA	6.0	9.0	NA	NA	NA	1,000 mg/L	NA	NA
4B (animal drinking) proposed	NA	NA	6.0	9.0	NA	3,000-5,000 mg/L	NA	Remove	100 mg/L	500 - 2,000 mg/L
AQUATIC LIFE										
Class 2A	NA	NA	6.5	8.5	NA	NA	NA	NA	NA	NA
Class 2Bd	NA	NA	6.5	9.0	NA	NA	NA	NA	NA	NA
Class 2B	NA	NA	6.5	9.0	NA	NA	NA	NA	NA	NA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

MAY 13 2011

REPLY TO THE ATTENTION OF:
W-15J

The Honorable Thomas M. Bakk
Minnesota Senate
147 State Office Building
100 Rev. Dr. Martin Luther King, Jr. Blvd.
St. Paul, Minnesota 55155-1606

The Honorable David Dill
Minnesota House of Representatives
147 State Office Building
100 Rev. Dr. Martin Luther King, Jr. Blvd.
St. Paul, Minnesota 55155-1606

Dear Mr. Bakk and Mr. Dill:

I am writing in response to your May 9, 2011 letter, in which you requested that the U.S. Environmental Protection Agency provide its views of two draft bills, which would alter the Minnesota Pollution Control Agency's (MPCA) implementation of the current, federally-approved water quality standard of 10 mg/L sulfate for wild rice waters. Because you requested a prompt response, we are able to offer only general comments that focus on two aspects of the bills.

As you know, H.F.1010 and S.F. 1029 propose to modify or suspend the current, federally-approved water quality standard for wild rice waters of 10 mg/L, and H.F. 1010-3 (sec. 19, lines 41.15-41.20), specifically sets 50 mg/L as the numeric criterion for sulfate in wild rice waters until a new standard is developed. To the extent that any legislation changes the EPA-approved water quality standards for Minnesota, such revised water quality standards must be submitted to EPA for review and approval pursuant to 33 U.S.C. §1313(c)(2)(A), Clean Water Act (CWA) §303(c)(2)(A), and are not effective for CWA purposes, including National Pollutant Discharge Elimination System (NPDES) permits, unless and until approved by EPA (see 40 C.F.R. §131.21). Should Minnesota wish to submit these to EPA as changes to Minnesota's water quality standards, the federal regulations at 40 C.F.R. §131.6 provide the submittal requirements. These include, among other things, the methods and analyses conducted to support the water quality standards revisions, including how the revised water quality criteria are sufficient to protect the designated uses (see generally 40 C.F.R. §131 Subpart B, and 40 C.F.R. §§ 131.11 and 131.20). Federal regulations require that criteria be protective of a state's designated uses and EPA's approval is based, among other factors, on determining that there is a scientifically

defensible basis for finding that the criteria are sufficient to protect designated uses (see generally 40 C.F.R. §§ 131.5, 131.11, and 131.21). Absent such a showing, EPA would be unable to approve a revised criterion (see generally 40 C.F.R. §131.6(b)). An EPA decision to approve water quality standards would be available for judicial review.

With respect to S.F. 1029, Sec. 62(f), lines 58.4 - 58.12 and H.F.1010-3, lines 40.34-41.13, Sec. 18(e) (both of which generally prevent MPCA from including sulfate limitations in permits until a new standard is developed), EPA believes that the effect of these respective provisions will be to prevent MPCA from including water quality based effluent limitations (WQBELs) based on the federally approved criterion in permits issued under the state's authorized NPDES program. A state with a federally authorized NPDES program is required to issue permits that ensure the protection of federally approved water quality standards. See 33 U.S.C. §1311(b)(1)(C), CWA §301(b)(1)(C); and generally, 40 C.F.R. Part 123 (see especially 40 C.F.R. §123.25(a)(1)); and 40 C.F.R. §§122.4 and 122.44(d)(1). Where a state proposes to issue a permit that fails to apply, or to ensure compliance with, any applicable requirement, including WQBELs, EPA has the authority to review and to object to such permit issuance pursuant to its authority under 40 C.F.R. §123.44. Should EPA object to a state-proposed permit, the state or any interested person would be provided 90 days (from the date on which EPA makes a specific objection) to request a public hearing on the objection, consistent with 40 C.F.R. §123.44(e). EPA would hold such a hearing, pursuant to the procedures outlined in 40 C.F.R. §§123.44(e)-(f). Pursuant to 40 C.F.R. §122.4(c), the state may not issue a permit over EPA's objection. Where EPA has provided notice of an objection, and where the state has failed to revise the permit to meet EPA's objection, EPA has the authority to issue a federal permit for a potential discharger, pursuant to the authority in 40 C.F.R. §123.44(e). Additionally, should EPA determine that a state is not administering its federally approved NPDES program in accordance with requirements of the CWA, EPA has the authority to require the state to take corrective action, and if necessary, to withdraw authorization of the program, pursuant to 33 U.S.C. §§1342(c)(2)-(3).

I hope you find this information helpful.

Sincerely,

for Tinka G. Hyde
Director, Water Division

Anita—
Please make
copies for:
- Chris
- Robie
- Tom.

L.

MPCA Wild Rice Sulfate Standard (updated 1/28/13)

Status of the Wild Rice Standards Study

- The goal of the study is to enhance understanding of the effects of sulfate on wild rice and inform further evaluation and, as warranted, refinement of the wild rice sulfate standard.
- The study has begun and is on track to be completed at the end of 2013; MPCA staff are meeting with the Advisory Committee at least quarterly, with e-mail information exchange occurring more frequently.
- MPCA has contracted with researchers from the U of MN Duluth and Twin Cities to complete the study.
- The study design relies on three avenues of investigation – field survey, laboratory experiments, and container experiments.
- MPCA staff are also conducting a detailed literature review and compiling existing monitoring data available on sulfate and wild rice.
- The 2012 field survey involved sampling more than 100 Minnesota lakes and streams for a range of conditions; those data are currently being compiled and analyzed.
- Experiments on sulfate and sulfide effects on wild rice seed germination and initial growth have begun; seedling experiments will begin shortly, as soon as the method is finalized.
- Container experiments will be considered for this summer, as a follow-on to work already completed at UMD.
- A mid-project review is scheduled for February 28 and March 1 in St. Paul (including a public open house the evening of Feb. 28)
- MPCA is working very closely with the Wild Rice Standards Study Advisory Committee to keep them informed of the study progress and get their input on study approach, results, and potential rulemaking efforts.
    - For example, MPCA most recently met with the Advisory Committee on January 16, 2013, to get members' input on potential approaches to specifically listing and/or further colarifying the definition of "water used for production of wild rice," which is where the wild rice sulfate standard applies. A diverse range of input and suggestions were provided at that meeting, for which the MPCA is in the process of finalizing meeting notes to be posted on the MPCA's wild rice sulfate standard web page.
- Concern is still occasionally expressed by some interested parties that the study will not be complete at the end of 2013. MPCA recognizes the concern and continues to closely manage the project to ensure timely completion. While it is likely that some questions will remain at the end of the study, we believe that we will have the additional information needed to re-evaluate the wild rice sulfate standard to determine if a revision is needed and, if so, what the revised standard should be.
- Some stakeholders and EPA have also requested that MPCA develop a method for assessing waters for potential impairment of the wild rice sulfate standard. That method development is underway; the approach will be shared with the Wild Rice Standards Study Advisory Committee for their review and comment prior to finalizing the draft method.

Non-Enforcement of Wild Rice Sulfate Standard

- MPCA did state it opposed legislation to temporarily suspend the wild rice sulfate standard during the 2012 Environment Policy Bill conference committee, just as we opposed it last legislative session. The end result of the proposal would be delays to mining projects or even preventing them entirely and would not result in a benefit to the industry or environment. A further explanation is below.
- Minnesota is required to enforce the state assembled and federally approved water standards, including the wild rice sulfate standard.

- The Federal Clean Water Act requires that any changes to a state's water quality standards be approved by EPA prior to the new standard being effective.
- As a result, EPA has told MPCA we must enforce the federally approved standard or EPA will have to object to our permits. It was reaffirmed in EPA's May 13th, 2011 letter to the Iron Range Delegation.
- If MPCA does not enforce the standard (because of legislation, our own decision, etc.) EPA will object to the specific permit, delaying the project until we draft a second permit in compliance with the standard or EPA drafts a permit.
- The worst case scenario is the project never gets approved, because we do not draft the permit correctly in EPA's eyes because we are prohibited by state law or EPA does not have the staff to do it since they rely on states to draft permits.
- On a larger scale, such an executive order could result in EPA removing our program delegation to write permits, delaying all water permitting in the state (even those not connected to the wild rice sulfate standard).
- MPCA is working closely with permittees to ensure the sulfate standard is implemented in a way that meets our environmental protection responsibilities while allowing as much flexibility as possible. If the current standard was suspended and EPA stepped in, it is not likely that EPA would exercise the same level of creativity and coordination due to limited staff resources and lack of local knowledge.

How the Wild Rice Sulfate Standard is Implemented Now

- Prior to even putting a water quality-based effluent limit in a permit, MPCA must have data showing there is the "reasonable potential" to cause or contribute to a violation of the water standard.
- Collecting the necessary data is accomplished by adding a monitoring requirement to an existing facility's five year permit to collect sulfate data related to its discharge. MPCA does this when a permit comes up for renewal or the proposer requests a major change to the existing permit.
- If the information collected shows a "reasonable potential" for causing or contributing to a standards violation, MPCA puts an effluent limit in the existing facility's next permit (again when it comes up for renewal or a major change is requested by the proposer).
- Even if a facility is determined to need an effluent limit, we may be able to provide the existing facility three types of flexibility. 1) a site-specific standard based on local conditions and data (e.g. Clay Bowsell) 2) a schedule of compliance granting a facility time to achieve the limit "as soon as possible" as federally required (e.g. Kcetac) 3) a variance for a short time if the standard is deemed unattainable as allowed under federal regulations. Types 1 and 3 require formal EPA approval. A compliance schedule will be reviewed by EPA during the permitting process and they may choose to object to issuance of the permit but they do not do a formal approval.
- New facilities and permits must meet the standard right away. The rationale is since a facility is starting from scratch the standard can be met right away more easily during its initial design compared to an existing facility, which may require significant reconfiguring of existing systems.

State Options Moving Forward

- Minnesota cannot temporarily suspend or arbitrarily designate a different standard without a scientific defense. Otherwise EPA will step in and object to individual permits or in the worst case take our overall permitting authority away.
- We approached EPA last year to discuss ways to increase our flexibility in applying the standard while we do our wild rice sulfate study (e.g. statewide or multi-sector variances), but could not come to any viable legal options. (further discussion of efforts in attached email)
- The District Court ruling on the Chamber's lawsuit arguing the wild rice sulfate standard was created, written and being applied illegally was just issued. On May 11th 2012 the district court issued a

judgment in favor of the standard and MPCA on all counts. On June 1, 2012, the Chamber appealed the District Court's decision to the Minnesota Court of Appeals. On December 17, 2012, the Court of Appeals affirmed the District Court's decision to uphold the standard, and recognized that the Chamber did not bring this case in the appropriate court.

- This leaves us with waiting until our study is finished, which is expected to wrap up by the end of 2013. At that time we will know if there is scientific support for a change to the existing standard and the general idea of what range the standard should be. It will be enough information for facilities to make decisions on what type of technology, equipment, etc. they will need to meet the standard.
  -
- If there is information supporting a standard change, we would start the rulemaking process in 2014 to formally revise the existing standard. It would likely take a year to complete the rulemaking.
- Of the known mining projects, the study timeline is expected to be adequate. Essar Steel (and the once proposed Magnetation project) has proposed zero water discharges of process water to surface water, meaning there is nothing to apply the standard to. Keetac has a schedule of compliance that our timeline works for (only if we overrun our projected schedule does US Steel have a concern, however even then the schedule of compliance could be adjusted as needed). The recently issued permit for Mesabi Nugget Phase I (the nugget plant) includes a seasonal application of the wild rice standard. This approach works for Mesabi Nugget since they have the ability to hold water. Polymet, which is still in the environmental review phase with its project, has proposed a treatment plant that would meet the standard at the end of the discharge pipe.

Federal Options Moving Forward

- We do not believe the Chamber's suggested federal legislative language would work, even if it could get enacted.
- Under the federal Clean Water Act, permittees are required to comply with water quality standards "as soon as possible" as specified in the Act and clarified in the "Hanlon Memo."
- EPA theoretically could change its clarification in the "Hanlon Memo" without legislation, however it would first have to be convinced a temporary suspension of any water quality standard during a study on its scientific foundation is a wise idea. In addition, it would most likely require a public process similar to a federal rulemaking, which would take a year at least. Legal analysis may also be needed, since significant court decisions preceded and influenced the "Hanlon Memo" guidance.
- The other option would be legislation allowing for a temporary suspension of a water quality standard while it is being studied. Congress would need to be convinced it is a good idea. Given the history of failed proposed amendments to the federal Clean Water Act this is very unlikely. There is reluctance towards opening up this critical piece of environmental protection, because of fear of it being weakened in the process. Not to mention the politics associated with such a change.

Wild Rice Sulfate Standard and MNDOT Road Projects

- It has been stated the preferred improvement project for Highway 169 has been derailed because of the wild rice sulfate standard. It is a false claim. The issue was Sulfur content, not sulfates.
- The wild rice sulfate standard was not a factor nor applied in the project's review. Sulfur content of the rock was discussed because of its general acidity (pH) and metals issues (acid drainage from the exposed rock has the potential to leach heavy metals from the rock itself and potentially cause environmental contamination.)
- MNDOT requested meetings with MDNR and MPCA due to citizen concerns about the potential for acid rock drainage due to some of the geologic formations in the area.
- Neither MDNR nor MPCA recommended the road project be stopped.

State v. Halvorson

Court of Appeals of Minnesota

January 9, 2017, Filed

A16-1191

Reporter
2017 Minn. App. Unpub. LEXIS 31 *; 2017 WL 84146

State of Minnesota, Appellant, vs. Kim Marie Halvorson, Respondent.

Notice: THIS OPINION WILL BE UNPUBLISHED AND MAY NOT BE CITED EXCEPT AS PROVIDED BY MINNESOTA STATUTES.

Prior History: **[*1]** Rice County District Court File Nos. 66-CR-15-1718, 66-CR-15-2013, 66-CR-15-2471.

Bio Wood Processing, LLC v. Rice County Bd. of Comm'rs, 2015 Minn. App. Unpub. LEXIS 335 (Minn. Ct. App., Apr. 13, 2015)

Disposition: Affirmed.

Core Terms

dust, charges, ordinance, district court, void-for-vagueness, vagueness, abatement, emissions, probable cause

Counsel: For Appellant: Lori Swanson, Attorney General, St. Paul, Minnesota; and John Fossum, Rice County Attorney, Terence Swihart, Assistant County Attorney, Faribault, Minnesota.

For Respondent: Mark D. Nyvold, Fridley, Minnesota; and Gary Voegele, Faribault, Minnesota.

Judges: Considered and decided by Bjorkman, Presiding Judge; Reilly, Judge; and Connolly, Judge.

Opinion by: BJORKMAN

Opinion

UNPUBLISHED OPINION

BJORKMAN, Judge

Appellant challenges the district court's dismissal of all but two charges against respondent, arguing that the void-for-vagueness doctrine does not apply and that there is probable cause to believe respondent violated a conditional-use permit. We affirm.

FACTS

Bio Wood Processing, LLC operates a wood-grinding facility on approximately nine acres of land in Rice County. Bio Wood grinds wood to make animal bedding in the form of mulch and sawdust. The operation takes place in two buildings located under one roof and separated by a firewall. The west building houses the grinder; the finished product is transported by an enclosed conveyor belt to the east building for loading into semi-trailers. A dust collector is **[*2]** attached to the grinder and extracts 97% of the dust produced during the grinding process.

Respondent Kim Halvorson owns Bio Wood. On October 8, 2013, Halvorson obtained an amended

conditional-use permit (CUP) on behalf of the company. Condition 8 of the CUP states that "[d]ust abatement methods shall be required and enforced when processing materials or hauling materials to or from the site."

On July 9, August 11, and September 29, 2015, appellant State of Minnesota filed complaints charging Halvorson with multiple violations of CUP condition 8. The three complaints reference reports of dust emissions at the facility made to law enforcement on various dates, and allege that noncompliance with condition 8 violates Rice County Zoning Ordinance §§ 503.10F (making it a violation for a CUP holder to "maintain, permit or otherwise allow any non-compliance with the provisions of [a conditional use permit]"), and .10G (making it a violation for a CUP holder to "instruct, permit or otherwise allow a subordinate person or entity to violate the provisions of this ordinance or the conditions of the permit") (2015). The parties agreed to consolidate the three cases, and Halvorson moved to dismiss all of the charges. **[*3]**

During the contested omnibus hearing, Halvorson and Bio Wood manager Andrew Barna described the layout of the facility, the grinding operation, and the measures Bio Wood implemented to reduce dust emissions. These measures include: (1) a dust collector with seven points of suction overhead in both the west and east part of the building, (2) a 40-foot duct that runs down the length of the east part of the building with multiple suction points to collect additional dust, (3) an enclosed conveyor system under vacuum suction that moves the final sawdust product under a dust hood from the west to the east building, (4) the building itself where all grinding activities are conducted, (5) the use of calcium chloride on the driveway to reduce dust from being blown off-site, and (6) the use of tarps to cover semi-trailers leaving the site with finished product.

The district court granted Halvorson's motion in part, dismissing all but two charges in each complaint on the basis that condition 8 of the CUP is unconstitutionally vague and the charges are not supported by probable cause.[1] The state moved for reconsideration, which the district court denied. The state appeals.

DECISION

I. Dismissal of [*4] all but two charges in each complaint has a critical impact on the outcome of the trial.

When the state appeals a pretrial order, we will reverse "only if the state demonstrates clearly and unequivocally that the district court erred in its judgment and, unless reversed, the error will have a critical impact on the outcome of the trial." *State v. Trei*, 624 N.W.2d 595, 597 (Minn. App. 2001), *review dismissed* (Minn. June 22, 2001). "Dismissal of a complaint based on a question of law satisfies the critical impact requirement." *State v. Dunson*, 770 N.W.2d 546, 550 (Minn. App. 2009), *review denied* (Minn. Oct. 20, 2009).

The district court applied the law to the facts alleged and presented during the omnibus hearing, concluding that the state could not prosecute Halvorson as a matter of law. The district court noted that the record includes reports of dust emissions on the dates alleged in the complaints, but also undisputed evidence that Bio Wood was using several dust-abatement methods on those dates. After concluding that condition 8 of the CUP does not require zero dust emissions, the district court ruled that the prosecution is barred under the void-for-vagueness doctrine and that probable cause is lacking given the undisputed evidence of the dust-abatement measures in place at all relevant **[*5]** times. Because the district court dismissed the charges based on a legal

[1] The remaining charges relate to activities conducted wholly outside Bio Wood's buildings, where no dust-abatement methods are employed.

determination, the state may take this appeal.[2]

II. Condition 8 of the CUP is void for vagueness.

The United States and Minnesota Constitutions provide that a person shall not be deprived of life, liberty, or property without due process of law. U.S. Const. amend. XIV, § 1; Minn. Const. art. I, § 7. The right to due process includes the right to not be convicted and punished based on an unconstitutionally vague statute. *Dunham v. Roer*, 708 N.W.2d 552, 567 (Minn. App. 2006), *review denied* (Minn. Mar. 28, 2006). The void-for-vagueness doctrine "requires that a penal statute define the criminal offense with sufficient definiteness that ordinary people can understand what conduct is prohibited and in a manner that does not encourage arbitrary and discriminatory enforcement." *State v. Bussmann*, 741 N.W.2d 79, 83 (Minn. 2007) (quotation omitted). At its core, the doctrine is designed to ensure that individuals are warned about the criminal consequences of their conduct. *Jordan v. De George*, 341 U.S. 223, 230, 71 S. Ct. 703, 707, 95 L. Ed. 886 (1951). "Constitutional challenges are questions of law, which we review de novo." *Bussmann*, 741 N.W.2d at 82.

The state argues that a CUP is not subject to void-for-vagueness analysis because it does not reflect a legislative function. We are not persuaded. Halvorson was charged with violating two provisions of the **[*6]** Rice County Zoning Ordinance. An ordinance is subject to constitutional challenge on vagueness grounds. *See Hard Times Café, Inc. v. City of Minneapolis*, 625 N.W.2d 165, 171-72 (Minn. App. 2001) (holding that city ordinance allowing business-license revocation for good cause was not void for vagueness). The United States Supreme Court has held that both the crime, *and the elements constituting it*, must be so clearly expressed that the ordinary person can intelligently choose, in advance, a lawful course of conduct. *Connally v. Gen. Const. Co.*, 269 U.S. 385, 393, 46 S. Ct. 126, 128, 70 L. Ed. 322 (1926). The two ordinance provisions at issue incorporate condition 8 of the CUP and criminalize the failure of the CUP holder or her subordinates to comply with the condition. Minn. Stat. § 394.37, subd. 2 (2014) (stating that violation of an ordinance is a misdemeanor). In other words, proof that Halvorson violated condition 8 is a necessary element of the charged crimes. Accordingly, the void-for-vagueness doctrine applies.[3]

Having concluded that the void-for-vagueness doctrine applies, we turn to the substance of Halvorson's constitutional challenge. Condition 8 states that "[d]ust abatement methods shall be required and enforced when processing materials or hauling materials to or from the site." Halvorson asserts that condition 8 did not apprise her that the operations within Bio Wood's building **[*7]** were prohibited.

The state first argues that Halvorson forfeited her vagueness challenge by failing to bring the issue to this court by a writ of certiorari at the time the amended CUP was issued. We disagree. When the challenge is to the state's interpretation of an ordinance, rather than its issuance, certiorari review is not the appropriate remedy. *See Press v. City of Minneapolis*, 553 N.W.2d 80, 83-84 (Minn. App. 1996) (stating that district court had jurisdiction to decide property owner's challenge to city's enforcement of an ordinance). Moreover, it was only after the state asserted misdemeanor charges

[2] The state argues that dismissal of eight of the ten charges in each complaint has a critical impact on the outcome of the trial. Because dismissal of even a single charge may establish critical impact, we conclude that critical impact exists here. *State v. Koenig*, 649 N.W.2d 484, 487 (Minn. App. 2002) ("[E]ven an order dismissing only one count of a multi-count complaint may have critical impact."), *rev'd on other grounds*, 666 N.W.2d 366 (Minn. 2003); *State v. Poupard*, 471 N.W.2d 686, 689 (Minn. App. 1991) (finding that the dismissal of only one of two charges had a critical impact on the outcome of the trial). Halvorson does not contest that critical impact exists.

[3] We have previously applied the void-for-vagueness caselaw to non-legislative acts. *State v. Phipps*, 820 N.W.2d 282, 286 (Minn. App. 2012) (applying the void-for-vagueness doctrine to an order for protection).

against Halvorson for violating condition 8 that she learned the state interpreted condition 8 differently than she did. Under these circumstances, we conclude that Halvorson did not forfeit her constitutional challenge by failing to appeal the issuance of the amended CUP.

The state next argues that condition 8 is not vague because "dust abatement" means zero dust emissions. Halvorson contends that "dust abatement" means reduced dust emissions. When determining the plain meaning of an undefined word, we look to the dictionary definition and apply it in the context of the statute. *State v. Haywood*, 886 N.W.2d 485, 488 (Minn. 2016). The dictionary defines "abatement" as "[r]eduction in amount, degree, or intensity; **[*8]** diminution." *The American Heritage Dictionary of the English Language* 2 (5th ed. 2011). This definition is consistent with Halvorson's interpretation of "abatement" but inconsistent with the state's. Because "dust abatement" is susceptible to different interpretations, condition 8 did not apprise Halvorson that she could be criminally prosecuted for using dust-reduction methods that did not totally eliminate dust emissions. In sum, condition 8 is void for vagueness because it did not warn Halvorson that her conduct was unlawful.

Because we conclude that dismissal of the subject charges is constitutionally required, we need not address the issue of probable cause. But we note that the state may not appeal dismissal of a complaint for lack of probable cause based on insufficient evidence. *State v. Duffy*, 559 N.W.2d 109, 111 (Minn. App. 1997).

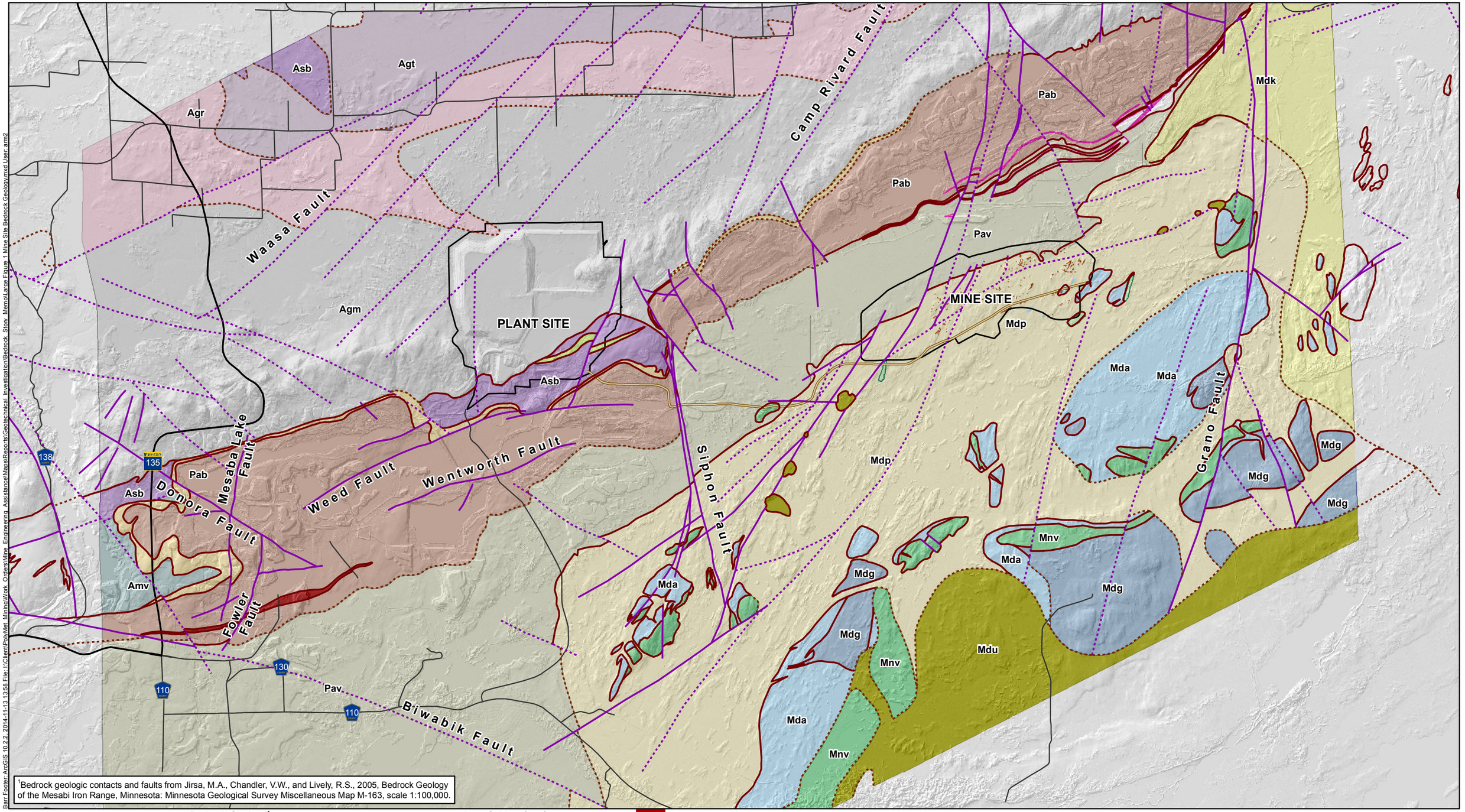
Affirmed.

Mercury Impaired Waters
Lake Superior Basin - St. Louis River Watershed

Bass	Lake or Reservoir	Lake	2002	Lake Superior	69-0553-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Beauty	Lake or Reservoir	Lake	1998	Lake Superior	31-0028-00	Itasca	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Cadotte	Lake or Reservoir	Lake	1998	Lake Superior	69-0114-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Coe	Lake or Reservoir	Lake	1998	Lake Superior	69-0562-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Colby	Lake or Reservoir	Lake	1998	Lake Superior	69-0249-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Deep	Lake or Reservoir	Lake	2002	Lake Superior	69-0666-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Dinham	Lake or Reservoir	Lake	2012	Lake Superior	69-0544-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Elbow	Lake or Reservoir	Lake	1998	Lake Superior	69-0717-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Ely	Lake or Reservoir	Lake	1998	Lake Superior	69-0660-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Embarrass	Lake or Reservoir	Lake	2002	Lake Superior	69-0496-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Embarrass River	Embarrass Lk to St Louis R	Stream	2016	Lake Superior	04010201-577	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Esquagama	Lake or Reservoir	Lake	1998	Lake Superior	69-0565-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Gilbert Pit	Lake or Reservoir	Lake	1998	Lake Superior	69-1306-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Golf Course Pond	Lake or Reservoir	Lake	1998	Lake Superior	69-1345-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Half Moon	Lake or Reservoir	Lake	2014	Lake Superior	69-0657-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Kelly	Lake or Reservoir	Lake	1998	Lake Superior	69-0901-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Linwood	Lake or Reservoir	Lake	1998	Lake Superior	69-0248-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Long	Lake or Reservoir	Lake	2018	Lake Superior	69-0495-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Longyear (North)	Lake or Reservoir	Lake	1998	Lake Superior	69-0857-01	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Longyear (South)	Lake or Reservoir	Lake	1998	Lake Superior	69-0857-02	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Loon	Lake or Reservoir	Lake	1998	Lake Superior	69-0426-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Lost	Lake or Reservoir	Lake	2002	Lake Superior	69-0556-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Lower Comstock	Lake or Reservoir	Lake	2002	Lake Superior	69-0412-02	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Mashkenode	Lake or Reservoir	Lake	2004	Lake Superior	69-0725-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Murphy	Lake or Reservoir	Lake	1998	Lake Superior	69-0646-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
North Twin	Lake or Reservoir	Lake	1998	Lake Superior	69-0419-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Otto	Lake or Reservoir	Lake	1998	Lake Superior	69-0144-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Partridge River	Headwaters to St Louis R	Stream	2016	Lake Superior	04010201-552	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Pike	Lake or Reservoir	Lake	2002	Lake Superior	69-0490-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Pine	Lake or Reservoir	Lake	1998	Lake Superior	69-0001-00	Lake	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Pleasant	Lake or Reservoir	Lake	2006	Lake Superior	69-0655-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Sabin	Lake or Reservoir	Lake	1998	Lake Superior	69-0434-01	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Seven Beaver	Lake or Reservoir	Lake	1998	Lake Superior	69-0002-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Silver	Lake or Reservoir	Lake	1998	Lake Superior	69-0662-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Six Mile	Lake or Reservoir	Lake	1998	Lake Superior	69-0840-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
South Twin	Lake or Reservoir	Lake	2006	Lake Superior	69-0420-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	Artichoke R to Stoney Bk	Stream	1998	Lake Superior	04010201-505	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	Cloquet R to Pine R	Stream	1998	Lake Superior	04010201-503	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	East Savanna R to Artichoke R	Stream	1998	Lake Superior	04010201-506	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	East Two R to West Two R	Stream	2004	Lake Superior	04010201-554	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	Embarrass R to East Two R	Stream	1998	Lake Superior	04010201-511	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	Floodwood R to East Savanna R	Stream	1998	Lake Superior	04010201-507	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	Fond du Lac Dam to Mission Cr	Stream	1998	Lake Superior	04010201-513	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	Headwaters (Seven Beaver Lk 69-0002-00) to T58 R13W S36, west line	Stream	1998	Lake Superior	04010201-631	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	Knife Dam to Potlatch Dam	Stream	1998	Lake Superior	04010201-524	Carlton	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	Mission Cr to Oliver bridge	Stream	2002	Lake Superior	04010201-532	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	Oliver bridge to Pokegama R	Stream	2004	Lake Superior	04010201-533	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	Partridge R to Embarrass R	Stream	1998	Lake Superior	04010201-526	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	Pine R to Knife Dam	Stream	1998	Lake Superior	04010201-517	Carlton	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	Potlatch Dam to Scanlon Dam	Stream	1998	Lake Superior	04010201-516	Carlton	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	Scanlon Dam to Thomson Reservoir	Stream	1998	Lake Superior	04010201-515	Carlton	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	Stoney Bk to Cloquet R	Stream	1998	Lake Superior	04010201-504	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue

Mercury Impaired Waters
Lake Superior Basin - St. Louis River Watershed

St Louis River	Swan R to Whiteface R	Stream	1998	Lake Superior	04010201-525	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	T58 R13W S35, east line to Partridge R	Stream	1998	Lake Superior	04010201-644	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	Thomson Reservoir to Fond du Lac Dam	Stream	1998	Lake Superior	04010201-523	Carlton	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	West Two R to Swan R	Stream	1998	Lake Superior	04010201-510	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River	Whiteface R to Floodwood R	Stream	1998	Lake Superior	04010201-508	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St Louis River (St Louis Bay)	Pokegama R to Mouth of St Louis Bay at Blatnik bridge	Stream	1998	Lake Superior	04010201-501	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
St. Mary's	Lake or Reservoir	Lake	2014	Lake Superior	69-0651-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Strand	Lake or Reservoir	Lake	2002	Lake Superior	69-0529-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Superior Bay	Mouth of St Louis Bay at Blatnik bridge to Duluth Ship Channel	Stream	1998	Lake Superior	04010201-530	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Superior Bay	Mouth of St Louis Bay at Blatnik bridge to Superior Entry	Stream	1998	Lake Superior	04010201-531	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Thomson Reservoir	Lake or Reservoir	Lake	1998	Lake Superior	09-0001-00	Carlton	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Upper Comstock	Lake or Reservoir	Lake	2002	Lake Superior	69-0412-01	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Virginia	Lake or Reservoir	Lake	1998	Lake Superior	69-0663-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
West Two Rivers Reservoir	Lake or Reservoir	Lake	1998	Lake Superior	69-0994-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Whiteface Reservoir	Lake or Reservoir	Lake	1998	Lake Superior	69-0375-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Whiteface River	Bug Cr to Paleface R	Stream	2002	Lake Superior	04010201-528	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Whiteface River	Paleface R to St Louis R	Stream	2002	Lake Superior	04010201-509	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Whiteface River	Whiteface Reservoir to Bug Cr	Stream	2002	Lake Superior	04010201-529	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Whitewater	Lake or Reservoir	Lake	1998	Lake Superior	69-0376-00	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue
Wynne	Lake or Reservoir	Lake	1998	Lake Superior	69-0434-02	St. Louis	04010201	St. Louis River	Aquatic Consumption	Mercury in fish tissue



[1]Bedrock geologic contacts and faults from Jirsa, M.A., Chandler, V.W., and Lively, R.S., 2005, Bedrock Geology of the Mesabi Iron Range, Minnesota: Minnesota Geological Survey Miscellaneous Map M-163, scale 1:100,000.

Barr Footer: ArcGIS 10.2.2, 2014-11-13 13:58 File: I:\Client\PolyMet Mining\Work Orders\Mine Engineering Assistance\Maps\Reports\Geotechnical Investigation\Bedrock Story Memo\Large Figure 1 Mine Site Bedrock Geology.mxd User: am2

- Fault (approximate)
- Fault (inferred)
- Geologic Contact (approximate)
- Geologic Contact (inferred)
- Dunka Road
- Project Areas

Bedrock Geology[1]

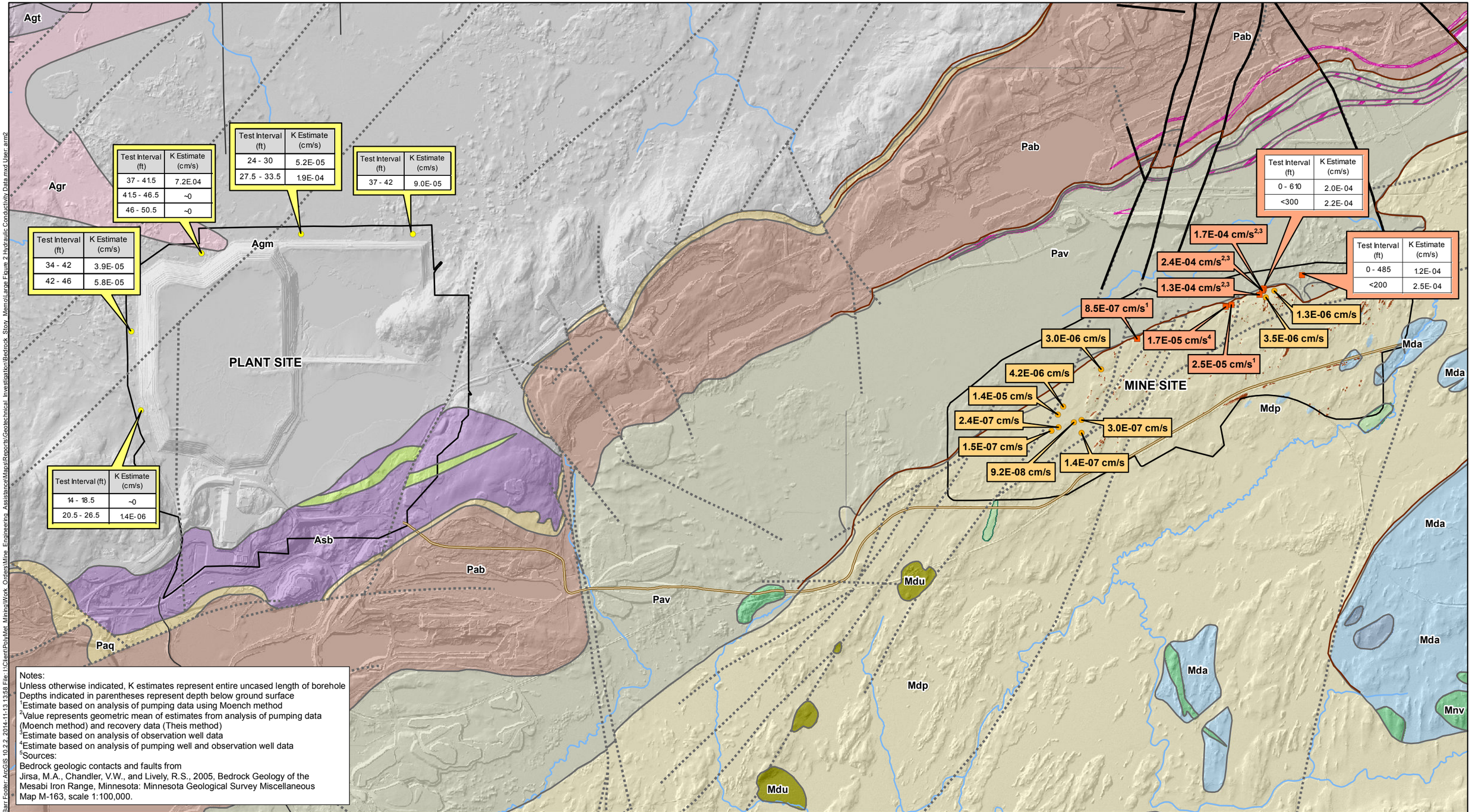
- Agm - Quartz monzonite and monzodiorite
- Agr - Quartz monzonite, monzodiorite, and monzogranite
- Agt - Tonalite to granodiorite
- Amv - Tholeiitic to calc-alkalic volcanic rocks
- Asb - Schist of sedimentary protolith
- Asv - Schist of mafic to intermediate volcanic protlith
- Mda - Anorthositic series subsuite of the Duluth Complex
- Mdg - Gabbro
- Mdk - South Kawishiwi intrusion
- Mdp - Partridge River intrusion
- Mdu - Ultramafic, oxide-rich intrusions
- Mia - Aurora sill
- Mmi - Mafic intrusions
- Mnv - North Shore Volcanic Group
- Pab - Biwabik Iron Formation
- Paq - Pokegama Quartzite
- Pav - Virginia Formation

N

0 0.75 1.5 3

Miles

Large Figure 1
BEDROCK GEOLOGY
Minnesota Geological Survey M163
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN


Agt
Agr
Agm
Pab
Pav
Paq
Asb
Mda
Mdp
Mdu
PLANT SITE
MINE SITE
Test Interval (ft) | K Estimate (cm/s)
37 - 41.5 | 7.2E.04
41.5 - 46.5 | ~0
46 - 50.5 | ~0
Test Interval (ft) | K Estimate (cm/s)
24 - 30 | 5.2E- 05
27.5 - 33.5 | 1.9E- 04
Test Interval (ft) | K Estimate (cm/s)
37 - 42 | 9.0E- 05
Test Interval (ft) | K Estimate (cm/s)
34 - 42 | 3.9E- 05
42 - 46 | 5.8E- 05
Test Interval (ft) | K Estimate (cm/s)
14 - 18.5 | ~0
20.5 - 26.5 | 1.4E- 06
Test Interval (ft) | K Estimate (cm/s)
0 - 610 | 2.0E- 04
<300 | 2.2E- 04
Test Interval (ft) | K Estimate (cm/s)
0 - 485 | 1.2E- 04
<200 | 2.5E- 04
1.7E-04 cm/s[2,3]
2.4E-04 cm/s[2,3]
1.3E-04 cm/s[2,3]
8.5E-07 cm/s[1]
1.7E-05 cm/s[4]
2.5E-05 cm/s[1]
1.3E-06 cm/s
3.5E-06 cm/s
3.0E-06 cm/s
4.2E-06 cm/s
1.4E-05 cm/s
2.4E-07 cm/s
1.5E-07 cm/s
9.2E-08 cm/s
3.0E-07 cm/s
1.4E-07 cm/s
Notes:
Unless otherwise indicated, K estimates represent entire uncased length of borehole
Depths indicated in parentheses represent depth below ground surface
[1]Estimate based on analysis of pumping data using Moench method
[2]Value represents geometric mean of estimates from analysis of pumping data (Moench method) and recovery data (Theis method)
[3]Estimate based on analysis of observation well data
[4]Estimate based on analysis of pumping well and observation well data
[5]Sources:
Bedrock geologic contacts and faults from
Jirsa, M.A., Chandler, V.W., and Lively, R.S., 2005, Bedrock Geology of the Mesabi Iron Range, Minnesota: Minnesota Geological Survey Miscellaneous Map M-163, scale 1:100,000.
Giants Range Granite
Duluth Complex
Virginia Formation
Bedrock Geologic Contact and Faults from PolyMet
Geologic Contact (Approximately Located)
Fault (Approximately Located)
Bedrock Geology[5]
Agm - Quartz monzonite and monzodiorite
Agr - Quartz monzonite, monzodiorite, and monzogranite
Agt - Tonalite to granodiorite
Amv - Tholeiitic to calc-alkalic volcanic rocks
Asb - Schist of sedimentary protolith
Asv - Schist of mafic to intermediate volcanic protlith
Mda - Anorthositic series subsuite of the Duluth Complex
Mdg - Gabbro
Mdk - South Kawishiwi intrusion
Mdp - Partridge River intrusion
Mdu - Ultramafic, oxide-rich intrusions
Mia - Aurora sill
Mmi - Mafic intrusions
Mnv - North Shore Volcanic Group
Pab - Biwabik Iron Formation
Paq - Pokegama Quartzite
Pav - Virginia Formation
Project Areas
Dunka Road
Public Waters Inventory (PWI) Watercourses
0 2,000 4,000 8,000
Feet
Large Figure 2
BEDROCK HYDRAULIC CONDUCTIVITY (K) DATA
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN
Barr Foster ArcGIS 10.2.2 2014-11-13 13:58 File: I:\Client\PolyMet Mining\Work Orders\Mine Engineering Assistance\Maps\Reports\Geotechnical Investigation\Bedrock Story Memo\Large Figure 2 Hydraulic Conductivity Data.mxd User: arm2

A Review of the PolyMet NorthMet Supplementary Draft Environmental Impact Statement and Selected Supporting Documents Related to the Predictions of Solute Levels in Discharge

Review Conducted for WaterLegacy

Bruce Johnson, Chemist, Retired Regulator

March 2014

Introduction

My review is based on 30 years of experience in environmental research, NPDES enforcement, and resolving contamination and waste management issues for a regulated party. I have extensive experience with mining in Northeast Minnesota. This experience includes extensive metal sulfide field research. I have authored/coauthored eight publications on waste management procedures and copper/nickel metals leachate research. I was a member of the National Academy of Sciences, Transportation Research Board.

This review evaluates the predicted chemical inputs and assumptions used to predict the quality of wastewater/leachates that will be generated.

Reviewed as a whole, the PolyMet NorthMet Supplementary Draft Environmental Impact Statement (SDEIS) fails to adequately address major ions and trace elements. The document ignores aquatic toxicity and possible synergistic impacts from waste rock leachates. The SDEIS fails to evaluate parameters in a scientifically defensible manner.

As a result, predictions of impacts to surface and ground water are understated. Parameters that are minimized or not analyzed may also impair the ability of installed water quality treatment to meet surface and groundwater standards.

Mine Site Assumptions Regarding Rock Characterization

Mine Site water quality assessment is based on improper assumptions about rock characterization and chemistry. Category 1 waste rock pile will create acidic pore water and leach high volumes of sulfates and toxic metals.

1. The SDEIS improperly uses small sample size and averaging to design waste rock humidity cell tests.

The discussion of Category 1 waste rock sulfur cutoff of 0.12% sulfur (SDEIS, p. 3-45) contains faulty model inputs from the results and conclusions of PolyMet 2013l Waste Characterization Data Package.

Mathematical modeling of environmental conditions is a tool that can be used to provide rough estimates when significant field data results parameters are not adequate to provide a basis for predictions. The use of high quality chemical input data (both laboratory and field) to mathematical models is critical to the accuracy of models predictions. Poor quality data inputs and assumptions in models produce predictions that are inaccurate, the result of which is unanticipated contamination and/or under-designed wastewater treatment systems.

The SDEIS humidity cell testing lacks the rigor necessary to predict sulfur content of the waste rock stockpiles. It is very well documented in the geologic open literature that the Duluth Complex mineralogy is highly disseminated. This variation is demonstrated in both reports and

drill core analyses [1]. In this reference, Patelke and Severson discuss a report on a bulk sample operated by Tec Cominco, site B1-321:

> Thus, one lesson to be learned here is that if the grade is important it is imperative to conduct detailed drilling of a site to establish the boundaries of the future bulk sample! The extreme variability of the Unit 1, both in geology and mineralization style, can produce dramatic changes within a few tens of feet (both horizontally and vertically).

The report documents the Duluth Complex contains inclusions of Virginia formation.(*Id*.) An inclusion is defined as "A fragment of older rock within an igneous rock to which it may or may not be genetically related" (Bates, 1983). The Virginia formation contains high sulfur and other metals [2]. The inclusions vary from large ones, that may be identified by coring, to rather small inclusions (a few inches to multiple feet in size) that are environmentally significant and are easily missed with drill cores. [3]

This Partridge River intrusion, where the proposed PolyMet mine site is located is highly disseminated as well. As a result, both the mineralogy and the concentrations from an environmental standpoint vary extensively throughout the deposit.

Sulfur concentration variation can be observed in drill cores[4] ,(SRK, RS53/RS42 – Waste Rock Characteristics/Waste Water Quality Modeling – Waste Rock and Lean Ore - NorthMet Project. Draft 01. Prepared for PolyMet Mining Inc. March 9, 2007, SDEIS reference SRK 2007b, Appendix c.2.) and in the open literature [5]. The SRK RS53/RS42 document describes the humidity cell process, stating 89 samples were used to categorize waste rock, a total of 309 million tons of waste rock (NorthMet Project Waste Characterization Data Package V. 9, March 7, 2013, SDEIS reference PolyMet 2013l, section 4.3). This sample size is scientifically inadequate for characterization of such a massive pile of waste rock.

The humidity cell test rock was separated by rock type (geological units); in describing the process for the selection of the test cores, the document states cores were determined by "knowledge" to select representative samples of each unit (SRK, RS78 – Block Ore and Waste March 2, 2007, SDEIS reference SRK 2007a, p. 8). In such an important evaluation an accepted statistical protocol, such as use of a random number generator, must be used to select cores. The cores used in the testing were not selected using a scientifically valid statistical procedure. This likely skews the predicted sulfide metals in the tests.

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[1] *A History of Copper-Nickel and Titanium Oxide Test Pits, Bulk Samples, and Related Metallurgical Testing in the Keenawan Duluth Complex, Northeastern Minnesota*, Richard L. Patelke and Mark J. Severson, Jan 2005, Technical Report NRRI/TR-2005/01, p. 74.
[2] *Geology and Mineral Potential of the Duluth Complex and Related Rocks of Northeastern Minnesota*, James D. Miller, Jr; John C. Green; Mark J. Severson; Val W. Chandler; Steven A. Hauck; Dean A. Peterson; Timothy E,.Wahl. Report Investigations 58 ISSN0076-9177, University of Minnesota, St Paul, 2002. pp. 85, 87, 89.
[3] *Geology and Mineralization in the Dunka Road Copper-Nickel Deposit, St Louis County, Minnesota*, Stephen Geerts, Randal J. Barnes and Steven A. Hauck. March 1990, NRRI/GMIN-TR-89-16, p. 17.
[4] *Ibid.* 1, p. 74.
[5] *Mineral Potential of the Duluth Complex and Related Intrusions*. Chapter 8. Mark J. Severson, James D. Miller, Jr., Dean M. Peterson, John C. Green, and Steven A. Hauck. p. ix, 74, 78, 165, 167.

The selected cores segments were divided into their geological units. Each unit was combined and the sulfur content for each unit was averaged. The average concentration was used for the humidity testing. Averaging conceals the effect of actual isolated high sulfur concentrations within the waste rock, and by default assumes all waste rock sulfur concentrations will be as well mixed within the Category 1 waste rock stockpile as it is in the test cells. Only under these waste rock well mixed conditions would the resultant leachate be similar to the humidity cell results.

From an environmental standpoint, average concentrations fail to adequately address environmental impacts. High sulfur "seed" inclusions[6] are of environmental concern (SDEIS reference SRK 2007a, p. 6.). This procedure, by default, assumes all waste rock sulfur concentrations will be as well mixed within the stockpile as they were in the test cells. Thus, in theory, the leachate observed in the field will be similar to the humidity cell results. However, in practice the waste rock will not be well mixed and numerous seed quantities of sulfur much greater than 0.12% will be within the stockpile. These seeds will initiate acid and leach both its high sulfur waste rock and also the lower sulfur rock in its drainage path. The acid may exit the stockpile or may be neutralized before exit, but either way it will carry out a load of dissolved metals [7].

Thus the ore block model, excellent for assessing the economic value of a resource for production purposes, will not upscale adequately to meet environmental, chemical and toxicological requirements. Separation of the very heterogeneous waste rock containing high sulfate inclusions[8] using an average concentration block model will not prevent higher concentration sulfur rock from being placed in lower concentration waste rock stockpiles [9].

The up-scaling of theoretical modeling to field operations will unavoidably result in high concentration inclusions (seed quantities) of sulfur being placed in lower sulfur stockpiles [10]. These high sulfur inclusions will produce pockets of acid leachates within the piles. These acid leachates will drain and leach other low sulfur materials below. If neutralizing rock is not sufficiently present, over time the leachate will be acid and contain metals and other contaminants. Even if the acid were to be neutralized to some degree before discharge exits the stockpile, the drainage will carry out a load of dissolved metals influenced by the higher acidity of the disseminated sulfates. [11]. Leached metals will not be adsorbed by the host rock in the pile and will result in much higher leachate values than predicted by the model. The higher the stockpile, the higher concentration of leachate will be produced.[12]

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[6] *Geology and Mineralization in the Dunka Road Copper-Nickel Mineral Deposit St. Louis County, Minnesota,* Stephen Geerts, Randal J. Barnes, and Steven A. Hauck, March 1990, NRRI/GMIN TR-89-16; p. 11.
[7] *Alternative Acid Mine Drainage Abatement Measures*, Dr. A. MacG. Robertson, Steffen Robertson, and Kirsten (B.C.) Inc., Vancouver B.C. Canada, p. 4.
[8] Ibid 8, p. 11.
[9] *Environmental Leaching of Duluth Gabbro Under Laboratory and Field Conditions: Oxidative Dissolution of Metal Sulfide and Silicate Minerals.* Paul Eger, Kim Lapakko, Minnesota Department of Natural Resources, Division of Minerals 1980, p. 12.
[10] Ibid 9, p, 4.
[11] Ibid 9, p. 4.
[12] Ibid 11, p. 188.

2. Sorting waste rock stockpiles will not be possible to the degree presumed in the SDEIS.

The SDEIS proposes to use block modeling to separate heterogeneous waste rock into four classes based on the sulfur concentrations in block modeling (SDEIS, p, 3-44). This modeling cannot be consistently duplicated in the physical action of loading trucks from the windrowed blast rock. Since the deposit is disseminated and the blocks are averaged, high levels of sulfur can be unidentified and unaccounted within a block, and/or adjacent block averages could vary in sulfur concentration significantly. The permanent unlined Category 1 waste rock stockpile is classified as less than or equal to 0.12% sulfur (SDEIS, p. 3-45). In practice the block model sorting process will result in blocks or portions of blocks with high concentrations placed into the Category I pile.

The block model was designed to estimate ore resources for production purposes. It averages the nearest 10-foot drill core analyses to the 20 foot height of the block, and then averages all nearby drill core averages adjusted to distance to determine a number for sulfur content in the 50 x 50 x 20 feet block (PolyMet Rock and Overburden Management Plan V. 5, December 28, 2012, SDEIS reference PolyMet 2012s, Section 2.3). There are 436 drill cores in the mine area. The economic portion of the mine is 528 acres. This calculates to an average of less than one drill core per acre. The mine area is divided into 133,000 blocks (SDEIS, pp. 3-39, 40).

This process determining the block's average sulfur number will not reflect the highest concentration of an element such as sulfur found in the nearest drill core. As noted previously, mine site drill core logs demonstrate large variability of sulfur, even between analyses completed at 10 foot intervals [13],and waste rock will contain "seed quantities" of sulfur much greater than 0.12% that will initiate acid and leach metals both from the high sulfur seed and from other rock in its drainage path. Any block may contain rock portions with much higher sulfur than what is calculated as the average.

This process of waste rock characterization is further adulterated by the gross separation of waste rock by category during the extraction process. Consider that over 13 years, the Category 1 stockpile will contain 167,922,000 tons of waste rock (SDEIS p. 3-43). Each blast will remove 250,000 to 300,000 tons of rock (SDEIS, p. 3-41). Thus each blast will remove approximately 85 blocks. A block weighs 3,518 tons (PolyMet, Rock and Overburden Management Plan, SDEIS reference PolyMet 2012s, p 39.) and each truck holds 240 tons of rock. Therefore each block contains approximately 15 truckloads. It is likely that blocks or portions of blocks with higher sulfur seed concentrations will be transported to the Category I pile. Without a tight system, if one block from a blast is mis-characterized and transported to Category I, more subsequent trucks moving the blasted rock may replicate this error. The Plan discusses the possibility of GPS tracking that "can be" used to assist in separating rock types (SDEIS Reference PolyMet 2012s, p. 34) but the SDEIS fails to commit to implementing such practices In any case, GPS use cannot resolve the issue of averages missing higher concentration seed rock.

[13] Ibid.1, Fig. 24, p. 66 .

Consequences of Analysis:

As a result of these practical constraints, the proposed block evaluation process will result in stockpiles that will not uniformly meet proposed cutoff concentrations resulting in much higher concentrations of leachate production than predicted in the SDEIS. If neutralizing rock is not sufficiently present, the leachate will be acid and contain metals and other contaminants. Leached metals will not be adsorbed by the host rock in the pile and will result in much higher leachate values than predicted by the model. These elevated concentrations will impact surface and/or groundwater. Unpredicted elevated concentrations will also adversely affect the removal efficiency of the mine site wastewater plant (SDEIS Reference PolyMet 2012s, p. 39).

The SDEIS states its plan to use Category 1 waste rock for construction material (SDEIS, Table 3.2-8). However, this material should be considered reactive waste (SDEIS PolyMet 2013l, p. 2). It has a high potential for leaching beyond surface water standards and should not be used as construction material.

Although the SDEIS acknowledges that much higher rates of leachates would result if waste rock piles were to become acidic, up to a factor of 8.2 with the onset of acidic conditions (SDEIS, p. 5-51), predictions of leachates from the permanent Category 1 waste rock stockpile are based on an assumption that this waste rock does not become acidic.

Approaches to determining stockpile sorting were considered in SDEIS Reference SRK 2007b. While discussing models, this document noted on page 4: "Northwest Geochem (1991) comprehensively reviewed modeling methods to predict the chemistry of waste rock stockpile drainage and concluded that 'no model exists which can even generally simulate the most critical physical, geochemical, and biological processes in waste-rock piles'. Subsequently, MEND (2000) concluded that 'If assessments of the behavior of waste rock stockpiles are required, it should be realized that no reliable modeling approaches are available. Advances have been made in understanding and modeling the various processes (e.g. flow in unsaturated materials, pyrite oxidation) but reliably coupling the models remains primarily a topic of research.'" Other theoretical and empirical approaches were discussed, and the decision was made to use the current block model approach, but the block model cannot escape the faults enumerated in both the SDEIS Reference SRK 2007b and this review.

Analysis of water quality outcomes must be revised based on a reasonable range of predictions about disseminated sulfates and localized acidic conditions.

Improper Characterization of Waste Rock Parameters

The use of a block model intended to predict the amount of profitable resource to determine concentrations of other parameters does not accurately predict potentially toxic waste rock leachates. This error will compound the inaccuracies resulting from the averaging of the sulfate mineralogy from the humidity testing.

The SDEIS uses block modeling, originally used to predict the amount of profitable resource, to separate very heterogeneous waste rock into four classes based on the sulfur concentrations.

Elements both of economic and non-economic interest within the Duluth Complex are disseminated (heterogeneous). Copper, nickel, cobalt, zinc, mercury, lead, arsenic, sulfur, chlorides and others vary in both economic metallurgical interest and in environmentally significant concentrations within the host rock. Waste rock will not be blended to an average concentration, as it can be for the beneficiation process.

The humidity testing sampling focused only on the presence of sulfide heavy metals in its core and geologic unit selection process, so the sample selection focused only on parameters closely associated with the sulfide bearing minerals. (SDEIS Reference PolyMet 2013l, pp.7-21). This process fails to address concentrations of other parameters that exist within the non-sulfide host rock. Some non-sulfide parameters are also of environmental concern.

During the humidity cell testing numerous parameters from the PolyMet test rock demonstrated metals release at near neutral to basic pH (SDEIS Reference SRK2007b, App. H.2.).These metals can be expected to be at environmentally elevated concentrations in the leachate of all stockpiles.

As discussed previously, high concentration inclusions (seed quantities) of sulfur will produce pockets of acid leachates within the piles, leaching metals in the drainage path. If neutralizing rock is not sufficiently present, the leachate will be acidic and contain metals and other contaminants. If neutralizing rock is sufficiently present, circumneutral leachate will still contain metals, especially nickel which is very environmentally mobile, and other contaminants. As in the humidity testing to predict sulfates, use of the block modeling averages underestimates metals leachate production.

Unlike many other copper (Cu) deposits in the nation, the PolyMet Duluth Complex deposit also includes significant quantities of nickel, cobalt, and zinc (Ni, Co, Zn) ore. Rock from the Duluth Complex in this area contains disseminated (unevenly distributed) mineralization, that may or may not produce acid leachate, and will still leach heavy metals far above surface water standards at potentially toxic levels.[14] The release of Cu can be reduced with circumneutral pH (pH 6.7 to 7.2), such as limestone additions to waste rock piles, but this is not true for Ni, Co, and Zn, which are readily released in near neutral pH (+/- pH 7).[15] Unlike the PolyMet SDEIS, which did not discuss this issue, the Regional Cu-Ni Study states that leachate impacts of nickel, cobalt and zinc are of great significance.[16]

Acid rock drainage related to copper and sulfur is not a sufficient indicator for leaching of toxic metals, since there are numerous reports on the Duluth Complex in the area demonstrating

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[14] K. Lapakko and P. Eger, *Environmental Leaching of Trace Metals from Waste Rock and Lean Ore Stockpiles*, p. 3 (1980)("Lapakko 1980") *available from author on request*; MDNR 1980, *supra*, pp. 195-196.
[15] *Id*; *see also* M.J. Rinker, R. V. Nicholson, M.A. Venhuis, & B. Swarbrick, *Implications of Non-Acid Metal Leaching on Mine Rock Management at a Nickel Mine in Permafrost Terrain: 1-Mine Rock Evaluation* (1999), *available from author on request*; Minn. Envt'l Quality Bd., *Spruce Road Bulk Sample Site* & *Spruce Road Bulk Sample Site Monitoring Results*, Reports to Minnesota Regional Copper-Nickel Study, p. 19 (1977)("MEQB 1977") *available at* http://archive.leg.state.mn.us/docs/pre2003/other/CN148.pdf; S. J. Eisenreich, M.R. Hoffman & I. Iwasaki, *Metal Sulfide Leaching Potential in the Duluth Gabbro Complex*, Report to Minnesota Regional Copper-Nickel Study (1976)("Eisenreich 1976"); Lapakko 1980, *supra*, pp. 3-4.
[16] Minnesota Regional Copper-Nickel Study, Executive Summary, p. 45, 48-49, *available at* http://www.leg.state.mn.us/docs/pre2003/other/792632.pdf

significant releases of Ni, Co, and Zn at circumneutral pH.[17] Toxic metal releases at near neutral pH of Cu, Ni, Co, Zn have occurred from the Duluth Complex stockpiles and test plots at the LTV Dunka Taconite Mine (a.k.a. Cliffs Erie Dunka Mine), Amax test site and Spruce Road Bulk Sample Site. Cliffs Erie required a variance from Minnesota water quality standards with respect to acute toxicity for its 2001 NPDES permit[18] and continues to request variances from toxicity water quality standards for metals releases from the Dunka Mine.

Minnesota's Cu-Ni Study data showed that Duluth Complex waste rock leachates have a high probability of aquatic toxicity.[19] The median trace metal concentrations (Ni, Cu, Zn and Co) from Dunka Mine stockpiles with circumneutral pH had leachate seepages that ranged from ten to 10,000 times the natural background levels of streams in the area.[20] In August 1988 MPCA determined all of these discharges to be acutely toxic. The leachates were found toxic to *Ceriodaphnia dubia* in as low as 3 to 14 percent dilutions. These discharges are the most acutely toxic discharges known in the state.[21] Copper, nickel, cobalt and zinc metals are all highly toxic to aquatic life at low levels (micrograms per liter), and may have negative human health effects at marginally higher levels. For example, ATSDR has stated Ni to be a potential carcinogen.[22]

The average annual precipitation for the Project area is 28.4 inches. The 855.9 acres of stockpiles projected for the PolyMet mine site can be expected to receive 660,008,592 gallons of precipitation in an average year. Uncovered AMAX test plots indicated 50 to 60 percent of precipitation was released as leachate.[23] In an *average* year, a rough estimate would predict Polymet stockpiles will produce 330,000,000 to 396,000,000 gallons of leachate, containing metals and sulfides.

Acid and circumneutral leaching must be anticipated from all stockpiles of mineralized Duluth Complex waste rock.[24] This leaching would far exceed surface water standards and should be expected to be acutely toxic.[25] Experience suggests that toxic metal releases of Ni, Co and Zn exceeding surface water standards can be expected indefinitely, if not in perpetuity, in the Partridge River Watershed.

Mineralized mine pit sidewalls will also leach acid and metals orders of magnitude above surface water standards. This was documented in the Cu-Ni Study sampling of the U.S. Steel bulk sample pit at the Filson Creek bulk sample site. A 33-day laboratory test of the Duluth Complex Rock resulted in elevated metals releases in water, with increased release as the water's oxygen

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[17] S.J. Eisenreich, M.R. Hoffman, K. Lapakko, *Mechanism and Control of Metal Sulfide in Gabbro Mining-Related Solids*, Report to Minnesota Regional Copper-Nickel Study, p, 27 (1977); Lapakko 1980, *supra*, p. 3; MDNR 1980, *supra*, *see e.g.* pp. 9-10. Pilot testing has demonstrated only a 10 percent reduction in Ni release by the use of limestone in a Dunka Mine Duluth Complex waste rock seepage.
[18] Dunka Mine NPDES Permit MN0042579, pp. 11, 12, 15.
[19] MDNR 1980, *supra*, see e.g. p. 197.
[20] Lapakko 1980, *supra*, p. 3.
[21] MDNR, *Bob Bay Study* (1983)("MDNR 1983"); B. Johnson, J. Strudell, MPCA Proposed Dunka Memorandum to Russell Felt (Mar. 28, 1989) ("Johnson 3/28/89") *available from author on request*; MPCA Dunka Reports, *supra*.
[22] Agency for Toxic Substances and Disease Registry ("ATSDR"), Nickel ToxFAQs CAS # 7440-02-0 *available at* http://www.atsdr.cdc.gov/tfacts15.pdf
[23] P. Eger, B. Johnson, G. Hohensteen, DNR/*AMAX Leaching and Reclamation* (Jan. 29, 1979).
[24] *See* MDNR 1980, *supra*; MEQB 1977, *supra*; Eisenreich 1976, *supra*, p. 27; Lapakko, 1980, *supra*.
[25] *See* MPCA Dunka Reports, *supra*; MDNR 1983, *supra*; Johnson 3/28/89, *supra*.

content increased.[26] In the Cu-Ni Study, the MDNR also expressed concerns over mine pit sidewall leaching.[27]

Consequences of Analysis

Predictions of metals leachates in the SDEIS are likely to be understated and additional mass balance analysis of non-production metals should be required, particularly for environmental parameters of concern, especially but not limited to mercury, cobalt, zinc, lead, chlorides and arsenic.

SDEIS Failure to Adequately Evaluate Chlorides

Summary: The SDEIS fails to adequately evaluate chlorides. Chlorides will be much higher than predicted, impacting wastewater treatment performance and surface and groundwater quality.

1. Basic Information Regarding Chlorides

Background regarding chlorides is important for the chloride discussion below. Chloride compounds do not biodegrade, readily precipitate, volatilize, or bioaccumulate. Chloride ions do not adsorb readily onto mineral surfaces and therefore concentrations remain high in surface water and sediment pore water, and low in sediment (Health Canada, 1999).

Chloride in fresh water has many environmental impacts. Low levels of chlorides are toxic to invertebrates and aquatic plants (USEPA, 1988). Chlorides in low concentrations are documented to impact aquatic plants and amphibians, and fish shifts in aquatic populations have been observed (Sadowski; Karraker 2008).

As early as 1980 the MDNR reported results of laboratory studies where chloride solutions as low as 140 mg/l (.005 M) increased nickel leachate[28]. Later reports agree that elevated levels of chloride at approximately 2000 mg/l (0.1M) have been demonstrated to increase the dissolution of sulfide metals for ore processing (Lin,1988; Doner,1978).

Chloride in water can only be treated through dilution or high performance treatment such as by reverse osmosis. Elements like chloride cannot be created or destroyed; treatment simply concentrates chlorides into another media.

In 1979 the baseline average of chloride from 462 samples from streams in the Lake Superior and Rainy River watersheds had a median average of 2.0 mg/l (n=462), and in 94 lake samples chloride averaged 1.6 mg/l (n= 94). In 1979, in impacted sites (Bob Bay, St. Louis River and Partridge River) chlorides ranged from 2.8-38 mg/l with a median average of 29 mg/l (n= 55).

[26] MDNR 1980, *supra*, pp. 108, 110.
[27] *Id.*, p. 263.
[28] Ibid 11, Fig. 3.41.

The same report identifies fluoride in unimpacted streams (group c) ranging from 0.2-1.5 mg/l (n=347)[29]. The Partridge River, adjacent to the proposed mine pit, has a 7-day ten-year low stream flow (7Q10) of near zero. According to Minn. R. 7050.0210 negligible mixing of wastewater will be allowed and any discharge limit will be near the in-stream standard of 230 mg/l.

2. The SDEIS incorrectly assumes the occurrence and concentrations of chlorides are few in number and only in fractures containing water.

The SDEIS (SDEIS, p.5-113) discusses chlorides. The discussion mis-states referenced articles, and ignores other more recent peer-reviewed literature regarding the sources of chlorides in the Duluth Complex.

The SDEIS (p. 5-113) cites Morton and Ameel 1985 for the conclusion "saline ground water is encountered sporadically in deep (greater than 1000') bedrock wells in northeastern Minnesota."

The cited reference was an attempt by the authors to evaluate if there was a relationship between brackish water and metals of economic interest. This was stated in their objectives on p. 2 : "1) locate saline wells within the North Shore Volcanic Group and Duluth Complex, 2) sample and analyze waters from these wells and if feasible to establish base-line values of trace metals, 3) sample and analyze saline wells associated with known areas of economic mineralization, 4) compile analyses of potable and non-potable wells from the literature, and 5) establish if there were any relationship between rock type and the incidence of saline wells." The objective was not to determine the origin, depth or the frequency of wells located with saline water. The authors had trouble finding saline wells, not because of the frequency of occurrence, but as a result of poor reporting in drill logs, and the fact that unusable saline wells are required to be sealed.

2. The SDEIS incorrectly assumes chlorides are mostly found in fractures exceeding PolyMet's mine pit depth.

The SDEIS (SDEIS, p. 5-113; Barr, John Swenson and Jeré Mohr Memorandum to Bill Johnson. Response to questions on saline groundwater, September 7, 2012, SDEIS Reference Barr 2012v) further assumes if brackish, high chloride water occurs it will found very deep -- 1,200 to 1,400 feet. The SDEIS further states that PolyMet's pit will not be deep enough to hit saline water if it exists. They reference the Amax shaft produced brackish water, and attribute its production of brackish water to location of shafts at depths of approximately 1,200 to 1,400 ft.

Reviewing cited Amax data[30] this assumption is also in error. The Table indicates sampling locations by elevations not in depth. Thus converting the elevation data to feet from the surface one finds the samples were taken at the surface, at 406 feet, 512 feet, 554 feet. These samples are all well within the proposed depth of the PolyMet pit.

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[29] *Water Quality Characterization of the Copper-Nickel Water Quality Research Area*, Daryl Thingvold, Nancy Sather, Peter Ashbrook December 1979, Table 5, Appendix 2.

[30] *Analysis of Groundwater From shaft and Drill Holes at the MinnAmax Site Near Babbit, MN*, T. Hargy, Kennocott Copper,Table 5.

In addition the table indicates three borings encountered extremely high chlorides (11,000, 6,300 and 3,900 mg/l). The depth of a boring is not related to the chloride concentrations since the borings are only cased to bedrock, below which the boring is not cased. Brackish water can enter at any location within the un-cased borehole.

Furthermore, the Morton and Ameel 1985 report cited by PolyMet clearly indicates that high levels of chloride occur at shallower depths. On p. 35 the authors conclude: "The saline and brackish waters in the Duluth Complex and N.S.V.G. occur at shallower depths than those in most occurrences in the Canadian Shield tabulated by Fritz and Frape (1982)." Morton and Ameel 1985, Figure 16, chloride concentration vs well depth, demonstrates that chloride, in their study, does not increase with depth. This figure demonstrates little difference between Duluth Complex 100 and 600 feet wells. Table 7 of the report shows results of chlorides in bedrock wells less than 400 feet.

PolyMet's statement on SDEIS page 5-113, "In general, the potential for encountering saline water increases with depth, such that briny groundwater (defined as TDS greater than 35,000 mg/L) may be nearly ubiquitous in bedrock at depths greater than approximately 3,000 ft throughout the Lake Superior Basin in northeastern Minnesota (Morton and Ameel,1985)." mis-represents the conclusions drawn by Morton and Ameel (1985).

4. The SDEIS incorrectly assumes that the Amax site chlorides are localized to the Amax site.

The SDEIS (SDEIS, p, 5-113) and Barr (SDEIS Reference Barr 2012v) also state that the Amax test shaft that encountered saline water was 3.2 miles northeast of PolyMet, thus the appearance of chlorides is likely not to be present at the PolyMet mine pit. The PolyMet pit will be 2.6 miles long, 528 acres (SDEIS, pp.3-39, 40), with its closest point approximately 2.93 miles from the Amax shaft.

PolyMet assumes but does not substantiate that chlorides are localized to Amax. Such an assumption is not consistent with scientific evidence. Chlorides are known to be in inclusions in the "dry" troctolite. PolyMet's mine will be located primarily in troctolite. Furthermore, the SDEIS, p. 3-33, contradicts this assumption, stating, "All of the mineral deposits share a broadly similar geologic setting to the NorthMet Deposit."

PolyMet has hundreds of borings with thousands of feet of core available. A thorough analysis of these cores would help to determine the presence or absence of chloride inclusions.
The U.S. Forest Service recently tested for chlorides in the water of five exploratory borings in the area of the drill site southwest of PolyMet near the South Kawishiwi River. The water testing found the following chloride concentrations in the 5 borings tested contained the following chloride concentrations: 38 mg/l, 3460 mg/l, 440 mg/l, 476 mg/l, 1,500 mg/l[31]. Thus high

[31] Superior National Forest, *Federal Hardrock Minerals Prospecting Permits Project, Final Environmental Impact Statement*, Appendix G. 04/09/2012 (rev).
http://www.fs.usda.gov/wps/portal/fsinternet/!ut/p/c5/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gDfxMDT8MwRydLA1cj72BTUwMTAwgAykeaxRtBeY4WBv4eHmF-YT4GMHkidBvgAI6E

chlorides were found in 4 of the five borings tested. This recent U.S. Forest Service testing further demonstrates high chloride have been found both to the North and South of PolyMet's proposed pits**.**

5. The SDEIS incorrectly assumes chlorides are found only on the rock surface and in inundated fracture zones.

The SDEIS (SDEIS, pp. 5-113, 114) incorrectly assumes that brackish water is contained only in fractured rock, rather than in inclusions within the rock. Because the SDEIS contends both that brackish water is only in fractures and that fractures at the mine site are insignificant; the SDEIS then assumes that the brackish water will not be a continuing source of pollutant. These assumptions are inaccurate.

Reports from the MDNR, NRRI, and Washington University geologists contradict the SDEIS assumption. The first report is a publication by Eduard H. Dahlberg, a geologist employed by Minnesota Department of Natural Resources (DNR), Division of Minerals and the University of Minnesota[32]. His report identified that drill cores from Duluth Complex contain high chloride and fluoride concentrations in serpentinized ultramafic rocks. Within drill cores at distances ranging from 11.3 to 917.5 meters (37 to 3009 feet) from the footwall of the Duluth Complex, the chlorides were present as salts. "The phase occurs as vein-filling material in grains up to 200 pm (picometer, one trillionth part of a meter) long and 20 pm wide... Analyzed rock cores also contain very high concentrations of chlorides (up to 3200 ppm) and fluoride (up to 760 ppm)."

The Dahlberg report continued, "This effect has been observed over intervals ranging in thickness from 30 cm (about 12 inches) to a few meters and occurs within "zones" up to 44 meters (144 feet) thick. The drill cores bearing the alteration product come from drill holes located in troctolitic rocks in the area of the Maturi, Minnamax, Water Hen, Dunka Road, and Dunka Pit Cu-Ni sulfide occurrences." The form of salt was identified as an iron chloride.

In 1991, an NRRI report identified chloride encrustations in crisscrossing hairline fractures giving the rock a "cracked" appearance. These were found in parts of the Local Boy area[33]. In 1995, a paper by Pasteris, Harris, and Sassani analyzed the mineralogy of the Duluth Complex and further documented that drill core samples of troctolite contained high concentrations of both calcium chloride and sodium chloride in fluid inclusions. These concentrations ranged from 0 to 48% (0 to 480,000 ppm) [34].

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[32] *A Chlorine-bearing Phase in Drill Core of Serpentinized Troctolitic Rocks of the Duluth Complex, Minnesota*, Eduard H. Dahlberg, Bernhardt Saini-Eidukat; Canadian Mineralogist Vol. 29, 1991,
pp. 239-244.

[33] *Geology, Mineralization, and Geostatistics of the MinnAmax/Babbitt Cu-Ni Deposit (local Boy Area),Minnesota, Part II:Mineralization and Geostatistics,* Mark J.Severson, Randal J.Barnes, NRRI Technical Report NRRI/TR-91/13b, June 1991, pp. 55-57.

[34] *Interactions of Mixed Volatile-Brine Fluids in Rocks of the Southwestern Footwall of the Duluth Complex, Minnesota: Evidence from Aqueous Fluid Inclusions,* Jill Dill Pasteris, Teresa N. Harris, David C. Sassani, American Journal of Science, Vol.295, February 1995, pp. 125-172.

All three publications also determined that brackish liquids are contained in fluid inclusions. Fluid inclusions are defined as "a tiny cavity in a mineral 1.0-100.0 microns in diameter, containing liquid and/or gas formed by the entrapment in crystal irregularities of fluid, commonly that from which the rock is crystallized" (Bates, 1983). These inclusions are microscopic, less than 20 um (micrometers) in length. The inclusions contain chlorides from NaCl, CaCl2-H20, FeCl2. The inclusions have been reported in the troctolite rock. Troctolite is a major constituent of the PolyMet pit rock.

The SDEIS also ignores data from the Amax site that demonstrates years of elevated chlorides in the mine dewatering and a DNR three-year field study of MinnAmax tailing leachate[35] that demonstrated very high chloride leachates (averaging 433 mg/l with a max of 4,690 mg/l).

The DNR at that time simply speculated that the high level of chlorides was an unidentified error in tailing processing. In the same leachate, sodium averaged 467 mg/l, with a maximum of 2500 mg/l. Literature and field experience demonstrates that the SDEIS assumption that the brackish water is solely on the surface of rock in fracture pockets is in error.

This error affects the presumption in the SDEIS (p. 5-114) that if saline water were encountered discharging in the pit, it would be quickly diluted with fresh water and then be a discharge of a one-time nature that would be diluted by incoming freshwater. The SDEIS modeling predicts with 90% confidence that between $7.67x10^{-20}$ to 46 mg/l of chlorides will be input into the WWTF west and east basin respectively (PolyMet 2013g, Large Table1).

The SDEI- predicted basin influent numbers reflect concentrations found in Bob Bay, the St. Louis River, and Partridge River after in-stream dilutions. [36] The modeled chloride numbers cannot be justified. Elevated concentrations of chloride will be found in the leachates of the waste rock and even at higher levels in the tailing leachate, since the tailing exposed surface area is much larger.

Consequences of Analysis
The SDEIS fails to accurately evaluate the impacts of high levels of chlorides on the inundated meromictic east, central, and west pits water at closure (Novotny, 2007). Meromictic impacts from chlorides to ground and potentially surface water and wetlands must be addressed.

The SDEIS fails to address impacts of high chloride that is not captured from the seepage and liner leaks; potential impacts on surface water, groundwater and wetlands quality must be addressed.

The SDEIS fails to discuss how chlorides may affect reject concentrate and sludge chemistry, potentially impacting waste storage.

The SDEIS fails to discuss how any passive treatment systems proposed for closure would control chlorides.

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[35] *Drainage from Copper-Nickel Tailings: Summary of a Three Year Field Study,* Minnesota Department of Natural Resources, Division of Lands and Minerals, July 2004.
[36] Ibid, 2.

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Chemist, retired regulator with extensive field and technical experience with environmental impacts of copper-nickel sulfide mining and peat mining, remediation of water quality impacts, compliance with state and federal regulations.

Employment

(1990-2004) Minnesota Department of Transportation

- Supervisor of Environmental Investigations and Compliance Unit
- Supervised all the Department's Superfund, Petrofund, Hazardous and Solid Waste Management;
- Developed a waste management and environmental audits program to reduce environmental liabilities;
- Developed a unique method to compost petroleum contaminated soils;
- Developed environmentally safe methods to remove and legally dispose hazardous lead based paint from bridges within the state;
- Reduced the Department's hazardous waste production 84%, from a large quantity generator to a small quantity generator;
- Developed a program to safely and legally remove abandoned hazardous waste from state administered transportation properties;
- Eliminated use of lead and chromium based paints as roadway striping while maintaining US/DOT requirements for reflectivity.
- Drastically reduced the use of treated wood in highway guard rails;
- Developed a chemistry baseline for heavy metals concentrations in high way rights-of-way in the Twin Cities metropolitan area;
- Assessed the potential environmental chemical and biological impacts from using waste tires as a light-weight fill in roadway construction;
- Developed chemical and biological procedures to test new products for potential environmental impacts prior to full-scale implementation.

(1984-1990) Minnesota Pollution Control Agency – Pollution Control Specialist Intermediate, Industrial Enforcement Team Leader

- Technical leader for the NPDES industrial enforcement unit staff;
- Enforced NPDES industrial permit requirements for all state industries;
- Enforced all NPDES Mining Permits;
- Developed statewide permit conditions for the land application of cannery wastes;
- Water quality lead staff to enforce environmental crimes.

(1979-1984) Minnesota Department of Natural Resources

Minerals Supervisor, Peat Mining Study of the environmental impacts from a test peat mining operation near Cotton, Minnesota.

- Researched potential water quality impacts from a pilot fuel peat mining operation;
- Developed sampling protocols to assess impacts from the state's test fuel peat mining program;
- Analyzed project chemical data from study;
- Co-author of the study report.

Hydrologist II, Peat Mining Research

- Developed and designed monitoring and methods to comply with regulations
- Developed plan and quality assurance for compliance with NPDES permit

Land Reclamation specialist for MinnAmax test piles construction
Field Chemist in charge of the MinnAmax metal pathways field study of environmental impacts from sulfide mining.

- Researched metal sulfide metal leaching mechanisms;
- Developed sampling protocols to assess impacts from sulfide waste rock and tailing field test plots;
- Insured chemical quality control quality assurance is maintained;
- Analyzed project chemical and water volume data;
- Assisted in developing project reports.

(1976-1979) State of Minnesota - Regional Copper Nickel Study
Field Chemist in charge of metal pathways portion of analysis, including:

- Researched sulfide metal leaching mechanisms;
- Assessed chemical data;
- Assessed water quality impacts from Erie Mining Company's Dunka mine sulfide waste rock leachates;
- Developed sampling protocols to assess potential water quality impacts
- Develop sediment sampling protocols to assess ambient metal concentrations in lake sediments;
- Surveyed existing lake sediments for ambient heavy metal concentrations;
- Surveyed selected bulk sample sites for leachate impacts;
- Assisted in developing project reports.

(1973-1976) U.S. Environmental Protection Agency
Shagawa Lake Eutrophication Project.
Assisted in assessment of remediation of a lake impacted from municipal sewage resulting in hyper-eutrophic conditions. Operated a carbon-14 primary productivity laboratory; developed in situ sediment sampling procedures; analyzed data.

(1972-1979) U.S. Army
First Lieutenant, Chemical, Biological, and Radiological Staff Officer.

Education & Certifications
1969 **B.A. - Biology/Chemistry** - Winona State University
1972 **B.S. - Education** - Winona State University

Hazardous Waste Investigations Training, U.S. Department of the Treasury, Federal Law Enforcement Training Center, Glencoe GA.

Certified Hazardous Materials Manager - Masters level. Certified by: Academy of Hazardous Materials Managers

Professional Recognition:
2000 MPCA Award for Northern Minnesota Abandoned Hazardous Waste Pilot Project,
1990 MPCA Meritorious Service Award
1990 Letter of Appreciation, Attorney General Office State of Minnesota

1990 Letter of Recognition, Attorney General State of Minnesota

Publications:

Decision Support Model for Assessing Net Public Benefits of Reuse of Waste Materials in Highway Maintenance and Construction, Hyman, Johnson, 2001.

Hazard Analysis And Risk Management Of Road Subbase Materials Using The Comparative Risk Bioassay Methodology, Johnson Belluck, Melby, 1997.

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Program review of Environmental Analysis Technology and Water Resources Technology at Vermilion Community College, Sept. 1986.

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Hydrologic and Water Quality Monitoring of a Fuel Peat Mine Near Cotton, Minnesota, Eger, Lapakko, Johnson, 1985.

Environmental Leaching of Duluth Gabbro Under Laboratory and Field Conditions: Oxidative Dissolution of Metal Sulfide and Silicate Minerals, Eger, 1980. (Contributor)

Additional Professional Activities:

2006 - present. Chairperson, Isanti County Water Board that sets policy for surface and ground water management in the County.

2002 – present. Owner of bandsaw mill and hardwood specialty sales business, designed and installed solar panels, solar hot water wood kiln and two wind generators.

1996 – 2000 National Academy of Sciences, Transportation Research Board member of the Environmental Maintenance Subcommittee.

1990 Republic of Germany - 5-week working internship with the Umwelt Bundes Amt (German Federal EPA) to share environmental scientific expertise.

1979 –1981, Owned, designed and engineered a unique, energy efficient 7000 sq. ft. hydroponic greenhouse that included designing the nutrients used in the facility.

Subject: material related to bedrock-wetland connections at Polymet mine site
From: "john.coleman" <jcoleman@glifwc.org>
Date: 7/29/2015 8:12 AM
To: bill.johnson@state.mn.us, Sedlacek.Michael@epa.gov, mwatkins@grandportage.com, NancySchuldt@FDLREZ.COM, blatady@boisforte-nsn.gov, esteban@glifwc.org, TKaspar@1 [...]

Following up on the webinar last week, here is some material related to the hydrologic connection between surficial wetlands and the bedrock aquifer.

Throughout the development of the EIS, the applicant and their consultants have made the argument that the surficial deposits, and in particular wetlands such as the 100 Mile Swamp, are not hydrologically well connected to the bedrock aquifer. 8 inches/year of leakage to establish a groundwater mound in the bedrock would require that the 100 Mile Swamp be well connected to the underlying bedrock aquifer. Statements by the applicant claiming a weak to non-existent connection between surficial deposits and the bedrock include:

1) "there may be an unsaturated zone between the surficial deposits and bedrock present in some portions of the site, which would suggest **a minimal degree of hydraulic connection between the surficial aquifer and bedrock**." (WMDP v13, Section 4.3.3.2 Bedrock)
and

2) "As discussed in Section 4.3.3.2, available data indicates that, **although the surficial aquifer and bedrock are likely hydraulically connected to some degree, the connection is believed to be weak or non-existent in many areas of the Mine Site**." (WMDP v13, Section 5.2.3.1 Groundwater Flow Path Modeling)
and

3) "Because **the dense underlying till acts as an aquitard that restricts downward water flow**, most of the organic and mineral soils in the depressional areas of the site have perched water tables." (page 3, Barr June 2, 2008, Indirect Wetland Impacts at the Mine Site).
and

4) "Figure 4 identifies the moisture content throughout the soil profiles from the soil surface to the bedrock surface (Barr, Overburden Soil Boring Logs - Draft, January 2008). The moisture content was field described as dry, moist or wet. The moisture content changes throughout each soil profile, **indicating the surficial aquifer is not always continuous from the soil surface to the bedrock surface**." (page 4, Barr June 2, 2008, Indirect Wetland Impacts at the Mine Site).
and

5) "Because of the **lack of interaction between the surficial and bedrock aquifers**, the hydrology of the wetlands at the site is primarily supported by direct precipitation with some variable surficial groundwater component from the uplands." (page 4, Barr June 2, 2008, Indirect Wetland Impacts at the Mine Site).
and

6) "A number of factors contribute to the stable hydrology of the wetlands on the site including: 1) **the lack of continuity between the bedrock and surficial aquifers**; 2) the variability of the hydraulic conductivities within the soil layers causing perched water tables;" (page 12, Barr June 2, 2008, Indirect Wetland Impacts at the Mine Site).
and

7) "**Wetlands generally have a perched surficial water table and no interaction with the bedrock aquifer.**" (page 12, Barr June 2, 2008, Indirect Wetland Impacts at the Mine Site).

8) "Because of the **general lack of interaction between the surficial and bedrock aquifers**, the hydrology of many wetlands at the Mine Site is primarily supported by direct precipitation with some variable surficial groundwater components from the uplands." (PFEIS Page 4-167, lines 191-193)

9) "indicating that **the connection between the bedrock, unconsolidated deposits, and wetlands may be be relatively weak.**" (PFEIS, page 4-168, line 246)

The above quotes are a few examples of the many statements in the EIS materials that contend that the surficial aquifer, and in particular wetlands, are isolated from the bedrock.

The sections of the Water Modeling Da ckage (WMDP) are available as part of the PFEIS package.
The Barr June 2, 2008, Indirect Wetland Impacts at the Mine Site is available at:
https://app.box.com/s/fj9lfpppml5a1av2himffyi3c0opjia9
and is cited in the PFEIS as Barr 2008hfs

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● MEMBER TRIBES ●

MICHIGAN	WISCONSIN		MINNESOTA
Bay Mills Community	Bad River Band	Red Cliff Band	Fond du Lac Band
Keweenaw Bay Community	Lac Courte Oreilles Band	St. Croix Chippewa	Mille Lacs Band
Lac Vieux Desert Band	Lac du Flambeau Band	Sokaogon Chippewa	

Via Electronic Mail / Original by Mail August 11, 2015

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Environmental Policy and Review
Division of Ecological Services
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Re: Comments on PolyMet mine site contaminant northward flowpath and groundwater model calibration.

NorthMet EIS Co-lead Agency Project Managers:

Following up on the web-meeting of July 22, emails of February 26, April 10 , April 20, letter of June 18 and emails of July 21 and July 29, we will clarify our concerns related to a northward flowpath and model calibration These comments are based on: 1) our letter of June 18th; 2) the materials provided in the Co-lead Agency draft memos on a northern flowpath and model calibration; 3) the webinar/meeting conducted July 22, 2015; 4) materials in the PFEIS of June 2015; and 5) further analysis. Since before 2008, GLIFWC staff have consistently raised concerns about the quality and validity of the groundwater characterization at the mine site. Most recently it has come to our attention that the mine site MODFLOW model was incorrectly bounded and calibrated and unlikely to provide the hydrologic characterization of the site that is needed in order to perform adequate project impact evaluations. It has also come to our attention that detailed (MODFLOW) and simplistic (MathCad) models predict that a northward contaminant flowpath is probable under likely closure conditions.

GLIFWC is acting in coordination with our member tribes, including the Fond du Lac Band, to review and contribute to the PolyMet EIS process. As you may know, GLIFWC is an organization exercising delegated authority from 11 federally recognized Ojibwe (or Chippewa) tribes in Wisconsin,

Michigan and Minnesota.[1] Those tribes have reserved hunting, fishing and gathering rights in territories ceded in various treaties with the United States. GLIFWC's mission is to assist its member tribes in the conservation and management of natural resources and to protect habitats and ecosystems that support those resources. The proposed PolyMet mine is located within the territory ceded by the Treaty of 1854.

Mine-site MODFLOW model calibrated to conditions that did not exist in the 1980s, do not exist now and will not exist in the future:

The existing Northshore Peter-Mitchell (P-M) taconite mine pits on the north side of the PolyMet project area play a significant role in the groundwater hydrology of the project site. In the applicant's groundwater model of 2014 (and earlier versions), documented in the "Water Modeling Data Package Vol 1-Mine Site v13 DEC2014.pdf" (WMDPv13), those pits supply approximately 90% of the groundwater baseflow to the upper Partridge River (see GLIFWC email of 4/20/2015). It is not surprising that those taconite pits play a significant role in the local groundwater hydrology since they are positioned high in the local terrain, at times contain large volumes of water, and sit in relatively high conductivity bedrock (Biwabik Iron Formation or BIF and Virginia Formation). Because they play a dominant role in the local hydrology, it is critical that they be correctly incorporated into the project hydrologic modeling.

Unfortunately, the existing project MODFLOW model for the PolyMet mine site was calibrated using P-M taconite pit water levels that were 13 or more meters too high. The project model incorporates the P-M pits as constant-head-cell boundary conditions (Large Figure 7 of Attachment B of the WMDPv13, attached as Figure 1**)**. The project model sets the P-M pit lakes as constant-head-cells approximately 5 meters above the level of the upper Partridge River, yet pit lakes during the period when flow data was collected (1979-88) were actually well below the elevation of the upper Partridge. Because of this error, the calibration model has the local direction of groundwater flow from the pits 180 degrees reversed from the actual conditions during the calibration period. The model predicts that during the calibration period water was flowing from the hydrologic high at the P-M pits to the hydrologic low at the upper Partridge River, when in fact, because the pits were partly to completely empty, water would have been flowing from the upper Partridge River to the P-M pits.

Attached is a figure that shows the predicted water tables and groundwater flow between the upper Partridge and the P-M pits when the P-M pits are set at different levels (attached as Figure 2). In red are the project model results used in recent and past project reports. In those models the P-M pits are assumed to be at their 1996 elevation of 493 meters. The 483 meter model (in purple) is the same as the project model except that the water levels in the P-M pits, that are adjacent to the upper Partridge, are set to 483 meters. An average pit water elevation of less than 480 meters appears to be the correct elevation for the calibration period of 1979-1988 (attached as Table 1). Calibration and use of the MODFLOW model with the P-M pits erroneously set to the unusually high conditions in 1996 (493 meters) is a problem for the following reasons:

- The baseflow used in formulating (calibrating) the PolyMet project MODFLOW mine site

1 GLIFWC member tribes are: in Wisconsin -- the Bad River Band of the Lake Superior Tribe of Chippewa Indians, Lac du Flambeau Band of Lake Superior Chippewa Indians, Lac Courte Oreilles Band of Lake Superior Chippewa Indians, St. Croix Chippewa Indians of Wisconsin, Sokaogon Chippewa Community of the Mole Lake Band, and Red Cliff Band of Lake Superior Chippewa Indians; in Minnesota -- Fond du Lac Chippewa Tribe, and Mille Lacs Band of Chippewa Indians; and in Michigan -- Bay Mills Indian Community, Keweenaw Bay Indian Community, and Lac Vieux Desert Band of Lake Superior Chippewa Indians.

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model was calculated from flow conditions in the 10 years of 1979 through early 1988. During calibration, the MODFLOW model was adjusted until the baseflow it predicted matched the 0.51 cfs baseflow target at station SW003, where the Dunka Road crosses the Partridge River.

- The water level in the P-M pits used as boundary conditions when calibrating the project model was assumed to be 493 meters elevation, the water elevation in 1996. This level is much higher than any water levels that occurred during the period when flow was measured.

- The average water level in the P-M pits, when the baseflow at SW003 was estimated to be 0.51 cfs (i.e. in the 10 years of 1979 to early 1988), was actually more than 13 meters lower, at less than 480 meters.

As the diagram shows, with the pit water levels that occurred in November of 1986 (i.e. ~483 meters), the upper Partridge would have been losing water to the pits and would have had no baseflow. The water table would have sloped down northward from the Partridge River toward the P-M taconite pits. This is because the riverbed of the upper Partridge River is at 486-489 meters elevation, whereas the water levels in the adjacent P-M pits were at approximately 483 meters elevation in 1986. Average water levels in the P-M pits during the 10 years for which baseflow was calculated (1979-1988) were *even lower* than the 483 meter elevation found in 1986.

Water levels in the P-M Area003-East pit increased from an elevation of less than 478 meters in 1979 to 488 meters in the fall of 1987. During most of that period the Area003-East pit was empty, i.e. less than 478 meters elevation. In contrast the 1996 water level used for the Area003-East pit was 492.6 meters elevation. The P-M pit water levels were not vaguely "variable" as stated in the draft memo on calibration, but rather consistently well below the levels used in the Barr MODFLOW modeling. The 1996 water level used for the P-M pits as a boundary condition in the modeling was abnormally high. Such high levels did not occur in the 1980s, do not occur now and will not occur at closure.

The significance of this is that the MODFLOW model was calibrated (adjusted to fit reality) to average baseflow calculated for 1979-88, yet the P-M pit water levels used as boundary conditions in calibration were the unusually high levels that occurred in 1996, not those that occurred in 1979-88 or those that occur now. A fundamental requirement of model calibration is that the calibration targets (i.e. baseflows) and the model boundary conditions (i.e. the water levels in the taconite pits) must be from the same time period. The hydrologic system in 1996 was significantly different from the system in 1979-88 because the water levels in the taconite pits were so different. The result of this mis-match of boundary conditions and calibration targets is that the model is incorrectly calibrated and can not be expected to produce accurate predictions. The model gives the impression of generating reasonable results but is based on conditions that never existed at the same point in time. The 1996 boundary conditions in the form of P-M pit water levels did not occur in the 1980s, do not occur now and are not expected to occur in the future. Given the importance of the P-M pit water elevations as boundary conditions, this is a critical flaw.

Contrary to statements in the WMDP (v13) section on Model Technical Review Checklist, the MODFLOW model was not evaluated to sensitivity of some of the most significant boundary conditions, the Constant-head boundary conditions representing the P-M pits. If such evaluation had been done, it would have been obvious that the model was very sensitive to the levels specified at those pits. Our analysis suggest that approximately 90% of upper Partridge River baseflow comes from the P-M pits when the P-M are at their 1996 level and the shape of the watertable and bedrock potentiometric surface is highly dependent on the P-M pits boundary condition in the model.

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Sensitivity analysis as a substitute for correct model bounding and calibration:

It has been proposed that sensitivity analysis can substitute for understanding site hydrology. While sensitivity analysis on a properly bounded and calibrated model provides insights on the range of possible predictions, sensitivity analysis conducted on a grossly mis-configured model can not be depended upon. The closure period model, on which the sensitivity analysis was conducted, was configured with boundary condition in the form of P-M pit water levels at their 1996 levels, over 300 feet higher than the water levels actually expected at the time of PolyMet closure. Those P-M pits are close to the center of the model used for sensitivity analysis and, therefore, erroneous boundary conditions of this magnitude invalidate the results of the sensitivity analysis.

Northward Flow of Contaminants from PolyMet Pits and Category 1 Stockpile at Closure:

Northward flow in the bedrock aquifer:

The project mine site MODFLOW model distributed to cooperating agencies on January 5, 2015 was used by the applicant to predict that contaminants would flow from the mine site at closure to the south and south-east (for example: Large Figures 28 & 29 of the WMDPv13, attached as Figures 3 and **4**). In those project model runs of closure conditions, the water levels in the P-M taconite pits were assumed to remain at the level found in 1996. At closure the P-M pits will not be at 1996 levels but over 300 feet lower. In fact those 1996 levels were atypical; they did not occur in the 1980s, do not occur now and will not occur at closure. A plot of water levels in the Area003-East P-M pit, the pit closest to the PolyMet east pit, shows how atypical the mid-1990s water levels were (attached as Figure 5). In the project predictive models of closure conditions, the adjacent taconite pits to the PolyMet project site were set to have a 1996 water elevation of 1616 feet or 493 meters. However, the P-M taconite pit water levels expected at P-M pit closure are 1300 feet or 396 meters. After reflooding of the P-M pits, the water levels in those pits will be maintained by an outfall in the north-east at 1500 feet or 457 meters (see figure from the Northshore Watershed Mitigation Plan of 2011, attached as Figure 6).

Given the large effect that the project groundwater MODFLOW model and ERM's MathCad cross-section model indicate the water in the taconite pits has on the local bedrock hydrology, one would expect that a large change in the elevation of the water in the taconite pits would have a significant impact on local hydrology and predictions of closure conditions. The close proximity of the P-M pits to the Partridge River and PolyMet mine features (attached Figure 7) suggests that the taconite mine pits would impact the hydrology of these features. In fact, runs of the project model indicate that the groundwater flow direction between the PolyMet project and the taconite pits would be reversed if the taconite pits had the correct P-M pit closure water elevation of 396 meters or even the very long-term level of 457 meters (attached as Figure 8). This initial modeling, conducted by GLIFWC, limited the amount of water that could be lost by the Partridge River to the aquifer because the Partridge can not be an infinite source of water. However, supplemental modeling such as that provided during the July 22nd meeting, (see email of July 21 "Materials for July 22nd modeling discussion, part 2", attached as Attachment A) had no such limitation, yet still showed a strong bedrock gradient toward the P-M taconite pits at closure. That supplemental modeling, without limiting leakage from the bottom of the Partridge River, showed a steep bedrock groundwater gradient from the PolyMet east pit to the P-M pits at closure water levels of 1300 ft (396 meters) and 1500 ft (457 meters) (attached as Figure 9). Additional MODFLOW modeling with recharge to the top of the model set at over 8 in/yr also showed northward flow from the PolyMet project at closure. Under this high recharge modeling scenario, a

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small mound does develop in the bedrock aquifer but not one large enough to prevent northward flow. Development of a groundwater mound is limited, not because of low recharge, but because of the low vertical conductivity of the surficial deposits and the strong pull of the low water levels in the P-M pits.

Northward flow of groundwater is in agreement with ERM's Mathcad model which shows bedrock water levels sloping steeply to the north given the water levels expected at closure of the P-M pits. According to ERM's MathCad analysis, only if a groundwater mound forms in the bedrock would flow to the north not occur (attached as Attachment B). Formation of such a substantial mound by movement of water downward from the 100 Mile Swamp is simply not possible given the hydrogeology defined by project documents (e.g. WMDPv13 Table 3-4, attached as Table 2).

The draft co-lead memo on a northward flowpath correctly states that:

> "for the case where downward leakage is negligible ..., the mound does not develop, there is no drainage divide, and the bedrock system would have continuous northward flow from the proposed NorthMet East Pit to the Northshore pits."

and

> "a key factor in the conceptual model is the amount of downward leakage from the surficial deposits into bedrock."

The memo goes on to state that at least 8 inches/year of leakage into the bedrock would be necessary to prevent northward flow. What has not been demonstrated is that the 8 inches per year of leakage into the bedrock is theoretically possible, given the low vertical conductivity of the overlying wetlands.

The result, from both the project MODFLOW model runs with the correct closure water elevations and ERM's MathCad model runs, indicate that water in bedrock will flow to the north from the PolyMet site at closure, unless a bedrock groundwater mound forms. No feasible natural mechanism for such a mound has been articulated. A bedrock groundwater mound at the level necessary to prevent northward flow, i.e. a mound of elevation of approximately 1600 feet, appears to be hydrologically impossible without long-term active management. Northward flow would be primarily from the PolyMet east pit and, despite attempted containment in the surficial aquifer, from the Category 1 stockpile. These flowpaths have been overlooked in project evaluations of contaminant transport. The current project contaminant transport modeling, which assumes contaminant flow paths only to the south and south-east, is incomplete because it is based on the incorrect assumption of 1996 era water levels in the taconite pits, even during closure, a water level that is more than 300 feet too high.

Northward flow in the surficial aquifer:

In addition to potential for northward flow of contaminants in the bedrock that is documented in our previous correspondences, including our email of July 21 ("Materials for July 22nd modeling discussion, part 2", attached as Attachment A) and ERM's MathCad modeling, there is evidence that flow may be to the north in the surficial aquifer. In the examples from other taconite pits represented by Figures 2 and 3 of the Barr June 4th memo (attached as Figures 10 and 11), accounting for the compressed x-axis scale, the cross-sections appear to show that the cone of depression caused by taconite pits extends 1.4 to 1.5 miles from the pits in the surficial aquifer. The PolyMet east pit is only 1.2 miles and the Category 1 stockpile is only 0.8 miles from the edge of the final Peter-Mitchel pit (attached as Figure 7). Preliminary MODFLOW modeling of the surficial aquifer shows northward flow of contaminants from the PolyMet east pit in the surficial aquifer. This is the case if model recharge is limited to the 0.75 in/yr used in the PolyMets closure model (PFEIS page 5-27) but also if the model is run with more than 8 in/yr of recharge to the surficial aquifer. The drawdown by the over 300 foot deep

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taconite pits is so great that the surficial aquifer becomes partly dewatered and all baseflow in the upper Partridge ceases.

Importance of understanding groundwater hydrology for prediction of surface water impacts:

Adequate characterization of the groundwater system at a proposed mine site is essential to understanding most of the potential impacts from the project. The amount of water entering the groundwater system, be it precipitation or discharge from the bed of lakes, rivers or mine pits, determines the direction of flow and dilution of contaminants, and dictates points of compliance for both ground and surface waters. The horizontal and vertical conductivity of the soil and bedrock materials determines how the groundwater system responds to stresses and the rate at which the groundwater flows horizontally and vertically. The character of interaction between surface water features and the groundwater system, whether it is loss of water from rivers or wetlands to the groundwater system, or discharge from the groundwater system to the surface water features, determines predicted impacts to surface water features by stresses such as mine dewatering. Estimating water budgets and quantities of water that must be treated requires an adequate understanding of the groundwater system. None of the above effects of a mine project can be predicted accurately if there is not an adequate characterization of the groundwater system. Without an integrated model of the groundwater system, one would be left with only professional judgment to determine the value of the many interrelated parameters that are used for impact prediction. Professional judgment is useful in checking the reasonableness of the predictions from a groundwater model but, by itself, can not adequately integrate the complex site specific information, all pieces of which must fit together like a complex puzzle.

The essential role of groundwater system characterization, characterization that integrates information from the available sources into a coherent model, is demonstrated by the myriad of uses that the project groundwater model has been put to by the applicant during impact evaluation. We have compiled, from the text in the WMDPv13 and the PFEIS, references to the use of the groundwater modeling to predict impacts from the proposed project . Those uses range from contaminant flow direction and gradients (PFEIS page 5-26) to delineation of the Area of Potential Effect for cultural impacts (PFEIS page 4-309 and Figure 4.2.9-5). Project documents include very clear statements about the importance of MODFLOW in formulating impacts, for example the Water Modeling Data Package v13 Section 5.1.2.6 states:

> "Groundwater contours for the unconsolidated deposits and bedrock are the primary source of information used to delineate the flow path areas. The groundwater contours are from the Mine Site MODFLOW model"

The GoldSim contaminant transport modeling in particular uses many outputs from the MODFLOW groundwater modeling (attached as Table 3). These extend far beyond the original purpose of the groundwater model; which was to predict pit inflow, thus making it very clear that a valid model that characterizes site groundwater hydrology is foundational for impact prediction.

The project MODFLOW model was used to characterize the general nature of the groundwater system such as mine site head distribution (e.g. watertable, Large Figure 14 of the WMDPv13, attached as Figure 12), groundwater levels at closure (e.g. Large Figure 30 of Attachment B of WMDPv13, attached as Figure 13) and contaminant flow paths (Large Figures 28 & 29 of the WMDPv13, attached as Figures 3 & 4). In addition, the MODFLOW model was used to supply the numeric input parameters to the GoldSim model that is used for prediction of contaminant flow and contaminant concentrations (WMDPv13, Table 1-1). That table, attached as Table 4, identifies approximately 12 critical GoldSim input parameters that are outputs from the mine site MODFLOW groundwater model. Of those twelve,

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approximately 6 parameters are related to mine pit inflow; the rest of the 12 parameters relate to the groundwater system across the entire mine site. Those parameters include contaminant flowpath conductivity (K_flowpath), flowpath gradients (I_ops), bedrock porosity (Bedrock_Porosity), recharge (Recharge_min and Recharge_max) and flowpath gradients at closure (I_close). While some of these parameters, such as flowpath conductivity, are secondarily derived from MODFLOW outputs, MODFLOW is an input to calculation of the GoldSim parameter, as documented in WMDP(v13) Section 5.2.3.3.

It is clear that without the conceptual (flow directions etc.) and numeric (gradient, conductivity etc.) outputs from the MODFLOW model, the GoldSim model could not be run. Because of the dependence of the GoldSim modeling of contaminant transport on MODFLOW model outputs, it is essential that the MODFLOW outputs be valid. Because the MODFLOW model was incorrectly calibrated to baseflow from 1979-88 and bounded with taconite pit water levels from 1996 it is very unlikely that the MODFLOW outputs are correct. Not only was the calibration model incorrectly bounded but the predictive runs use the same abnormally high P-M pit water levels. In particular the predictive runs for long-term closure (MODFLOW run "SS_west_fill_Sept2014_1585ec1595" resulting in Large Figures 29 and 30, WMDPv13 and PFEIS Figure 5.2.2-7) use the 1996 taconite pit water levels that are over 300 feet higher than the expected closure water levels.

Need for a consistent conceptual model of site hydrology:

There are two conflicting conceptual models presented in the draft northward flowpath memo: 1) that surface water features are not well connected to the bedrock, e.g. the Argo & Iron Lakes examples, and a multitude of previous EIS documents arguing for separated surficial and bedrock aquifers and against wetland impacts (see email of July 29, 2015, attached as Attachment C); and 2) that surface water features are well connected to the bedrock aquifer and that the 100 Mile Swamp (a wetland) can supply at least 8 inches/year of leakage. These two arguments would seem to be mutually exclusive. Both arguments can not be used simultaneously to support the concept of a groundwater mound between the PolyMet and Peter-Mitchel projects. A third argument has been hinted at during meetings; that the bedrock between PolyMet and the P-M pits is of such low conductivity that the cone of depression from the mine pits does not extend any significant distance from the pits. This argument is not supported by the site-specific conductivity data collected on the Virginia Formation or the documented conductivity of the Biwabik Iron Formation (see PFEIS tables 4.2.2-5 and 5.2.2-7).

A coherent conceptual model needs to be articulated, either one in which surface water features are poorly connected to the bedrock aquifer and are therefore, unaffected by pit dewatering, or one in which surface water features are well connected to the bedrock aquifer and can provide leakage to support a groundwater mound between the PolyMet and Peter-Mitchel pits. If the first model is accepted then wetlands and the upper Partridge River may be little affected by pit dewatering but dewatering of the Peter-Mitchel pits causes a bedrock northward flowpath to develop at closure. If the second conceptual model is accepted then a bedrock groundwater mound develops, but wetlands and the upper Partridge River are severely impacted by PolyMet and Peter-Mitchel pit dewatering.

"Adaptive management" as a substitute for understanding the site and predicting impacts:

Given the uncertainty that the co-leads feel there is in characterization of contaminant flowpath direction, the draft co-lead memo of June 22 proposes several mitigations that attempt to prevent northward flow of contaminants. The feasibility of any of those measures has not been evaluated. Even with the minimal information presented in the memo, several obstacles to successful mitigation of a

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northward flowpath are evident: 1) The thickness of the low conductivity surficial deposits between the PolyMet site and the P-M pits, approximately 50 feet thick according to Minnesota Geological Survey 2005 publication M158, makes the practicality of an infiltration trench questionable; 2) Lowering of water levels in the the PolyMet pits would expose reactive Virginia Formation rock to air and water, creating acid generation and dewatering surrounding wetlands; 3) Groundwater injection or extraction wells may be a feasible, but costly, mechanism to block northward flow but, as noted in the memo, would require perpetual operation, care and replacement.

In addition to the proposed adaptive management appearing to be impractical, substituting 'adaptive management" for understanding of the hydrologic system is contrary to the NEPA concept of site characterization and impact prediction. NEPA is a forward looking process with the goal of anticipating and describing impacts so that measures can be taken to avoid or minimize those impacts. A northward flowpath for contaminants is indicated by both MODFLOW and MathCad. The character of the hydrology between the PolyMet and P-M projects needs to be described correctly so that impacts of that northward flowpath can be evaluated and the feasibility of mitigation measures can be determined.

In summary:

- The project mine site groundwater flow model (MODFLOW) was calibrated with multiple conditions that did not exist simultaneously, i.e. boundary conditions in the form of taconite pit water levels from 1996 and river baseflows from 1979-88. This means that the mine site model is not correctly configured and, therefore, unlikely to generate accurate predictions.

- The project model was configured and used by the applicant as a basis for contaminant transport predictions at closure. As configured, it predicts that contaminants would flow from the PolyMet site south to the Partridge River at project closure. However, if the model is configured with correct closure boundary conditions in the form of taconite pit water levels at their closure level of 396 meters (1300 feet) or the very long-term level of 457 meters (1500 feet), contaminants are predicted to flow to the north toward the P-M pits. This contaminant flow direction (to the P-M pits) is opposite the direction assumed for the current project contaminant transport modeling. The project contaminant modeling is incomplete because it does not evaluate northward flow of contaminants from either the PolyMet pits or the Category 1 stockpile.

- The conceptual model used for the basis of many of the conclusions in project reports and in the PFEIS text is that the taconite pits have little influence on the surrounding aquifer, regardless of whether they are full of water or pumped dry and that the surface water features are not hydraulically connected to the bedrock aquifer. However, the mine site MODFLOW model, which incorporates historical and site-specific conductivity data on the bedrock formations and is used by the applicant to predict closure conditions, indicates that the taconite pits have a profound impact on the surrounding aquifer. This is because the cone of depression caused by taconite pit dewatering extends well into the surrounding bedrock. Impact on the aquifer makes sense because of the relatively high horizontal conductivity of the bedrock in which the taconite pits sit.

-The current concept, articulated in the draft co-lead memo on a northward flowpath and the supporting MathCad modeling, appears to recognize the documented horizontal conductivities of the bedrock formations, yet seems to propose both the isolation of surface water features and the transmission of large quantities of water from surface water features to the bedrock. Both

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isolation and transmission are not simultaneously possible. A consistent conceptual model must be presented.

-Pit dewatering may induce significant quantities of water from the surficial aquifer into the bedrock. Although this would likely cause substantial wetland & stream impacts, natural formation of a groundwater mound in the bedrock, adequate to prevent northward flow, is impossible given the conductivities documented in the project materials.

The mine site groundwater model needs to be reconfigured to contain realistic water levels in the P-M taconite pits, both for a "current conditions" model and a "closure conditions" model, not the 1996 water levels that were unusually high. The predictive modeling for the post closure period must use the correct closure water elevations for the P-M pits which are 300 feet lower than the unusually high 1996 levels. Groundwater modeling with MODFLOW, with correct P-M pit closure water levels of 396 meters, and MathCad modeling, both indicate that at closure contaminants are likely to flow north in addition to the southward direction currently assumed by project reports. Evaluation of contaminate flow to the north must be conducted and impacts predicted. Sensitivity analysis and adaptive management can not be substitutes for consistent and rational characterization of site hydrology.

Sincerely,

John Coleman, GLIFWC Environmental Section Leader

cc: Randall Doneen, Environmental Review Unit Supervisor, MN-DNR
Brenda Halter, Forest Supervisor, Superior National Forest
Tamera Cameron, Chief, Regulatory Branch, St Paul District of the Army Corps of Engineers
Kenneth Westlake, NEPA Coordinator, USEPA Region 5
Nancy Schuldt, Water Projects Coordinator, Fond du Lac Environmental Program
Neil Kmiecik, GLIFWC Biological Services Director
Ann McCammon Soltis, Director, GLIFWC Division of Intergovernmental Affairs

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Subject:	Materials for July 22nd modeling discussion, part 2
From:	"john.coleman" <jcoleman@glifwc.org>
Date:	7/21/2015 3:41 PM
Attachments:	Fig.30_Attach.B_of_Water_Modeling_Data_Package_Vol_1-Mine_Site_v13_DEC2014.pdf (417 KB), Fig.30_with_Peter-Mitchel_pits_at_closure_level_of_1500ft.pdf (553 KB)
To:	"Johnson, Bill H (DNR)" <bill.johnson@state.mn.us>, Sedlacek.Michael@epa.gov, mwatkins@grandportage.com, NancySchuldt@FDLREZ.COM, blatady@boisforte-nsn.gov, est [...]

Closure period modeling files:
The Barr modeling file for the closure period is named "Steady_State_west_pit_filling_Sept2014_1585ft_ec1595ft.gwv" and "SS_west_fill_Sept2014_1585ec1595.nam ." It is the model run used to generate:

Large Figures 28 and 29 of the Water Modeling Data Package Vol_1-Mine_Site_v13_DEC2014, .pdf pages 510 & 511 (contaminant flowpaths)
and
Large Figures 29 and 30 of Attachment B of Water Modeling Data Package Vol_1-Mine_Site_v13_DEC2014, .pdf pages 713 & 714 (bedrock and surficial water levels)

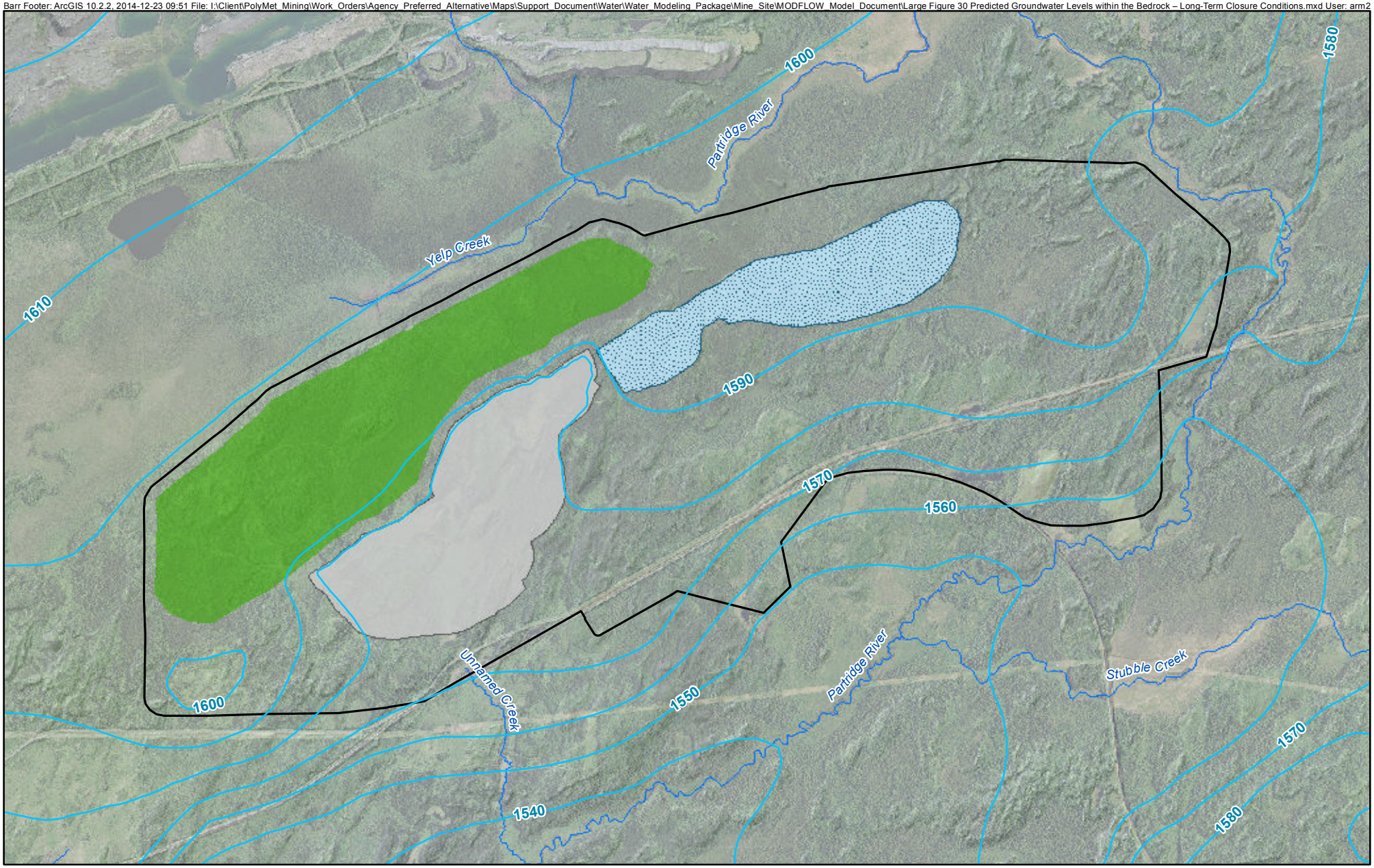
The model files were distributed to cooperating agencies by Bill Johnson in February of this year.
Is is described by Barr in an accompanying txt file as:
"Steady-state simulations of closure under baseline conditions:"
"West pit at 1585 feet MSL, East and Central pit at 1595 feet MSL:
Steady_State_west_pit_filling_Sept2014_1585ft_ec1595ft.gwv"

Polymet use of closure period modeling files:
Polymet predicted groundwater levels in the bedrock under long-term closure conditions using the MODFLOW model run referenced above. For example, the attached Large Figure 30 of Attachment B of the Water Modeling Data Package Vol_1-Mine_Site_v13_DEC2014 shows the bedrock water level contours predicted by that model run.
Those predicted contours were used in the Water Modeling Data Package to define flow paths (Large Figure 29 of the Water Modeling Data Package Vol_1-Mine_Site_v13_DEC2014). As stated on page 75 of the Water Modeling Data Package v13 (.pdf page 82):

> "Groundwater contours for the unconsolidated deposits and bedrock are the primary source of information used to delineate the flow path areas. The groundwater contours are from the Mine Site MODFLOW model"

Closure period model with correct closure levels:
Using the same model "Steady_State_west_pit_filling_Sept2014_1585ft_ec1595ft.gwv" except that water levels in the Peter-Mitchel taconite pits were set at their correct long term level of 1500 feet, we find that the model predicts different groundwater contours in the bedrock (figure attached). Neither "downward leakage" nor any other parameters in the model were modified. The contours predicted by the model when the P-M pits are at their long-term closure level of 1500 ft, indicate that there are bedrock flow paths to the north from the Polymet pits. At the time of Polymet closure, the P-M pits are expected to be at an elevation of approximately 1300 ft, amplifying the effect on the aquifer.

Barr Footer: ArcGIS 10.2.2, 2014-12-23 09:51 File: I:\Client\PolyMet_Mining\Work_Orders\Agency_Preferred_Alternative\Maps\Support_Document\Water\Water_Modeling_Package\Mine_Site\MODFLOW_Model_Document\Large Figure 30 Predicted Groundwater Levels within the Bedrock – Long-Term Closure Conditions.mxd User: arm2

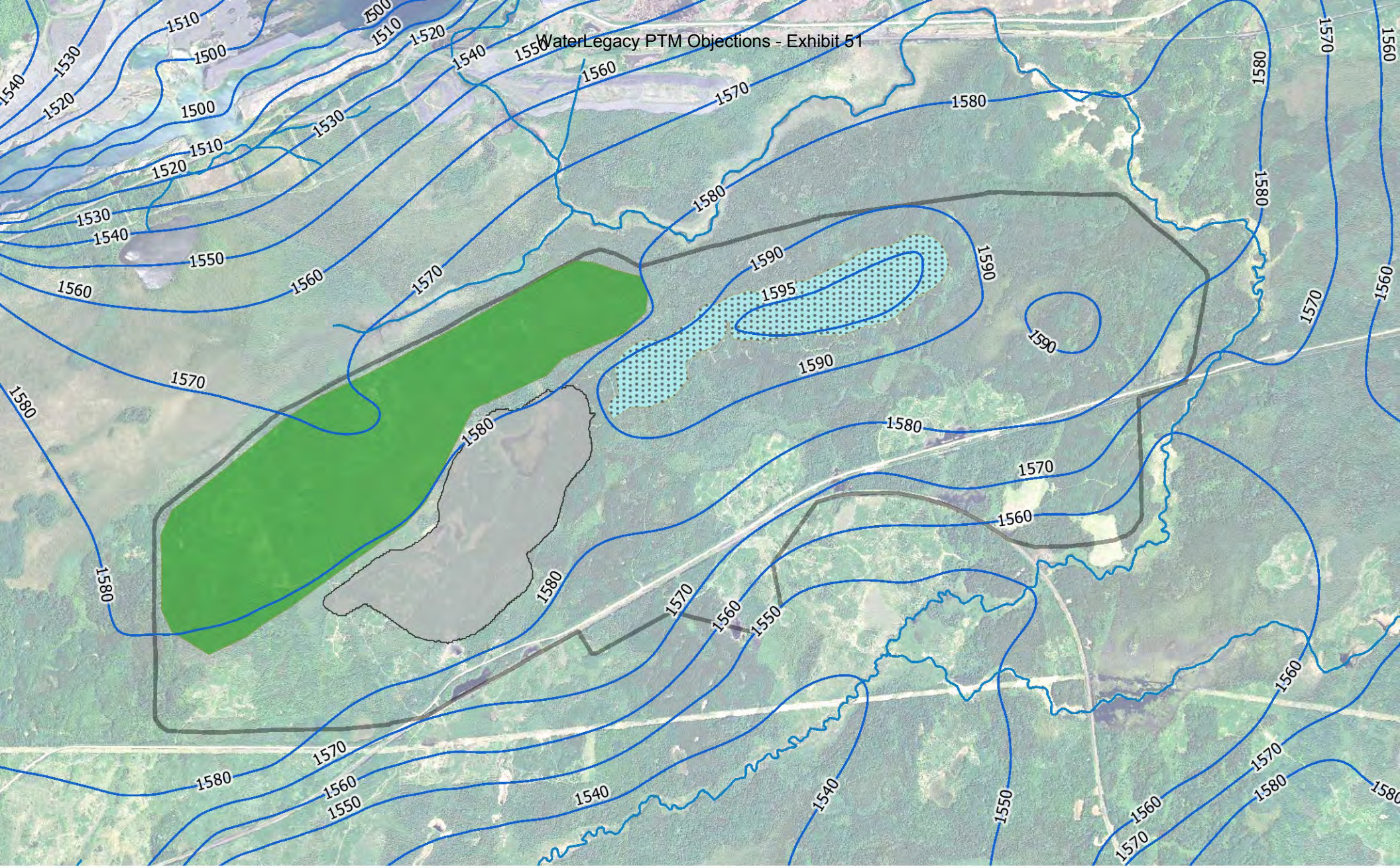


Simulated Piezometric Surface (feet)
Contour Interval = 10 feet
Project Areas
Covered Stockpile
West Pit
East Pit Wetland

N

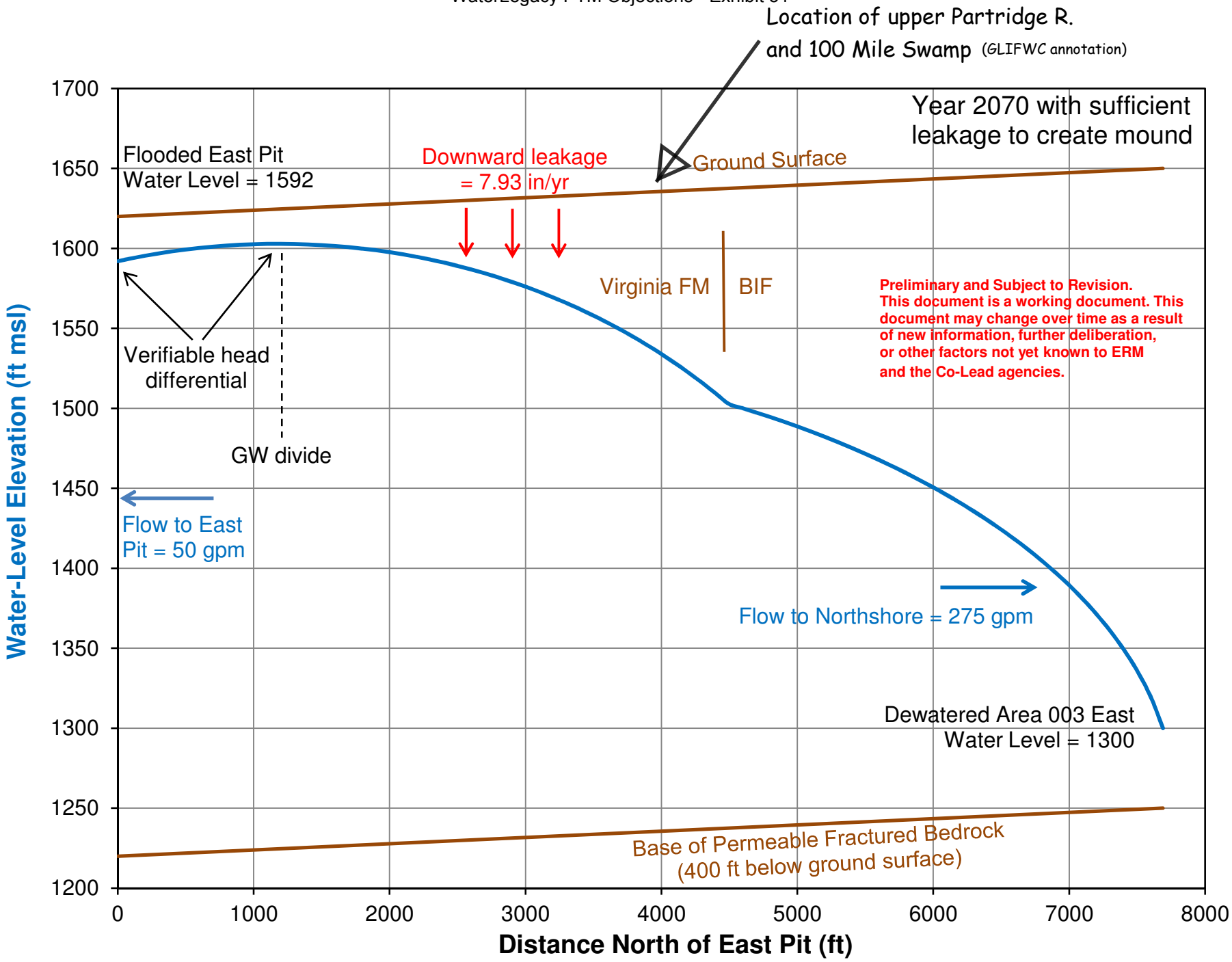
0 1,250 2,500 5,000
Feet

Large Figure 30
PREDICTED GROUNDWATER LEVELS
WITHIN THE BEDROCK –
LONG-TERM CLOSURE CONDITIONS
NorthMet Project
Poly Met Mining, Inc.



PREDICTED GROUNDWATER LEVELS
WITHIN THE BEDROCK -
LONG-TERM CLOSURE CONDITIONS
FOR NORTHMET
AND NORTHSHORE PROJECTS

GLIFWC, 2015-06-28


Location of upper Partridge R.
and 100 Mile Swamp (GLIFWC annotation)
Year 2070 with sufficient leakage to create mound
Flooded East Pit
Water Level = 1592
Downward leakage
= 7.93 in/yr
Ground Surface
Virginia FM
BIF
Preliminary and Subject to Revision.
This document is a working document. This document may change over time as a result of new information, further deliberation, or other factors not yet known to ERM and the Co-Lead agencies.
Verifiable head differential
GW divide
Flow to East Pit = 50 gpm
Flow to Northshore = 275 gpm
Dewatered Area 003 East
Water Level = 1300
Base of Permeable Fractured Bedrock
(400 ft below ground surface)
Water-Level Elevation (ft msl)
1700
1650
1600
1550
1500
1450
1400
1350
1300
1250
1200
0
1000
2000
3000
4000
5000
6000
7000
8000
Distance North of East Pit (ft)

Polymet - Leakage conditions for mound at year 2070

Units below are ft-day

$KK_1 := 0.31 \cdot \frac{ft}{day}$	Hydraulic Conductivity Upper Virginia Fm.	$K_1 := KK_1 \cdot ft^{-1} \cdot day$	$K_1 = 0.310$
$KK_2 := 0.9 \cdot \frac{ft}{day}$	Hydraulic Conductivity Biwabik Fm.	$K_2 := KK_2 \cdot ft^{-1} \cdot day$	$K_2 = 0.900$
$WW := 7.93 \cdot \frac{in}{yr}$	Downward leakage flux into bedrock	$W := WW \cdot ft^{-1} \cdot day$	$W = 1.81 \times 10^{-3}$
$LL := 7690 \cdot ft$	Length of flow system (East Pit to PMP)	$L := LL \cdot ft^{-1}$	$L = 7690.0$
$DD := 4490 \cdot ft$	Distance to Virginia/Biwabik contact	$D := DD \cdot ft^{-1}$	$D = 4490.0$
$ww := 4500 \cdot ft$	Flow tube width	$w := ww \cdot ft^{-1}$	$w = 4500.0$
$GG_o := 1620 \cdot ft$	Ground elevation at x=0	$G_o := GG_o \cdot ft^{-1}$	$G_o = 1620.0$
$HH_o := 1592 \cdot ft$	Head at x=0	$H_o := HH_o \cdot ft^{-1}$	$H_o = 1592.0$
$BB_o := 1220 \cdot ft$	Base elevation at x=0	$B_o := BB_o \cdot ft^{-1}$	$B_o = 1220.0$
$S_G := 0.0039$	Ground slope		$S_G = 0.00390$
$S_B := S_G$	Aquifer base slope		$S_B = 0.00390$
$QQ_o := -50gpm$	Inflow at x=0	$Q_o := QQ_o \cdot ft^{-3} \cdot day$	$Q_o = -9.625 \times 10^{3}$
$G(x) := G_o + S_G \cdot x$	Ground elevation	$G(0) = 1620.0$	$G(L) = 1650.0$
$B(x) := B_o + S_B \cdot x$	Base elevation	$B(0) = 1220.0$	$B(L) = 1250.0$
$K(x) := \begin{cases} K_1 & \text{if } x \le D \\ K_2 & \text{otherwise} \end{cases}$	Hydraulic conductivity distribution along flowpath		

Given $\quad H'(x) = -\dfrac{\frac{Q_o}{w} + W \cdot x}{K(x) \cdot (H(x) - B(x))} \quad H(0) = H_o \quad H := Odesolve(x, L)$ Governing ODE and BC

"Point-and-shoot" solution method

Iterate on QQ_o and/or WW until the head at x = LL is 1300 ft; that is, H(L) = 1300 $\quad H(L) = 1300.1$

This solution is for 1-D horizontal flow and accounts for:
Variable saturated thickness
Uniform downward leakage
Sloping aquifer base

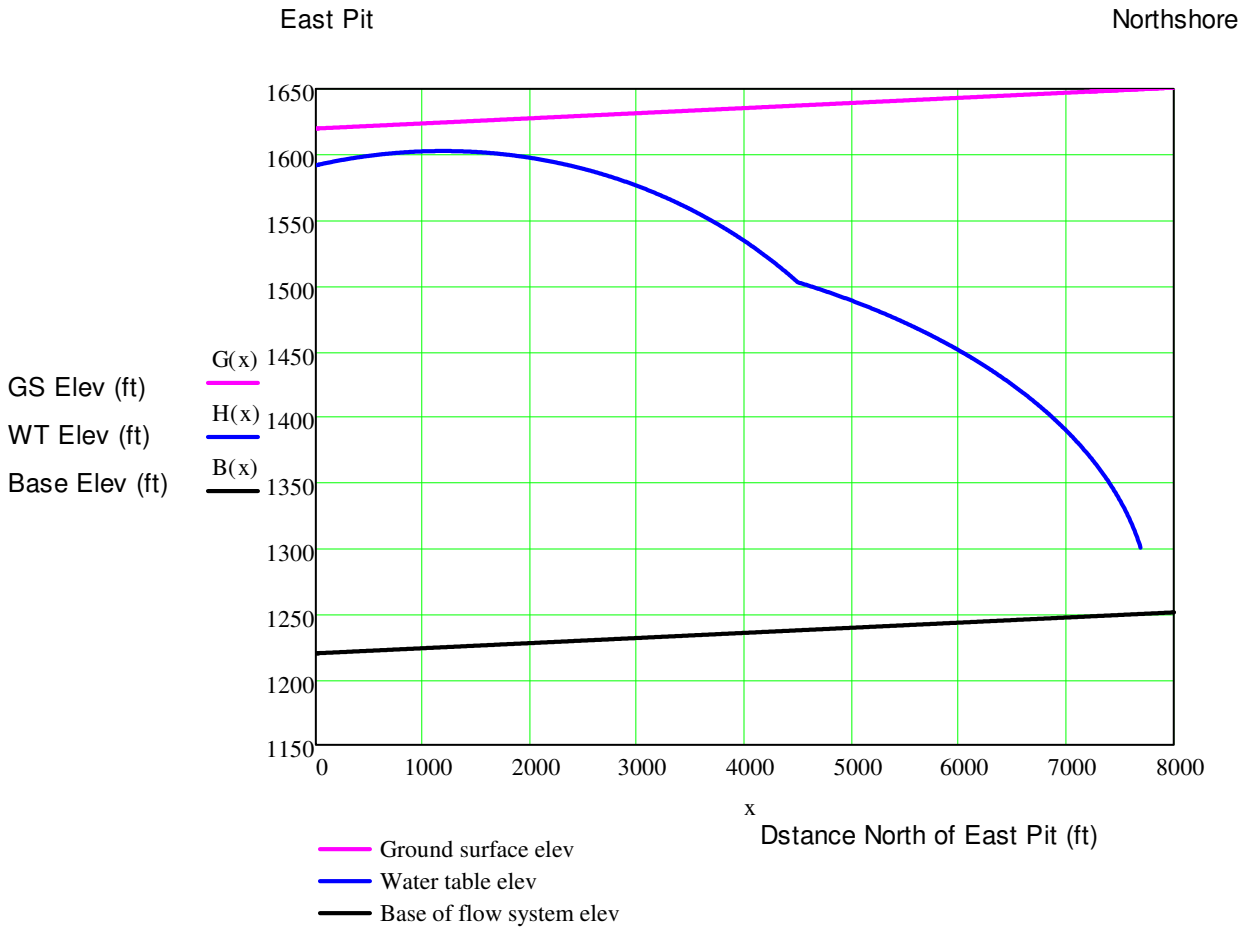
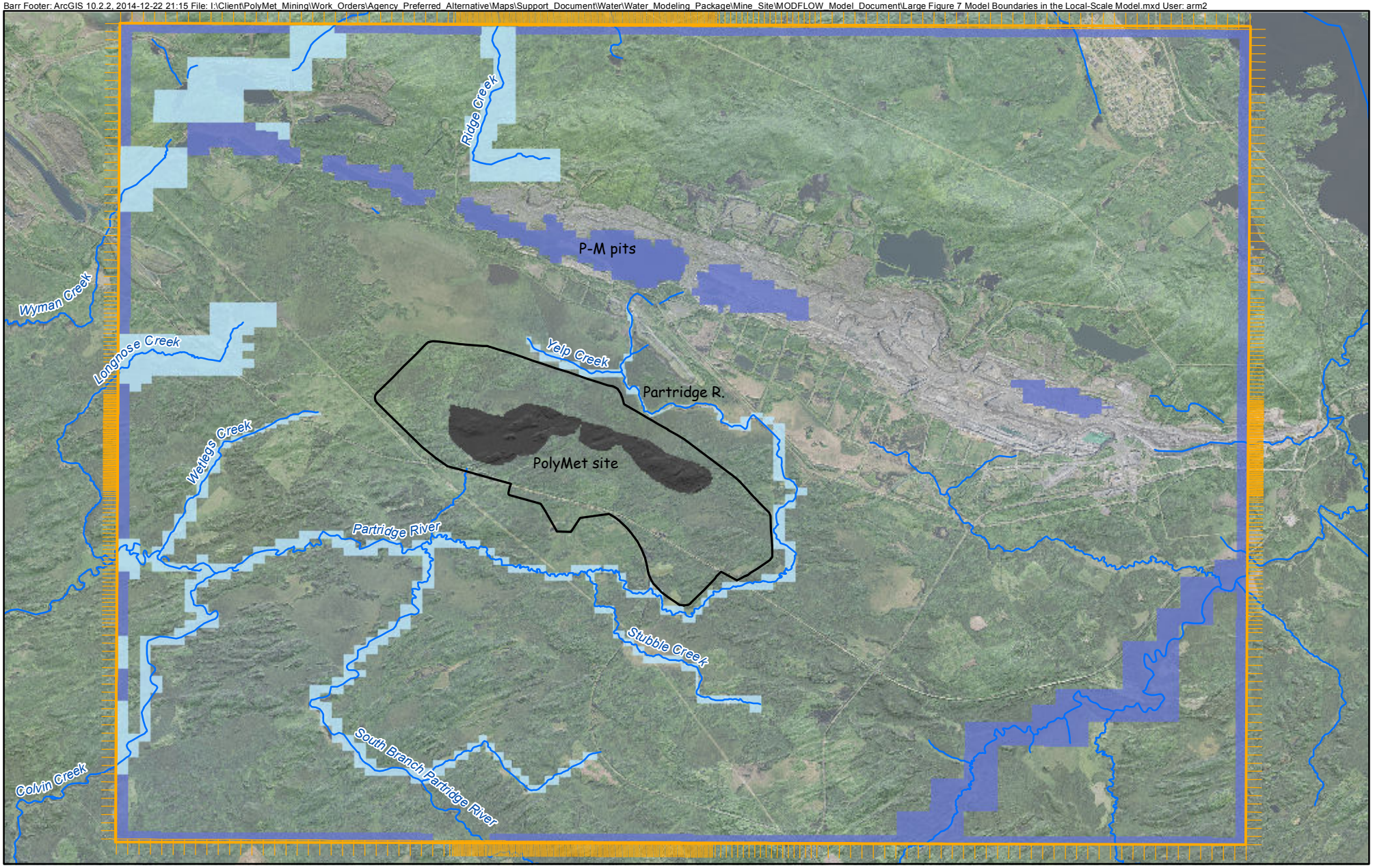

East Pit
Northshore
GS Elev (ft)
WT Elev (ft)
Base Elev (ft)
G(x)
H(x)
B(x)
1650
1600
1550
1500
1450
1400
1350
1300
1250
1200
1150
0
1000
2000
3000
4000
5000
6000
7000
8000
x
Dstance North of East Pit (ft)
Ground surface elev
Water table elev
Base of flow system elev

Figure 1

WaterLegacy PTM Objections - Exhibit 51

Barr Footer: ArcGIS 10.2.2, 2014-12-22 21:15 File: I:\Client\PolyMet_Mining\Work_Orders\Agency_Preferred_Alternative\Maps\Support_Document\Water\Water_Modeling_Package\Mine_Site\MODFLOW_Model_Document\Large Figure 7 Model Boundaries in the Local-Scale Model.mxd User: arm2



Local-Scale Model Area
Model Grid
Constant Head Cell
River Cell
Mine Site
Pits - Mine Year 11

0 0.65 1.3 2.6
Miles

Large Figure 7
MODEL BOUNDARIES IN
THE LOCAL-SCALE MODEL
NorthMet Project
Poly Met Mining, Inc.

Figure 2

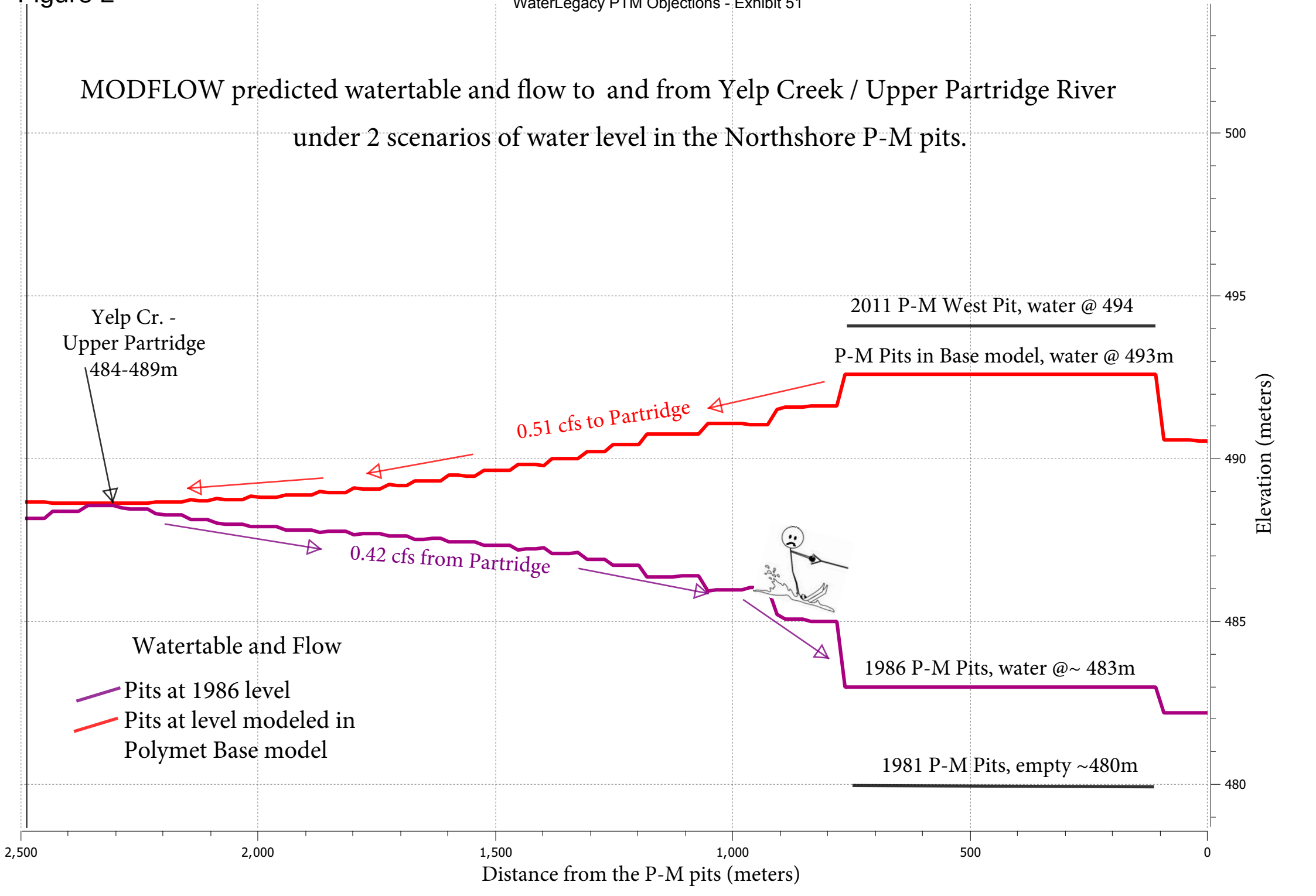
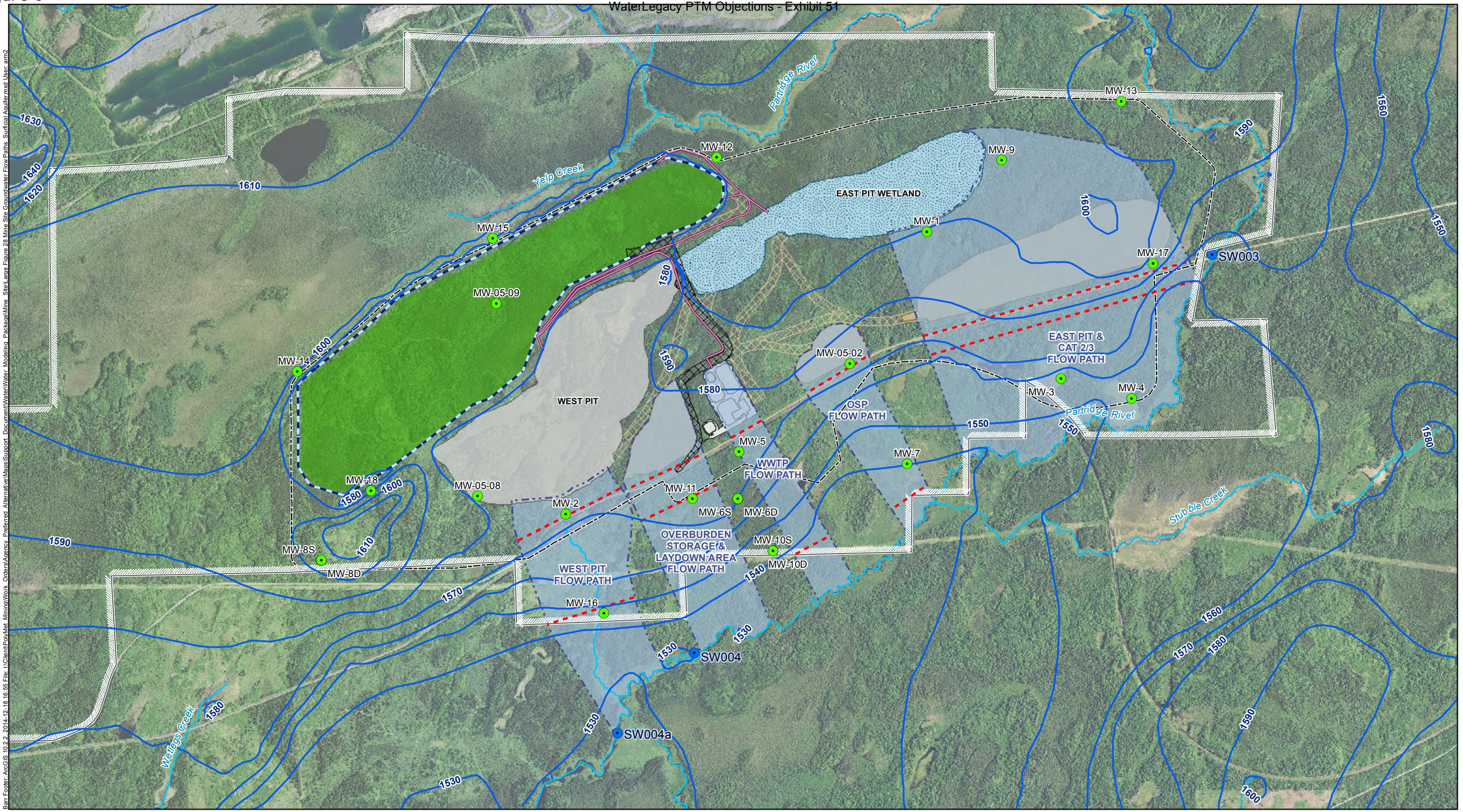

MODFLOW predicted watertable and flow to and from Yelp Creek / Upper Partridge River
under 2 scenarios of water level in the Northshore P-M pits.
Yelp Cr. -
Upper Partridge
484-489m
2011 P-M West Pit, water @ 494
P-M Pits in Base model, water @ 493m
0.51 cfs to Partridge
0.42 cfs from Partridge
1986 P-M Pits, water @~ 483m
1981 P-M Pits, empty ~480m
Watertable and Flow
Pits at 1986 level
Pits at level modeled in
Polymet Base model
500
495
490
485
480
Elevation (meters)
2,500
2,000
1,500
1,000
500
0
Distance from the P-M pits (meters)

Figure 2 - Profile of the water table between the upper Partridge and the P-M pits under 2 scenarios of water level in the pits.
The red stair-step line in the figure is the water table between the upper Partridge R. and the Peter-Mitchel taconite pits when the pits are at 493 meters elevation. Water is flowing from the pits to the upper Partridge R.
The purple stair-step line is the water table between the upper Partridge R. and the Peter-Mitchel taconite pits when the pits are at 483 meters elevation (the elevation that they had in 1986). In the 483 meter model run, water is flowing from the upper Partridge R., to the P-M pits.

Figure 3



Mine Features
- West Pit
- East Pit Wetland
- Reclaimed Stockpile
- Removed and Reclaimed Stockpile
- Haul Roads
- Reclaimed Haul Roads

- Surface Water Monitoring Location
- Groundwater Monitoring Location
- Groundwater Containment System
- Process Water Pipe
- Groundwater Elevation Contours (Ft) at Closure[1]

[1] Inferred water table contours were developed using contours from the Mine Site MODFLOW model.

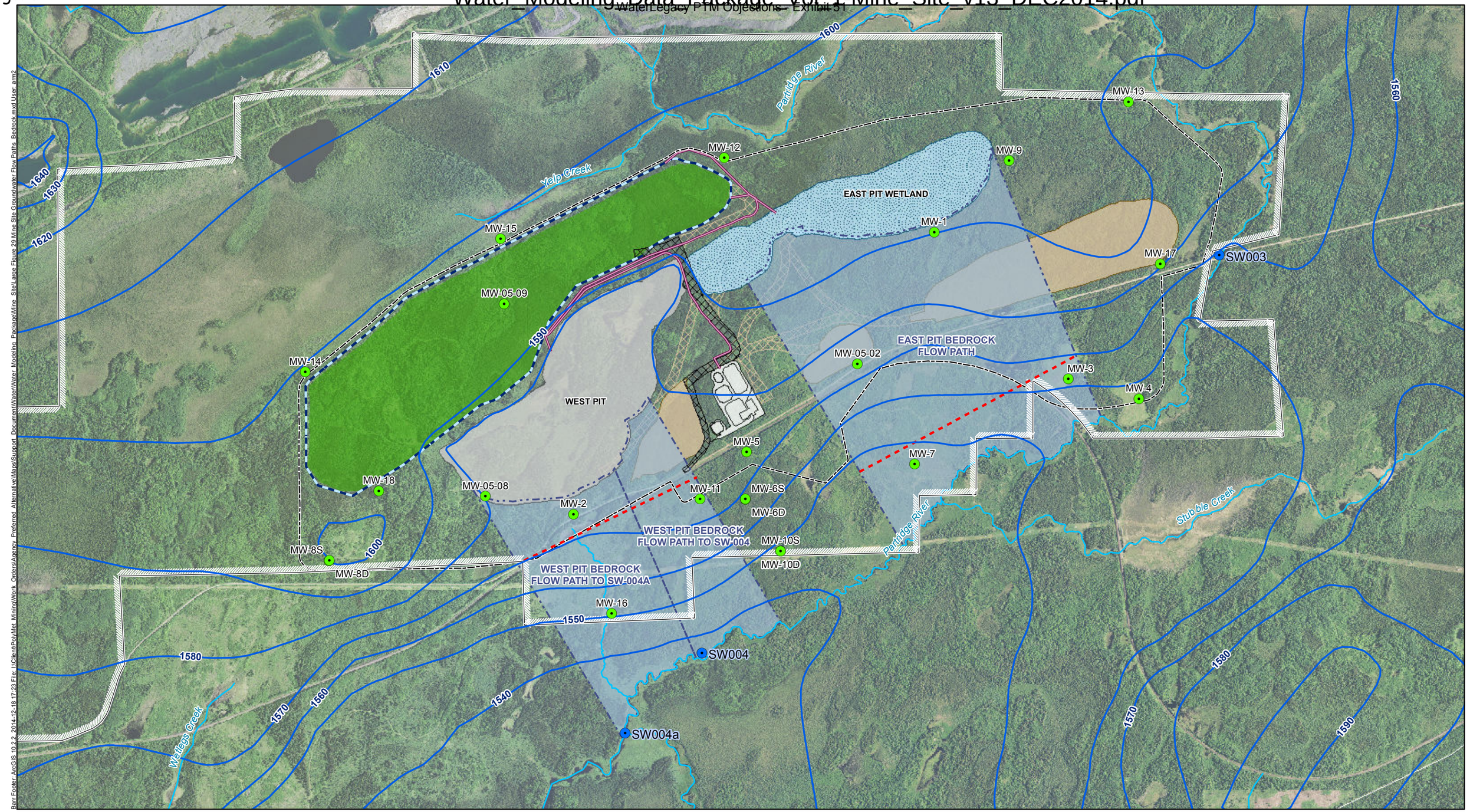
- Groundwater Evaluation Distances
- Groundwater Flow Path
- Mine Site
- Extent of Future PolyMet Lands

0 1,000 2,000 4,000
Feet

Large Figure 28
MINE SITE GROUNDWATER FLOW PATHS - SURFICIAL AQUIFER
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN

Figure 4

Water_Modeling_Data_Package_Vol_1-Mine_Site_v13_DEC2014.pdf



Mine Features
- West Pit
- East Pit Wetland
- Reclaimed Stockpile
- Removed and Reclaimed Stockpile
- Haul Roads
- Reclaimed Haul Roads

- Surface Water Monitoring Location
- Groundwater Monitoring Location
- Groundwater Containment System
- Process Water Pipe
- Groundwater Elevation Contours (Ft) at Closure[1]

[1] Inferred water table contours were developed using contours from the Mine Site MODFLOW model.

- Groundwater Evaluation Distances
- Groundwater Flow Path
- Mine Site
- Extent of Future PolyMet Lands

0 1,000 2,000 4,000
Feet

Large Figure 29
MINE SITE GROUNDWATER FLOW PATHS - BEDROCK
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN

Figure 5

Water Levels in Peter-Mitchel Area003-east pit

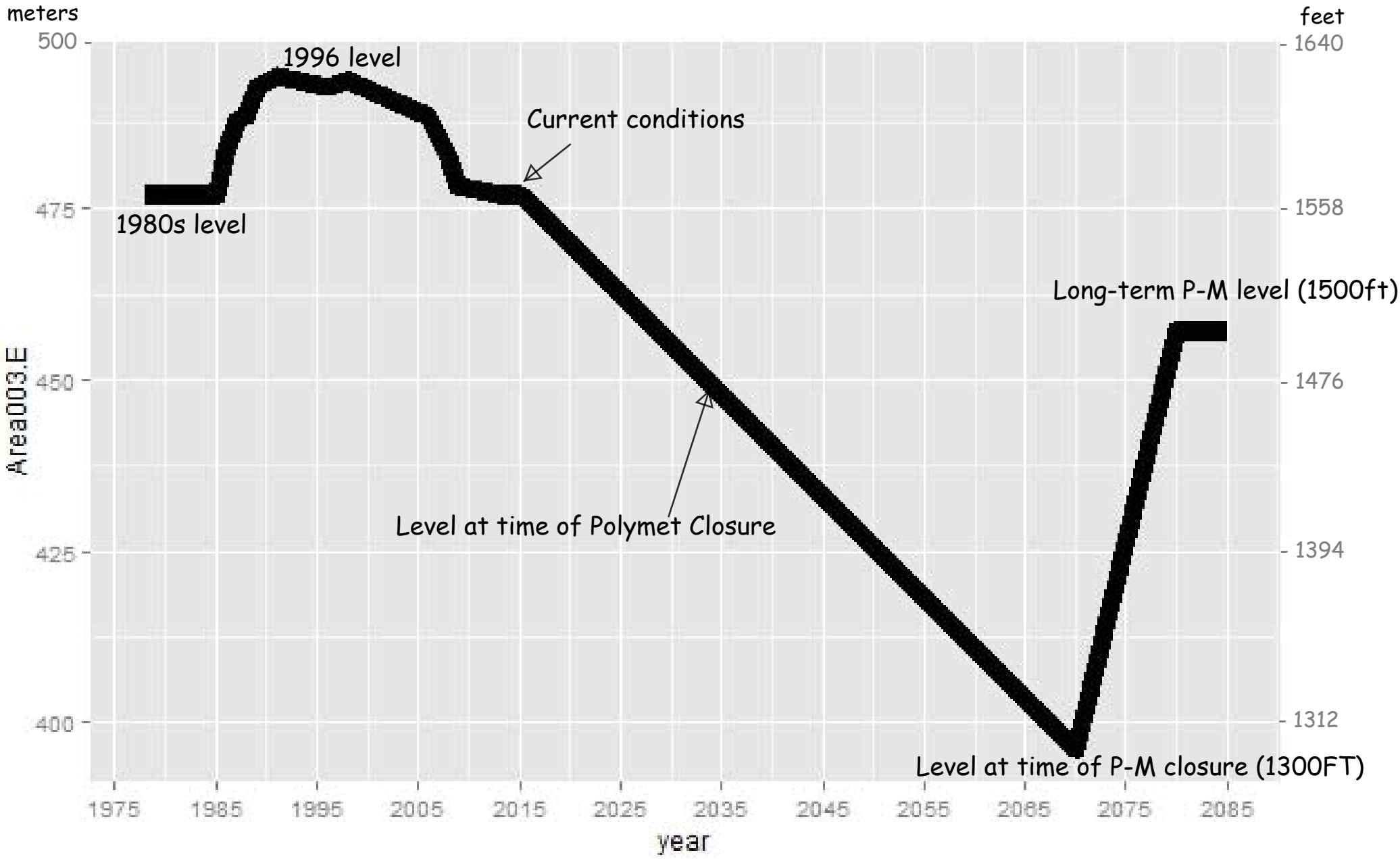
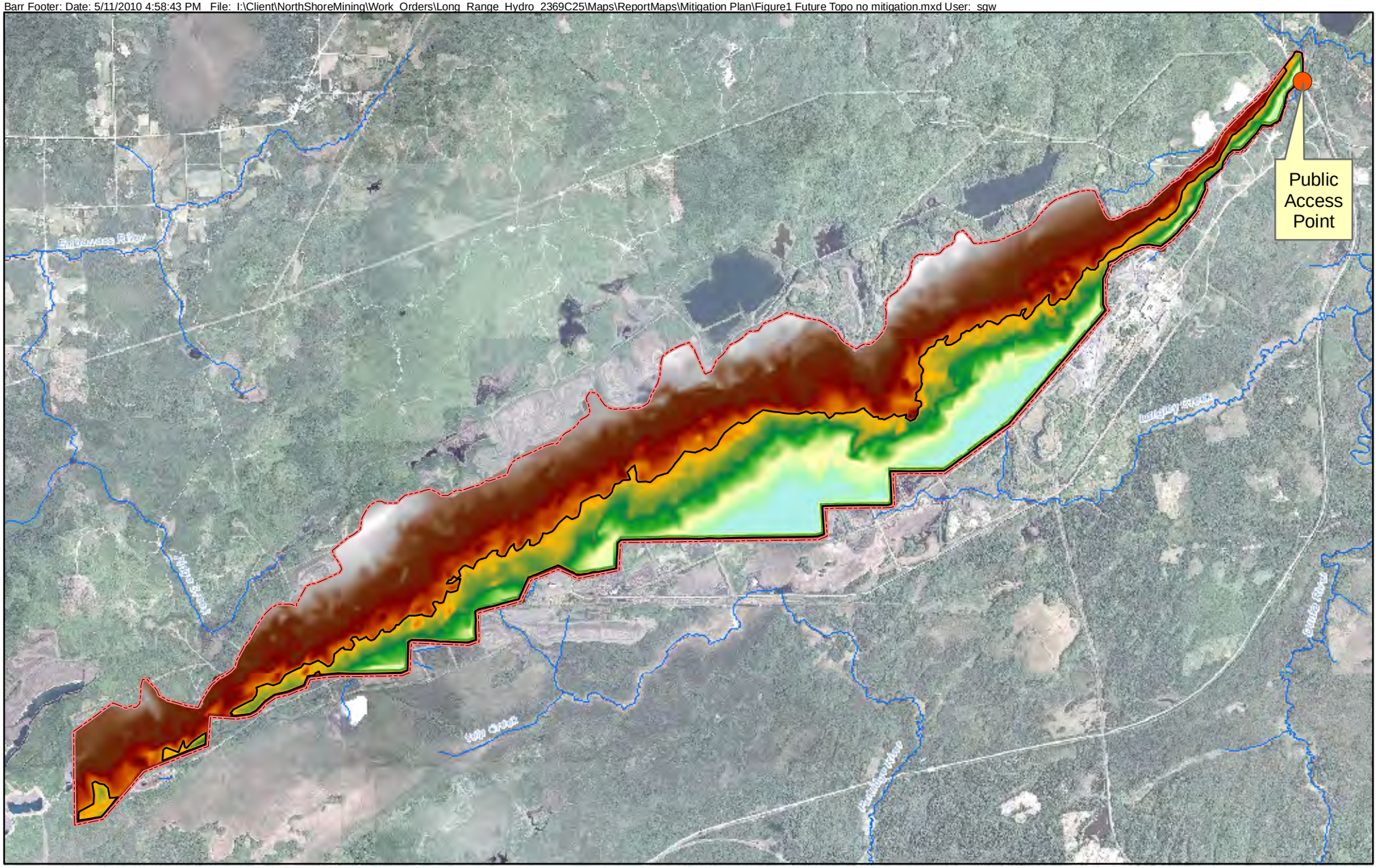


Figure 6

WaterLegacy PTM Objections - Exhibit 51

Barr Footer: Date: 5/11/2010 4:58:43 PM File: I:\Client\NorthShoreMining\Work_Orders\Long_Range_Hydro_2369C25\Maps\ReportMaps\Mitigation Plan\Figure1 Future Topo no mitigation.mxd User: sgw



1500 ft contour

Mine Site Boundary

Streams

Future Topography (no mitigation)

Elevation (feet)

High : 1785.95

Low : 1195.2

N

Kilometers

1 0 1 2 3

Miles

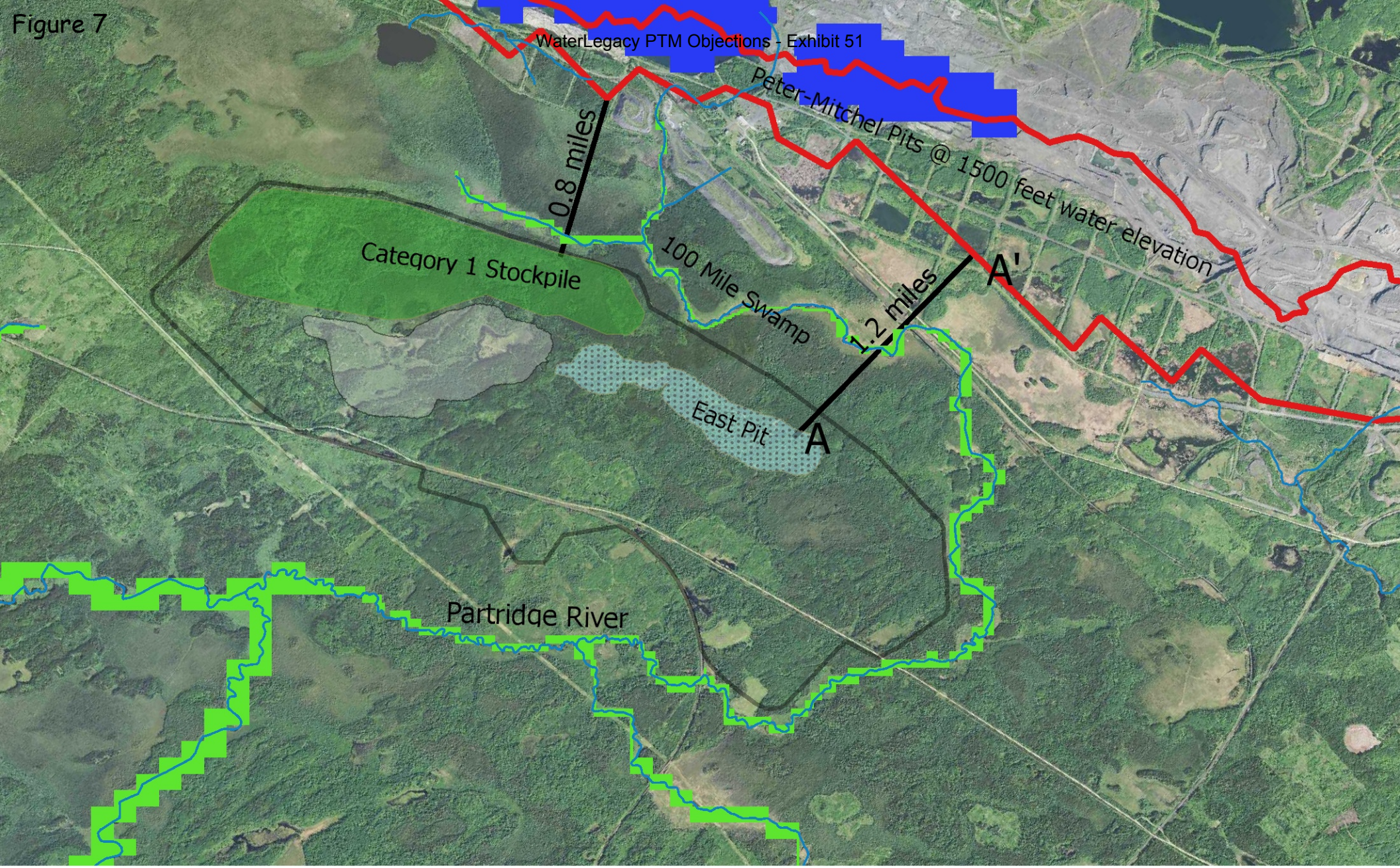
1 0 1 2

Figure 1

Ultimate Topography of the PMP (without Mitigation)
Peter Mitchell Pit Mitigation Plan
North Shore Mining
Babbitt, Minnesota

Figure from the Northshore Watershed Mitigation Plan of 2011. - A map of the Peter-Mitchel pit final lake water elevation from the Feb. 11, 2011 report titled "Watershed Mitigation Plan" (MDNR 2011s.pdf) which contains the May 2010 BARR Engineering document titled: "Peter Mitchell Pit Concept Mitigation Plan". That plan identifies the final status of the P-M pits as being connected into a long east-west pit that will be allowed to fill to a water elevation of 1500 ft (457 meters). The recreational lake formed by this filling is scheduled to passively discharge to a tributary of the Dunka River in the north-east. While the ultimate water level in the reflooded P-M pits is expected to be 1500 feet, in the interim, the taconite pit bottoms continue to be deepened to an elevation of approximately 1300 ft (396 meters). In 2011 the bottoms of the P-M pits ranged down to an elevation of 1394 feet (425 meters).

Figure 7



Outline of Peter-Mitchel1500 ft pit lake.

Project Areas

Cat. 1 Stockpile

West Pit

East Pit

2500 0 2500 5000 ft

Polymet pits and Category 1 stockpile at closure.
Northshore Peter-Mitchel pit lake at 1500 foot level

GLIFWC, 2015-08-06

Figure 8 Flow of particles when P-M pits are at closure levels (457 meters).

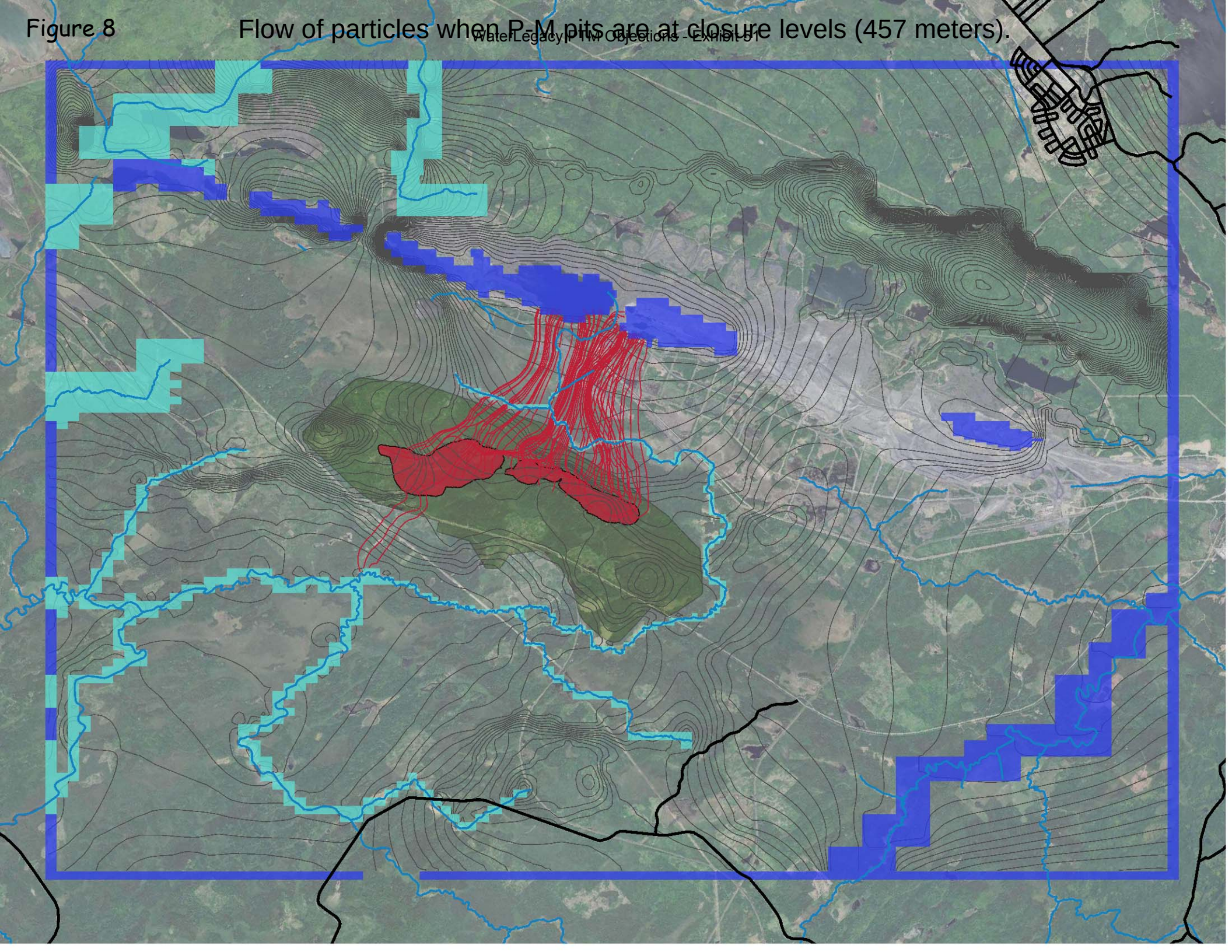
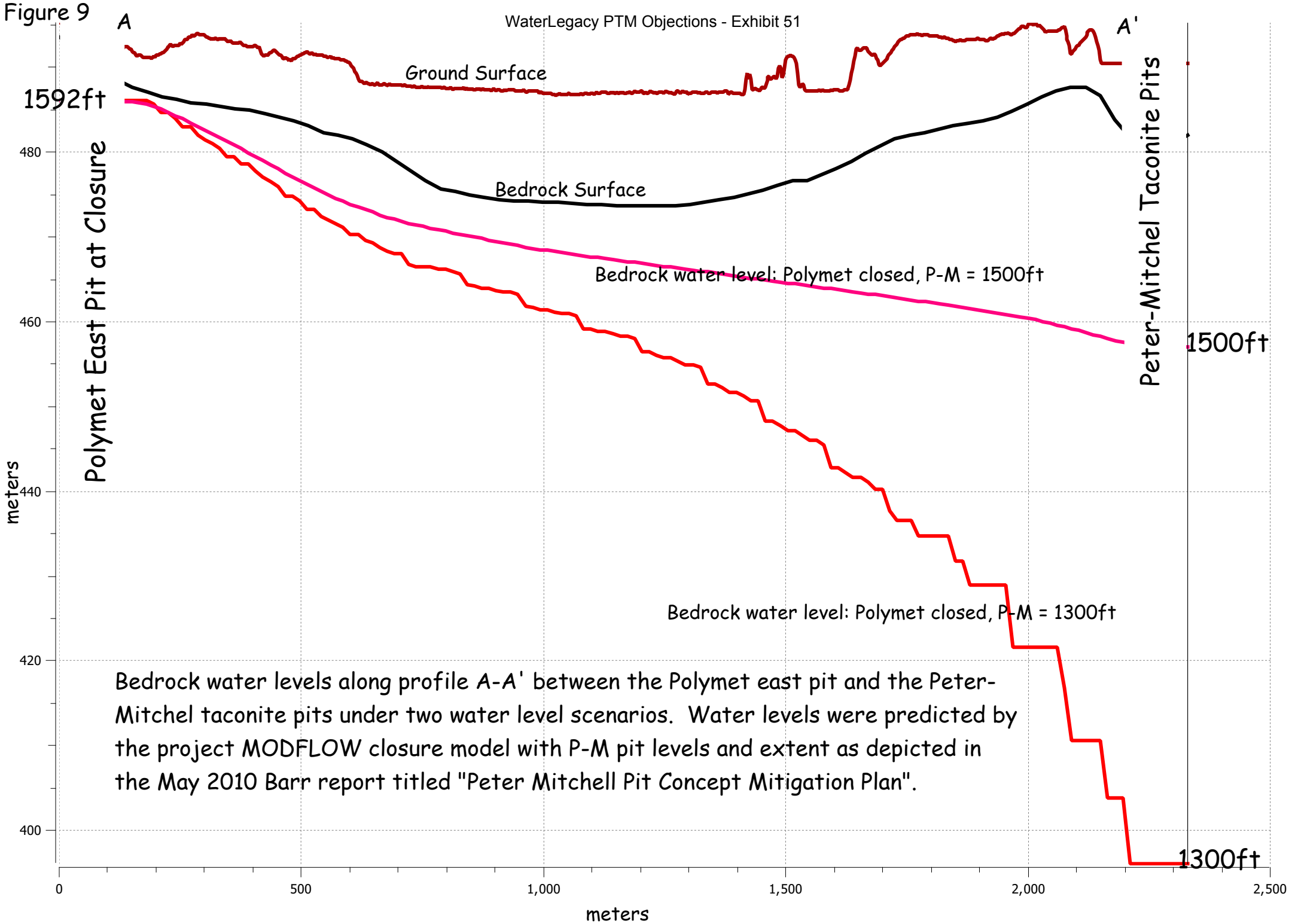


Figure 8 - A map of particles (water) moving from the Polymet pit areas to the P-M pits. This scoping level modeling used the Polymet base MODFLOW model with P-M pits set to their long-term level of 457 meters (1500 ft). Because the upper Partridge River would be unable to supply unlimited water to the aquifer, discharge from the upper Partridge River to the groundwater system is prevented in this model run.

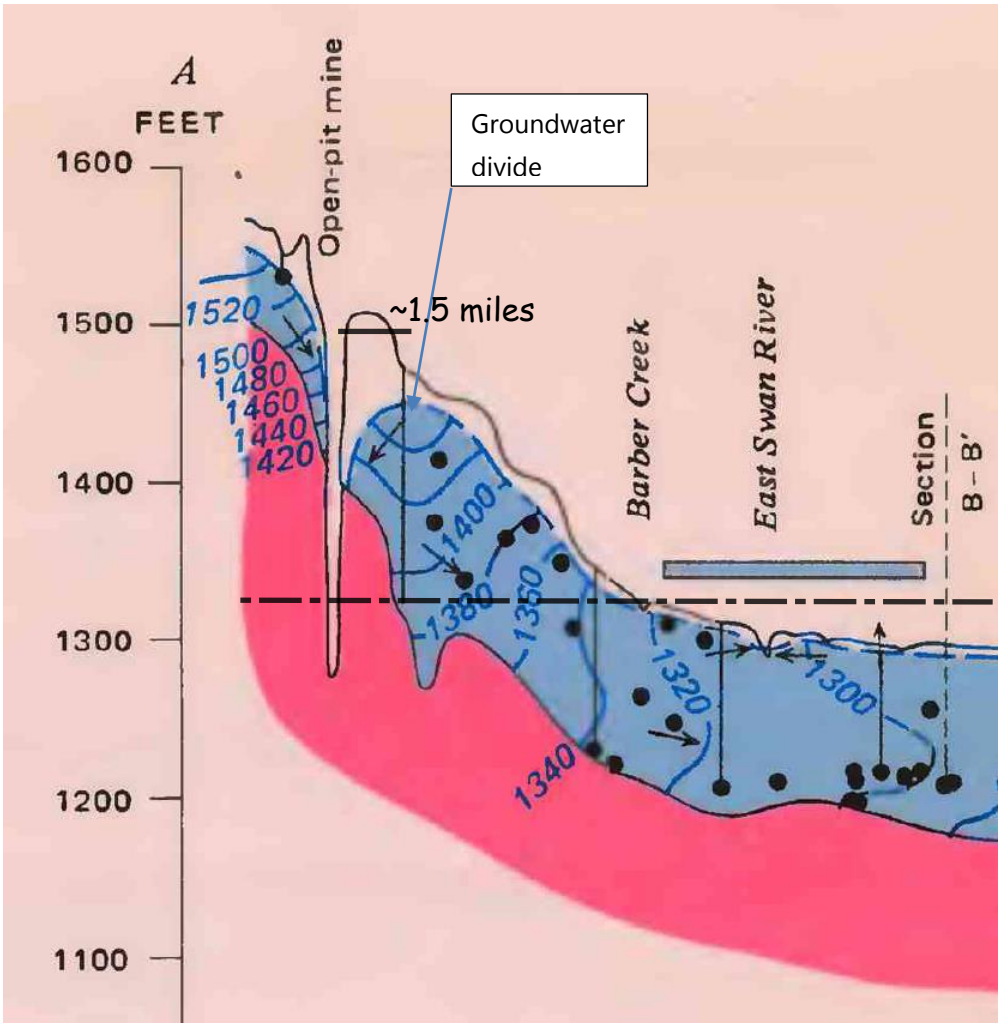
Particles were added to the surficial aquifer and allowed to travel in the direction that the aquifer carried them. These particle tracks originate in the area of the proposed Polymet pits and end at the P-M taconite pits. A few particles leave the Polymet west pit area and travel to the Partridge River because the S-W corner of the Polymet west pit is on the south side of the watertable divide.

Figure 9



Bedrock water levels along profile A-A' between the Polymet east pit and the Peter-Mitchel taconite pits under two water level scenarios. Water levels were predicted by the project MODFLOW closure model with P-M pit levels and extent as depicted in the May 2010 Barr report titled "Peter Mitchell Pit Concept Mitigation Plan".

Figure 10. From Barr 2015-07-04 memo titled: Response to Cooperating Agency Comments Related to Peter Mitchell Pit – Version 3



Note: Polymet E. pit is 1.2 miles from P-M

Figure 2 Portion of a Cross Section Showing Hydraulic Head Contours in the Drift Aquifer Adjacent to an Open-pit Mine (from Cross-section A-A' of Reference (2)). ***The portion shown has a length of approximately 17 miles***

Figure 11. From Barr 2015-07-04 memo titled: Response to Cooperating Agency Comments Related to Peter Mitchell Pit – Version 3

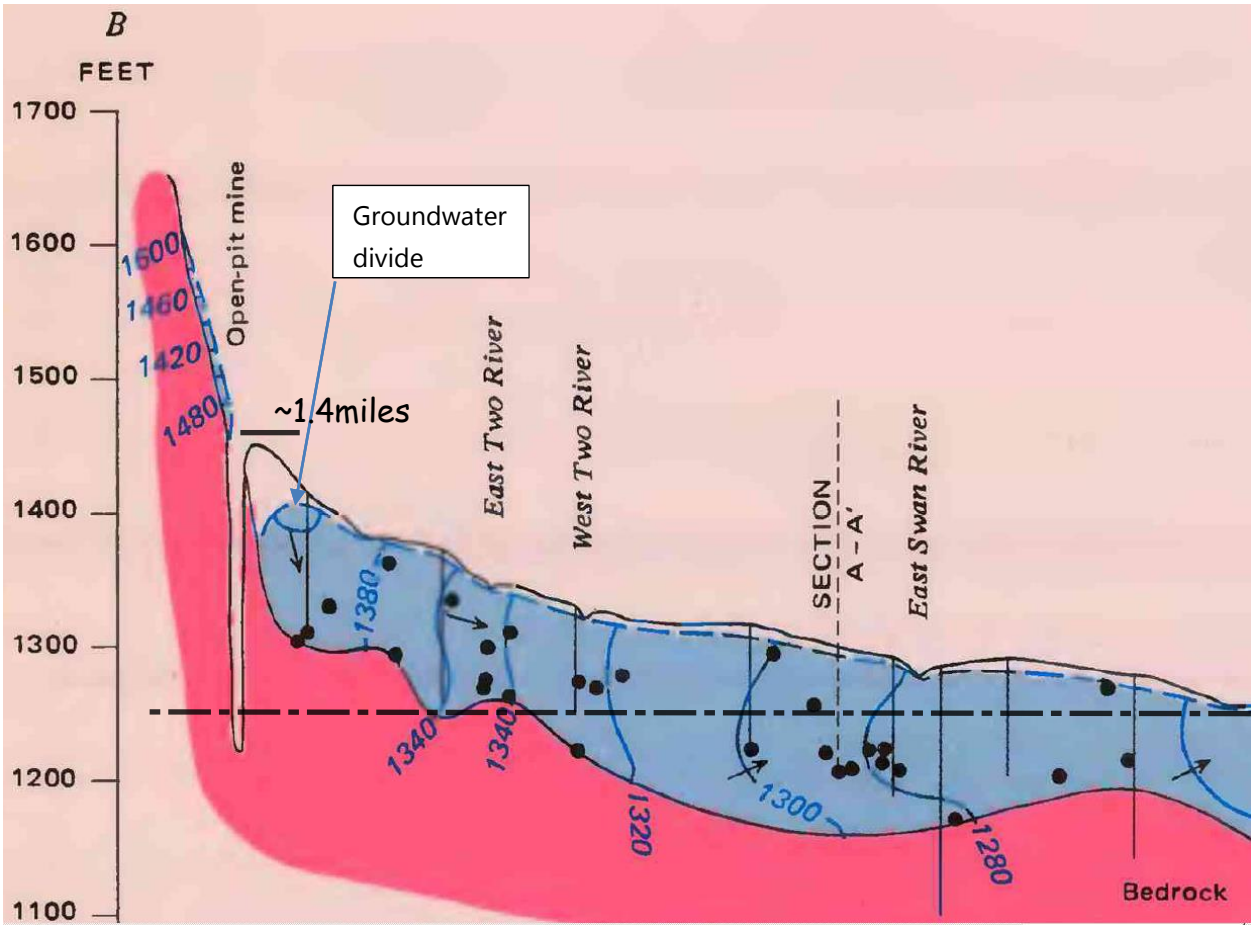
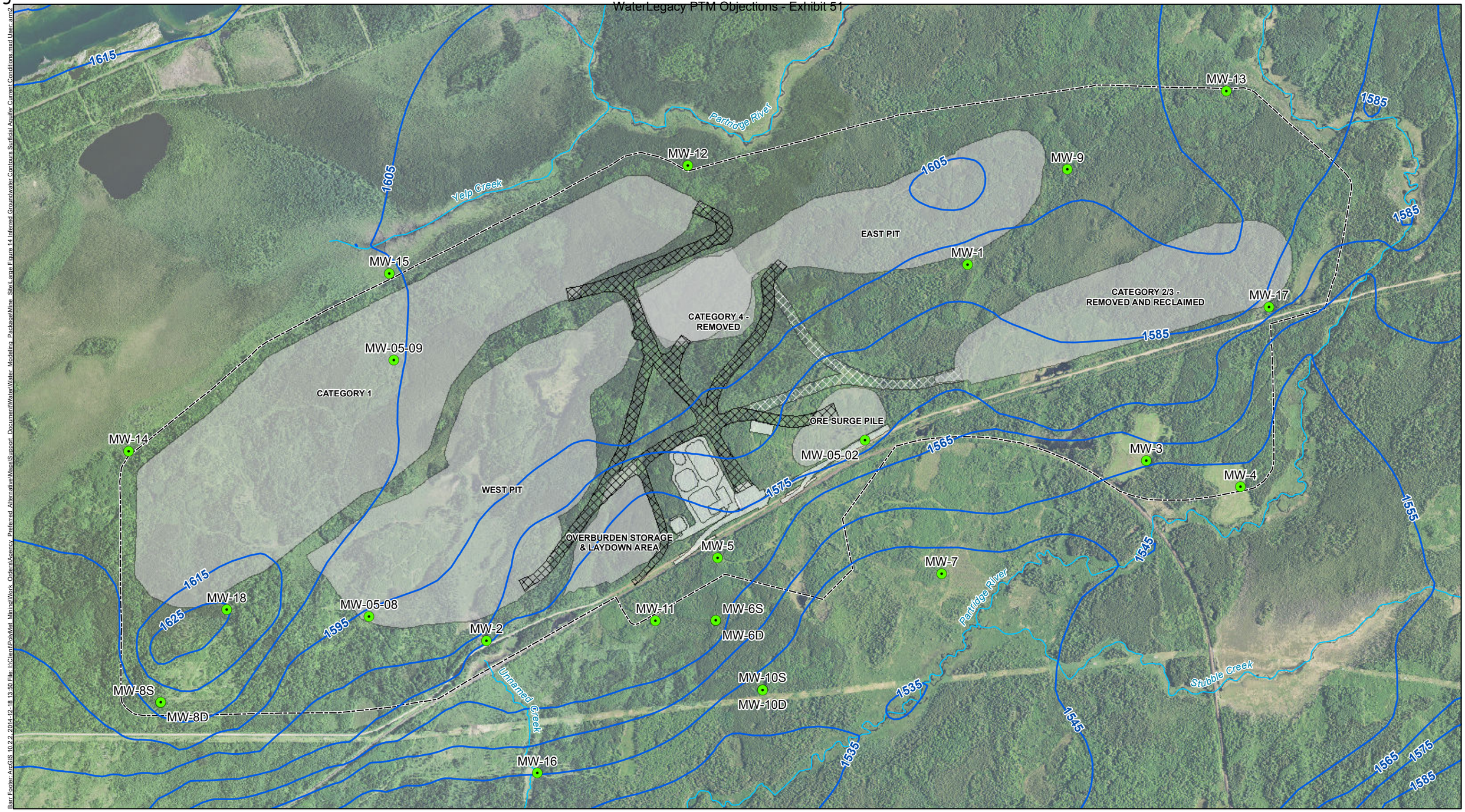


Figure 3 Portion of a Cross Section Showing Hydraulic Head Contours in the Drift Aquifer Adjacent to an Open-pit Mine (from Cross-Section B-B' of Reference (2)]). ***The portion shown has a length of approximately 22 miles***

Figure 12



Barr Footer: ArcGIS 10.2.2, 2014-12-18 13:50 File: I:\Client\PolyMet Mining\Work Orders\Agency Preferred Alternative\Maps\Support Document\WaterWater Modeling Package\Mine Site\Large Figure 14 Inferred Groundwater Contours Surficial Aquifer Current Conditions.mxd User: amz

- Monitoring Well
- Groundwater Elevation Contours (Ft)[1]
- Streams/Rivers
- Mine Site

[1]Inferred water table contours were developed using a combination of measured groundwater elevations in site monitoring wells and contours from the Mine Site MODFLOW model.

N

0 750 1,500 3,000

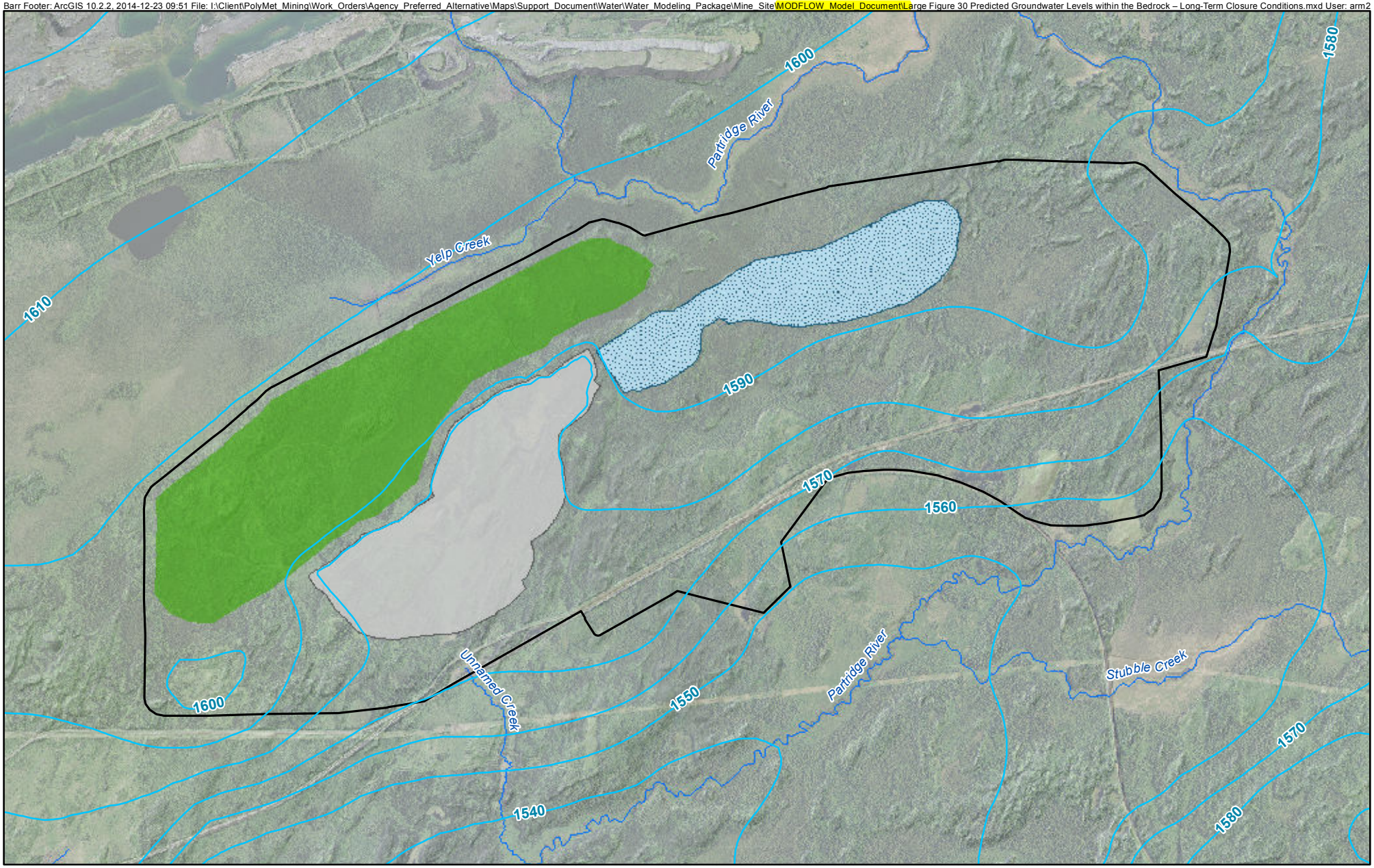
Feet

Large Figure 14
INFERRED GROUNDWATER CONTOURS
SURFICIAL AQUIFER, CURRENT CONDITIONS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN

Figure 13

WaterLegacy PTM Objections - Exhibit 51

Barr Footer: ArcGIS 10.2.2, 2014-12-23 09:51 File: I:\Client\PolyMet_Mining\Work_Orders\Agency_Preferred_Alternative\Maps\Support_Document\Water\Water_Modeling_Package\Mine_Site\MODFLOW_Model_Document\Large Figure 30 Predicted Groundwater Levels within the Bedrock – Long-Term Closure Conditions.mxd User: arm2



Simulated Piezometric Surface (feet)
Contour Interval = 10 feet

Project Areas

Covered Stockpile

West Pit

East Pit Wetland

N

0 1,250 2,500 5,000

Feet

Large Figure 30
PREDICTED GROUNDWATER LEVELS WITHIN THE BEDROCK –
LONG-TERM CLOSURE CONDITIONS
NorthMet Project
Poly Met Mining, Inc.

GREAT LAKES INDIAN FISH AND WILDLIFE COMMISSION

P. O. Box 9 ● Odanah, WI 54861 ● 715/682-6619 ● FAX 715/682-9294

● MEMBER TRIBES ●

MICHIGAN	WISCONSIN		MINNESOTA
Bay Mills Community	Bad River Band	Red Cliff Band	Fond du Lac Band
Keweenaw Bay Community	Lac Courte Oreilles Band	St. Croix Chippewa	Mille Lacs Band
Lac Vieux Desert Band	Lac du Flambeau Band	Sokaogon Chippewa	

Via Electronic Mail

October 20, 2015

Michael Jimenez
Minerals NEPA Project Manager
Superior National Forest
8901 Grand Avenue Place
Duluth, MN 55808

Doug Bruner
Project Manager
United States Army Corps of Engineers, St. Paul District
190 Fifth St. East
St. Paul, MN 55101-1638

Lisa Fay
EIS Project Manager
Environmental Policy and Review
Division of Ecological Services
500 Lafayette Road
St. Paul, MN 55155

Re: Discharge from PolyMet east pit at closure greater than previously reported

NorthMet EIS Co-lead Agency Project Managers:

Following up on discussions of closure and post-closure discharge from the PolyMet mine pits, GLIFWC staff have conducted water budget analysis that indicates that east pit discharge is likely to be approximately an order of magnitude greater than reported in the pFEIS.

GLIFWC is acting in coordination with our member tribes, including the Fond du Lac Band, to review and contribute to the PolyMet EIS process. As you may know, GLIFWC is an organization exercising delegated authority from 11 federally recognized Ojibwe (or Chippewa) tribes in Wisconsin, Michigan and Minnesota.[1] Those tribes have reserved hunting, fishing and gathering rights in territories ceded in various treaties with the United States. GLIFWC's mission is to assist its

1 GLIFWC member tribes are: in Wisconsin -- the Bad River Band of the Lake Superior Tribe of Chippewa Indians, Lac du Flambeau Band of Lake Superior Chippewa Indians, Lac Courte Oreilles Band of Lake Superior Chippewa Indians, St. Croix Chippewa Indians of Wisconsin, Sokaogon Chippewa Community of the Mole Lake Band, and Red Cliff Band of Lake Superior Chippewa Indians; in Minnesota -- Fond du Lac Chippewa Tribe, and Mille Lacs Band of Chippewa Indians; and in Michigan -- Bay Mills Indian Community, Keweenaw Bay Indian Community, and Lac Vieux Desert Band of Lake Superior Chippewa Indians.

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Madison, WI 53706
608-263-2873 Fax 608-262-2500

member tribes in the conservation and management of natural resources and to protect habitats and ecosystems that support those resources. The proposed PolyMet mine is located within the territory ceded by the Treaty of 1854.

Analysis indicates that post-closure groundwater flow from the east pit will be substantial:

The magnitude of the roles that water levels in the Peter-Mitchel (P-M) taconite pits play during post-closure continue to be under-appreciated. We first raised concerns about the effects of P-M pit water levels in 2009 as comments on the 2008 CPDEIS.

Flow direction is not the only factor affected by correctly implementing the P-M pit water elevations at closure. The volume of water leaving the PolyMet east pit is significantly greater if correct P-M pit water elevations are considered.

Both common sense (strong gradient to the north and more conductive bedrock to the north) and modeling, suggest that a substantial portion of the contaminants leaving the PolyMet east pit will move north in the post-closure period (see attached figure). Please note that because the mine pits are both deeply excavated into the bedrock but natural lakes are generally underlain with a lakebed, arguments related to the presence of Argo or other pit-side lakes are not hydrologically relevant to this issue; The connection between the PolyMet pits and the P-M pits is primarily through the relatively high conductivity Virginia Formation and Biwabik Iron Formation bedrock.

Our recent water budget analysis using the USGS utility ZoneBudget indicates that approximately 90% of the water leaving the 1595 foot elevation PolyMet east pit will travel north in bedrock toward the Peter-Mitchel pits when the P-M pits are at their correct closure elevation (1300 feet). Because of the 295 foot greater head pressure of the closed PolyMet east pit compared to the P-M pits and the relatively high conductivity of the Virginia and Biwabik Iron bedrock formations, it is not surprising that the majority of water leaving the PolyMet east pit would flow north.

Preliminary water budget analysis indicates that approximately 300 gpm will exit the PolyMet east pit through bedrock post-closure, when the P-M pits are at 1300 feet. This is in contrast to the total of 10 gpm that Barr Engineering estimated using the same mine pit inflow/outflow model but with P-M pit water elevations that were 316 feet too high (see attached figure). Contaminant transport analysis that accounts for approximately 300 gpm rather than 10 gpm of east pit groundwater discharge is likely to generate different conclusions for water quality at points of compliance.

Additional modeling, with the P-M pit water elevation at 1500 feet (the very long-term P-M pit water elevation), unsurprisingly, shows less flow from the PolyMet east pit (approximately 75 gpm), but the northward flow is still approximately 90% of the total flow from the east pit. The amount of east pit water loss when the P-M pits are at 1300, or at 1500 feet is large, but is of similar scale to the quantities of bedrock flow found by ERM in their bedrock cross-sectional models using MathCad. Those MathCad models were distributed prior to, and discussed in, the July 22 agency technical meeting. The estimates of substantial PolyMet pit outflow identified in this letter were made with the MODFLOW model that was designed by Barr Engineering to estimate mine pit inflow/outflow (Water Modeling Data Package v14, Attachment B, Table 4-4, pFEIS reference Polymet 2015m). A sensitivity analysis of how estimates of pit inflow/outflow at closure respond to boundary conditions (i.e. the P-M pit water levels are model boundary conditions) would further clarify the role that the taconite pits play in the hydrology of the PolyMet site.

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Regardless of whether the PolyMet east pit outflow at closure is 75 or 300 gpm, the scale of flow from the PolyMet pits when the P-M pits are set at their correct closure levels appears to be approximately an order of magnitude greater that the quantity of flow previously considered in contaminant transport. The large underestimate of water leaving the PolyMet east pit by PolyMet's consultant deserves additional evaluation, evaluation that should be conducted by independent experts.

Thank you for considering this issue. As we have in the past, we ask to have technical discussions with other agency staff so that an approach to clarify and address this issue can be developed.

Sincerely,

John Coleman, GLIFWC Environmental Section Leader

cc: Randall Doneen, Environmental Review Unit Supervisor, MN-DNR
Brenda Halter, Forest Supervisor, Superior National Forest
Tamera Cameron, Chief, Regulatory Branch, St Paul District of the Army Corps of Engineers
Kenneth Westlake, NEPA Coordinator, USEPA Region 5
Nancy Schuldt, Water Projects Coordinator, Fond du Lac Environmental Program
Neil Kmiecik, GLIFWC Biological Services Director
Ann McCammon Soltis, Director, GLIFWC Division of Intergovernmental Affairs

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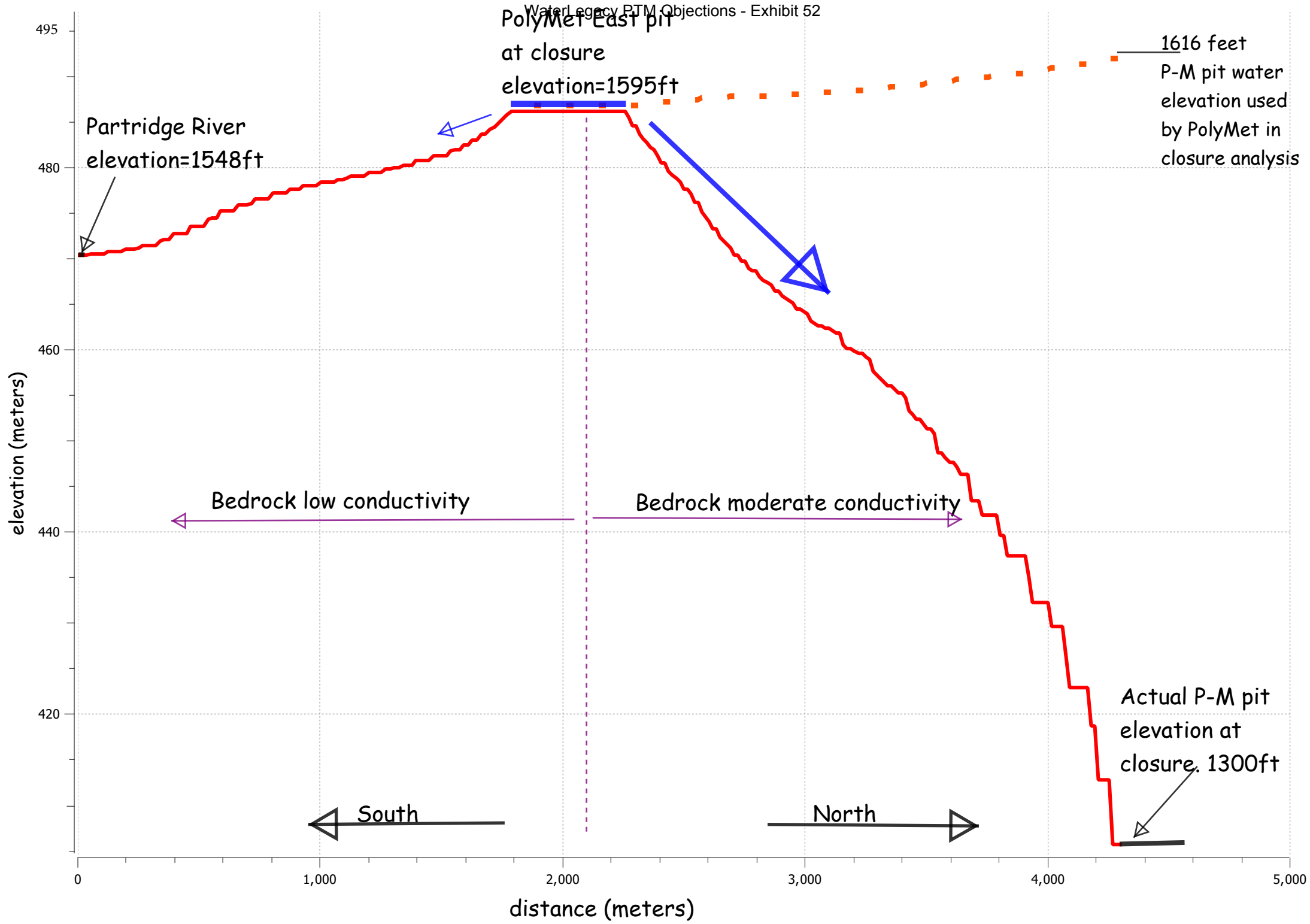
PolyMet East pit
at closure
elevation=1595ft
1616 feet
P-M pit water
elevation used
by PolyMet in
closure analysis
Partridge River
elevation=1548ft
Bedrock low conductivity
Bedrock moderate conductivity
Actual P-M pit
elevation at
closure. 1300ft
South
North
495
480
460
440
420
elevation (meters)
0
1,000
2,000
3,000
4,000
5,000
distance (meters)

ENVIRONMENTAL ASSESSMENT WORKSHEET

This Environmental Assessment Worksheet (EAW) form and EAW Guidelines are available at the Environmental Quality Board's website at:
http://www.eqb.state.mn.us/EnvRevGuidanceDocuments.htm. The EAW form provides information about a project that may have the potential for significant environmental effects. The EAW Guidelines provide additional detail and resources for completing the EAW form.
Cumulative potential effects can either be addressed under each applicable EAW Item, or can be addresses collectively under EAW Item 19.
Note to reviewers: Comments must be submitted to the RGU during the 30-day comment period following notice of the EAW in the *EQB Monitor*. Comments should address the accuracy and completeness of information, potential impacts that warrant further investigation and the need for an EIS.

1. Project title: Northshore Mining Company Progression of the Ultimate Pit Limit

2. Proposer: Northshore Mining Company
Contact person: Andrea Hayden
Title: Section Mgr. – Environmental Services
Address: 10 Outer Drive
City, State, ZIP: Silver Bay, MN 55614
Phone: (218) 226-6032
Fax: (218) 226-6037
Email: andrea.hayden@cliffsnr.com

3. RGU: MN Department of Natural Resources
Contact person: Ronald Wieland
Title: Environmental Review Planner
Address: Box 25, 500 Lafayette Road
City, State, ZIP: St. Paul, MN 55155-4025
Phone: (651) 259-5157
Fax: (651) 297-1500
Email: ronald.wieland@state.mn.us

4. Reason for EAW Preparation: (check one)

Required:	Discretionary:
☐ EIS Scoping	☐ Citizen petition
☐ Mandatory EAW	☐ RGU discretion
	☒ Proposer initiated

If EAW or EIS is mandatory give EQB rule category subpart number(s) and name(s): NA

5. Project Location:
County: St. Louis
City/Township: Babbitt

PLS Location:

NE ¼	NW ¼	Section 30	Township	60N	Range 12W
NW ¼	NE ¼	Section 30	Township	60N	Range 12W
NE ¼	NE ¼	Section 30	Township	60N	Range 12W
SW ¼	SE ¼	Section 19	Township	60N	Range 12W
SE ¼	SE ¼	Section 19	Township	60N	Range 12W
SE ¼	SW ¼	Section 19	Township	60N	Range 12W
SW ¼	SW ¼	Section 20	Township	60N	Range 12W
NW ¼	SW ¼	Section 20	Township	60N	Range 12W
NE ¼	SW ¼	Section 20	Township	60N	Range 12W
SE ¼	NW ¼	Section 20	Township	60N	Range 12W
SW ¼	NE ¼	Section 20	Township	60N	Range 12W

Watershed (Major watershed 72, Rainy River Headwaters): Langley Creek reporting to the Dunka River. The Dunka River flows to Birch Lake, and eventually to Rainy Lake. Rainy River flows generally west-northwest from Rainy Lake, ultimately draining through the Winnipeg River, Lake Winnipeg and the Nelson River into Hudson Bay.

GPS Coordinates (at project center): 5279036.393 North, 582207.271 East (UTM NAD83, Zone 15 North)

Tax Parcel Numbers: 105-0060-04700; 105-0060-04660; 105-0060-03020; 105-0060-03140; 105-0060-03100; 105-0060-03060, 105-0060-03010

At a minimum attach each of the following to the EAW:

- County map showing the general location of the project (attached as Figure 5-1);
- U.S. Geological Survey 7.5 minute, 1:24,000 scale map indicating project boundaries (attached as Figure 5-2); and
- Site plans showing all significant project and natural features. Pre-construction site plan and post-construction site plan (attached as Figure 5-3).

6. Project Description:

a. Provide the brief project summary to be published in the EQB Monitor, (approximately 50 words).

Northshore Mining Company proposes to progress the Ultimate Pit Limit within its Permit to Mine at its Peter Mitchell Mine to access additional economic taconite ore, consistent with Northshore's long-term development plan for the mine. In this 108 acre progression, the taconite ore is overlain by Type II Virginia Formation (VF) rock that will be mined and stockpiled to access the ore. Northshore will permanently stockpile Type II VF rock from the progression on-site following a stockpile plan that minimizes contact of groundwater and runoff with stockpiled rock.

b. Give a complete description of the proposed project and related new construction, including infrastructure needs. If the project is an expansion include a description of the existing facility. Emphasize: 1) construction, operation methods and features that will cause physical manipulation of the environment or will produce wastes, 2) modifications to existing equipment or industrial processes, 3) significant demolition, removal or remodeling of existing structures, and 4) timing and duration of construction activities.

Background

Northshore Mining Company (Northshore) owns and operates the Peter Mitchell Mine, an open pit taconite mine near Babbitt, Minnesota. Lean ore, rock and surface material are stripped and stockpiled on-site to access the valuable underlying ore. The mined iron ore is loaded into rail cars and transported to Northshore's processing plant located at Silver Bay, Minnesota for the production of taconite pellets and management of tailings. The mine has all the facilities required to meet the processing plant's ore demands at full plant capacity.

The mine has been in operation since the 1950's and has decades of iron ore reserves available for continued mining. The mine is being developed and operates in accordance with the MNDNR Permit to Mine and associated approvals. The Permit to Mine is based on a conceptual long term development plan and includes a process for approval of incremental development plans for the mine in accordance with Minnesota statutes and rules. The proposed project which is the subject of this EAW is an incremental development that would extend mining consistent with the conceptual long term development plan.

The proposed Project, which is the subject of this EAW, involves the mining of two metamorphic rock formations at the Peter Mitchell Mine. These are the Virginia Formation (VF) and the Biwabik Iron Formation (BIF). These formations are discussed in detail in Item 10, Geology, under the Bedrock Geology section.

The VF is further classified into Type I VF and Type II VF. These are defined in the Virginia Formation Development Plan[1] (Northshore 2004) as follows:

- Type I VF – Blast patterns containing Virginia Formation rock with whole rock sulfur content of less than 0.20 weight percent and NPR[2] greater than or equal to 3 for the pattern averages.
- Type II VF – Blast patterns containing Virginia Formation rock with whole rock sulfur content of greater than or equal to 0.2 weight percent and less than 1.0 weight percent sulfur, or with a NPR of less than 3.

Northshore is currently permitted to remove and stockpile Type I VF material following the Virginia Formation Development Plan, which has been utilized and referenced by the Minnesota Department of Natural Resources (MNDNR) and Minnesota Pollution Control Agency (MPCA) in previous permit amendments. The proposed Project will mark the first time Northshore has encountered in situ Type II VF material at the Peter Mitchell Mine. Northshore has developed and submitted to the MNDNR a Type II VF Stockpile Plan. The Stockpile Plan was completed in May 2013, and was made available to the public as part of Northshore's Permit to Mine amendment application.

[1] Northshore. 2004. Virginia Formation Development Plan. Cliffs Natural Resources, Northshore Mining, June 15, 2004.

[2] Neutralization potential ratio (NPR) is defined as the ratio of the acid neutralizing potential to the acid generating potential (ANP/AGP).

Major activities at the Peter Mitchell Mine typify current northeastern Minnesota taconite mining operations. Equipment employed at the mine is also typical of standard iron ore mining operations, and includes drill rigs, mechanized shovels, haul trucks, loaders, bulldozers and support vehicles. Typical proposed activities include the following:

- Removal of vegetation;
- Removal of surface overburden, stockpiling, and progressive reclamation;
- Removal of rock overburden, including VF and BIF, rock drilling, blasting, loading and hauling, stockpiling, and progressive reclamation of materials overlying the ore;
- Mining of BIF ore, including drilling, blasting (with standard mining blasting materials), removal, loading and hauling, crushing, storage, and rail loading for shipment;
- Management of water by transferring between sumps within mining areas, design and reclamation of stockpiles to minimize erosion, drainage of water to sumps for storage and water quality improvement, and pumping water from the sumps to two different treatment streams;
- Maintenance and support of mining and rail operations, maintenance shops and storage, and office buildings, etc.

The Proposed Project

The Peter Mitchell Mine operates under a Permit to Mine issued by the MNDNR Division of Land and Minerals. The current Ultimate Pit Limit (UPL) identified in the MNDNR Permit to Mine is proposed to be adjusted to allow the continued progression of mining in the Main Pit (area of the pit extending approximately 2 miles to the west of the permanent facilities; see Figure 6-1 and Figure 5-4). The principal components of the proposed Project include mining in the proposed UPL progression area, which includes the removal of Type II VF rock, and developing and implementing an engineered stockpile for Type II VF rock.

In this document, the term “the proposed Project” comprises all aspects of the proposed work, including the UPL progression into Type II VF rock and the Type II VF stockpile. When the project components are indicated separately, they are referred to as “the UPL progression” and “the Type II VF stockpile”, respectively.

<u>UPL Progression</u>

The UPL progression footprint includes 108.33 acres to the south of the current UPL (see Figure 6-1). This would extend the pit approximately 250 to 750 feet southward from the current UPL for a distance of about 1.5 miles directly west of the permanent Peter Mitchell Mine facilities. The boundary of the proposed UPL progression generally follows the southern limit of existing permitted wetland impacts across much of the area. Wetlands and wetland permitting are discussed in detail in Item 11*b* (*iv)*(*a*) and Figure 11-1.

Removal and stockpiling of overburden Type I VF rock and BIF rock would follow current mining practices and would be placed in permitted stockpile locations. Haul roads and stockpile locations are shown on Figure 6-2.

The estimated quantity and sulfur content of the materials to be removed during mining within the proposed Project area are detailed in Item 10, Geology, Table 10-1. The UPL progression would result in approximately 94 million long tons of total stripping, including overburden, VF and BIF rock. The UPL

progression would not result in the mining or uncovering of any Duluth Complex rock, or VF bedded phyrrhotite rock.

Type II VF Stockpile Design

Mining and stockpiling of Type II VF material will include design, operation and reclamation practices that limit stockpiled Type II VF rock's exposure to water. Mining practices would include:

- Planning mine development to avoid exposing more Type II VF material than what is required to sustain the processing demands of the downstream operation.
- Designing benches along the UPL to minimize horizontal surface exposure of Type II VF material while maintaining safe operating conditions.
- Utilizing appropriate blasting techniques to limit generation of Type II VF fines, and to minimize the damaged rock zones at the ultimate pit boundary.
- Moving blasted Type II VF rock to the Type II VF stockpile in an efficient and timely manner.

Prior to mining, the sulfur content of the VF rock to be blasted will be estimated based on exploration drill core samples. If the average content of the material meets the criteria to be classified as Type II VF, it will be segregated and stockpiled on an engineered stockpile within mined-out areas on the north side of the pit.

During operations, seepage from the Type II VF stockpile will report to the pit sumps where it will mix with general pit stormwater runoff, groundwater inflows, and seepage from other stockpiles and ultimately discharge from the pit through the designated National Pollutant Discharge Elimination System (NPDES) discharge points. The mixture of runoff, groundwater and seeps currently collected in the sumps tends to be mildly alkaline due to its interaction with in-situ and stockpiled Type I VF and BIF rock already existing in the pit. The mildly alkaline nature of this mixture is expected to offset any low pH Type II VF stockpile seepage. The Type II VF stockpile is planned to be approximately 153 acres, located entirely within the existing UPL. The specific stockpile location is shown on Figure 6-3.

The design concepts for the Type II VF Stockpile Plan were developed by Golder Associates, Inc. (Golder), and are engineered to provide isolation of stockpiled Type II VF rock and minimize its contact with groundwater and surface runoff. The conceptual model for the Type II VF stockpile during operations is shown in Figure 6-4, and at closure in Figure 6-5. The minimum elevation for all stockpiled Type II VF material will be 1,600 feet above mean sea level (AMSL). The maximum predicted pit lake level upon mine closure under any current plan is approximately 1,500 feet AMSL, which is the current approximate minimum elevation at the east end of the pit, based on topography, at which the outfall would discharge to the Dunka River via the Unnamed Creek[3] tributary.

The design concepts for the Type II VF Stockpile Plan are:

[3] In this document, "Unnamed Creek" refers to two different water courses. For discussions of post-closure, "Unnamed Creek" refers to a water course originating at the extreme northeast end of the pit and reporting to Dunka River. This is the outfall of the post-closure pit lake. For discussion of operations, "Unnamed Creek" refers to a water course originating at SD-002 and reporting to Dunka River via a series of wetlands. This is the operational SD-002 outfall.

- All Type II VF material will be stockpiled above the maximum pit lake water elevation at closure to prevent contact of ponded water with the stockpiled material.
- Type II VF material will be placed on top of and adjacent to a minimum 5-foot-thick layer of blasted rock, primarily BIF rock, with lesser amounts of Type I VF rock, which will act as a water conveyance layer to minimize or eliminate contact of groundwater and stormwater with Type II VF material.
- The BIF will contribute alkalinity, which would provide some undefined offset to low pH water associated with the Type II VF material.
- Stockpile configuration and height will be flexible such that a stable stockpile design is provided while: 1) minimizing the surface area and footprint of the Type II VF materials subjected to precipitation during construction, 2) minimizing net infiltration following reclamation , and 3) minimizing duration of exposure of the Type II VF materials to precipitation prior to placement of a final cover.
- The outer slope of the stockpile will be covered with Type I VF or BIF rock, with the crest of the covering rock extending a minimum of 20 feet beyond the Type II VF footprint, to prevent direct precipitation and runoff from contacting Type II VF rock.
- Final cover, including a geomembrane-backed geosynthetic clay liner (GCL), will be progressively placed on stockpile areas at the final elevation. Figure 6-6 shows a detailed cross-section of the proposed Type II VF stockpile cover. The cover system will provide a suitable growth medium to establish vegetation. The basal material below the cover will be compacted prior to construction of the bedding layer. The bedding layers and GCL will be installed using standard construction industry practices. The bedding layers will meet manufacturer's recommendations. The GCL will be manufacturer certified to meet a $5x10^{-10}$ cm/sec hydraulic conductivity or less. The cover will be inspected and surveyed during construction. Following construction, annual observations will be made to verify cover performance and DNR-approved control test plots will be monitored to assess GCL performance.
- The final cover will be reclaimed with an approved grass mix to control erosion and provide an area that is conducive to other post-closure uses.
- Final stockpile exterior slope lift height and bench width will be constructed using Type I VF or BIF rock to satisfy applicable reclamation requirements, as follows:
    - Final lift height for Type I VF or BIF rock on the outer slope will be limited to 30 feet (MNDNR Reclamation Standards, Minn. R. 6130.2400 A(1));
    - The minimum bench width will be limited to no less than 30 feet measured from the crest of the lower lift to the toe of the next lift (MNDNR Reclamation Standards, Minn. R. 6130.2400 A(2));
    - The sloped area between benches will be no steeper than the angle of repose (MNDNR Reclamation Standards, Minn. R. 6130.2400 A(3)); and
    - Benches shall be designed and constructed to control runoff (MNDNR Reclamation Standards, Minn. R. 6130.2400 A(4)).

Given the expected mine plan and mining sequence, the stockpile will be constructed over a period of approximately seven to ten years. The stockpile is expected to grow progressively each year as Type II VF is mined to access underlying ore; Type II VF rock will not be mined continuously or all at one time. A progressive reclamation plan will be implemented during stockpile construction so that exposure of the Type II VF rock is limited. This will reduce the potential for the onset of low pH drainage and metals leaching. The reclamation plan will also result in progressive growth of the stockpile and subsequent progressive placement of the cover before the stockpile reaches its final configuration and size.

The reclamation design criteria that have been developed provide for placement of a cover system over Type II VF rock within 30 months of placement in a stockpile. The 30-month criterion is based on the observed lag time before exposed Type II VF rock begins to create low pH conditions or leach metals. The Research and Productivity Council (RPC) conducted laboratory tests using humidity cells to determine that the lag time before development of low pH (drainage with pH less than 5.5) and metal leaching was at least 30 months (Golder 2012). The methods for humidity cell testing generally followed ASTM standards (ASTM D5744-96)[4], which tend to accelerate metal-mine rock weathering rates. As a result, actual time before commencement of low pH conditions or metals leaching from the Type II VF rock would likely be longer than the 30-month lag time estimated by the humidity cell testing. Nevertheless, placement of the cover over the stockpile will begin prior to 30 months to avoid conditions that could result in generation of low pH conditions or the leaching of metals.

Time Frame

The proposed Project is expected to meet the Peter Mitchell Mine's Main Pit area ore requirements for five to ten years. These requirements are consistent with the development plan for an orderly progression of mining iron ore over the life of the mine. Mining activities are scheduled to begin in the proposed Project area as soon as possible in 2014 upon receipt of required permits. Due to the progressive nature of mining activities, surface material must be removed first followed by removal of VF rock and BIF rock prior to accessing the underlying ore horizons. Typical mining schedules will include 1-1.5 million long tons of surface overburden stripping per year in the UPL progression. The Peter Mitchell Mine has sufficient stockpile capacity to handle the surface overburden.

Reclamation

Overall mine reclamation will be ongoing and will follow reclamation regulatory obligations described in the current Permit to Mine. Moreover, Northshore will consult with the Laurentian Vision Partnership, a regional coalition of mining, governmental, business and community interests that promotes the development of productive post-mining landscapes on the Mesabi Iron Range, for additional input on reclamation goals. Final reclamation plans will comply with MNDNR reclamation regulations.

Proposed Project BIF and Type I VF rock will be stockpiled in mined-out areas of the active pit. Proposed Project lean ores and rock will be stockpiled in mined-out areas of the active pit. Stockpiles will not disturb any new lands outside of the footprint of the proposed Project UPL. Specific considerations for the Type II VF stockpile have already been discussed above.

Surface stripping material will be placed on final stockpiles, which will be benched and reclaimed in accordance with current MNDNR reclamation standards. The Type II VF stockpile will be reclaimed using shallow-rooted grass species, to avoid root penetration into the stockpile cover. Other non-Type II VF stockpiles will be reclaimed to develop mixed habitats of hardwood and coniferous wooded areas, and open grasslands. Northshore, as an active member of the Laurentian Vision Partnership, has been and will continue to work with the Partnership to design and meet the reclamation goals for the site.

[4] Details on the deviations from the humidity cell testing method ASTM D5744-96 can be found in Appendices D and E of Golder, 2012.

Wetland Mitigation

The proposed Project would impact wetlands beyond the limits of currently permitted wetland mitigation. Northshore will address these additional wetland impacts through amendments to its existing Wetland Replacement Plan (dated March 2004 and approved by the MNDNR on August 10, 2006) and through amendments to its Clean Water Act 404 Permit #2005-1500-TWP, including CWA Section 401 certification requirements. See Item 11 for details on wetlands.

Existing Watersheds

Northshore's Peter Mitchell Mine resides on the south slope of the Giants Range, and straddles two major watershed divides, at approximately the mid-point of the current pit. The southwest half of the mine drains to the Lake Superior Basin, via the St. Louis River watershed. The northeast half of the mine drains to the Rainy River Basin, via the Rainy River Headwaters watershed. Figure 5-1 shows the major watershed divides in the region. Note that the major watershed divide bisecting the center of the pit as shown in Figure 5-1 is based on the approximate areas of the pit dewatered to each watershed. The watershed pillar that historically separated the two watersheds was removed under a MNDNR permit, and the divide is currently maintained by the placement and operations of the pit sumps. After closure, when dewatering ceases, the entire pit footprint will be within the Rainy River Headwaters watershed (Barr 2008).

The specific area in which the proposed UPL Progression and Type II VF Stockpile lie is entirely within the Rainy River Basin. No part of the proposed Project drains to the Partridge River or other parts of the St. Louis River watershed or Lake Superior Basin. Historically, the land on which the proposed Project lies was part of the Langley Creek watershed. Therefore, during active mining, water from the local subwatersheds of the proposed Project will drain to existing sumps and be pumped to Langley Creek, which reports to the Dunka River, and eventually to the Rainy River Headwaters watershed. Because of water quality management practices that require transfers within the pit, occasionally runoff and seepage may be moved to a sump that discharges to Unnamed Creek or SD-002, both of which also report to the Dunka River. Figure 6-7 shows the local subwatersheds draining to the pit in the immediate vicinity of the proposed Project, as delineated for the purpose of estimated inflow to the pit. These were mapped and labeled by Golder as subwatersheds A, B, and C, with subwatershed A the largest of the three. Runoff from the Type II VF stockpile will flow into an existing sump in subwatershed A. Water pumped from the sumps will continue to be subject to NPDES permitted outfall limits, to help meet water quality standards. The existing NPDES limits would not be exceeded as a result of the project.

Figure 6-7 also presents the subwatershed area tributary to Langley Creek that does not drain to the pit under existing conditions and for the proposed project (based on the current pit extent and data included in Barr 2008). The project reduces the surface area tributary to Langley Creek by approximately 2.6 to 5 percent of the existing surface watershed. The area removed from the Langley Creek watershed becomes tributary to the pit sumps, which are dewatered to Langley Creek and to the Unnamed Creek associated with SD-002 (not the same Unnamed Creek as the pit lake outfall). With the exception of occasional water management practices, the project is entirely contained within the Langley Creek watershed; no substantial hydrologic impacts to the pit lake outfall Unnamed Creek are anticipated until final pit closure. Note that the surface watersheds for the proposed Project differ from the watersheds anticipated at pit closure, which is presented in the *Long Range Hydrology Study* (Barr 2008). However, the southern edge of the proposed UPL is consistent with the final pit footprint that was the subject of the 2008 Barr study. In final closure, the pit lake will become tributary to Unnamed Creek, resulting in hydrologic impacts to

Unnamed Creek at that time. Figure 6-8 presents the watersheds to Langley Creek and Unnamed Creek in final pit closure. Note that the project area is entirely contained within the footprint of the pit lake in final closure.

Watershed Reclamation

Long term watershed reclamation concepts for the mine have been established and approved by the MNDNR (MNDNR 2011). The concepts involve alteration of the Langley Creek, Partridge River and Dunka River watersheds and mitigation including development of a pit lake with aquatic habitat enhancement. Aquatic habitat enhancement would be accomplished through strategic in-pit placement of overburden and waste rock. The long term watershed reclamation concepts are intended to meet MNDNR and Great Lakes Basin Compact agreement for developments that preceded the Compact.

Northshore Mining's reclamation plan is a result of a MNDNR permit that allowed the removal of an in-pit watershed pillar. That permit was contingent on a watershed mitigation plan that requires the pit to be reclaimed to a higher standard than those mandated by the MNDNR Taconite Mineland Reclamation rules with an emphasis on creating aquatic habitat. Foremost among these new requirements is the stipulation that a minimum 20% of the final pit lake area comprises littoral zones. These are the shallow portions of a lake that support a disproportionally large amount of plant and animal life compared to the deeper sections of a lake. Northshore is able to deposit part of its mined material back into the pit after the ore has been mined out. This allows a degree of control over the shape and depth of the final shoreline and by extension enables the mine to build large littoral zones into the final reclamation plan (Figure 6-9). Other parts of the reclamation plan include but are not limited to: the construction of islands for bird habitat, areas for fish spawning, public access to the lake (post-closure) and flooding organic debris to aid in the initiation of biological productivity.

The concept for the watershed reclamation plan was initially proposed in a 2008 *Long Range Hydrology Study* prepared for Northshore by Barr Engineering (Barr 2008). The plan has further evolved through Northshore's engagement of the Laurentian Vision Partnership involving the MNDNR University of Minnesota Landscape and Design Department and others with the focus on pit lake aquatic enhancement. Further details of the concepts are provided below as well as the watershed changes associated with the proposed project.

After mine closure, water from the entire mine, including the proposed Project, will flow into the pit lake, creating a deep aquatic habitat with at least of the pit lake area having 20% littoral zones. The pit will be flooded to approximately 1,500 feet above mean sea level, and ultimately discharge to the Dunka River via the Unnamed Creek tributary located on the east end of the mine pit. These actions are consistent with the watershed mitigation plan approved by MNDNR on February 11, 2011 (MNDNR 2011).

After mine closure, the current stream characteristics of Langley Creek are likely to change, because discharge from the pit sump to the creek will end. The channel may widen, and there may be loss of fish habitat. The changes to the current stream characteristics of Langley Creek estimated in closure include the incremental impact of the proposed Project, which is a small step in pit progression relative to what is presented in the *Long Range Hydrology Study*. Hydrologic impacts in post-closure are presented in the *Long Range Hydrology Study* (Barr 2008) and include an overall reduction in the Langley Creek watershed area of 46 percent and on overall increase in the Unnamed Creek watershed area of 450 percent, relative to existing conditions. The impact of the proposed project on the Langley Creek watershed is approximately six percent of the total Langley Creek watershed impact estimated in the *Long*

Range Hydrology Study (Barr 2008), and approximately three percent of the total impact to the Unnamed Creek watershed, relative to current conditions. Moreover, the proposed Project will not augment or magnify the expected changes to Langley Creek or Unnamed Creek stream characteristics post-closure beyond what is presented in the *Long Range Hydrology Study*, as the area of the proposed UPL progression is included in what is assumed will be the pit lake in closure (see Figure 6-8).

c. Project magnitude:

Area	**Acreage**
Mine Area:	~108.33 Acres
Stockpile Area:	~153 Acres*
Linear project length	NA ǂ
Number and type of residential units	0
Commercial building area (in square feet)	0
Total Proposed Project Acreage	***~261.33 Acres****

*Note: The UPL progression is 108.33 acres, representing new, currently un-mined area. The 153-acre Type II VF stockpile will be located within the existing mine pit. As a result, the total proposed Project acreage is 261.33 acres. However, only the UPL progression acreage will be new mining area outside of the existing pit.
ǂ This is a non-linear project.

d. Explain the project purpose; if the project will be carried out by a governmental unit, explain the need for the project and identify its beneficiaries.

The purpose of the UPL progression is to access additional ore reserves. Current economic evaluation of the ore reserves requires the progression of the current UPL, consistent with Northshore's development plan for orderly progression of mining ore within the Peter Mitchell Mine.

The purpose of the proposed Project's Type II VF stockpile is to segregate rock types and minimize contact of groundwater and runoff with the stockpiled Type II VF rock.

e. Are future stages of this development including development on any other property planned or likely to happen? ☒*Yes* ☐*No*
If yes, briefly describe future stages, relationship to present project, timeline and plans for environmental review.

The box for Item 6e has been checked "yes," but only with regard to the UPL progression aspect of the proposed Project. The UPL progression is a stand-alone project that is expected to satisfy the Peter Mitchell Mine Main Pit mining requirements for five to ten years, depending on production requirements. There are no other stages planned that are directly related to achieving the objectives of the UPL progression. Nevertheless, the proposed Project is located on an active mining site. Part of the long-term plan for the Peter Mitchell Mine is to continue to develop the mine to the south and west. However, no specific plans have been developed for potential future progression of the ultimate pit boundary. Therefore, although additional progressions within the Mine are expected in the future, there will be no "future stages" of the Project proposed here.

There will also be no future stages of the Type II VF stockpile aspect of the proposed Project. The Type II VF stockpile is only designed and intended to address Type II VF materials associated with this particular pit progression. There will be no future additions made to the Type II VF stockpile. Northshore will address separately the presence of any Type II VF materials encountered in any future pit progressions. The need for environmental review of such efforts also will be evaluated when and if such materials are identified in future proposed progressions.

f. Is this project a subsequent stage of an earlier project? ☒ *Yes* ☐ *No*
If yes, briefly describe the past development, timeline and any past environmental review.

The box for 6f has been checked "yes," but again only with regard to the UPL progression aspect of the proposed Project. As its name implies, the UPL progression will be an extension of mining efforts that have existed for decades at the Peter Mitchell Mine.

The Stockpile aspect of the proposed Project, however, is not a "subsequent stage of an earlier project". In 2006, Northshore stockpiled materials blasted during the Reserve Mining bankruptcy period through an approved amendment to Northshore's Permit to Mine. This blasted rock included some Type II VF materials. The Proposed project will mark the first time Northshore has encountered in situ Type II VF materials as part of its own mining activities at the Peter Mitchell Mine, which is why Northshore has developed and submitted its Type II VF Stockpile Plan. Stockpiles created pursuant to that Plan for Type II VF material encountered during the proposed Project will be separate and distinct from the previous stockpiling of Reserve Mining blasted material and will not be "subsequent stages" of that previous stockpile.

7. Cover types: *Estimate the acreage of the site with each of the following cover types before and after development:*

Cover type	**Acres Before**	**Acres After**	**Cover type**	**Acres Before**	**Acres After**
Wetlands	62.83	0	Lawn/landscaping	0	0
Deep water/streams	0	0	Impervious surface	0	0
Wooded/forest	7.62	0	Stormwater Pond	-	-
Brush/Grassland	29.12	0	Barren Land	8.76	0
Cropland	-	-	Other (Mined)	153.00[a]	261.33[b]
			TOTAL	**261.33**	**261.33**

[a] Represents the 153-acre footprint of the proposed Type II VF stockpile. This area is in the mine pit.
[b] Represents the proposed Type II VF stockpile (153.0 acres), plus the UPL progression (108.33 acres)

Land cover within the UPL progression is primarily wetland with minor amounts of forest, grassland, and barren land (i.e. roads). See Figure 7-1 for the National Land Cover Database (NLCD) mapping of land cover in the vicinity of the proposed Project. The proposed Project would convert all land cover types within the 108.33-acre UPL progression to use as an active mine. Northshore has an existing U.S. Army Corps of Engineers (USACE) Section 404 permit and Wetland Conservation Act (WCA) approval that allow the removal of most of the wetlands, with mitigation for replacement of the lost wetland area. Northshore has filed a separate joint Section 404/WCA permit application with USACE and with the MNDNR to allow for the removal of additional wetland acreage not covered under the existing permit. Wetlands are discussed in detail in Item 11.

Land use within the Type II VF stockpile location is currently active mine land.

8. Permits and approvals required: *List all known local, state and federal permits, approvals, certifications and financial assistance for the project. Include modifications of any existing permits, governmental review of plans and all direct and indirect forms of public financial assistance including bond guarantees, Tax Increment Financing and infrastructure. All of these final decisions are prohibited until all appropriate environmental review has been completed. See Minnesota Rules, Chapter 4410.3100.*

Unit of government	Type of application	Status
MNDNR	Permit to Mine	Current Permit /Amendment Pending
USACE	Clean Water Act Sec. 404	Current Permit /Addendum Pending
MNDNR	Wetland Conservation Act	Current Permit /Addendum Pending
MNDNR	Water Appropriations	Current Permit Sufficient
MPCA	NPDES	Current Permit Sufficient
MPCA	Clean Water Act Sec. 401	Certification Pending for Project

Cumulative potential effects may be considered and addressed in response to individual EAW Item Nos. 9-18, or the RGU can address all cumulative potential effects in response to EAW Item No. 19. If addressing cumulative effect under individual items, make sure to include information requested in EAW Item No. 19

9. Land use:

a. Describe:

i. Existing land use of the site as well as areas adjacent to and near the site, including parks, trails, prime or unique farmlands.

The proposed Project and surrounding lands are designated for mining use within Northshore's existing Permit to Mine. There are no parks, trails, or prime or unique farmlands within or adjacent to the proposed Project.

ii. Plans. Describe planned land use as identified in comprehensive plan (if available) and any other applicable plan for land use, water, or resources management by a local, regional, state, or federal agency.

Lands within the proposed Project will be used for mining purposes.

iii. Zoning, including special districts or overlays such as shoreland, floodplain, wild and scenic rivers, critical area, agricultural preserves, etc.

The proposed Project is entirely within the City Limits of the City of Babbitt and is zoned as "Minerals Mining".

b. Discuss the project's compatibility with nearby land uses, zoning, and plans listed in Item 9a above, concentrating on implications for environmental effects.

The proposed Project would result in the conversion of approximately 108 acres of undeveloped land to mine use. The conversion is compatible with surrounding land uses, which include mining and associated access roads and is zoned accordingly.

c. Identify measures incorporated into the proposed project to mitigate any potential incompatibility as discussed in Item 9b above.

There are no land use incompatibilities resulting from the proposed Project, and mitigation would not be required.

10. Geology, soils and topography/land forms:

a. Geology - Describe the geology underlying the project area and identify and map any susceptible geologic features such as sinkholes, shallow limestone formations, unconfined/shallow aquifers, or karst conditions. Discuss any limitations of these features for the project and any effects the project could have on these features. Identify any project designs or mitigation measures to address effects to geologic features.

b. Soils and topography - Describe the soils on the site, giving NRCS (SCS) classifications and descriptions, including limitations of soils. Describe topography, any special site conditions relating to erosion potential, soil stability or other soils limitations, such as steep slopes, highly permeable soils. Provide estimated volume and acreage of soil excavation and/or grading. Discuss impacts from project activities (distinguish between construction and operational activities) related to soils and topography. Identify measures during and after project construction to address soil limitations including stabilization, soil corrections or other measures. Erosion/sedimentation control related to stormwater runoff should be addressed in response to Item 11.b.ii.

Bedrock Geology

Bedrock geology at the Peter Mitchell Mine can be viewed as a relatively simple set of rock layers. Giants Range granite forms the base and is exposed on the north side of the Peter Mitchell Mine. The Biwabik Iron Formation (BIF) and Virginia Formation (VF) lie unconformably on top of the Giants Range granite and generally dip to the southeast at 5 to 10 degrees, except in the eastern end of the formations where they are in close proximity to the overlying Duluth Complex. In those eastern areas, the BIF and VF dip as steeply as 30 degrees. Due to glacial erosion, the BIF is exposed under glacial till for a width of 0.5 to 2 miles to the south of the Giants Range granite, and a band of VF is exposed farther south for a width of 200 feet to several miles. The upper bedrock is Duluth Complex, which approaches the BIF at an oblique angle in the vicinity of the Peter Mitchell Mine, eventually cutting the BIF off a few miles to the east of the mine. Figure 10-1 and Figure 10-2 show the cross-section of these geological relationships and the

location of the cross-section extending across the UPL and south of the proposed pit progression. The UPL progression will impact only the BIF and the VF, which are described below:

- BIF: Including the ore to be mined and overlying lean ore, the BIF rock is between 225 to 350 feet thick within the UPL progression and is a thick-bedded, layered, sedimentary sequence. The gross mineralogy in the Eastern Mesabi Range (in which the Peter Mitchell Mine is located) largely consists of magnetite, quartz and iron-rich silicates. (Gunderson and Schwartz 1962 p.7). Iron content in the BIF ranges from 0% to greater than 30%. Analysis of iron content grades and processing characteristics are measured on a grid of exploration drillholes to determine which portions of the BIF can be economically mined as ore and sent to the Silver Bay plant for processing. BIF with low iron grades, or other poor processing characteristics, are stripped and placed in on-site stockpiles to allow access to underlying ore material.
- VF: The southward progression of the Peter Mitchell Mine requires the stripping and stockpiling of VF rock to access underlying BIF ore. In general, the VF comprises a sequence of argillite, siltstone, and greywacke, and contains trace amounts of sulfides. Pyrrhotite is the dominant sulfide within the VF with minor pyrite and chalcopyrite (Lucente and Morey, 1983; Severson and Hauck, 2008). In the vicinity of the Peter Mitchell Mine, the VF can generally be described as a somewhat laminated, fine-grained, light gray quartzose hornfels that is locally rich in biotite (Gunderson and Schwartz, 1962 p. 68). The VF exposed in the southern high wall of the Peter Mitchell Mine Main Pit, and as intersected by exploratory drilling, includes diabase sills, metasediments, and bedded VF (Golder, 2012). The term metasediments is used by Northshore to describe a variety of metamorphic textures that occur within VF rock in close proximity to the Duluth Complex. These textures are generally not continuous from drillhole to drillhole, but define rock of similar quartz / biotite composition. In the vicinity of the Peter Mitchell Mine, a variety of VF referred to as “bedded pyrrhotite” occurs which has a significantly higher sulfur content than other VF rock units. No occurrences of bedded pyrrhotite have been identified by exploratory drilling in the project area. Diabase sills appear locally within the Peter Mitchell Mine pit as basal sills of highly variable thickness (Grout and Broderick, 1919; Severson and Hauck, 2008; Severson, 1991) and consist of mafic amphibolites and metabasalts that are primarily fine- to medium-grained in texture, with minimal local coarse-grained texture.

Northshore has completed extensive characterization of potential VF rock stockpiling effects in cooperation with state regulatory agencies and following industry best practices. In 2004, a classification system, based on characterization results, was proposed to and later utilized by MNDNR for identifying and distinguishing VF rock at the Peter Mitchell Mine site, according to sulfur content and neutralizing potential (Golder, 2013). MNDNR has not formally approved the classification criteria, but has acknowledged the classification system by referencing it in permit amendments that MNDNR has granted to Northshore[5]. The VF classification, as defined in the Virginia Formation Development Plan (Northshore, 2004), is as follows:

[5] An example of MNDNR utilization of the VF classification is in a March 24, 2006 letter approving a PTM UPL amendment from Steve Dewar, MNDNR Mineland Reclamation Field Supervisor (at the time), to Doug Halverson at Northshore.

- Type I VF: Blast patterns containing Virginia Formation rock with whole rock sulfur content of less than 0.20 weight percent and NPR[6] greater than or equal to 3 for the pattern averages.
- Type II VF: Blast patterns containing Virginia Formation rock with whole rock sulfur content of greater than or equal to 0.2 weight percent and less than 1.0 weight percent sulfur, or with a NPR of less than 3.
- Type III VF: Blast patterns containing Virginia Formation rock with sulfur content of greater than 1 weight percent. Type III VF will not be uncovered during this proposed project.

Type I VF generally occurs at the base of the VF, directly above the BIF, and is composed of a mixture of VF rock, including the diabase sills. Type II VF generally overlies the basal VF sills and is predominantly made up of VF metasediments. A histogram showing the percent sulfur in the VF materials is available in Figure 3-16 of the May 2013 Golder Report.

Type II VF is expected to have significantly less potential to generate mineral fibers than Type I VF or BIF, because amphibole minerals present in the Virginia Formation are primarily associated with the diabase sills (Golder, 2012), which are generally categorized as Type I VF. In addition, the Virginia Formation is non-ore grade, so it would not be crushed and processed. Avoiding the crushing of Virginia Formation rock would result in a low potential for generation of mineral fibers.

Surficial Geology

Surficial materials are variable and include peats, glacial tills, water eroded glacial tills, and lake deposits (Jennings and Reynolds, 2005) associated with the Rainy Lobe glaciation. Peat lands are the primary surficial geology within the proposed UPL progression, especially within the western portion where they are interspersed with small bodies of open water. Glacial till within the UPL progression is generally clast-poor, variable in color, and consists of sand (21% to 38%), silt (29% to 38%), and clay (31% to 41%). The clay within the glacial till is interpreted to be localized incorporation of lake sediment from ponded water along Giants Ridge. Some water eroded till within the UPL progression has a smoother surface expression with coarser grain clasts at the surface. Lacustrine sediments are also present and include a mix of silts, clays, and organic matter. These lacustrine sediments are interpreted to have been deposited by Glacial Lake Dunka, which likely also formed the smooth, wave-washed surfaces, and which drained to the north along the current location of the Dunka River (Stark, 1977).

The thickness of surficial materials is highly variable and depends on local bedrock topography, the morphology of glacial landforms, and the associated deposit. In areas where peat is the predominant surficial geology overburden thickness can extend greater than 50 feet (Jennings and Reynolds, 2005), whereas glacial till tends to extend to approximately 20 feet below the surface (Minnesota County Well Index).

Groundwater

Groundwater is present in surficial deposits under generally unconfined conditions with surface waters in the western portion of the Proposed UPL. Water also occurs in bedrock, primarily within fractures or weathered zones, and typically near the upper surface of the bedrock. The bedrock generally has

[6] Neutralization potential ratio (NPR) is defined as the ratio of the acid neutralizing potential to the acid generating potential (ANP/AGP).

extremely low primary hydraulic conductivity and there is little to no yield of water unless secondary openings exist (Ericson et al., 1976; and Siegel and Ericson, 1980).

Currently, unconfined groundwater drainage generally mimics surface water drainage, and within unconsolidated deposits is locally directed along relatively short flow paths toward the nearby surface water features in the surficial peat deposits. Mine features, bedrock, low permeability till, and lake deposits disrupt flow through the surficial deposits in some areas (Siegel and Ericson, 1980). Locally, groundwater from the UPL progression and the area immediately to the south flows into the pit, where it is mixed with runoff and seepage and pumped through collection sumps for discharge to Langley Creek. Refer to Item 11*a(ii)* for further information regarding groundwater resources. Because of water quality management practices that require transfers within the pit, occasionally runoff and seepage may be moved to a sump that discharges to Unnamed Creek or SD 002.

Impacted Geologic Resources

In order to access the underlying ore, the proposed Project will require the removal of 1 to 1.5 million long tons of surface materials and 7.9 to 8.4 million long tons of bedrock each year within the 108.33 acre UPL progression, for a total of 9.9 million long tons of surface materials and bedrock removed annually over a ten-year period. Impacts related to the removal of this material will occur immediately adjacent to the existing mine, thus these activities are effectively an extension of current mining activities. Mining activities and the subsequent stockpiling of lean ore and rock are described in Item 6.b. The total estimated quantities of bedrock that will be impacted and are required to be excavated as part of operational activities are included in Table 10-1.

Surficial Materials

Surficial impacts will include the removal of surface materials within the 108.33 acre UPL progression. Past removal of surface materials, including similar soil, peat and wetland soils during Peter Mitchell Mine operations, has not resulted in exceedances of NPDES permit limitations, other than for pH, which are being managed. Therefore, additional permit exceedances are not expected to occur with the UPL progression. The contribution of surface materials to pH is negligible; surface materials are segregated and stockpiled in order to manage and monitor runoff. All types of surface materials excavated from the UPL progression will be available for use in reclamation, with most material to be placed on final stockpiles, which will be benched and reclaimed in accordance with current MNDNR reclamation standards. Surface materials on lands outside the UPL progression will not be used or disturbed as part of the project.

Bedrock

Excavated bedrock not used for processing will be stockpiled and managed in a similar manner to that described in Item 6.b.

Because stockpiles will be placed in previously mined areas, they will not disturb any new lands outside of the UPL progression. As such, impacts to additional geological resources are negligible because no ore resources are present within or under the proposed stockpile areas.

Given the site stratigraphy and pit configuration, BIF, Type I VF, and Type II VF formations will all be exposed along the pit's southern high wall. At the conclusion of mining, Northshore estimates from block model and geologic configuration that an exposure of approximately 10.9 acres of Type II VF, corresponding to an approximately 55-foot thick layer running the length the southern pit wall (approximately 8,600 feet), will be exposed above the elevation of the pit lake.

VF was previously mined in the early 1980s by Northshore's predecessor. The exposure of several VF outcrops allowed for the opportunity in 2002 and 2003 to observe weathering characteristics under natural conditions and to collect water quality samples from drainage impacted by VF exposures. The VF exposures had areas where precipitation would collect in ponds or sumps, providing locations to collect drainage samples for the investigation. If sampling locations that are within Northshore's mining areas and that could flow to Langley Creek had been directly discharged offsite at the time of the investigation (2002-2003), the discharges would have consistently met the most stringent water quality standards applicable to Langley Creek (NPDES permit issued June 27, 2002). An exception is exceedances of total aluminum and total copper, which were limited to isolated, discrete events occurring at certain specific sampling locations and were not representative of overall typical conditions. Because wild rice has not been found to be present during recent wild rice surveys, the surface water quality sulfate standard for wild rice is not applied. The study's detailed sampling location maps and collected water quality data are available in the Virginia Formation Development Plan (2004; revised 2008) submitted by Northshore to the MNDNR.

Table 10-1. Mining Material Estimates[1]

Formation	Excavated Quantities (long tons)	Sulfur Content	Neutralization Potential[2]	Total Excavated Quantity (long tons)
Biwabik Iron Formation (BIF) Ore	81,000,000	NA	NA	81,000,000
Lean Biwabik Iron Formation (BIF) Rock	55,000,000	<0.2%	NA	94,000,000
Type I Virginia Formation (Type I VF)	13,703,000	<0.2%	≥ 3:1	
Type II Virginia Formation (Type II VF)	16,297,000[3]	≥0.2% but <1%	< 3:1	
Surface Overburden	9,000,000	NA	NA	

1. Quantities of excavated units are from Northshore's Permit to Mine Amendment application to the MNDNR dated April 12, 2013.
2. For VF material to be classified as Type I, the material must have a sulfur content AND neutralization potential that meets the restrictions in the above table. For VF material to be classified as Type II, the material can have either a sulfur content OR neutralization potential that meets the restrictions in the above table.
3. The quantity of Type II VF includes the excavation of sills (6,571,000 long tons) and metasediments (9,727,000 long tons)

Soils and Topography

Natural Resources Conservation Service's (NRCS) Soils Survey Geographic Database SSURGO has identified soils within the UPL progression as Udorthents identified in soils mapping unit 1003B(Figure 10-3). Specifically, the Udorthent soils are loamy and consist of cut and fill material from previous mining and development operations. In uplands soils may typically be derived from glacial till and contain rock fragments. Upper soil profiles are relatively coarse stony loams or sandy loams. The loamy soils have moderate permeability and erodibility. Wetland soils and soils associated with peat lands may also be present in low areas and include peat, muck, and mucky loam.

Topography of the UPL progression is flat with little variability (<1% slope), especially in the western portion of the UPL progression where peat land areas occur within topographic depressions and contain small ponds of surface waters (Hobbs and Goebel, 1982).

11. Water resources:

a. Describe surface water and groundwater features on or near the site in a.i. and a.ii. below.

i. Surface water - lakes, streams, wetlands, intermittent channels, and county/judicial ditches. Include any special designations such as public waters, trout stream/lake, wildlife lakes, migratory waterfowl feeding/resting lake, and outstanding resource value water. Include water quality impairments or special designations listed on the current MPCA 303d Impaired Waters List that are within 1 mile of the project. Include DNR Public Waters Inventory number(s), if any.

Surface water resources in the vicinity of the proposed Project include lakes, streams, and wetlands as identified in Figure 11-1. The surface water resources, and their classifications per Minnesota Rules Ch. 7050.0140, are outlined in Table 11-1.

Table 11-1. Surface Water Resources in the Proposed Project Area

Surface Water	Public Waters Inventory # (Kittle Numbers)	Classification
Argo Lake	69-53	Class 2B, Class 3C, Class 4A, Class 4B, Class 5 and Class 6
Iron Lake	69-152	
Langley Creek	NA (H-1-92-14-5; H-192-14-5-1)	
Dunka River	NA (H-1-92-14)	
Unnamed Creek	NA (H-1-92-14-1)	
Partridge River	NA (S-2-57)	

Argo Lake and Iron Lake are listed as MNDNR Protected (i.e. Public) Waters. There are no other MNDNR Protected Waters within the vicinity of the proposed Project. Argo Lake and Iron Lake are north-northwest of the northern edge of the Peter Mitchell Mine. Argo Lake is a 83-acre basin ~1,600 feet from the pit edge, and Iron Lake is a 172-acre basin ~ 750 feet from the pit edge. The University of Minnesota Lake Browser tool (U Minn 2013) shows that both Argo and Iron Lakes have clarity depths ranging from ~2 to 3 meters. MNDNR has not assessed either lake for aquatic recreation or fish consumption. Neither lake will be affected by the proposed Project.

Dunka River is a 17.4-mile long small river that at its closest approach is ~0.25 mile northeast of the east end of the Peter Mitchell Mine. Most of the Dunka River is about one mile east of the mine. Partridge River is an 11-mile long small river that at its closest approach is ~1.1 mile south of the south edge of the Peter Mitchell Mine. Both rivers are warm-water streams, with generally broad, open channels, and occasional narrow riffles and scattered boulder fields. The proposed Project will have no impact on the Partridge River, as all operations discharges will be primarily to Langley Creek. No discharges from the proposed Project will flow to Partridge River.

Langley Creek is a 3.9-mile long small-medium creek that at its closest approach is ~0.85 mile southeast of the south edge of the Peter Mitchell Mine (Figure 11-2). Langley Creek flows into Dunka River. Over most of its length, it is a well-defined, warm-water open channel, becoming shallow and narrow further west. Finally, “Unnamed Creek” refers to two different water courses. Post-closure, “Unnamed Creek” refers to a water course originating at the extreme northeast end of the pit and reporting to Dunka River. This is the outfall of the post-closure pit lake, and all post-closure discharge will report to this “Unnamed Creek”. During operations, “Unnamed Creek” refers to a water course near the southeast end of the pit,

originating at SD-002 and reporting to Dunka River via a series of wetlands. This is the operational SD-002 outfall.

No impaired waters or special designations listed on the current MPCA 303(d) Impaired Waters List are located within 1 mile of the proposed Project. The proposed Project is located within the Langley Creek watershed as defined by current permitted discharges but is part of an overall pit expansion that will ultimately also impact the watershed of Unnamed Creek to the Dunka River, as described in the *Long Range Hydrology Study* (Barr 2008).

There are a total of 62.83 acres of wetlands within the proposed project area. These wetlands are primarily forested/scrub-shrub types partitioned by internal mine roads (Table 11-2). Of these wetlands, approximately 50.74 acres are currently permitted for impacts under Section 404 through USACE. An additional 12.09 acres of wetland--shallow marsh (10.15 ac), alder thicket (1.21 ac), and shrub-carr (0.73 ac--are not covered under the existing permit. Northshore will apply for a Section 404 permit for these impacts pending EAW approval. The removal of the additional wetland acreage will also require a permit amendment under the State Wetland Conservation Act (WCA). The approving authority for WCA permitting for these wetlands is the MNDNR Division of Lands and Minerals.

Table 11-2. Wetland Types within the Proposed Project Area

Wetland Types Following Major Classification Systems[1]					
Eggers & Reed		**USFWS Circular 39**		**Cowardin et al.**	
Classification	Area (ac.)	Classification	Area (ac.)	Classification	Area (ac.)
Shallow marsh	20.40	Type 3	20.40	Palustrine emergent	20.40
Alder thicket	1.21	Type 6	20.90	Palustrine scrub-shrub	20.90
Shrub-carr	19.69				
Coniferous swamp	21.53	Type 7	21.53	Palustrine forested	21.53
Total	62.83	Total	62.83	Total	62.83
[1] Included in the total are 50.74 acres of wetlands that are currently permitted under Section 404 and WCA permits. The remaining 12.09 acres of the total will require Section 404 and WCA permits for their removal.					

Northshore contracted with Barr Engineering to conduct wild rice surveys in Dunka River, Langley Creek and Unnamed Creek during 2013, and no wild rice was found. A report on the wild rice surveys was prepared and submitted to the MPCA[7]. Wild rice was previously found in Dunka Bay of Birch Lake.

ii. Groundwater – aquifers, springs, seeps. Include: 1) depth to groundwater; 2) if project is within a MDH wellhead protection area; 3) identification of any onsite and/or nearby wells, including unique numbers and well logs if available. If there are no wells known on site or nearby, explain the methodology used to determine this.

Groundwater resources in the immediate vicinity of the proposed Project area include the following:

[7] Barr Engineering Company (Barr). 2013. Wild Rice Literature Review and 2013 Field Survey for the Peter Mitchell Mine. Technical Memorandum to Nathaniel Schroeder, Northshore Mining Company. December 11, 2013. p. 8-11.
Barr Engineering Company (Barr). 2011. Wild Rice Literature Review and 2011 Field Survey for the Dunka Mining Area. Technical Memorandum to Craig Hartmann, Cliffs Erie. December 20, 2011. p. 6-13.

- Surficial aquifers – These are present in the various unconsolidated glacial deposits above the rock surface. The depth to groundwater (i.e., water table elevation) in these aquifers generally mimics surface water drainage patterns, and groundwater flow is locally directed along relatively short flow paths toward the nearby surface water features and wetlands shown in Figure 11-1. Groundwater in the surficial aquifer immediately south of the proposed Project area flows into the mine pit, with the flow being constrained by the hydraulic conductivity of the materials. Groundwater will continue to flow toward the pit post-closure. Refer to "Discuss Effects to Surface Water and Groundwater from the Mine Water Discharge" in Item 11.b.i below for details.
- Bedrock aquifers – The BIF is considered a usable groundwater resource along the Iron Range primarily because abandoned mine pits provide a storage reservoir adequate for municipal water supply. In addition, there is sufficient fracturing in some locations for individual residential well water supply. The VF is generally not considered an aquifer due to its low storage capacity. However, on a localized basis, there is groundwater within fractures or weathered zones, typically near the upper surface of bedrock.

Figure 11-3 shows wells recorded in the Minnesota County Well Index. All identified wells within the immediate vicinity of the proposed Project area are exploration or monitoring wells. As indicated on Figure 11-3, there are no residential wells identified in the Minnesota County Well Index in the immediate vicinity of the proposed Project. The proposed Project is not within a Minnesota Department of Health (MDH) wellhead protection area.

The bedrock groundwater level in the UPL progression is influenced by the elevation of water in the mine sumps, and the fact that the mine is actively dewatering those sumps. Groundwater in the bedrock adjacent to the mine flows into the mine pit because the sumps depress the static water level in the immediate vicinity of the mine. The nearest BIF well identified in the Minnesota County Well Index is approximately 15 miles from the UPL progression.

b. Describe effects from project activities on water resources and measures to minimize or mitigate the effects in Item b.i. through Item b.iv. below.

i. Wastewater - For each of the following, describe the sources, quantities and composition of all sanitary, municipal/domestic and industrial wastewater produced or treated at the site.

1) If the wastewater discharge is to a publicly owned treatment facility, identify any pretreatment measures and the ability of the facility to handle the added water and waste loadings, including any effects on, or required expansion of, municipal wastewater infrastructure.

2) If the wastewater discharge is to a subsurface sewage treatment systems (SSTS), describe the system used, the design flow, and suitability of site conditions for such a system.

3) If the wastewater discharge is to surface water, identify the wastewater treatment methods and identify discharge points and proposed effluent limitations to mitigate impacts. Discuss any effects to surface or groundwater from wastewater discharges.

The Peter Mitchell Mine produces sanitary wastewater, stormwater, miscellaneous industrial wastewaters and mine water. Each of these has treatment systems that are addressed under the existing NPDES/SDS permit.

There will be no change to the sources, quantities or composition of the sanitary or industrial wastewater produced at the mine. The proposed Project will result in some changes to mine water produced at the proposed Project location. The proposed project will only affect mine water; therefore, the rest of this section describes mine water sources, quantity, composition, treatment methods, discharge points, and effluent limitations to mitigate impacts. It also discusses effects to surface and groundwater from the mine water.

Mine Water Management Overview

During the operational life of the mine, the sources of mine water are precipitation runoff and groundwater inflows, which drain to the mine pit sumps. The sump water is discharged to receiving streams in accordance with the MNDNR water appropriation permit requirements to maintain base stream flow and NPDES permit discharge limits. These mine water sources would exist regardless of the implementation of the proposed Project.

After the mine closes, sump pumping will stop and the pit water will fill to its runout elevation. The resulting pit lake will eventually overflow to Unnamed Creek and discharge to the Dunka River. Similar to the case of sump water, this pit lake overflow will occur regardless of whether the proposed Project is implemented. The specific nature of the pit lake design and overflow is subject to the closure and post-closure requirements of the Permit to Mine.

Also, with the cessation of sump pumping, the flow to the receiving streams will be decreased because the loss of watershed from mining activities would no longer be mitigated by pumping. The flow of Unnamed Creek will initially decrease at closure, once pumping stops and the pit lake fills. Once the pit lake level reaches the outfall at Unnamed Creek, flow to the creek will increase, and will reach Dunka River via Unnamed Creek. An evaluation of the anticipated effect of the proposed Project on the quantity and quality of mine water is contained in the sections below for the operations and closure scenarios.

Finally, the mine employs ongoing progressive reclamation practices in conjunction with sump water management to meet water quality discharge limits. The proposed Project will continue to employ these systems and practices, and will further supplement the current mine water management practices with the addition of the Type II VF stockpile design, management of a DNR-approved test plot program, supplemental sump water monitoring, and a contingency plan that would provide additional sump water management practices if necessary. Water quality is projected to meet applicable standards.

Quantity of Mine Water

During operations, the mine water to be discharged from the proposed Project would flow to the Block 9 Bn7 sump and the Block 15 Bn5 sump, shown on Figure 11-2. The quantity of water received at these sumps due to the proposed Project would primarily be from increased precipitation and runoff to the sumps as a result of mined watershed draining to the sumps, and secondarily from an increase in groundwater flowing into the proposed Project mine area. A minimal increase in runoff and groundwater inflow is expected due to the Project and is discussed further below. The size of the proposed Project is small relative to the size of the overall mine pit and therefore would contribute a relatively small change in the sump discharge.

Most of the groundwater inflow into the existing pit is from the unconsolidated surficial deposits that lie on top of bedrock. This is similar to other pits in the area, such as the Dunka pit, where analyses of pumping records and pit water levels has demonstrated that nearly all of the groundwater inflows into the

pit are from the surficial deposits. Lowering the dewatering level in the pit is not expected to cause substantial increases in groundwater inflows because the deeper portions of the Biwabik Iron Formation are less fractured and therefore less permeable than the shallow portions. Furthermore, contributions of groundwater inflows from the Pokegama quartzite (to the north) and the Virginia Formation (to the south) will be negligible because these units have a substantially lower permeability than the Biwabik Iron Formation.

The amount of the water currently discharged from the Block 9 Bn7 and Block 15 Bn5 mine pit sumps was calculated as part of the water quality evaluation study for the Type II VF Stockpile. The study used mine pumping records to estimate annual average discharge at 2629 gpm (Golder 2013). Modeling was then completed to estimate contributions from various sources, as shown in Table 11-3.

In addition, as part of the water quality evaluations for the Type II VF stockpile design, upper and lower bound water balance conditions were developed to bracket possible water quality changes. However, these water balances were developed to assess the stockpile cover design and not the expected discharge rates from the sumps to Langley Creek during mining of the proposed Project. Therefore, in order to calculate the expected changes in water received by the sumps due to the proposed Project, the method employed in the 2008 Long-term Hydrology Study (Barr 2008) was used. This method approximates water yield change due to both surface water drainage changes and groundwater flow as a result of the pit development, based on actual flow monitoring of Langley Creek while mine discharges were occurring. The results of this calculation estimate the increase in annual average flow at the sumps to be on the order of 200 gpm, which would be added to the 2629 gpm under current conditions, or an approximately 8% increase in pumping rates. However, this increase is offset by reduction of the natural flow to Langley Creek as a result of the mining of the proposed UPL progression. Accounting for the elimination of the natural watershed area, the net change in flow to Langley Creek is estimated to be an average annual increase of 80 gpm, or a 2% increase in total flow in Langley Creek during operations.

At closure, once mining ceases, all of the mine pit sumps will stop operating. All of the current and future Peter Mitchell Pit will drain to the pit lake and outflow to Unnamed Creek and then to Dunka River. The amount of water discharged through the pit lake at full development was estimated to be a maximum of 21.4 cfs in the 2008 Hydrology Report. The proposed Project will not change this discharge estimate. The proposed pit expansion is approximately 3 percent of the total increase in drainage area to Unnamed Creek, relative to existing conditions.

In addition, as part of the Type II VF Stockpile Design Study (Golder 2013), water quality evaluations, upper and lower bound water balance conditions were included in the design evaluations for the closed mine. These water balances assumed a pit lake watershed area on the order of one half the total pit area planned at closure, which approximates the current state of mine development without any further development. It also assumed that only a fraction of the water in the assumed pit lake would mix with the Type II VF stockpile seepage. Therefore the water quality evaluations assume a minimum amount of pit lake water available for dilution in the Type II VF stockpile design evaluation.

Tables 11-3 and 11-4 show the water balances used in the Type II VF stockpile design evaluations that result in highest water quality impacts due to minimal mixing volume at the sumps and pit lake. Comparing these tables to the actual anticipated discharge estimated from the 2008 Long Term Hydrology Study shows that the flow values used in the water quality impact evaluations represent a lower than expected amount of water available for dilution, thereby representing an upper bound condition in the water quality impacts analysis discussed further below in this section.

Table 11-3. Summary of Water Balance Model Predictions for Conditions during Operations, Compared with Existing Water Balance (All Flows shown as Average Flow over a Year)

Modeling Scenario	Groundwater Inflow (gpm)	Disturbed Pit Subbasin Runoff (gpm)	Open Water Subbasin Runoff (gpm)	Upland Vegetation Subbasin Runoff (gpm)	Change in FRZ* Storage (gpm)	Predicted Stockpile Seepage (gpm)	Total (gpm)
"Current Conditions"; Calibration to 1999-2007	760	1452	375	47	-5	n/a	2629
Prediction of future water balance, assuming constant groundwater inflow	760	1412	350	31	0	0.46	2553

*****Fractured Rock Zone – the rock immediately adjacent to the mine pit boundaries that has been cracked as a result of standard mining activities, primarily blasting. Data summarized from Tables 3-5 and 3-6 in "Type II Virginia Formation Stockpile Plan" (Golder, 2013; tables revised in March 2014).

Table 11-4. Summary of Water Balance Model Predictions for Conditions Post-Closure (Following Full Pit Lake Development) (All Flows shown as Average Flow over a Year)

Groundwater Inflow	Disturbed Pit Subbasin Runoff (gpm)	Open Water Subbasin Runoff (gpm)	Upland Vegetation Subbasin Runoff (gpm)	Change in FRZ* Storage (gpm)	Predicted Stockpile Seepage (gpm)	Direct Pit Lake Precip. (gpm)	Direct Pit Lake Evap. (gpm)	Total (gpm)
1779	1606	351	53	0	0.46	602	-497	3894

*Fractured Rock Zone – see definition above. Data summarized from Table 3-7 in "Type II Virginia Formation Stockpile Plan" (Golder, 2013; tables revised March 2014).

Composition of Mine Water

A chemical mass balance model was constructed to predict a range of constituent concentrations in water reporting to a conceptual pit sump (during operations) and of the pit lake water (post-closure, following full development of the pit lake) after the proposed Project is implemented (Golder, 2013). As stated in the report:

> *The purpose of the model was to provide a tool to bracket viable engineering designs for the stockpile plan that will satisfy water quality criteria. The model was not intended to represent all physical and chemical processes nor provide precise predictions of water chemistry.*

Inputs to the model were defined on the basis of an experimental test program (Golder, 2012), data from existing surface water chemistry, and established geochemical principles. Model assumptions were selected to bracket a range of potential conditions. The model runs for during-operation conditions were performed under two sets of scenarios, one in which groundwater inflow into the pit is assumed to be the same as current conditions, and a second set of scenarios where the groundwater inflow is assumed to

increase due to deepening of the pit in the future. All three scenarios (two during-operation scenarios and one post-closure scenario) are executed using six different sets of assumptions, resulting in 18 different model runs. The six sets of assumptions are outlined in Table 11-5.

Table 11-5. Sets of Assumptions Used in Model Scenarios

Scenario	Humidity cell(s) used to determine stockpile concentration limits[1]	Seepage % of Annual Precipitation
1	NSM-HC10 Scaled, 0.15%S	0.21%
2	NSM-HC10 Scaled, 0.15%S	0.45%
3	Composite Scaled, 0.24%S (weighted avg)	0.21%
4	Composite Scaled, 0.24%S (weighted avg)	0.45%
5	NSM-HC17 Scaled, 0.42%S	0.21%
6	NSM-HC17 Scaled, 0.42%S	0.45%

[1] The approach used in this evaluation included developing a range of stockpile seepage concentrations through geochemical modeling of the humidity cell effluent chemistries to establish more reasonable stockpile seepage concentrations. Humidity cell effluent chemistries were scaled upward to account for the relatively high water to rock ratio and flushing rate in the laboratory conditions relative to field conditions. Scaling was performed using a computer based geochemical thermodynamic equilibrium model (Golder 2013).

Of these, the scenario that would predict the greatest potential impact from the proposed Project is the during-operations scenario, which assumes that the volume of water flowing into the pit in the future is the same as current conditions, using the set of assumptions listed as #4 in Table 11.5. This represents an "upper bound" on the potential impact from the proposed Project, because it brackets a condition with the highest concentration limits predicted for the stockpile drainage along with the highest infiltration rates. This upper bounds scenario (along with the other scenarios run for conditions during operations with constant groundwater inflow) does not reflect the dilution that would result from additional water flowing into the pit if groundwater inflow increases because of pit deepening.

The numeric water quality predictions at the sump are not directly representative of water quality at a current or future discharge location (either with or without the Proposed Project), because:

1) The surface water quality data that were used to define inputs into the chemical mass balance were derived from water samples collected around the mine site during the time period 2004-2008, and do not precisely match all constituent concentrations from the most recent surface water quality data set. The 2004-2008 surface water quality data was used for the chemical mass balance model and not the most recent data because this is the data that was available at the time that the chemical mass balance was developed. The process of developing the stockpile plan was initiated in early 2008.
2) It is current practice to transfer mine sump water between sumps and/or retain mine sump water prior to discharge for the purpose of mitigating potential impacts of discharge. Pumping and/or retention of mine sump water can be performed to promote particulate settling and clarification, lower unionized ammonia concentrations, and/or moderate pH of the water. The potential transfer and/or retention of mine sump water was not included in the chemical mass balance.

This practice represents an additional level of mitigation that could be applied after the inflows report to the first sump.

While the methodology used in the chemical mass balance model remains sound, given the factors listed above, the modeled water quality at the sump does not directly indicate the future quality of water being discharged from the site as a result of the proposed Project. A comparison of the quality of water discharged with and without the proposed Project is made by using the results of this chemical mass balance model (Golder, 2012) to identify the percent change in constituent concentrations attributed to the Project (as indicated by the chemical mass balance results). This percent change is applied to the most current water quality measurements observed at the active permitted discharge location (SD005) (See Figure 19-1). Table 11.6 summarizes the predicted water quality at a future pit sump location both with and without the contribution from the Type II VF stock pile drainage (as indicated from the upper bounds scenario of the chemical mass balance model), as well as the percent change in constituent concentrations that results from this drainage. Water quality observed at discharge location SD005 during 2013 is summarized in Table 11.7, along with projected percent change due to the proposed Project, and the resulting projected water quality at SD005. To calculate the minimum, maximum, and average from the SD005 water quality monitoring results, data that were below the reporting limit were substituted with half of the reporting limit for that parameter. This results in values above zero for all calculations, even if concentrations were below the reporting limit for all sampling events for the period used in this analysis. Potentially applicable water quality standards are shown in Table 11-8.

Table 11-6. Predicted Water Quality at In-Pit Sump Location, With and Without Proposed Project, Based on 2013 Golder Report[1]

Parameter	Units		Without the Proposed Project	With the Proposed Project[2]	Projected % change due to Proposed Project
Aluminum, Total	µg/L	Minimum	43	44	2%
		Maximum	93	110	18%
		Average	72	80	11%
Arsenic, Total	µg/L	Minimum	4.6	4.6	0%
		Maximum	10	10	0%
		Average	8.8	8.9	1%
Cobalt, Total	µg/L	Minimum	0.56	0.72	29%
		Maximum	1.6	4.7	194%
		Average	1	2.4	140%
Copper, Total	µg/L	Minimum	1.1	1.2	9%
		Maximum	2.5	4.5	80%
		Average	1.8	2.7	50%
Hardness, Total	mg/L	Minimum	112	113	1%
		Maximum	137	138	1%
		Average	132	133	1%
Iron, Dissolved	mg/L	Minimum	0.44	0.46	5%
		Maximum	0.88	1.1	25%
		Average	0.79	0.89	13%

Parameter	Units		Without the Proposed Project	With the Proposed Project[2]	Projected % change due to Proposed Project
Nickel, Total	µg/L	Minimum	1.3	2.5	92%
		Maximum	7	29	314%
		Average	3.8	14	268%
Sulfate, Total	mg/L	Minimum	31	31	0%
		Maximum	43	45	5%
		Average	42	43	2%
Zinc, Total	µg/L	Minimum	5.2	5.9	13%
		Maximum	10	22	120%
		Average	7	13	86%

[1]Predicted water quality, both with and without proposed Project, are taken from the modeled scenario that indicates the largest change due to the proposed Project. This scenario represents conditions during operations, assuming low pH stockpile drainage, constant groundwater inflow to the pit, and that 0.45% of annual precipitation infiltrates the stockpile cover.
[2]Water quality predictions for "with proposed Project" conditions are summarized from Table A-3A in "Type II Virginia Formation Stockpile Plan" (Golder, 2013). Water quality predictions for "without Proposed Project" are taken from Table A-3A Supplement; provided by Golder on March, 2014 (Golder 2014b).

Table 11-7. Comparison of 2013 SD 005 Monitoring Results and Projected Future Water Quality Based on 2013 Golder Report

Parameter	Units		Existing NPDES Permit Limit[1]	SD 005 Monitoring Results[1]	Projected % Change due to Proposed Project	Projected Future Water Quality at SD005
Aluminum, Total	µg/L	Minimum	None	10	2%	10.2
		Maximum		48.1	18%	56.9
		Average		21.6	11%	24.0
Arsenic, Total	µg/L	Minimum	None	7.2	0%	7.2
		Maximum		27.7	0%	27.7
		Average		14.9	1%	15.1
Cobalt, Total	µg/L	Minimum	None	1	29%	1.3
		Maximum		1	194%	2.9
		Average		1	140%	2.4
Copper, Total	µg/L	Minimum	Monitor Only	2.5	9%	2.7
		Maximum		2.5	80%	4.5
		Average		2.5	50%	3.8
Hardness, Total	mg/L	Minimum	None	151	1%	152.3
		Maximum		279	1%	281.0
		Average		198	1%	199.5
Iron, Dissolved	mg/L	Minimum	None	0.025	5%	0.03
		Maximum	2.0	0.025	25%	0.03
		Average	1.0	0.025	13%	0.03
Nickel, Total	µg/L	Minimum	Monitor Only	2.5	92%	4.8
		Maximum		2.5	314%	10.4
		Average		2.5	268%	9.2
Sulfate, Total	mg/L	Minimum	Monitor Only	66.3	0%	66.3
		Maximum		150	5%	157.0
		Average		90.4	2%	92.6
Zinc, Total	µg/L	Minimum	None	5	13%	5.7

Parameter	Units		Existing NPDES Permit Limit[1]	SD 005 Monitoring Results[1]	Projected % Change due to Proposed Project	Projected Future Water Quality at SD005
		Maximum		5	120%	11.0
		Average		5	86%	9.3

[1]For potentially applicable future water quality standards refer to Table 11-8
[2]To calculate the minimum, maximum, and average from the SD005 monitoring results, data that were below the reporting limit were substituted with half of the reporting limit for that parameter. This results in values above zero for all calculations, even if concentrations were below the reporting limit for all sampling events for the period used in this analysis.

Identification of Mine Water Treatment Methods

Potential treatment methods include physical treatment systems and management strategies. While the direct seepage from the Type II stockpile will not be collected or monitored, there are six components to the strategy to mitigate possible but unlikely impacts from the proposed Project:

- The Type II VF stockpile design will limit infiltration and thus water contact with Type II VF material, thereby limiting potential for seepage.
- A DNR-approved pilot test plot program will be implemented to demonstrate the hydrologic performance of the cover system. The goal of the DNR-approved test plot program is to replicate the Type II cover system on a field scale to evaluate whether it can meet performance specifications under site conditions. The preliminary results of the test plot program are currently under review by MNDNR (Golder 2014a).
- All proposed Project mine water will flow to mine sumps for treatment by settling.
- Type II VF contact mine water will mix with other water at the sumps (or within the pit lake).
- Supplemental water quality monitoring consisting of increased frequency and/or water quality parameters will be performed at locations SD004 and SD005 and at the in-pit sumps that could potentially be affected by the stockpile seepage, as well as any surface discharge locations receiving transfer water containing stockpile seepage. Water quality results for in-pit sumps will be reported with those from SD004 and SD005. Figure 11-2 provides the locations and nomenclature (150 sump, Blk9 Bn7 sump and SD004 and SD005) for the sumps affected by the Type II stockpile seepage.
- A mine water management contingency plan will be developed to respond to existing and supplemental water quality monitoring results and address conditions that may have the potential to affect effluent quality. This plan would include water transfers between sumps, sampling and, if necessary, treatment for specific parameters.

Supplemental monitoring of water quality will be conducted prior to Type II VF stockpile development, as well as following reclamation, at the established NPDES outfalls. Future supplemental monitoring will complement current monitoring performed by Northshore in accordance with the Type II VF Stockpile Plan and the existing NPDES/SDS Permit MN0046981 and any future permits. Supplemental monitoring will occur monthly prior to stockpile construction to establish baseline chemistry, monthly during stockpile development, and monthly thereafter during operations. This supplemental monitoring will provide the basis for the mine water management strategy to ensure compliance with the NPDES effluent limits.

Identify Discharge Points

During operations, the primary discharge point for the proposed Project mine water is from mine pit sumps to Langley Creek via NPDES permitted outfalls SD004 and SD005. Because of water quality management practices, mine water is occasionally routed from the main sump to a sump that discharges via a permitted NPDES outfall to Unnamed Creek. The frequency of this movement and the volume of the re-routed mine water varies. However, the discharge of proposed Project mine water would be minor, and the primary discharge point would be via the permitted NPDES outfall at SD-004. During the post-closure period, after full development of the mine pit lake, the primary discharge point would be the location of pit overflow into Unnamed Creek, which discharges to the Dunka River.

Identify Proposed Effluent Limitations to Mitigate Impacts

If necessary, to meet current and future NPDES effluent limitations, a mine water management contingency plan will be developed to address conditions that may have the potential to affect effluent quality. The contingency plan will be based on existing and supplemental water quality monitoring results. The strategy will use the existing and supplemental monitoring results (as identified above) to develop this plan, which would include water transfers between the sumps and possible treatment for specific parameters. Such a strategy is currently employed to meet existing effluent limits.

Discuss Effects to Surface Water and Groundwater from the Proposed Project Mine Water Discharge

The water and chemical mass balance models indicate that the mine water discharged to Langley Creek from the proposed Project is predicted to increase some chemical constituents but will have minimal impact in most cases. For constituents where the predicted percent increase is substantial, as with cobalt and nickel, the modeling nonetheless predicts that the water concentrations will likely be below applicable standards. The chemical mass balance from Golder (2012) indicates that constituent concentrations in discharge to Unnamed Creek after closure are predicted to be less than their concentrations during operations.

The Proposed project will reduce the surface watershed area tributary to Langley Creek by approximately 2.6 to 5 percent of the current surface watershed area (see Figure 6-8). The area reduced from the surface watershed will become tributary to the pit sumps, which are then discharged to Langley Creek. The net change in total tributary area to Langley Creek, when dewatering is considered, is zero during mine operation. Changes in the land surface may result in a net increase in total flow to Langley Creek during operations, as the decrease in surface runoff will be offset by increased pit dewatering.

Using the hydrologic methods for Langley Creek described in the *Long Range Hydrology Study* (Barr 2008), this land use change results in an estimated increase in flow in Langley Creek of approximately 100 gpm (0.2 cfs). The change in Langley Creek flow estimated using the methods from the *Long Range Hydrology Study* (Barr 2008) is similar to the change in total water balance estimated by Golder and presented in Table 11-3 (+100 gpm versus -80 gpm). The estimated change in flow due to the Project corresponds to approximately 2 percent of the average annual flow in Langley Creek (Barr 2008). In general, there are no anticipated hydrologic impacts to Unnamed Creek; however, due to existing mine water quality management practices that require transfers within the pit, water that would normally discharge to Langley Creek may on occasion be partially routed to a sump that discharges to Unnamed Creek. The limited degree of transfer of water between the sumps, combined with a minimal change in

sump inflow would have a negligible impact on the sump discharge volume. By extension, there would be a negligible effect on flow in Unnamed Creek.

Hydrologic impacts to Langley Creek and Unnamed Creek at closure are presented in the *Long Range Hydrology Study* (Barr 2008), but do not address the specific, incremental impacts of the proposed Project on that final condition. At closure, dewatering to Langley Creek will cease, resulting in a 46 percent decrease in watershed area relative to the current condition, and a decrease in average annual flow relative to the current condition and to the Project condition of approximately 60 percent (i.e., the majority of existing flow originates from pit dewatering). The proposed project accounts for approximately 6 percent of the cumulative reduction in watershed area estimated in final closure (and by extension, a similar reduction in flow) relative to existing conditions.

The watershed tributary to Unnamed Creek will increase by approximately 450 percent in final pit closure, relative to existing conditions. Flow in Unnamed Creek will increase at closure to six to seven times the current flow, as the entire pit lake will drain to the Dunka River via Unnamed Creek (Barr 2008). The proposed project accounts for approximately 3 percent of the change in watershed (and by extension, a similar increase in flow) relative to the current condition.

At closure, the average annual flow in the Dunka River will increase by approximately 11 cfs, a 30 percent increase over the existing condition (Barr, 2008). These impacts are described in greater detail in the *Long Range Hydrology Study* (Barr 2008), as approved by the MNDNR. Flow impacts at closure will be mitigated with development of pit-lake littoral habitat area (as described in the Peter Mitchell Pit Mitigation Plan).

During operations, the proposed Project will not affect groundwater quality. Because of the depression of the local water table caused by dewatering, all groundwater flows during operations will be towards the mine pit and will be collected in the sumps, as shown conceptually on Figure 6-4 and in Figure 11-2. There will be no post-closure effects to groundwater quality. Based on elevations of existing wetlands, lakes, and streams, the entire post-closure pit lake will be surrounded by surface-water features with elevations greater than the proposed pit lake elevation, and the pit lake will act as a groundwater sink, as shown conceptually on Figure 6-5. The locations of lakes, streams, and wetlands are shown on Figure 11-1. The pre-mining topography in the region is shown on Figure 11-4. With the exception of the Dunka River north-northeast of the pit (to which the pit lake surface outlet will flow), the regional surface water features surrounding the pit are all at elevations greater than the proposed pit lake elevation. These waters are approximately 100 feet higher than the proposed pit lake elevation in the immediate vicinity of the proposed Project and are likely perched above the regional potentiometric surface by low-permeability bottom sediments and low-permeability bedrock.

The zone of influence (i.e., “cone of depression” of the water table) created by the mine pit during mining and post-mining will undergo a southward shift associated with the proposed Project. This change will be limited to the immediate vicinity of the proposed Project and the change in location in the zone of influence will be approximately equivalent to the horizontal distance between the current pit wall and the future pit wall location associated with the proposed Project. In general, the cone of depression will be limited to the area of the Biwabik Iron Formation and will not extend substantially into the much lower permeability bedrock of the Virginia Formation (to the south) and the Pokegama quartzite (to the north). Wetlands are located near the current southern pit wall in the area of the proposed Project (Figure 11-1) and are at elevations similar to pre-mining conditions (Figure 11-4), indicating that either the zone of influence does not extend a significant distance from the pit or the surficial aquifer system is perched

above the bedrock aquifer system by low-permeability sediments and/or low-permeability bedrock and is not adversely affected by pit dewatering.

For sulfate, arsenic and hardness, the maximum potential increase in concentration resulting from the proposed Project is less than 5%. Comparison of these potential standards to the projected water quality at SD005 after the proposed Project (Table 11-7) indicates that for aluminum, iron, nickel, cobalt, copper, and zinc, even though the proposed Project does contribute to the projected concentrations, the resulting concentrations remain substantially below any potentially applicable water quality standards (Table 11-8). This evaluation of potential effects due to the proposed Project is based on the chemical mass balance scenario designed to provide an upper bound on Project impacts by compounding multiple assumptions, each representing upper bound conditions. This is a during-operations scenario that assigned the highest concentration limits (derived from the highest %S humidity cell #17), infiltration of 0.45% of annual precipitation, and a constant volume of groundwater flowing into the pit. Under this scenario, the assumed %S, infiltration and groundwater flow are all upper bound conditions. The maximum concentration for this scenario would correspond to a period in winter when precipitation is at a minimum.

Table 11-8. Potentially Applicable Water Quality Standards (for hardness-dependent metals hardness is 100 mg/L)

Potentially Applicable Water Quality Standards					
Parameter	**NPDES Permit[1] Limits**		Dunka River[2] Water Quality Standards[3]		
	Average	**Maximum**	**CS[4]**	**MS[5]**	**FAV[6]**
Iron, ug/L (Dissolved)	1,000 [7]	2,000 [7]	None		
Aluminum, ug/L	To be assessed[8]		125	1,072	2,145
Copper, ug/L	To be assessed[8]		9.8 [9]	18 [9]	35 [9]
Cobalt, ug/L	To be assessed[8]		5.0	436	872
Zinc, ug/L	To be assessed[8]		106 [10]	117 [10]	234 [10]
Nickel, ug/L	To be assessed[8]		158 [11]	1,418 [11]	2,836 [11]
Arsenic, ug/L	To be assessed[8]		53	360	720
Sulfate[12], mg/L	To be assessed[8]		N/A [11]		

NOTES:

[1] NPDES/SDS Permit MN0046981, Surface Discharge Stations SD001, SD002, SD003, SD004, and SD005.

[2] Where Dunka River is a Class 2B, 3C, 4A, 4B, 5, and 6 water. Both Unnamed Creeks and Langley Creek flow to the Dunka River and are also Class 2B, 3C, 4A, 4B, 5, and 6 waters.

[3] The most stringent of the Class 2B, 3C, 4A, 4B, 5, and 6 water quality standards are shown as applicable.[4] Chronic Standard (CS); "the highest water concentration of a toxicant to which organisms can be exposed indefinitely without causing chronic toxicity" (Minn. R. 7050.0218, Subp.3, I).

[5] Maximum Standard (MS); "the highest concentration of a toxicant in water to which aquatic organisms can be exposed for a brief time with zero to slight mortality. The MS equals the FAV divided by 2." (Minn. R. 7050.0218, Subp.3, T).

[6] Final Acute Value (FAV); "an estimate of the concentration of a pollutant corresponding to the cumulatively probability of 0.05 in the distribution of all the acute toxicity values for the genera or species from the acceptable acute toxicity tests conducted on a pollutant. The FAV is the acute toxicity limitation applied to mixing zones in part Minn. R. 7050.0210, subpart 5; and to discharges in parts Minn. R. 7053.0215, subpart 1; 7053.0225, subpart 6; and 7053.0245, subpart 1." (Minn. R. 7050.0218, Subp.3, O).

[7] Dissolved concentration.

[8] NPDES permit limits to be assessed next permit cycle.

[9] The water quality standards represented here for copper, a hardness-dependent metal, assumes a total hardness of 100 mg/L. The applicable equations for hardness-dependent metals are found in Minn. R. 7050.0222, subpart 4.

[10] The water quality standards represented here for zinc, a hardness-dependent metal, assumes a total hardness of100 mg/L. The applicable equations for hardness-dependent metals are found in Minn. R. 7050.0222, subpart 4.
[11] The water quality standards represented here for nickel, a hardness-dependent metal, assumes a total hardness of 100 mg/L. The applicable equations for hardness-dependent metals are found in Minn. R. 7050.0222, subpart 4.
[12] As of the date of this EAW the Dunka River has not been designated as a water used for the production of wild rice.

ii. Stormwater - Describe the quantity and quality of stormwater runoff at the site prior to and post construction. Include the routes and receiving water bodies for runoff from the site (major downstream water bodies as well as the immediate receiving waters). Discuss any environmental effects from stormwater discharges. Describe stormwater pollution prevention plans including temporary and permanent runoff controls and potential BMP site locations to manage or treat stormwater runoff. Identify specific erosion control, sedimentation control or stabilization measures to address soil limitations during and after project construction.

All stormwater runoff from the proposed Project would continue to flow to the mine pit sumps, where it would then be discharged through established NPDES permit outfalls. Therefore, the proposed Project would not result in any changes to stormwater management practices at the Peter Mitchell Mine. Current stormwater management practices are detailed in the existing Stormwater Pollution Prevention Plan (SWPPP).

iii. Water appropriation - Describe if the project proposes to appropriate surface or groundwater (including dewatering). Describe the source, quantity, duration, use and purpose of the water use and if a MNDNR water appropriation permit is required. Describe any well abandonment. If connecting to an existing municipal water supply, identify the wells to be used as a water source and any effects on, or required expansion of, municipal water infrastructure. Discuss environmental effects from water appropriation, including an assessment of the water resources available for appropriation. Identify any measures to avoid, minimize, or mitigate environmental effects from the water appropriation.

Dewatering from the mine pit is currently permitted under MNDNR water appropriations permit #1982-2097. The increase in additional volume appropriated would be roughly proportional to the size of the proposed 108-acre UPL progression relative to the existing 4,642-acre UPL, or approximately 2% additional volume. This increase would be in compliance with the amount of water authorized for appropriation under the existing permit.

iv. Surface Waters

a) Wetlands - Describe any anticipated physical effects or alterations to wetland features such as draining, filling, permanent inundation, dredging and vegetative removal. Discuss direct and indirect environmental effects from physical modification of wetlands, including the anticipated effects that any proposed wetland alterations may have to the host watershed. Identify measures to avoid (e.g., available alternatives that were considered), minimize, or mitigate environmental effects to wetlands. Discuss whether any required compensatory wetland mitigation for unavoidable wetland impacts will occur in the same minor or major watershed, and identify those probable locations.

Approximately 62.83 acres of wetlands present within the proposed Project area will be directly affected by the proposed Project. Existing USACE Section 404 and State WCA permits allow the removal of 50.74 acres of those wetlands with mitigation for replacement of the lost wetland area. The remaining 12.09 acres of wetlands that will be affected include areas of shallow marsh (10.15 acres), alder thicket (1.21 acres), and shrub-carr (0.73 acre). These impacts will require coordination with USACE for permitting under Section 404 of the Clean Water Act, as well as MPCA water quality certification under Section 401 of the CWA. The wetland impacts will also require WCA permitting. As noted above, the MNDNR Division of Lands and Minerals is the approving authority for WCA permitting for these wetlands. Northshore has filed a joint Section 404/WCA permit application with USACE and with the MNDNR to allow for the removal of the 12.09 acres. Wetland mitigation credits for the 12.09 acres of impacts will be obtained from the Cliffs Erie Embarrass Wetland Bank. The Embarrass Wetland Bank was approved in 1997 by the USACE and MNDNR for use on Cliffs projects, including the Peter Mitchell Mine, on a 1:1 basis. Northshore recently purchased from Cliffs Erie all remaining credits from the Embarrass Wetland Bank for its use.

Potential indirect impacts, if any, will be evaluated as part of the permitting process. However, there are no indirect impacts anticipated. This is because there is a shallow depth to bedrock in the vicinity of the wetlands potentially affected by the proposed Project, and the bedrock surface is tilted away from the pit. Moreover, no notable indirect impacts have been observed in the existing wetlands that extend up to the current pit edge.

b) Other surface waters- Describe any anticipated physical effects or alterations to surface water features (lakes, streams, ponds, intermittent channels, county/judicial ditches) such as draining, filling, permanent inundation, dredging, diking, stream diversion, impoundment, aquatic plant removal and riparian alteration. Discuss direct and indirect environmental effects from physical modification of water features. Identify measures to avoid, minimize, or mitigate environmental effects to surface water features, including in-water Best Management Practices that are proposed to avoid or minimize turbidity/sedimentation while physically altering the water features. Discuss how the project will change the number or type of watercraft on any water body, including current and projected watercraft usage.

There are no anticipated impacts resulting from the proposed Project activities toother surface waters aside from Langley Creek during pit operation, including MNDNR Protected Waters, in the vicinity of the proposed Project. Cutoff of the headwatershed of Langley Creek will be offset by increased pit runout (dewatering). Hydrologic impacts to Langley Creek during mine operations are estimated to be small (approximately 2 percent), resulting in negligible impacts on water levels and associated riparian wetlands. Hydrologic impacts to Langley Creek and Unnamed Creek at closure are presented in the *Long Range Hydrology Study* (Barr 2008). At closure, estimated impacts to average annual flows will include a 60 percent reduction in Langley Creek, a 600-700 percent increase for Unnamed Creek, and a 30% increase for Dunka River (Barr, 2008). Based on watershed area (and measured relative to existing conditions), the proposed Project accounts for approximately 6 percent of the reduction in Langley Creek flow and approximately 3 percent of the increase in Unnamed Creek flow. The project has no net effect on flow in the Dunka River, as the footprint of the Project is ultimately tributary to the Dunka River under current conditions, with Project conditions, and after final pit closure.

A December 11, 2013 Barr Engineering technical memorandum reporting results of 2013 wild rice surveys to Northshore (Barr 2013) stated that no wild rice was found in the Dunka River. A December 20,

2011 Barr Engineering technical memorandum reporting results of 2011 wild rice surveys to Cliffs Erie (Barr 2011) identified wild rice in Dunka Bay, after the point where the Dunka River reports to Birch Lake. As of the date of this EAW, wild rice has not been identified in recent surveys of the Dunka River, and as such the Dunka River has not been designated as a water used for the production of wild rice. Therefore the Class 4B wild rice sulfate standard of 10 mg/l does not apply.

12. Contamination/Hazardous Materials/Wastes:

a. Pre-project site conditions - Describe existing contamination or potential environmental hazards on or in close proximity to the project site such as soil or ground water contamination, abandoned dumps, closed landfills, existing or abandoned storage tanks, and hazardous liquid or gas pipelines. Discuss any potential environmental effects from pre-project site conditions that would be caused or exacerbated by project construction and operation. Identify measures to avoid, minimize or mitigate adverse effects from existing contamination or potential environmental hazards. Include development of a Contingency Plan or Response Action Plan.

There are no known existing sources of contamination within the proposed Project.

b. Project related generation/storage of solid wastes - Describe solid wastes generated/stored during construction and/or operation of the project. Indicate method of disposal. Discuss potential environmental effects from solid waste handling, storage and disposal. Identify measures to avoid, minimize or mitigate adverse effects from the generation/storage of solid waste including source reduction and recycling.

There will be no new types of state-defined solid waste generated as part of the proposed Project.

c. Project related use/storage of hazardous materials - Describe chemicals/hazardous materials used/stored during construction and/or operation of the project including method of storage. Indicate the number, location and size of any above or below ground tanks to store petroleum or other materials. Discuss potential environmental effects from accidental spill or release of hazardous materials. Identify measures to avoid, minimize or mitigate adverse effects from the use/storage of chemicals/hazardous materials including source reduction and recycling. Include development of a spill prevention plan.

There are no hazardous materials directly associated with the proposed Project. Current operations include maintenance of mining-related equipment that requires certain hazardous materials to be used and stored at the Peter Mitchell Mine equipment maintenance facility. In addition, fuel spills that could occur during refueling and maintenance of mining equipment would be handled in accordance with Northshore's Spill Prevention Control and Countermeasure Plan (SPCC). Fuel tanks and oil barrels stored on site would also be managed according to the SPCC. The proposed Project will not cause any changes to these current practices.

d. Project related generation/storage of hazardous wastes - Describe hazardous wastes generated/stored during construction and/or operation of the project. Indicate method of disposal. Discuss potential environmental effects from hazardous waste handling, storage, and disposal. Identify measures to avoid, minimize or mitigate adverse effects from the generation/storage of hazardous waste including source reduction and recycling.

There will be no hazardous waste generated by the proposed Project.

13. Fish, wildlife, plant communities, and sensitive ecological resources (rare features):

a. Describe fish and wildlife resources as well as habitats and vegetation on or in near the site.

Based on the MNDNR/USFS Ecological Classification System (ECS), the proposed Project lies within the Laurentian Uplands Subsection of the Northern Superior Uplands (NSU) Section. The NSU Section is characterized by vegetative cover that is relatively uniform, comprising fire-dependent forests and woodlands. Much of the coniferous forest in the NSU Section was logged in the late 1800s and early 1900s (MNDNR 2003). Most of the area of the proposed Project is in an actively mined area, and is either not vegetated or recently disturbed. The dominant vegetation type in the proposed Project area is forested wetland and emergent wetland. The composition of vegetation communities adjacent to the proposed Project is typical of the NSU Section, with mixed coniferous-hardwood mixed second-growth forest and occasional small wetland areas.

The proposed Project is located in an actively-mined area that has limited habitat value for large wildlife species. Potential wildlife habitat within and near the UPL progression boundary is fragmented by mine access roads. Common wildlife that may use habitat in the proposed Project vicinity include pine marten (*Martes americana*), fisher (*Martes pennanti*), mink (*Mustela vison*), red squirrel (*Tamiasciurus hudsonicus*), red fox (*Vulpes vulpes*), bats, snowshoe hare (*Lepus americanus*), and other small mammals. Bird species in the vicinity may include bald eagles, cormorants, osprey, and hawks, as well as waterfowl, wading birds and perching birds. Wetlands may provide habitat for amphibians, great blue heron (*Ardea herodias*), common snipe (*Gallinago gallinago*), and swamp sparrow (*Melospiza georgiana*).

The MNDNR Comprehensive Wildlife Conservation Strategy (CWCS) lists 58 Species of Greatest Conservation Need (SGCN) in the Laurentian Uplands Subsection (MNDNR, 2006). SGCN species tend to be sensitive to disturbance and habitat degradation (MNDNR, 2006). It is unlikely, however, that most of the SGCN species listed for the subsection are present within the project area on a regular basis. This is because most of the project is within or immediately adjacent to an active mining area. Adjacent habitats are either young second-growth forest, areas disturbed by mining-related activities or roadway corridor. Moreover, non-SGCN species (e.g., raccoons, opossums, brown-headed cowbirds and crows) are better able to utilize edge and disturbed habitats, and likely displace SGCN species in those areas. SGCN species may utilize the wetland areas near the proposed Project; however, the wetlands are also near human disturbance, which tends to reduce SGCN presence. Many of the SGCN species may be active nearby, further from the road and disturbed areas, and may occasionally utilize parts of the project area.

Barr Engineering prepared a *Cumulative Effects Analysis of Wildlife Habitat and Threatened and Endangered Wildlife Species* in 2009 for U.S. Steel as part of the Keetac Expansion Project (Barr, 2009). The report was reviewed and approved by MNDNR. It evaluated opportunities for wildlife movement back and forth across the Iron Range from near Grand Rapids to Babbitt. The Barr study identified 18 wildlife corridors that provide opportunities along the length of the Iron Range for long-distance wildlife movement. The proposed Project area does not lie within or intersect any of the identified wildlife corridors. The nearest identified wildlife corridors are 5.5 miles to the southwest, and 2.2 miles to the northeast. Both of these corridors were rated of “moderate quality” in the Barr report, meaning that both corridors are currently degraded by existing human-related activities (i.e., logging and road construction). Wildlife attempting to make northwest-southeast movements through the general Project can continue to use the two nearest corridors without interference from the proposed Project. Moreover, the northeast extent of the Iron Range, and the barriers to wildlife movement that it presents, end approximately 5.3 miles north-northeast of the proposed Project, at the northeast end of the Dunka Pit.

The Dunka River and Langley Creek are the only fisheries resources in the project area. The MNDNR Fish Mapper Mapping Tool (MNDNR 2014) indicates that fish surveys were conducted at three locations on Langley Creek, including two locations in 1975 and one (at the confluence with Dunka River) in 2005. The results of these surveys are as follows:

- Dunka River. MNDNR conducted fish surveys on Dunka River in 1975 at two locations downstream of the confluence with Langley Creek and one location ~2 stream miles upstream of the confluence with Langley Creek. More recent surveys have not been conducted. In the three survey locations, a range of two to eleven fish species were found, including seven species of cyprinids (minnows, shiners and daces), two species of percids (darters and perch) and one species each from four other families of fish. The total number of fish species found in Dunka River, based on these studies, is thirteen. Some of the species from the 1975 fish surveys are disturbance-sensitive, including mottled sculpin, Johnny darter and Iowa darter. Dunka River has suitable habitat for gamefish species particularly in the lower reaches including good spawning habitat for walleye and northern pike. Upper reaches support primarily sucker non-game species based on the limited fisheries assessment data. Although MNDNR Fisheries staff indicate angler reports of brook trout being present, there are no documented occurrences of game fish in Dunka River. It is unlikely that Dunka River supports a substantial game fish population and is subject to light angling pressure.

- Langley Creek. Fish surveys were conducted on Langley Creek at two locations in 1975 by DNR and twice in 2005 by MPCA near the point where Langley Creek joins the Dunka River. Fourteen species of fish were found. Of these nine species were cyprinids, with one species each from five other families of fish. When the 2005 data was compared within Langley Creek's low gradient stream class, sampling indicated a high diversity of species and included at least one intolerant species. The two fish Index of Biotic Integrity (IBI) scores (65 and 73 out of 100) indicate Langley Creek is a healthy stream. Invertebrate IBI score was 39.

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The hydrologic impacts estimated for Langley Creek are approximately 2 percent of the existing flow, resulting in minimal impacts to water levels and associated riparian habitats. Hydrologic impacts are diminished further downstream, as tributary watershed area increases. At closure, impacts to average annual flows will increase: a reduction of 60 percent, an increase of 600-700 percent, and an increase of 30% are estimated for Langley Creek, Unnamed Creek, and Dunka River, respectively (Barr, 2008). Approximately 6 percent of the estimated reduction in Langley Creek flow in final pit closure is due to the Project (as estimated by watershed area). Similarly, about 3 percent of the increase in flow to Unnamed Creek is due to the Project. The estimated impact to the Dunka River in pit closure is independent of the Project, as the Project area is tributary to the Dunka River under current conditions, with Project conditions, and in final pit closure. The flow impacts at closure will be mitigated with development of pit-lake littoral habitat area (as described in the Peter Mitchell Pit Mitigation Plan).

b. Describe rare features such as state-listed (endangered, threatened or special concern) species, native plant communities, Minnesota County Biological Survey Sites of Biodiversity Significance, and other sensitive ecological resources on or within close proximity to the site. Provide the license agreement number (LA- 674) and/or correspondence number (ERDB 20140036-0003) from which the data were obtained and attach the Natural Heritage letter from the MNDNR. Indicate if any additional habitat or species survey work has been conducted within the site and describe the results.

According to the MNDNR Natural Heritage Information System (NHIS) database (license agreement number LA-674), no state-listed species have been recorded within one mile of the proposed Project area. Barr Engineering contacted MNDNR on October 22, 2013, to report the results of the NHIS search, and to get MNDNR concurrence on a finding that the proposed Project will have little or no impact on state-listed species. MDNR concurs with this finding (Attachment A).

The United States Fish and Wildlife Service (USFWS) lists two federally-threatened species in St. Louis County, and has designated critical habitats for each (USFWS 2013). They are the Canada lynx (*Lynx canadensis*) and the piping plover (*Charadrius melodus*). In addition, the USFWS proposed the northern long-eared bat (*Myotis septentrionalis*) for listing as federally-endangered on October 2, 2013. Though designated critical habitat for both the Canada lynx and piping plover has been established in St. Louis County, none is located within one mile of the proposed Project area (Figure 13-1).

Several extensive surveys for lynx have been conducted in association with other mining projects on lands within 20 miles of the proposed Project, dating back to 2005 (ENSR 2006). As part of a lynx survey conducted for the Birch Lake Project and Maturi Project for Franconia Minerals Corporation, a lynx was snow tracked in Townships 60 and 61 North, Range 12 West, including along survey routes immediately adjacent to the south side of Northshore's East Pit. Tracking occurred on approximately 11 miles of lynx trail over a 10-day period. The wildlife biologist conducting the survey determined that all trail segments tracked in these two townships were made by one lynx. Scat collections from lynx have also been made north and south of the Proposed project. Snowshoe hare (*Lepus canadensis*) and red squirrel (*Tamiasciurus hudsonicus*) sign, both prey species of lynx, have been observed during spring wildlife surveys in the vicinity of the proposed Project. Because the home range of the lynx is generally about 30 square miles (78 square kilometers), it is possible that one or more lynx could use habitat in the vicinity of the proposed Project.

The Canada lynx is a solitary species with a large range, preferring mature coniferous forest habitat and tending to avoid areas of human activity. Small quantities of marginal Canada lynx habitat may be found near the proposed Project; however, the areas receive frequent disturbance and are not anticipated to be preferred habitat. While land cover in the vicinity of the proposed Project lacks high quality Canada lynx habitat, several sightings of lynx have been reported near the Peter Mitchell Mine, most recently in February 2011. Documentation of lynx sightings by Northshore employees is part of a reporting policy implemented by Northshore in July 2006. It is also required by the USACE wetland permit for the site. The Peter Mitchell Mine's current lynx policy fulfills Northshore's Section 404 permit requirement to document and report all lynx sightings.

In Minnesota, the piping plover tends to nest on sparsely vegetated, sandy or gravely beaches. There is no suitable piping plover habitat at or near the Peter Mitchell Mine.

c. Discuss how the identified fish, wildlife, plant communities, rare features and ecosystems may be affected by the project. Include a discussion on introduction and spread of invasive species from the project construction and operation. Separately discuss effects to known threatened and endangered species.

The proposed Project would result in minor adverse impacts to common wildlife species due to the loss of approximately 108.33 acres of already fragmented wildlife habitat. For common wildlife species, this loss is considered minor because there is abundant similar habitat adjacent to the proposed Project. Furthermore, most common species are habitat generalists with a relatively high tolerance of disturbance and human presence.

The receiving waters are representative of healthy streams that exhibit a diversity of non-game species in the samples taken. These small stream resources play an important role in providing spawning habitat and prey animals to the greater gamefish populations in interconnected waters. The proposed UPL progression will cause minimal changes to the watersheds, flows, and temperatures of the receiving waters. It is anticipated that the native populations of resident fish will experience minor adverse effects. Discharges from the proposed Project are projected to meet applicable permit limits and water quality standards.

The proposed Project would not contribute notably to mercury concentrations downstream of the discharge points during operations or during post-closure. This is because 2013 mercury monitoring results for the Peter Mitchell Mine showed very low mercury in the pit discharges (<1 ng/L). Because the 2013 mercury monitoring results are significantly less than the 6.9 ng/L standard for the Rainy River Basin, mercury discharges from the project will not have an impact on a mercury total maximum daily load (TMDL).

The proposed project also does not have high potential to contribute to mercury methylation downstream of the discharge points. Increases in mercury methylation require increased amounts of mercury. As discussed above, 2013 monitoring shows that the Peter Mitchell Pit does not discharge mercury above the applicable standard. As the proposed Project is not anticipated to increase the amount of mercury in receiving waters, the proposed Project is also not anticipated to increase the amount of methyl mercury in receiving waters. Additionally, Berndt and Bavin (2009) Figure 22 shows that sulfate and methyl mercury are not correlated in the St. Louis watershed. As the St. Louis watershed is heavily impacted by mining, this indicates that increased sulfate may not be a direct cause of increased mercury methylation.

The proposed Project is located in an actively-mined setting, and it has been determined that it would not impact state-listed species. As noted above in Item 11*b*, the Environmental Review Coordinator MNDNR Natural Heritage and Nongame Research Program has reviewed and concurred with the finding that the proposed Project will have little or no impact on state-listed species.

Based on a lack of preferred, suitable habitat for the piping plover and Canada lynx at the Peter Mitchell Mine, the proposed Project would have no effect on these federally-listed species. The risk of vehicle collisions with these species would remain similar to the existing conditions.

d. Identify measures that will be taken to avoid, minimize, or mitigate adverse effects to fish, wildlife, plant communities, and sensitive ecological resources.

Potential impacts to sensitive ecological resources are expected to be minimal. There are no major habitat impacts, and as noted above, the hydrologic impacts estimated for Langley Creek are approximately 2 percent of the existing flow during mining operations. There are no anticipated impacts to Unnamed Creek hydrology during mining operations. Nevertheless, mitigation of potential impacts to fish and wildlife habitat, native plant communities and other sensitive ecological resources would be achieved via the implementation of Northshore's reclamation plan for the Peter Mitchell Pit. The reclamation plan includes among its features the creation of littoral zones within the pit lake. Littoral zones are the shallow portions of a lake that support most of the plant and animal life in a lake. The plan stipulates that a minimum 20% cover of the final pit lake comprises littoral zones. Littoral zones will be created by depositing part of the waste rock back into the pit after the ore has been mined out, thereby controlling the shape and depth of the final shoreline , including the near-shore areas. The proposed locations of littoral zones in the pit lake are shown on Figure 6-9.

14. Historic properties:

Describe any historic structures, archeological sites, and/or traditional cultural properties on or in close proximity to the site. Include: 1) historic designations, 2) known artifact areas, and 3) architectural features. Attach letter received from the State Historic Preservation Office (SHPO). Discuss any anticipated effects to historic properties during project construction and operation. Identify measures that will be taken to avoid, minimize, or mitigate adverse effects to historic properties.

A cultural resources data request was made to SHPO on October 21, 2013. The request encompassed all land within the proposed Project, and a one-section buffer in all directions. SHPO responded on November 12, 2013 with information reporting two archaeological sites documented in Township 60 North, Range 12 West, Section 20. One of the two recorded sites is in the southeast ¼ of the northwest quarter section, which would place it within the same ¼ quarter as the UPL progression. However, this site no longer exists because the entire area was previously mined by Reserve Mining Company prior to 1986. The other archaeological site is outside of the proposed Project. The SHPO report also included one historical site, a demolished crusher building, off County Highway 70, in Township 60 North, Range 12 West, Section 18. This is also outside of the proposed Project (Attachment B).

15. Visual:

Describe any scenic views or vistas on or near the project site. Describe any project related visual effects such as vapor plumes or glare from intense lights. Discuss the potential visual effects from the project. Identify any measures to avoid, minimize, or mitigate visual effects.

The proposed Type II VF stockpile would be constructed north of the ultimate pit limit progression area within the existing mine area. The Type II VF stockpile would be created following the current MNDNR Mineland Reclamation rules. It is designed to have a maximum upper elevation of 1,720 feet above mean sea level (AMSL). The natural ridge located between the proposed Type II VF stockpile and the City of Babbitt rises to an elevation of 1,850 feet AMSL. Because the elevations around the City of Babbitt are approximately 1,500 feet MSL, the proposed Type II VF stockpile would not be visible from populated areas.

Mining activities within the UPL progression would include lighting during nighttime operations, consistent with current ongoing mining activities. Therefore, there will be no increase in visual effects associated with lighting.

16. Air:

a. *Stationary source emissions - Describe the type, sources, quantities and compositions of any emissions from stationary sources such as boilers or exhaust stacks. Include any hazardous air pollutants, criteria pollutants, and any greenhouse gases. Discuss effects to air quality including any sensitive receptors, human health or applicable regulatory criteria. Include a discussion of any methods used assess the project's effect on air quality and the results of that assessment. Identify pollution control equipment and other measures that will be taken to avoid, minimize, or mitigate adverse effects from stationary source emissions*.

The Peter Mitchell Mine is a stationary source of air emissions. The proposed Project would involve activities that produce fugitive particulate matter. The emissions generated by the proposed Project activities are associated with blasting, loading, hauling, dumping of mined materials, and wind erosion from active stockpiles. Particulate emissions also occur from ore crushing and loading of rail cars.

Mine-related fugitive emissions are controlled by measures identified in the Peter Mitchell Mine's existing Fugitive Emissions Control Plan (FECP), summarized in Table 16-1 below.

Table 16-1. Summary of Northshore Fugitive Emissions Control Plan

Potential Dust Source	Measures to Mitigate Adverse Impacts
Handling of overburden and other rock prior to and during mining (e.g., truck loading/unloading and stockpiling)	Compaction, good stockpiling practices to minimize wind erosion
Handling of ore during mining (e.g., truck loading/unloading and stockpiling)	Compaction, good stockpiling practices to minimize wind erosion
Fugitive dust from unpaved roads	Dust suppressant application

Emissions from crushing operations are controlled by a bag house at the crushing facility. Emissions from the loading of ore into the railcars are mitigated during non-freezing months by spraying water onto the ore before it enters the bins. Emissions from these sources will not change as a result of the proposed project.

The proposed Project will not cause any increase over historical quantities of materials being processed. Further, because the proposed expansion area is located closer to the crushing plant and the rock stockpiles than areas mined historically, there will be no increase in the distances for hauling rock to the stockpile(s) and for hauling ore to the crushing plant.

b. Vehicle emissions - Describe the effect of the project's traffic generation on air emissions. Discuss the project's vehicle-related emissions effect on air quality. Identify measures (e.g. traffic operational improvements, diesel idling minimization plan) that will be taken to minimize or mitigate vehicle-related emissions.

Vehicle (exhaust) emissions from the proposed Project can be separated into three vehicle categories:

1. Haul trucks hauling ore from the pit to the crusher and hauling rock and overburden to stockpiles. Because the proposed Project will not cause any increase over historical levels in the quantity of materials being processed and because the UPL progression is located closer

to the crushing plant and the rock stockpiles than areas mined historically, no increase in exhaust emissions is anticipated from the haul trucks beyond historical levels.

2. Other vehicles operating at the mine include, but are not limited to, shovels, front-end loaders, backhoes, water trucks, dozers, fuel trucks, various maintenance vehicles, and pickup trucks. Because the proposed Project will not cause any increase over historical levels in the quantity of materials being processed, no increase in exhaust emissions is anticipated from these vehicles beyond historical levels.

3. Personal vehicles of employees, contractors and visitors. The proposed Project does not involve any change in staffing and no additional parking spaces. Therefore, there will be no change in the current air emissions from the personal vehicles of employees, contractors, and visitors.

Air emissions from these sources consist of emissions associated with the firing of #2 fuel oil and/or gasoline, and include:

- carbon monoxide (CO),
- nitrogen oxides (NOx),
- particulate matter (PM),
- particulate matter with a diameter of 10 micrometers or less (PM_{10}),
- particulate matter with a diameter of 2.5 micrometers or less ($PM_{2.5}$),
- sulfur dioxide (SO_2),
- volatile organic compounds (VOC),
- greenhouse gases (GHGs) and
- hazardous air pollutants (HAPs).

c. Dust and odors - Describe sources, characteristics, duration, quantities, and intensity of dust and odors generated during project construction and operation. (Fugitive dust may be discussed under item 16a). Discuss the effect of dust and odors in the vicinity of the project including nearby sensitive receptors and quality of life. Identify measures that will be taken to minimize or mitigate the effects of dust and odors.

Dust

Dust sources are detailed in section 16a. Moreover, the activities within the proposed UPL area would be along the south edge of the mine and will therefore be further away from the City of Babbitt, the nearest sensitive receptor.

Odors

The only odors anticipated from the proposed Project will be those associated with diesel exhaust from equipment for mining-related operations. The proposed Project will not involve any increase in such odors above those associated with the existing mining activities. There are no noticeable off-site odor impacts from these activities.

17. Noise

Describe sources, characteristics, duration, quantities, and intensity of noise generated during project construction and operation. Discuss the effect of noise in the vicinity of the project including 1) existing noise levels/sources in the area, 2) nearby sensitive receptors, 3) conformance to state noise standards, and 4) quality of life. Identify measures that will be taken to minimize or mitigate the effects of noise.

The proposed Project will not result in an increase in existing noise levels at the site. This is because proposed activities within the progression area and at the Type II VF stockpile are similar to ongoing, existing mining-related activities at the mine facility. The proposed Project will result in a continuation, not an increase, in existing mining-related activities. Moreover, the activities within the UPL progression will be along the south edge of the mine and will therefore be further away from the City of Babbitt, the nearest receptor.

18. Transportation

a. *Describe traffic-related aspects of project construction and operation. Include: 1) existing and proposed additional parking spaces, 2) estimated total average daily traffic generated, 3) estimated maximum peak hour traffic generated and time of occurrence, 4) indicate source of trip generation rates used in the estimates, and 5) availability of transit and/or other alternative transportation modes.*

There will be no additional parking spaces required for the construction or operation of the proposed Project. Estimated total average traffic and estimated maximum peak hour traffic and time of occurrence will remain at current levels.

In addition, the proposed Project will not result in an increase in the rate of ore generated. Therefore, the proposed Project will not result in increased railroad traffic between the Peter Mitchell Mine and Silver Bay Processing Facility.

Construction and operation of the proposed Project will not require additional specialized equipment or supplies.

b. *Discuss the effect on traffic congestion on affected roads and describe any traffic improvements necessary. The analysis must discuss the project's impact on the regional transportation system. If the peak hour traffic generated exceeds 250 vehicles or the total daily trips exceeds 2,500, a traffic impact study must be prepared as part of the EAW. Use the format and procedures described in the Minnesota Department of Transportation's Access Management Manual, Chapter 5 (available at: http://www.dot.state.mn.us/accessmanagement/resources.html) or a similar local guidance.*

The proposed Project will not generate increases above existing levels in employee or vendor traffic to and from the site. This is because the proposed Project will not result in an increase in the work force, nor will it result in increased vendor visits to the site. The proposed Project will require no improvements to existing traffic controls.

c. *Identify measures that will be taken to minimize or mitigate project related transportation effects.*

The proposed Project will not result in a change in existing transportation conditions. Therefore, there is no need to develop measures to minimize or mitigate proposed Project related transportation effects.

19. Cumulative potential effects: (Preparers can leave this item blank if cumulative potential effects are addressed under the applicable EAW Items)

a. Describe the geographic scales and timeframes of the project related environmental effects that could combine with other environmental effects resulting in cumulative potential effects.

The geographic scale of the primary environmentally relevant area is the subwatershed within the Rainy River Basin that drains to Birch Lake. This is the watershed in which the UPL progression and Type II VF stockpile are located. The environmentally relevant area is defined in this way because the principal potential effects of the project would be on water quality, and the principal concern with the project is whether its effects will result in exceedances of water-quality standards within the subwatershed or otherwise be important. This subwatershed discharges to the Dunka River via Langley Creek and Unnamed Creek during operations, and would discharge directly to Dunka River at mine closure. Figure 19 -1 identifies the NPDES discharge locations associated with the Peter Mitchell Mine.

The timeframe of the proposed Project is five to ten years. This is projected as part of development plans for an orderly progression of mining iron ore over the life of the mine. Mining activities are scheduled to begin in the proposed Project area as soon as possible in 2014 upon receipt of required permits. The greater Peter Mitchell Mine is expected to operate for another 70 years, at which time permanent closure and final reclamation will occur. This will include development of the pit lake at the time of closure.

b. Describe any reasonably foreseeable future projects (for which a basis of expectation has been laid) that may interact with environmental effects of the proposed project within the geographic scales and timeframes identified above.

Figure 19-2 shows two reasonably foreseeable future projects in the environmentally relevant area with the potential to interact with impacts resulting from the proposed Project.

- The first is the current ongoing activity at the Dunka Mine. Dunka Mine pit water is pumped to the Dunka River. The water pumped to the Dunka River undergoes treatment in passive wetland cells and is in compliance with the effluent limits contained within the NPDES permit for the Dunka Mine. It is anticipated that water quality impacts from future uses of this site would be managed through project-specific permitting when a project has been identified and advanced by a proponent.

- The second project is the proposed Twin Metals Minnesota LLC (Twin Metals) Bulk Sample Project located approximately 11.5 miles northeast of the proposed project. The Twin Metals Bulk Sample Project would collect a 1,000-ton bulk sample containing copper, nickel, and platinum group metals from the Maturi Deposit through the former INCO shaft southeast of Ely, Minnesota. Twin Metals submitted a draft Project Definition for the bulk sample to MNDNR on June 28, 2013. Since then MDNR has been notified that the project is not currently being pursued. There is however enough detail and likelihood for future activity for this EAW to consider it as a reasonably foreseeable action in considering potential cumulative effects for the Peter Mitchell Pit progression project.

Under the draft Project Definition, Twin Metals proposes to collect all water coming into contact with mineralized rock from the bulk sample process, and transport it to Publicly Owned Treatment Works (POTW) in Hibbing and/or Virginia. The Twin Metals project is not projected to any direct discharge of potentially-contaminated water to local surface waters. Indirect impacts to surface water and groundwater resources are expected to be marginal because the subsurface rock mass at the bulk sample site has relatively low hydraulic conductivity, and no major structural features were intersected by the INCO Shaft. If pursued the project would require mandatory preparation of an EAW.

Another project considered as a potential reasonably foreseeable action for water quality effects is PolyMet Mining's proposed NorthMet copper-nickel-precious metals project. The NorthMet Mine Site is approximately 1.8 miles south-southwest of Northshore's proposed Project.

For potential surface- and groundwater quality impacts it is typical for watershed boundaries to be the basis for establishing the environmentally relevant area used in consideration of cumulative potential effects. Although geographically close to the Northshore Peter Mitchell Pit, the PolyMet project's Mine and Plant Sites collectively drain to the Partridge and Embarrass River watersheds, and ultimately to the Lake Superior Basin via the St. Louis River. This is different than the proposed project, whose discharges report to Langley Creek during operations and the Dunka River in closure, both in turn discharging within the Rainy River watershed. Because the proposed Project and the PolyMet project are not in the same subwatershed or major basin, they are also not in the same environmentally relevant area for water quality effects.

Although not relevant for water quality effects, given its proximity to the proposed project the PolyMet project is potentially in the same environmentally relevant area for visual, noise and wildlife corridor impacts. This is because components of the PolyMet project could conceivably be seen and heard from the proposed Project, and vice versa. Moreover, wildlife in the area could potentially attempt to traverse both projects.

No other project within the environmentally relevant area for water quality impacts meets the EQB criteria for establishing a basis of expectation. These criteria include applications for permits, preparation of detailed plans, inclusion within comprehensive plans, historic or forecasted development trends, or other factors that definitively establish that the project is reasonably likely to occur.

c. Discuss the nature of the cumulative potential effects and summarize any other available information relevant to determining whether there is potential for significant environmental effects due to these cumulative effects.

Cumulative potential effects associated with the proposed Project are primarily related to potential impacts on surface water and groundwater quality. Secondary considerations include visual, noise, and wildlife corridor effects.

- Surface Water Quality. The proposed Project has the potential to make an incremental contribution to cumulative surface water quality in the environmentally relevant area. However, as discussed in Section 11, with implementation of mine water management practices, the proposed Project would be subject to applicable water quality standards. Moreover, the other contributing projects in the environmentally relevant area would also be subject to applicable

water quality standards. Therefore, any potential cumulative effects would occur within prescribed limits as a function of specific permit conditions for all three (3) actions.

- Groundwater Quality. Under the proposed Project groundwater would flow into the existing pit, both during operations and post-closure. Under this circumstance it is not anticipated that the project's effects on groundwater would interact with either reasonably foreseeable action, specifically the Dunka Mine or Twin Metals bulk sample. No cumulative effects to groundwater quality are anticipated resulting from the projects for which a basis of expectation has been laid within the environmentally relevant area.

- Visual Effects. As noted in Item 15, the proposed Project's activities will not be visible to the nearest residential community in Babbitt, MN, or from any other residences in the area. From the south, the top of the proposed Type II VF stockpile will be visible only from the internal road system at the Peter Mitchell Mine. With regard to other projects in the area, the Twin Metals Bulk Sample project is well outside of the visual range of the proposed Project. The PolyMet project is visible from the Project site, but minimally so. In concert the proposed Project, and the Twin Metals and PolyMet projects, have little or no additive cumulative effect on visual aesthetics in the area.

- Noise. Item 17 details that the proposed Project's activities are further away from the nearest noise receptor than current activities. Noise impacts from the PolyMet and Twin Metals projects would be too far away from the proposed Project to generate cumulative potential effects.

- Wildlife Corridors. The proposed project does not affect identified wildlife corridors as detailed in Item 13. Cumulative effects to these resources are not anticipated.

These are the only potential types of cumulative effects identified from the interaction of the proposed Project with other projects for which a basis of expectation has been laid within the environmentally relevant area.

20. Other potential environmental effects: *If the project may cause any additional environmental effects not addressed by items 1 to 19, describe the effects here, discuss the how the environment will be affected, and identify measures that will be taken to minimize and mitigate these effects.*

There are no additional environmental effects that are not discussed in items 1 to 19.

RGU CERTIFICATION. *(The Environmental Quality Board will only accept **SIGNED** Environmental Assessment Worksheets for public notice in the EQB Monitor.)*

I hereby certify that:

- The information contained in this document is accurate and complete to the best of my knowledge.
- The EAW describes the complete project; there are no other projects, stages or components other than those described in this document, which are related to the project as connected actions or phased actions, as defined at Minnesota Rules, parts 4410.0200, subparts 9c and 60, respectively.
- Copies of this EAW are being sent to the entire EQB distribution list.

Signature _____ Date Sept. 2, 2014

Title Environmental Review Planner

INTERAGENCY TECHNICAL MEMORANDUM

To: NorthMet Project EIS Managing Sponsors

From: NorthMet EIS Project Managers
Michael Jimenez (USFS); Doug Bruner (USACE); Lisa Fay/Bill Johnson (MDNR)

Re: NorthMet Environmental Impact Statement
Co-lead Agencies' Consideration of Possible Mine Site Bedrock Northward Flowpath

October 12, 2015

Executive Summary

PolyMet developed a groundwater flow model of the NorthMet Mine Site and surrounding area using the U.S. Geological Survey MODFLOW model to estimate groundwater inflows to the proposed NorthMet pits. The model assumed artificially high Northshore pit lake elevations that would lead to conservatively high groundwater inflows to the proposed NorthMet pits during Northshore operations and before the NorthMet pits refill in order to ensure sizing and effectiveness of the proposed wastewater treatment facility (WWTF) system. Recent comments and analysis from the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) hypothesize that a north bedrock groundwater flowpath from proposed NorthMet pits to Northshore pits could occur after the NorthMet pits refill if Northshore pit water levels representing current and future operations and closure are considered.

The Co-lead Agencies reviewed available information in the context of GLIFWC's comments and analysis and concluded that the lack of hydrologic response in bedrock wells at the proposed NorthMet Project Mine Site is consistent with a conceptual model that includes downward leakage from surficial deposits into the underlying bedrock. If this leakage rate is large enough, a bedrock groundwater mound would form between the two mines and prevent water from the proposed NorthMet pits from flowing northward to the Northshore pits. However, the Co-lead Agencies acknowledge that the well data and the NorthMet Mine Site MODFLOW model do not exclude the possibility of a future northward bedrock flowpath from the proposed NorthMet pits to the Northshore pits. Therefore, the Co-lead Agencies have determined that bedrock water-level monitoring and contingency mitigation preventive measures should be discussed in the NorthMet FEIS.

The Co-lead Agencies have also determined that attempting additional site data collection and modeling during the FEIS process to further assess whether a northward flowpath would develop is unwarranted. MODFLOW could be updated, however this would require additional field data collection, is unlikely to generate conclusive determinations, and contingency mitigation measures would likely be required with or without an updated model. Rather, the Co-lead Agencies conclude and recommend implementing monitoring from the start of actual NorthMet operations to supply more reliable information necessary

to understand the bedrock flow direction. If needed, contingency mitigation can be implemented using this monitoring information to preemptively stop a northward flowpath and prevent its potential impacts. This memorandum also provides a high level, qualitative discussion of the potential environmental effects of the identified contingency mitigation measures.

In summary, if the proposed project is permitted and becomes operational, then data could be collected to further evaluate the likelihood of a northward flowpath and any potential impacts of proposed mitigation if needed. Existing monitoring data, combined with future robust monitoring and contingency mitigation, will ensure that any potential northward bedrock groundwater flow from the proposed NorthMet pits to the Northshore pits would be preemptively addressed and prevented.

1.0 Background

PolyMet developed a groundwater flow model of the NorthMet Mine Site and surrounding area using the U.S. Geological Survey MODFLOW model, the details of which are described in Barr 2015a. The primary (though not only) purpose of the Mine Site MODFLOW (MODFLOW) model was to estimate groundwater inflows to the proposed NorthMet pits (Barr 2008). The model used fixed head cells with groundwater-level elevations of 1,617 ft above mean sea level (amsl) to simulate the hydrologic effects of the Northshore pit lakes. Since the primary purpose of the model was to estimate groundwater inflows to the proposed NorthMet pits, the model used assumptions for the area north of the proposed NorthMet pits. It was acknowledged that the Northshore pit lake water levels might be artificially high using this method, but the Co-lead Agencies supported this approach since it would lead to conservatively high groundwater inflows to the proposed NorthMet pits during Northshore operations and before the NorthMet pits refill. In 2008, the Co-lead Agencies (DNR and USACE at that time) agreed to this approach in their review and subsequent approval of document RS22 (Barr 2008) because it supported a more robust evaluation of the sizing and effectiveness of the proposed WWTF system.

The Co-lead Agencies received two sets of comments from GLIFWC on the Mine Site MODFLOW model during FEIS preparation. The first letter was provided on June 18, 2015 (GLIFWC; 2015a), with a second letter provided on August 11, 2015 (GLIFWC; 2015b). The comments detail how GLIFWC modified the MODFLOW model to reflect anticipated future water levels in the Northshore pits, which are expected to be lower than the estimated refill water levels in the proposed NorthMet pits in closure. With this change only, the modified MODFLOW model predicted northward groundwater flow through bedrock from the NorthMet pits to the Northshore pits.

GLIFWC's modification of MODFLOW is in contrast to that model's intended purpose of estimating NorthMet Mine pit groundwater inflows. Had the purpose of the EIS MODFLOW model been to evaluate the potential for groundwater flow in bedrock to the north, the model would have included additional hydraulic data and boundary conditions such as those associated with the hydrologic effects of 100 Mile Swamp. Note that the original MODFLOW model (and the GLIFWC version) assumed small downward leakage from surficial deposits into the bedrock in the area of the 100 Mile Swamp that was limited by the assumed aquifer recharge rate (Barr 2015a). This recharge rate (on the order of 1 inch/year) was used throughout the MODFLOW model and was not modified in the 100 Mile Swamp area even though it was possible that higher recharge could potentially occur below this extensive hydrologic feature. This is critical since the amount of downward leakage could influence the presence or absence of a groundwater divide or mound between the proposed NorthMet pits and the Northshore pits.

1.1 Site Hydrogeology

Figure 1 shows the area between and including the proposed NorthMet Mine and the Northshore Mine. It includes natural and man-made features, and the surface geologic contacts between the major bedrock units. At the NorthMet Mine, two open pits are proposed: the West Pit and the East Pit, with the latter being a consolidation of two pits excavated during the first part of operations. The current bedrock groundwater levels at the proposed NorthMet Mine Site are about 1,600 to 1,610 ft amsl.

At the Northshore Mine, there is a large excavation that is divided into several areas containing individual mine pits separated by bedrock walls. Currently, Area 003 West has a pit lake with a water level elevation of about 1,624 ft amsl, Area 003 East is dewatered with a pit bottom elevation of about 1,568 ft amsl, and Area 002 has dewatered pits with bottom elevations as low as 1,380 ft amsl. From southeast to northwest, the bedrock units at ground surface consist of Duluth Complex, Virginia Formation, and Biwabik Iron Formation (BIF). Duluth Complex rocks are interpreted to have a very low bulk hydraulic conductivity of about 5×10^{-4} ft/day, while the Virginia and Biwabik Formations are considered to have bulk hydraulic conductivities about three orders of magnitude higher (3×10^{-1} to 9×10^{-1} ft/day), respectively. The bedrock contacts generally dip south-southeast and the downward stratigraphic progression from younger to older is Duluth Complex, Virginia Formation, and BIF.

Figure 2 shows a north-south vertical cross-section passing through the proposed NorthMet West Pit and along section trace A-A' on Figure 1. As can be seen in the section, the bedrock contacts dip southeast at about 25 degrees in the area between the proposed NorthMet Mine Site and Northshore Mine, and the dip angle increases to about 45 degrees in the vicinity of the proposed NorthMet West Pit. The Area 003 West pits are excavated into the BIF except for an exposure of Virginia Formation at the top of the south pit wall. An important distinction is that the proposed future NorthMet West Pit would be excavated only into the low-permeability Duluth Complex. This explains why relatively low maximum inflow rates (about 80 gpm) are estimated in the FEIS for the proposed NorthMet West Pit during operations.

Figure 3 shows a north-south vertical cross-section passing through the proposed NorthMet East Pit and along section trace B-B' on Figure 1. The orientations of the bedrock contacts are similar to Section A-A' on Figure 2. Of importance is that the north wall of the proposed NorthMet East Pit is excavated into the higher permeability Virginia Formation, which explains the relatively high maximum inflow rate (760 gpm) estimated in the FEIS for the proposed NorthMet East Pit during operations. The bedrock between the proposed NorthMet East Pit and the Area 003 East pits consists of higher permeability Virginia Formation and BIF. For this reason, the focus of the Co-lead Agencies' review is on the theoretical possibility of a northward flowpath between the proposed NorthMet East Pit and the Area 003 East pits.

Table 1 shows estimated water levels at NorthMet and Northshore for different time points. As can be seen for current and future conditions, water-level elevations at the Northshore Area 003 East pit are, and would continue to be, lower than water levels at the proposed NorthMet East pit. Absent other sources of water entering bedrock between the two areas (such as the 100 Mile Swamp), this could establish a bedrock hydraulic gradient that could drive northward groundwater flow in bedrock between the two sites.

The Northshore Area 003 West Pit lake is currently only a few tens of feet deep. The Northshore 003 West Pit and 003 East Pit will be mined over the next several decades until closure. It is anticipated that

the Northshore pits will continue to be deepened and dewatered after the proposed NorthMet pits have refilled. However, the timing and duration of Northshore pit dewatering is not precisely known.

Table 1: Groundwater Level Elevations at the NorthMet and Northshore Sites

Condition	Year		NorthMet Mine Site		Northshore Site		
	Calendar	Mine	West Pit	East Pit	Area 003 West	Area 003 East	Area 002
Current	2015	0	1,600 to 1,610 (a)	1,600 to 1,610 (a)	1,624 (b)	1,568(c)	1,380 (c)
End of Northshore Operations	2070	55	1,576 (b)	1,592 (b)	1,350 (c)	1,300 (c)	1,250 (c)
Long-Term Closure	2080+	65+	1,576 (b)	1,592 (b)	1,500 (b)	1,500 (b)	1,500 (b)

Notes:

(a) Water levels in bedrock monitoring wells (ft amsl)

(b) Pit lake water level (ft amsl)

(c) Bottom of dewatered pit (ft amsl)

Northshore water level lower than NorthMet Mine Site water level

1.2 Scoping Calculation to Assess Bedrock Groundwater Flow Between the Mine Sites

A conceptual groundwater model is a simplification of the real system that contains the key hydrologic features affecting groundwater flow and is true to the available field data. For the NorthMet Mine Site, a key factor in the conceptual model is the amount of downward leakage (R) that passes from wetlands into the surficial deposits, and then from surficial deposits into bedrock. Figure 4 shows a simple conceptual/analytical groundwater flow model used to evaluate bedrock flow between the mine sites. For steady-state, essentially horizontal linear flow with variable saturated thickness, the governing differential equation (Darcy's law) is given by:

$$\frac{dH(x)}{dx} = -\frac{Q_o + R\,w\,x}{K(x)\,w\,[H(x) - B(x)]}$$

that is subject to the following boundary conditions:

$$H(0) = H_o \quad Water\ level\ in\ NorthMet\ East\ Pit$$

$$and$$

$$H(L) = H_L \quad Water\ level\ in\ Northshore\ Area\ 003\ East\ Pit$$

The variables are defined as follows:

- *x* = horizontal coordinate; distance north of East Pit
- *H(x)* = bedrock hydraulic head (groundwater-level elevation) at coordinate x
- *L* = horizontal length of flow system; distance from East Pit to Northshore Pit
- Q_o = East Pit flow at x=0; positive for flow from pit into bedrock; negative for flow from bedrock into pit
- *R* = downward leakage flux from surficial deposits into bedrock
- *w* = flow system width (perpendicular to flow direction)
- *K(x)* = function describing special distribution of bedrock hydraulic conductivity; accounts for distribution of Virginia Formation and Biwabik Iron Formation

B(x) = function describing the bottom elevation of the bedrock flow system, which is treated as a no-flow boundary
H_o = fixed hydraulic head at x=0; water-level elevation in East Pit
H_L = fixed hydraulic head at x=L; water-level elevation in Northshore Pit

The dependent variable H(x) is the hydraulic head (bedrock groundwater-level elevation) at a distance x north of the NorthMet East Pit. Table 2 (at the end of this memorandum) is an example Mathcad worksheet that solves this equation with the specified boundary conditions using the Runge-Kutta method, and also provides input values of the independent variables. For each set of inputs, the solution computes the bedrock groundwater-level profile between the NorthMet East Pit (x=0) and Northshore Area 003 East Pit (x=L). The solution strategy is to use the specified water-level elevation in the NorthMet East Pit (H_o) and a trial value for Q_o, which is flowrate from the NorthMet East Pit into the bedrock system. Then Q_o is varied in a trial-and-error manner until the computed hydraulic head at the Northshore Area 003 East Pit matches its specified water-level elevation (H_L). This iterative approach is one of several methods available for solving this type of one-dimensional boundary-value problem.

Figure 5 shows the computed bedrock groundwater-level profiles for different values of downward leakage at the end of Northshore operations. This is when the NorthMet East Pit has completely refilled to elevation 1,592 ft amsl and the Northshore Area 003 East Pit is completely dewatered to the pit bottom elevation of about 1,300 ft amsl. A groundwater mound occurs when the highest elevation of the groundwater-level profile is above the pit water levels at each end of the flow system. The mound represents a groundwater divide between the mines and would indicate that there is no continuous unidirectional flow across the flow system, which in this case is from NorthMet to Northshore. As shown on Figure 5, to have a mound that could be verified by field measurements would require an estimated downward leakage flux of about 8 in/yr.

Figure 6 shows a similar set of calculations for long-term closure (calendar year 2080 onward) when the NorthMet East Pit groundwater level remains at 1,592 ft amsl and the Northshore Area 003 East Pit reaches its final overflow elevation of about 1,500 ft amsl. To have a verifiable groundwater mound for this situation where both facilities are in closure would require an estimated downward leakage flux of about 5 in/yr.

For either scenario depicted in Figures 5 and 6, water to create a mound would come from a portion of the approximately 28 inches of precipitation falling annually in the area of the NorthMet mine. Water would then need to pass through ombrotrophic or minerotrophic wetlands, or non-wetland areas, then into the surficial deposits, eventually entering the bedrock underlying the whole area.

2.0 Evidence of Downward Leakage into Bedrock

Figure 7 shows groundwater levels in five NorthMet Mine Site bedrock wells (two in the Virginia Formation and three in the Duluth Complex) during an eight-year period from 2007 to 2015. Prior to and during this period, pit deepening and dewatering was occurring in the Northshore Area 003 East Pit. By 2010 the water level at Area 003 East Pit was more than 40 ft below the NorthMet bedrock water levels. As shown on Figure 7, the bedrock water levels in the NorthMet monitoring wells were stable during the period of record and did not exhibit any apparent responses to the decreased hydraulic heads at the Area 003 East Pit.

The lack of water level response in the existing NorthMet bedrock monitoring wells to decreasing Northshore Area 003 East Pit water levels is consistent with the idea that there is sufficient leakage into bedrock to maintain bedrock groundwater levels despite the influence of lower Area 003 East Pit lake elevations. The aerial downward leakage into bedrock would reduce (buffer) the drawdown response propagating away from Northshore Area 003 East Pit.

While these data are meaningful in attempting to understand existing bedrock groundwater behavior and may indicate vertical leakage between surficial deposits and bedrock, it remains uncertain if a bedrock groundwater mound would develop for the following reasons. First, the Area 003 West Pit water level was stable and relatively high during the period of interest. The presence of a high water level at the Area 003 West Pit could have reduced the extent of bedrock drawdown associated with low water levels at Area 003 East Pit. Second, while the well data could suggest the existence of downward leakage, the data cannot directly indicate the "rate" of leakage and whether it would be high enough to create a bedrock mound. However, if the conceptual model with insufficient leakage was operative, one would have expected to see at least some drawdown in the NorthMet bedrock monitoring wells.

3.0 Monitoring and Mitigation Strategies

If the NorthMet project proceeds to construction and operation, then monitoring would be applied to detect whether a northward flowpath between the proposed NorthMet pits and Northshore pits potentially would or would not occur. If indeed the potential for northward flow were to be detected, contingency mitigation measures would be available to address and prevent such a flowpath from occurring as necessary.

3.1 Monitoring

The goal of monitoring would be to determine future bedrock groundwater flow direction immediately north of the NorthMet pits for purposes of identifying any need for engineered preventive mitigation measures. Monitoring wells would measure bedrock groundwater levels starting in mine year 1 to evaluate groundwater flow direction. The determination would be based on bedrock groundwater levels and not on groundwater chemistry. Southward bedrock groundwater flow would be indicated if the monitoring wells show decreasing water levels as one progresses south toward the NorthMet East Pit. Northward bedrock flow would be indicated if water levels increase as one progresses south toward the NorthMet East Pit. Because of relatively rapid hydraulic response times in bedrock between NorthMet and Northshore, reliable determinations of the bedrock flow direction would be on-going with pit excavation and flooding, importantly without excessive lag times. Data evaluation and quantitative analysis would be used to predict the ultimate flow direction before the NorthMet West Pit and East Pit are fully refilled thus allowing time for implementing effective mitigation if necessary.

PolyMet proposed and the Co-lead Agencies have concurred that it would be reasonable to establish an enhanced bedrock monitoring network near the NorthMet pits to monitor bedrock groundwater levels. As shown on Figure 8, the Co-lead Agencies' recommended monitoring network consists of nine bedrock monitoring wells north of the NorthMet West and East pits, and four wells south of the pits, for a total of 13 wells. This is one well more than was proposed by PolyMet in Barr 2015a. West Pit and East Pit water-level elevations would also be routinely measured as part of the monitoring program to provide a total of 15 measurement points. At the direction of regulatory agencies, additional wells could be added

to the monitoring network before or during mine operations if deemed necessary as information is obtained from the wells installed at facility start-up.

The number and location of proposed and recommended monitoring wells is based upon a three-point, triangular monitoring network design. The monitoring points in the network are: water levels in pits; near field water levels; and far field water levels. Two rows of monitoring wells would be placed along the entire north edge of the NorthMet Mine Site where a potential northward flowpath could develop. The monitoring wells would also be grouped more tightly north of the East Pit, which would be expected to have a higher likelihood than the West Pit to develop a northward flowpath based on bedrock geology alone. Monitoring of proposed NorthMet pit water level elevations, along with monitored Northshore pit water elevations (also available), would complete the network. Taken together, the network would provide sufficient data to determine bedrock groundwater flow direction to inform decisions.

Water-level monitoring would start in mine year 1 and continue through operations, reclamation, and closure. If monitoring data and analysis predict northward bedrock groundwater flow from the NorthMet Mine Site, then additional site characterization would be performed to inform the type and design of contingency preventive mitigation to be implemented. Any contingency mitigation measure proposed would be assessed for the need to undergo additional environmental review to determine potential environmental impacts based on specific and detailed plans. After preventive mitigation is implemented, the monitoring wells would continue to be used to verify system performance.

Conditions potentially supporting development of a northward flowpath would not exist until water levels in the NorthMet East Pit are higher than at the Northshore pits. Due to the timing of the East Pit backfill, a decision to employ or not the Pit Lake Suppression mitigation measure (discussed below) would be made before mine year 11 (when the East Pit backfill starts) to potentially minimize unnecessary rock movement, delay backfilling, or revision to waste rock management. The monitoring and analysis window starting at pit development and continuing through operations and pit refill would provide ample opportunity to collect necessary data, and complete applicable environmental review and/or permitting, and engineering and construction prior to the development of a northward flowpath (if one were to form at all). The data collected during mining operations would provide regulators with information to evaluate potential contingency mitigation approaches and determine appropriate scale. *If delays are experienced during the engineering design process, depressed pit water levels (via dewatering) could be maintained until engineered mitigation is in place to assure no development of a northward flowpath*.

Permitting agencies would require PolyMet to minimize surface disturbance from the installation of new bedrock monitoring wells within wetlands north of the Mine Site. This could include drilling wells during the winter and limiting access to the wells. After well installation, water-level measurements would be taken continuously, with hand measurements likely taken at least several times per year to corroborate (or correct) automated data collection. The exact requirements for the construction and operation of these wells would be determined during permitting. However, the Co-lead Agencies believe that the environmental impacts associated with monitoring well installation and monitoring activities would be minimal.

3.2 Contingency Mitigation

Contingency mitigation measures are technically feasible options that could be undertaken should northward flow be determined likely between the proposed NorthMet pits and Northshore pits. A flexible approach is recommended where the types and/or designs of operational or engineered solutions evolve over time in response to new information from monitoring and evaluation. Under such a strategy, the original need for and performance of mitigation measure(s) are continually reassessed to ensure they are appropriate over the course of the project. If contingency mitigation is not producing a desired outcome, then mitigation can be added, or the design of the existing mitigation can be changed, until the desired outcome is achieved.

By the time contingency mitigation may be needed, much more would be known about the intervening hydrogeology given the data obtained during the early operational period, including actual pit inflows and hydraulic conductivities of bedrock surficial deposits and wetlands. It is expected that monitoring data would be available continuously from mine year 1 to inform potential mitigation options before engineered solutions might be needed and constructed. Options and associated designs would continue to be refined throughout this data collection period so that an effective engineering design is available to prevent any adverse impact.

There are a number of contingency mitigation measures that could be implemented, either individually or in combination with one another, which would prevent any northward flowpath. The exact type, location, scale, and timing of contingency mitigation measures are not known at this time. These measures, which are considered technically feasible in this region and have been shown to be effective in mitigating adverse impacts in similar conditions, are discussed conceptually because more site data would be necessary to complete detailed designs. Other methods to prevent northward bedrock groundwater flow from the proposed NorthMet pits to the Northshore pits may also become feasible as the hydrogeology is better understood during mine operations.

The description of each measure also includes a brief qualitative assessment of potential environmental effects. This is based upon the theoretical application of these mitigation measures and the water management dynamics understood through the evaluation of the NorthMet Project Proposed Action. If contingency mitigation is necessary, the action would need to meet all applicable environmental review and permitting requirements.

> ***Grouting*** **–** Industrial mining grout (commonly a mixture of bentonite, cement, and water) injection can be used to reduce the hydraulic conductivity of the fractures/faults network, which then controls bedrock groundwater flow to and from mine pits. Grout curtains can be used for groundwater control in both unconsolidated deposits and fractured rock. A grout curtain is constructed by drilling a series of purposely spaced and oriented bedrock drill holes and injecting grout into the surrounding rock to fill pore spaces, fractures, and faults.
>
> At the NorthMet Mine Site, if monitoring and analysis indicate conditions have arisen that create a northward flowpath, PolyMet would have the necessary information about site conditions to coordinate with the appropriate agencies and grout water transmitting fractures and faults. This method is desirable because of the relative lack of maintenance, and due to the inertness of the grout material there would be no effects expected to water quality. However, its effectiveness at the NorthMet site is uncertain and it may need to be combined with other mitigation options (Barr 2015b).

Pit Lake Depression - The water elevations within the NorthMet pits are expected to be higher than those in the Northshore pits after Northshore closes, and may be also be higher during the NorthMet and/or Northshore mine operations. However, water levels could be managed in the NorthMet East and/or West Pits to be equal to or lower than the Northshore pits. The purpose would be to reduce hydraulic heads between the projects such that potential for northward bedrock flow is avoided entirely, or provides a degree of head reduction in concert with application of other measures. The conceptual hydraulics for this measure are shown on Figure 9. The exact pit water levels required to maintain a bedrock groundwater mound with south flow to the NorthMet pits would depend on the extent of downward leakage from wetlands and surficial deposits north of the Mine Site (to maintain a mound and bedrock groundwater flow toward the proposed NorthMet pits), Northshore pit water elevations, and the potential implementation of other complementary mitigation measures.

The benefit of lowering the West Pit and/or East Pit water elevations would be the elimination of *all* surficial deposit and bedrock flowpaths (north and south) from these sources at the NorthMet Mine Site. This is a highly feasible option from an engineering perspective and can be implemented relatively quickly because the infrastructure to do so already exists, only requiring additional pumping capacity. If applied, the contingency would operate entirely within the area of disturbance described in the project proposal. However, this measure would expose pit walls to oxygen, which could increase the chemical loading to the West Pit lake water and East Pit backfill pore water. Reduced pit water quality and increased pit pumping would require a higher capacity water treatment facility and possibly additional treatment processes. If pit wall grouting were to be done, and if it proved effective, it would reduce the pit inflows and associated waste water treatment rates.

If the West Pit and East Pit water levels were kept depressed, additional water would need to be managed at the Mine Site and Plant Site, likely increasing the need to discharge more water at the Plant Site during NorthMet operations. Treated water would likely be discharged to the Partridge River in closure and increase its flows in comparison to the NorthMet Project Proposed Action. In addition, transition to a non-mechanical treatment system would be more difficult. With a depressed water level, construction of a wetland in the East Pit may be limited.

The Co-lead Agencies note that pit lake depression is of particular interest for the NorthMet East Pit because of the presence of higher permeability Virginia Formation in the north pit highwall. In the simplest sense, maintaining a depressed East Pit water level (relative to Northshore pit lake elevations) would ensure there is no bedrock groundwater flow to the north. Depending on the timing, implementing this mitigative strategy could have implications for mine waste management proposed for the NorthMet East Pit. This is because the proposed inundation of Category 2, 3, and 4 waste rock is an important water quality control feature and waste rock management strategy for the project. Although pit wall inundation is also planned for the NorthMet West Pit, depressing pit lake elevations there does not have the same implications as implementing this for the East Pit.

The water level that would need to be maintained can be evaluated based upon the monitoring information collected during the mining process and initial phases of pit refill. Short-term application of this measure would likely have lesser consequences to pit water quality or

operational requirements than long-term. Additionally, using artificial recharge in combination with pit lake depression could further reduce effects.

Groundwater Extraction Wells - Using extraction wells, PolyMet would pump water from bedrock to create a hydraulic depression in the bedrock groundwater system between the NorthMet and Northshore sites. The conceptual hydraulics of this engineering option are shown on Figure 10.

The wells would be located between the NorthMet mine pits and the Partridge River. The number, geographic extent and configuration of the wells would depend upon: 1) the width of the northward bedrock flowpath; 2) the hydrologic properties of bedrock; and 3) the potential addition of other mitigation measures such as a partial pit drawdown, grouting, or artificial recharge (described below).

There would be relatively small disturbance related to laying the water line(s), electrical lines, pads, and access. Wells would need to be drilled, water lines to transport pumped groundwater would need to be laid out, and likely electricity would need to be supplied to the sites. Roads would likely be needed to access the wells for ongoing operations and maintenance. If the condition of a northward flowpath occurs, the number, capacity, and location of wells would be considered based on monitoring information obtained during the mining process and after the contingency is adopted. The wells would be sealed and site(s) restored after the wells are no longer needed.

If implemented in isolation from other mitigation measures this system would increase flow rates to the WWTF. Potential flow rate increases to the WWTF could be reduced by using some of the extracted water to saturate the East Pit backfill. If pit wall grouting were to be done, and if it proved effective, it would lower extraction well pumping rates. Bedrock extraction wells would induce a north flow from the NorthMet Mine Site to the extraction wells, but no further. After the pits fill, water chemistry would stabilize and gradually improve as predicted under the NorthMet Project Proposed Action. Due to slower refill, the start of bedrock and surficial groundwater flow toward the Partridge River would be delayed when compared to the NorthMet Project Proposed Action.

Long-term WWTF influent water quality would not likely differ significantly from that modeled for the NorthMet Project Proposed Action. However, WWTF influent flow rates would likely be greater as it would consist of both pit pumping and bedrock well pumping. This would increase the NorthMet Project Proposed Action discharges to the Partridge River.

Wetlands would be directly impacted from groundwater extraction well installation and access road construction. The number of acres of ground disturbance is unknown as the location and number of wells is unknown. If the number of wells necessary resulted in unacceptable wetland impacts, other mitigation measures used in tandem with extraction wells would lower the number of required extraction wells.

Artificial Recharge – A bedrock groundwater mound could be artificially augmented between the NorthMet Mine and the Northshore Mine by increasing recharge into bedrock via wells, an infiltration trench, or combination of both. The recharge water would need to be free of particulates to minimize clogging. Periodic well or trench redevelopment would be required.

This type of system would be located between the NorthMet mine pits and the Partridge River. The extent, water source, and configuration of the artificial recharge system would depend upon the information obtained during monitoring of conditions during mining operations. The trench may only need to operate in non-frozen conditions to supply sufficient water to create a bedrock groundwater mound (Barr 2015b).

For wells, the geographic extent, number, and configuration of the artificial recharge system would depend upon the width of the northward bedrock flowpath. The wells would need to be drilled, water supply lines from the source water to the wells would need to be laid out, and likely electricity would need to be supplied to the sites. Roads would likely be needed for access to facilitate their operation and maintenance. If the condition of a northward flowpath occurs, the number, capacity, and location of wells would be considered based on monitoring information obtained during the mining process and after the contingency is adopted. The wells would be sealed and site(s) restored after the wells are no longer needed.

For an infiltration trench, road access would be needed for the trench excavation and backfilling. Construction details would depend upon the adopted design, though it is possible a single-pass construction methodology could be employed to minimize disturbance. Water lines would likely need to be laid out for introduction into the trench.

Both treated WWTF effluent or un-impacted (i.e. non-contact) stormwater would be available indefinitely during closure, and could provide water for recharge. Figure 11 shows conceptually how an artificial groundwater mound would create a flow divide between the NorthMet Mine Site and the Northshore Mine, and prevent the flow of pit water from the proposed NorthMet pits to the Northshore pits. Bedrock well field tests would be necessary to further evaluate the design and operation of this mitigation measure. Because this option would introduce recharge water migration northward to the Northshore pits, it might be necessary to combine this strategy with extraction wells to prevent the recharge water from migrating to the Northshore pits.

Artificial recharge would induce southern bedrock groundwater flow towards the West Pit and/or East Pit. Because the recharge water would have low chemical concentrations, it is unlikely to adversely affect pit water quality. As a result, estimates of bedrock and surficial deposit groundwater water chemistry entering the Partridge River from the Mine Site are unlikely to be significantly different from what is currently modeled in the FEIS. Surficial deposit groundwater flowpaths and flow rates to the Partridge River are unlikely to change significantly from what is currently predicted in the FEIS. Furthermore, the flow rates and effluent quality of the WWTF that would be discharged to a tributary of the Partridge River are unlikely to be significantly different from what is currently modeled in the FEIS. Under the artificial recharge scenario (without the extraction wells), treated or unaffected water would flow north to the Northshore Mine.

Wetlands would be directly affected from recharge wells and/or infiltration trench and access road construction. The number of acres of ground disturbance is unknown as the final location and number of wells and/or trench is unknown. If the design of the artificial recharge system resulted in unacceptable wetland impacts, other mitigation measures used in tandem with artificial recharge would decrease the number of wells or size of the trench.

The contingency mitigation measures discussed above, *if needed*, would be maintained indefinitely or until acceptable bedrock groundwater flow conditions are obtained without those measures. This may include maintaining and periodically replacing recharge or extraction wells. The performance of the mitigation measures would be determined by monitoring the direction of bedrock groundwater flow. If the artificial recharge or pit lake depression option is chosen, a south bedrock flow toward the NorthMet pits would need to be verified. If the groundwater extraction well is chosen, a south flow away from the Northshore pits would need to be verified.

4.0 Technical Summary and Recommendations

The Co-lead Agencies have concluded that the lack of hydrologic response in bedrock wells at the proposed NorthMet Project Mine Site is consistent with a conceptual model that includes downward leakage from surficial deposits into the underlying bedrock. However, the Co-lead Agencies acknowledge that the well data and the NorthMet Mine Site MODFLOW model do not exclude the possibility of a future northward bedrock flowpath from the proposed NorthMet pits to the Northshore pits. After careful consideration, the Co-lead Agencies have concluded that site-specific groundwater monitoring and analysis before and after the beginning of mine operations is an acceptable approach for evaluating the development or non-development of a northward flowpath between the NorthMet and Northshore mine sites. If a southward flow cannot be verified by water-level data and/or supporting analysis, then a northward flowpath would be assumed. The degree of mound development is strongly related to the amount of downward leakage into bedrock that would occur when bedrock hydraulic heads are depressed by dewatering or partial refill of the Northshore pits.

The Co-lead Agencies have concluded that attempting additional modeling of any potential flowpath between the proposed NorthMet pits and Northshore pits during the FEIS process is unwarranted. Additional modeling would need to reconcile that at present there are insufficient data north of the Mine Site on which to refine: 1) vertical hydraulic conductivity for wetlands and surficial deposits; 2) horizontal hydraulic conductivities in bedrock (e.g., Virginia Formation; BIF); 3) variability of hydraulic conductivities within the bedrock units, and 4) the hydrologic significance of 100 Mile Swamp in providing a source of water for downward leakage. Each of these refinements is important to quantitatively assess the likelihood and potential magnitude of a northward bedrock flowpath. Modeling would also have to reconcile uncertainty regarding the sequence and timing of future Northshore mining operations, including the depth of pit excavations and development of pit lakes relative to NorthMet-related pit conditions during operations and closure. Attempting to incorporate these uncertain parameters into MODFLOW would likewise lead to high uncertainty in model results.

The Co-lead Agencies recommend implementation of a robust monitoring and analysis program at mine year 1 through operations, reclamation, and closure to ensure with reasonable certainty that any potential northward bedrock groundwater flowpath from the proposed NorthMet pits to the Northshore pits would be preemptively addressed and prevented. This is because the current hydrologic information does not exclude the possibility of a northward bedrock groundwater flowpath from the proposed NorthMet pits to the Northshore pits. The monitoring program would be situated in bedrock in the area north of the proposed NorthMet pits to measure groundwater levels during and after NorthMet operations. The Co-lead Agencies are confident that monitoring and analysis of bedrock groundwater levels would detect and provide advance notice that a northward flowpath could occur. If this is the case, then applicable environmental review and permitting procedures would be implemented for the recommended engineered mitigation measures, followed by actual

implementation to eliminate and thus prevent the development of a northward flowpath from the NorthMet site to the Northshore site.

5.0 References

Barr Engineering (Barr). 2008. Mine Waste Water Management for the PolyMet NorthMet Mine Site, RS22 Technical Detail Report, Appendix B—Groundwater Modeling of the NorthMet Mine Site Version 3.

Barr Engineering (Barr). 2015a. NorthMet Project Water Modeling Data Package Volume 1—Mine Site, Version 14, Appendix B. February 27, 2015.

Barr Engineering (Barr). 2015b. Response to Cooperating Agency Comments Related to Peter Mitchell Pit—Version 4. September 14, 2015.

Great Lakes Indian Fish and Wildlife Commission (GLIFWC). 2015. Letter from John Coleman June 18, 2015. Re: PolyMet mine site groundwater model calibration and predictions.

Great Lakes Indian Fish and Wildlife Commission (GLIFWC). 2015. Letter from John Coleman August 11, 2015. Re: Comments on PolyMet mine site contaminant northward flowpath and groundwater model calibration.

Minnesota Department of Natural Resources (MDNR). 2008. Email Correspondence from John Adams December 8, 2008. Fwd: RE: Conference Call - RS22 Issue. December 9, 2008.

Table 2 Example Mathcad Scoping Calculation – Year 2070 with Leakage Equal to 8 in/yr

Units below are ft-day

$KK_1 := 0.31 \cdot \frac{ft}{day}$	Hydraulic Conductivity Upper Virginia Fm.	$K_1 := KK_1 \cdot ft^{-1} \cdot day$	$K_1 = 0.310$
$KK_2 := 0.90 \cdot \frac{ft}{day}$	Hydraulic Conductivity Biwabik Fm.	$K_2 := KK_2 \cdot ft^{-1} \cdot day$	$K_2 = 0.900$
$RR := 8 \cdot \frac{in}{yr}$	Downward leakage flux into bedrock	$R := RR \cdot ft^{-1} \cdot day$	$R = 1.83 \times 10^{-3}$
$LL := 7690 \cdot ft$	Length of flow system (NorthMet East Pit to PMP)	$L := LL \cdot ft^{-1}$	$L = 7690.0$
$DD := 4490 \cdot ft$	Distance to Virginia/Biwabik contact	$D := DD \cdot ft^{-1}$	$D = 4490.0$
$ww := 4500 \cdot ft$	Flow tube width	$w := ww \cdot ft^{-1}$	$w = 4500.0$
$GG_o := 1620 \cdot ft$	Base of surficial deposits elevation at x=0	$G_o := GG_o \cdot ft^{-1}$	$G_o = 1620.0$
$S_G := 0.0039$	Slope of surficial deposits (also ground slope)		$S_G = 0.00390$
	Equation for base of surficial deposits elevation	$G(x) := G_o + S_G \cdot x$	$G(0) = 1620.0$ $G(L) = 1650.0$
$BB_o := GG_o - 400 \cdot ft$	Base of permeable bedrock elevation at x=0	$B_o := BB_o \cdot ft^{-1}$	$B_o = 1220.0$
$S_B := S_G$	Slope of base of permeable berock		$S_B = 0.00390$
	Equation for base of permeable bedrock elevation	$B(x) := B_o + S_B \cdot x$	$B(0) = 1220.0$ $B(L) = 1250.0$
$HH_o := 1592 \cdot ft$	Hydraulic Head at x=0. Water level elevation in NirthMet East Pit	$H_o := HH_o \cdot ft^{-1}$	$H_o = 1592.0$
$QQ_o := -51.133 \, gpm$	Inflow at x=0. From NorthMet East Pit into bedrock	$Q_o := QQ_o \cdot ft^{-3} \cdot day$	$Q_o = -9.843 \times 10^{3}$

$$K(x) := \begin{cases} K_1 & \text{if } x \le D \\ K_2 & \text{otherwise} \end{cases}$$

Equation for hydraulic conductivity distribution along flowpath

Given $\quad H'(x) = -\frac{Q_o + R \cdot w \cdot x}{K(x) \cdot w \cdot (H(x) - B(x))} \quad H(0) = H_o \quad H := Odesolve(x, L)$ Governing ODE and BC

"Point-and-shoot" solution method using 4th order Runge-Kutta

Iterate on QQ_o until the head at x = LL is 1300 ft; that is, H(L) = 1300 $\quad H(L) = 1300.0$

This solution is for 1-D horizontal flow and accounts for:
Variable saturated thickness
Uniform downward leakage
Sloping aquifer base

Table 2 (cont.)

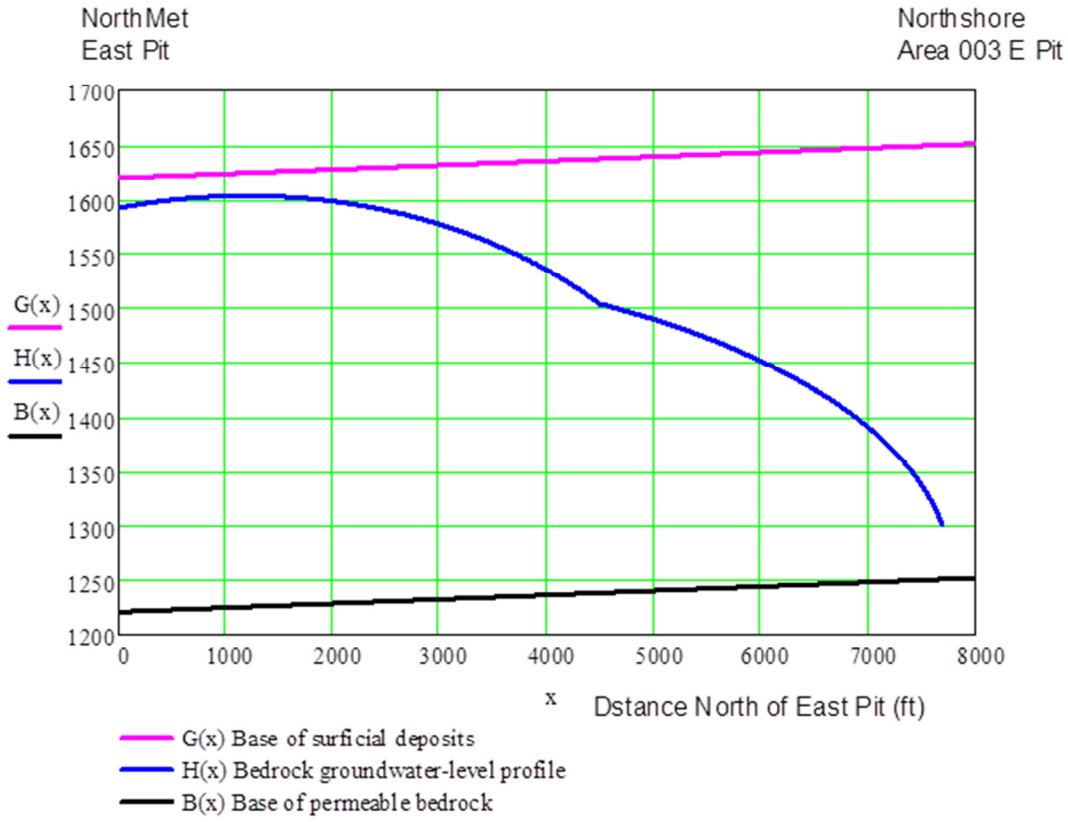

North Met
East Pit
Northshore
Area 003 E Pit
1700
1650
1600
1550
1500
1450
1400
1350
1300
1250
1200
G(x)
H(x)
B(x)
0
1000
2000
3000
4000
5000
6000
7000
8000
x
Dstance North of East Pit (ft)
G(x) Base of surficial deposits
H(x) Bedrock groundwater-level profile
B(x) Base of permeable bedrock

Figure 1: Physiographic Features and Bedrock Contacts

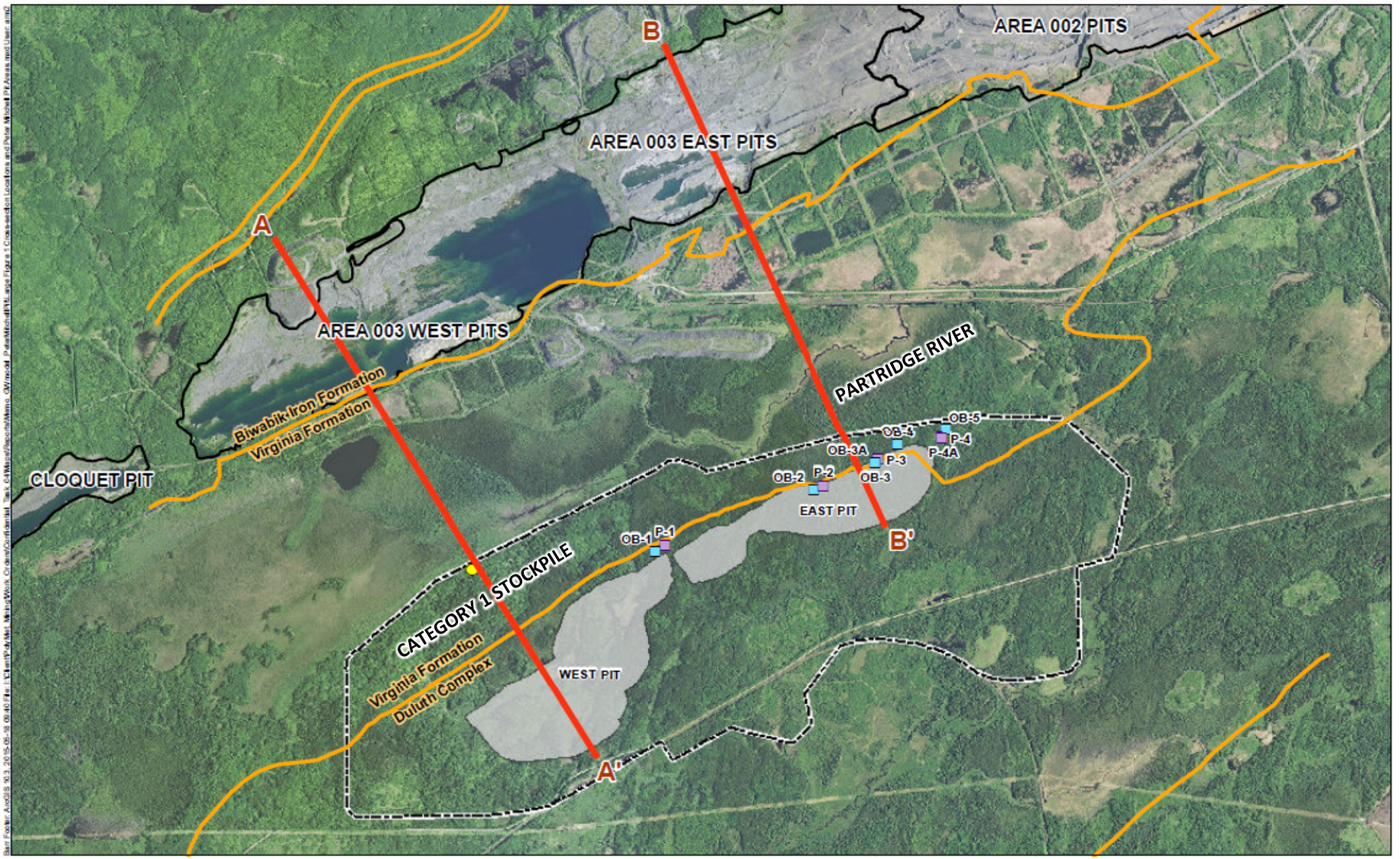


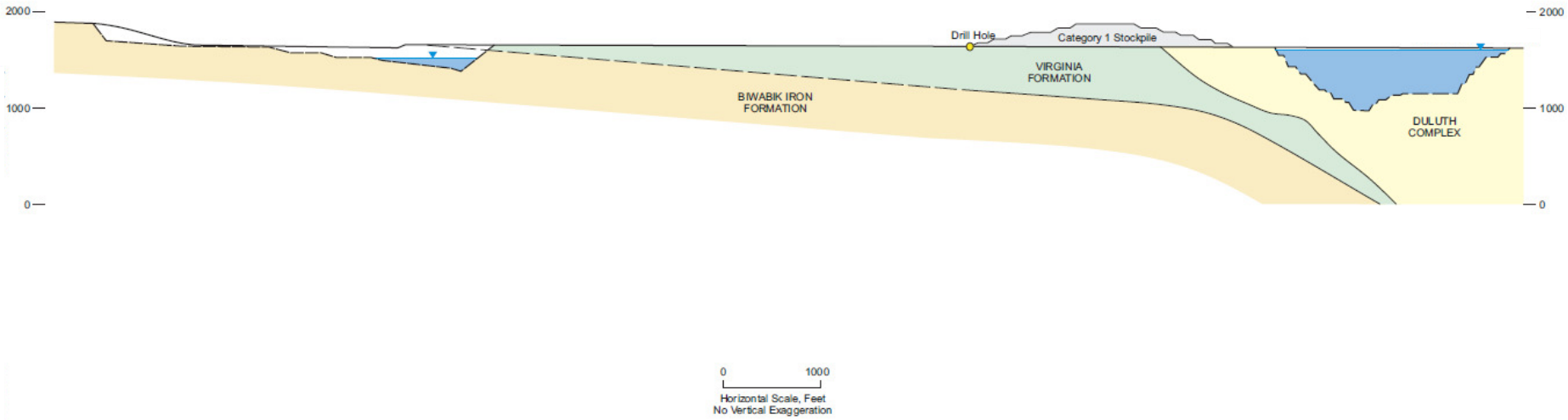
Figure 2: Scaled Cross-Section A-A'

A
North

A'
South

Northshore Area 003 West
WLE = 1,350 ft amsl (year 2070)
WLE = 1,500 ft amsl (year 2080 +)

NorthMet West Pit
WLE = 1,576 ft amsl (year 2035+)



No vertical exaggeration

WLE: Pit water-level elevation in feet (ft) above mean sea level (amsl)

— — — Inferred geologic contact

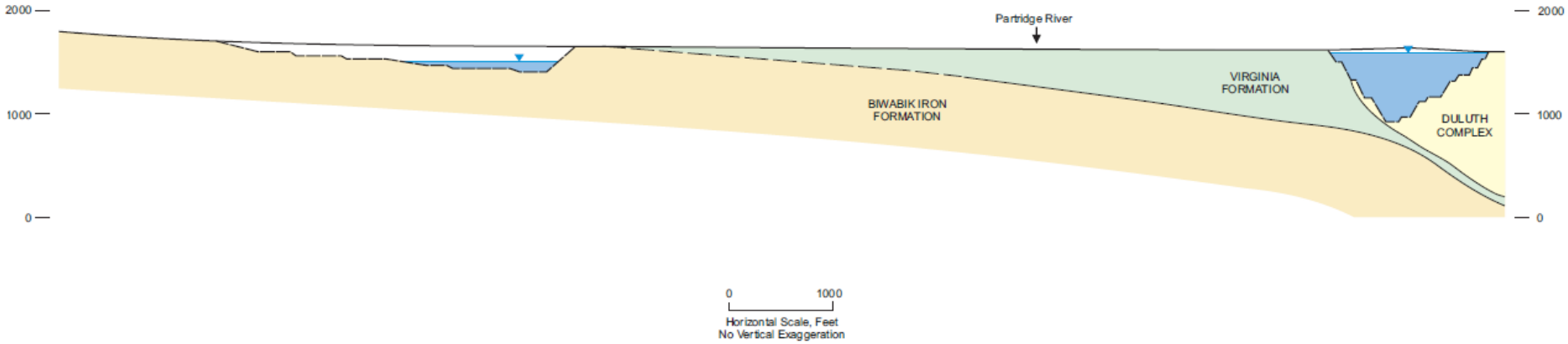
Figure 3: Scaled Cross-Section B-B'

B
North

B'
South

Northshore Area 003 East
WLE = 1,300 ft amsl (year 2070)
WLE = 1,500 ft amsl (year 2080+)

NorthMet East Pit
WLE = 1,592 ft amsl (year 2035+)



No vertical exaggeration

WLE: Pit water-level elevation in feet (ft) above mean sea level (amsl)

— — — Inferred geologic contact

Figure 4: Analytical Groundwater Flow Model Used for Scoping Calculations

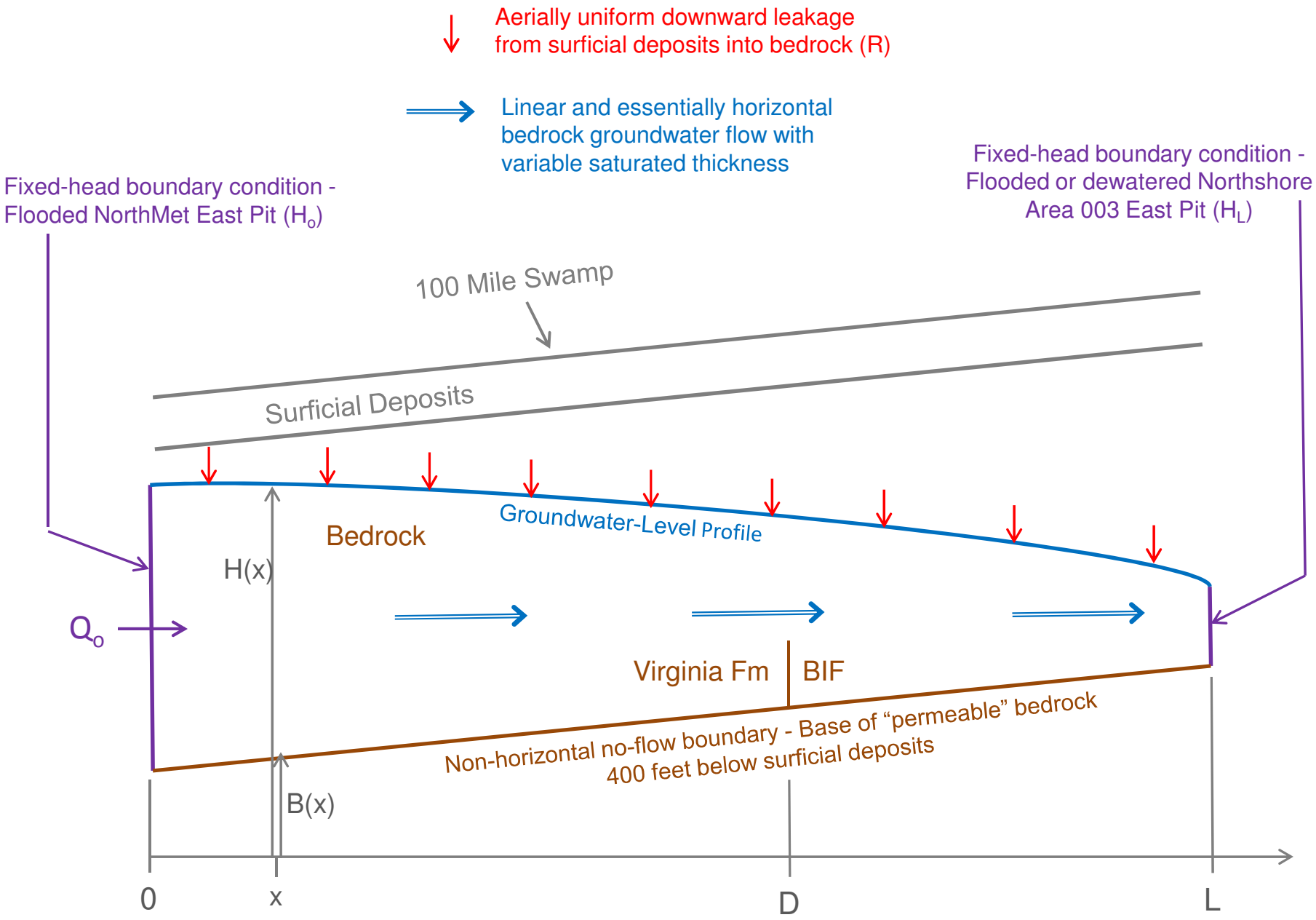


Figure 5: Scoping Calculation - Year 2070 - Effect of Downward Leakage Rates on Bedrock Groundwater-Level Profiles

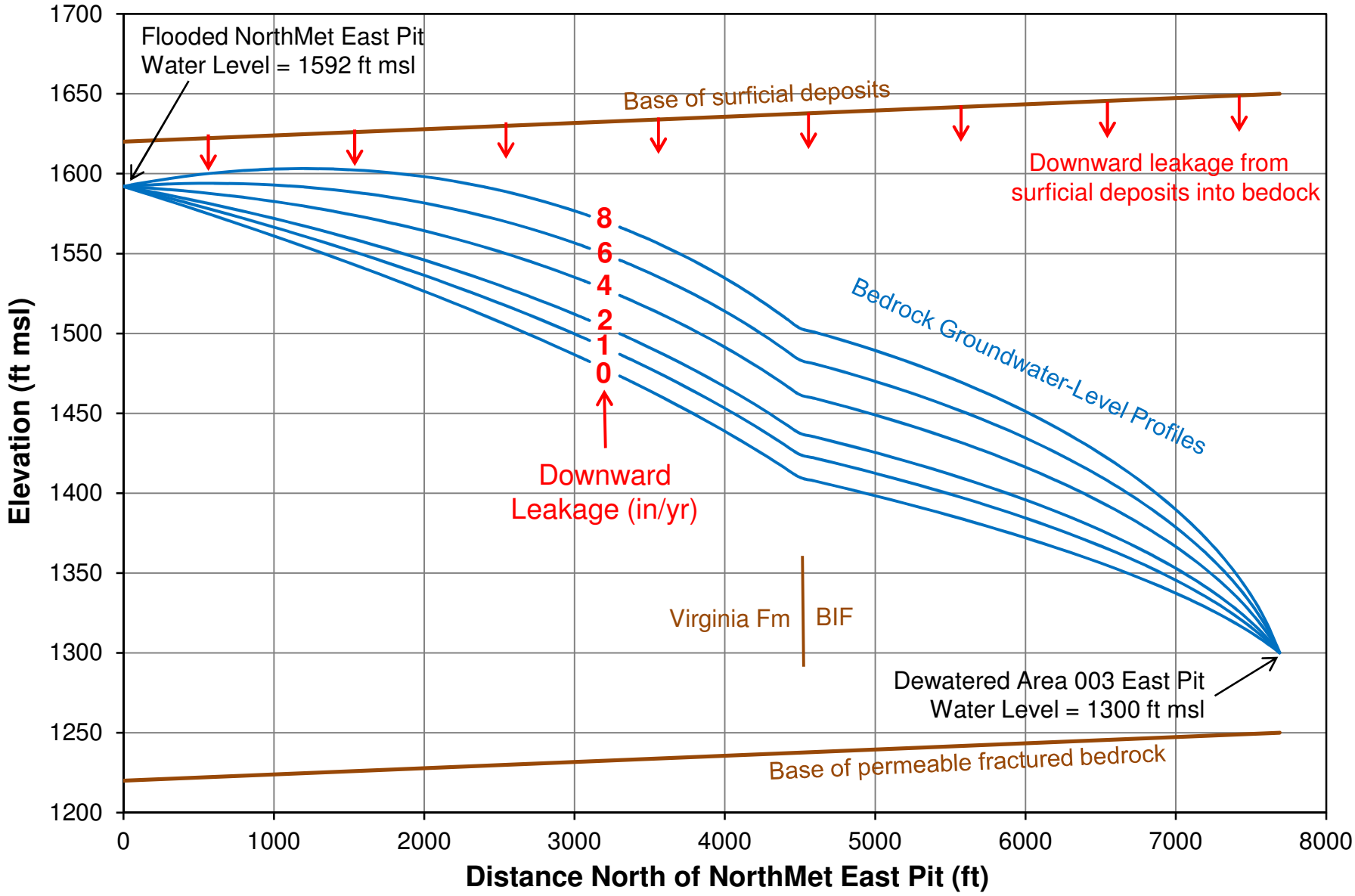


Figure 6: Scoping Calculation - Years 2080 Onward - Effect of Downward Leakage Rates on Bedrock Groundwater-Level Profiles

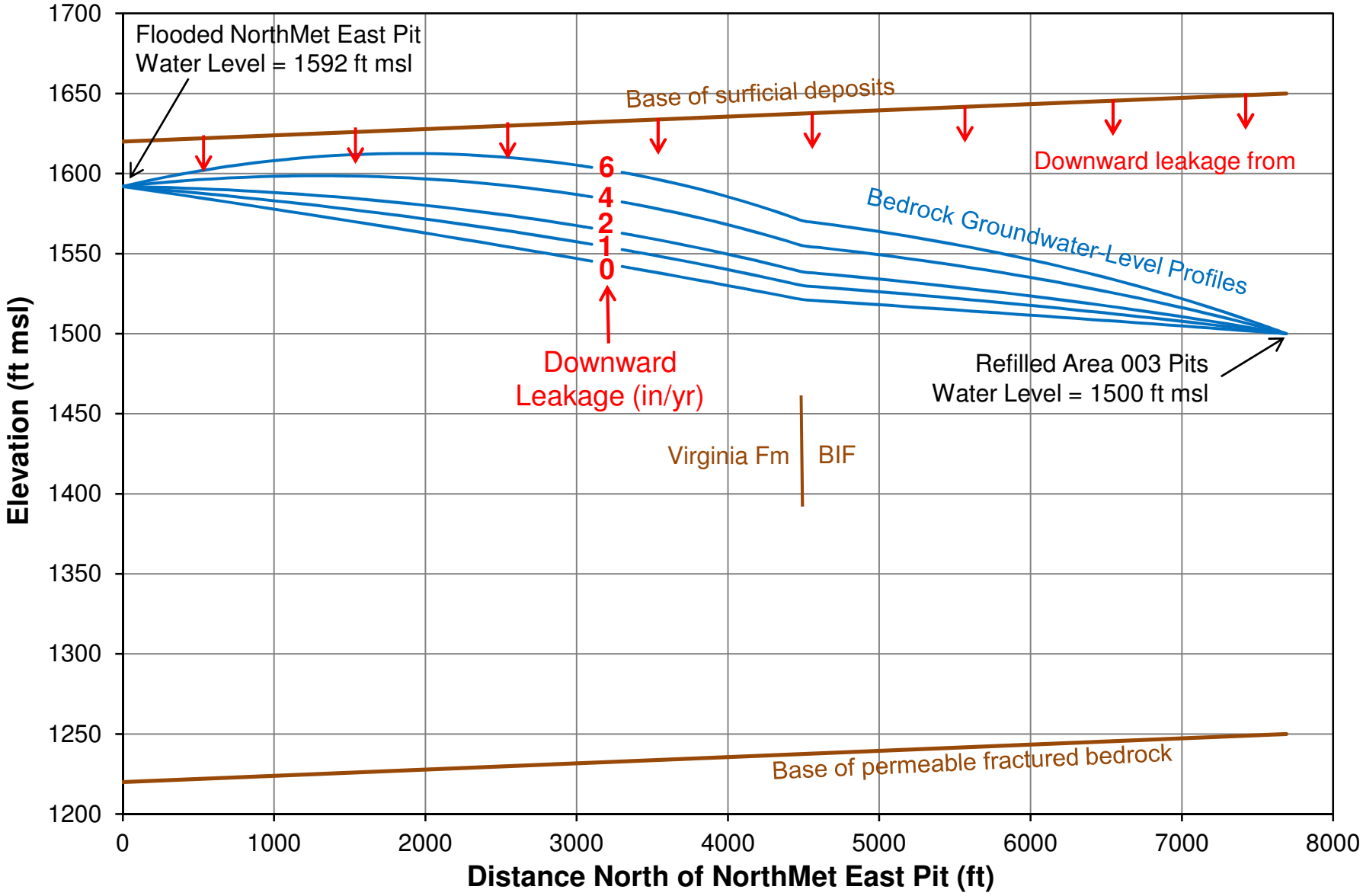


Figure 7: Response in NorthMet Bedrock Wells Compared to Water Level Changes at Northshore

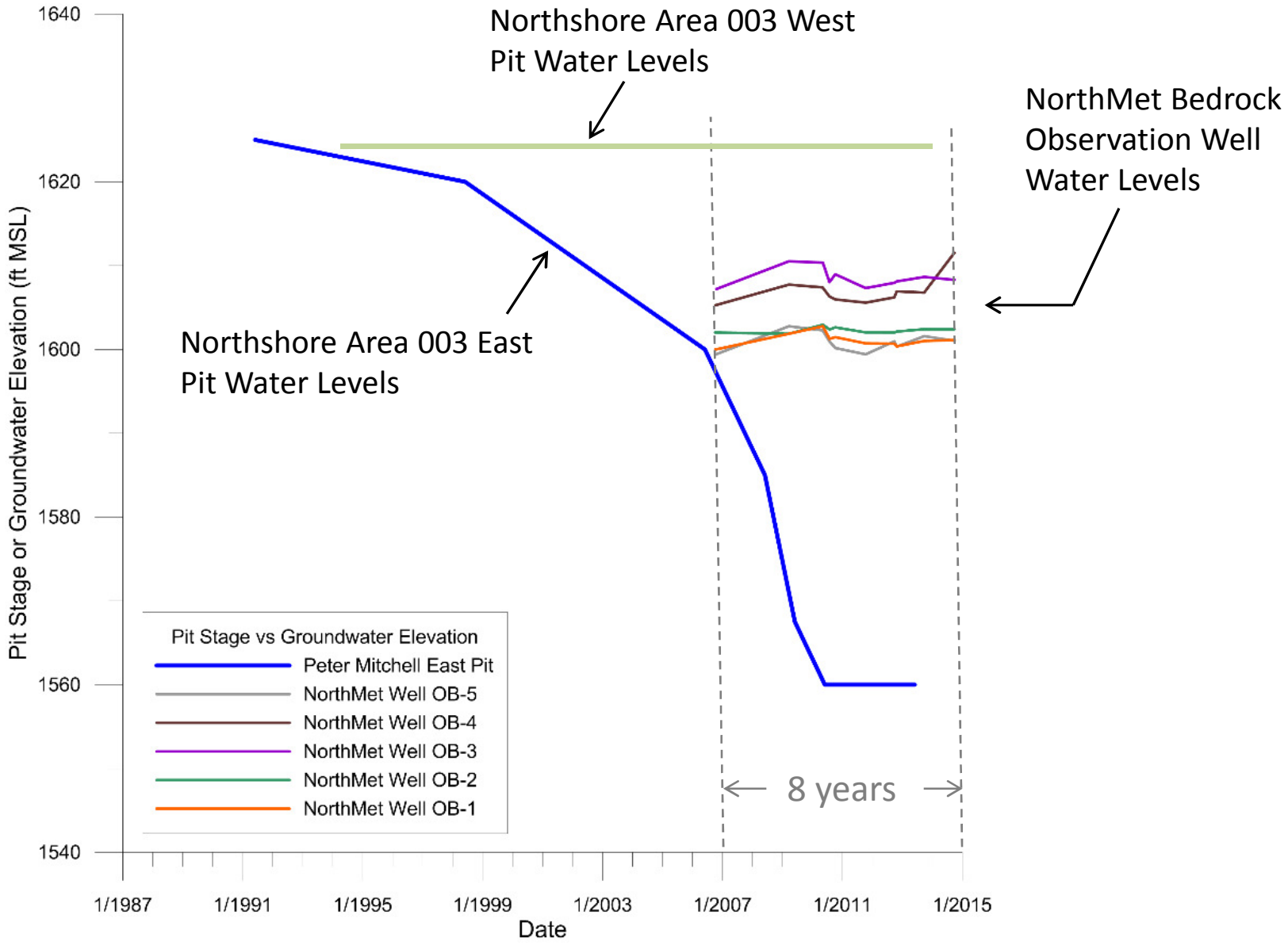
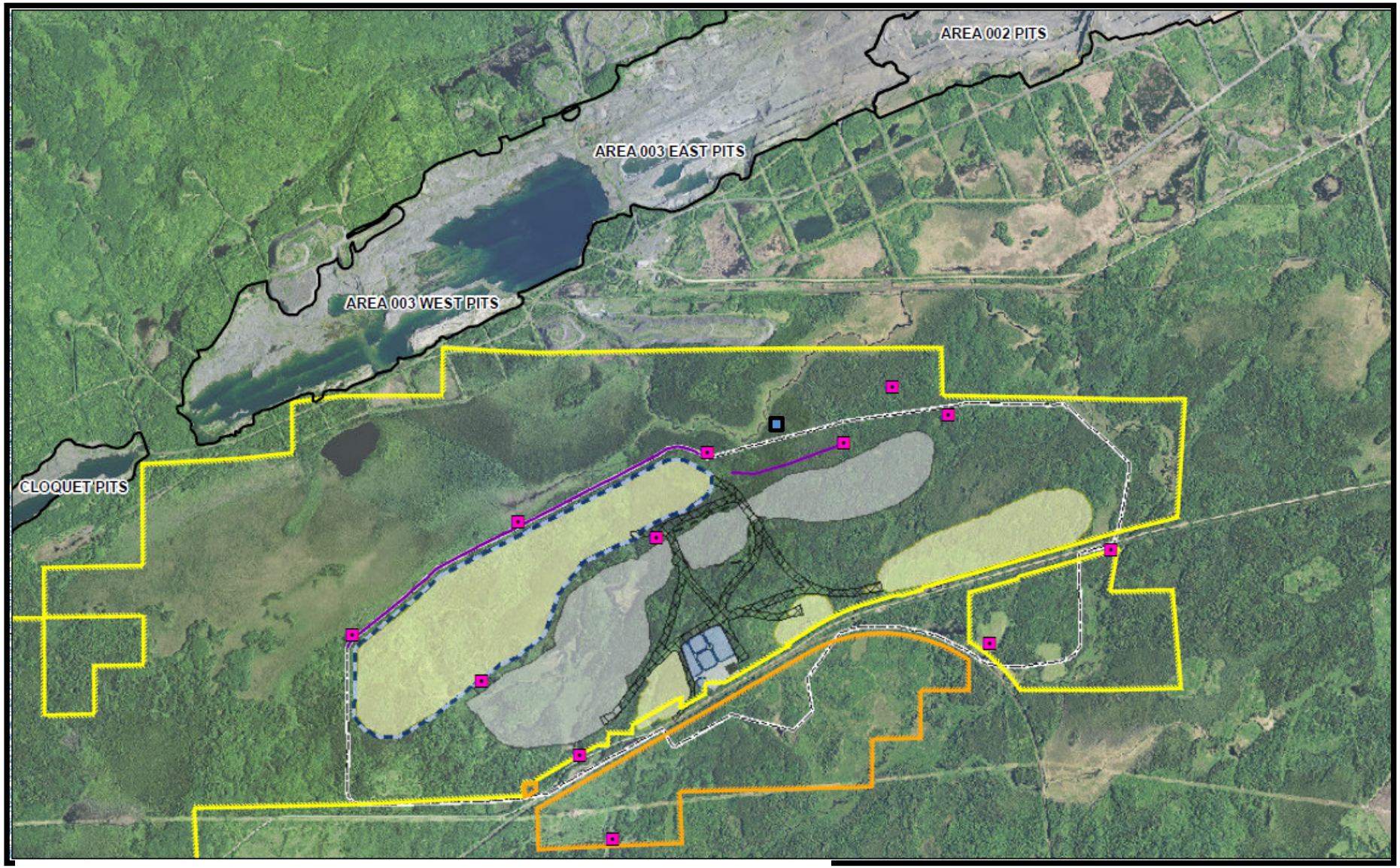


Figure 8: PolyMet Proposed and Co-Lead Agency Recommended NorthMet Bedrock Groundwater Monitoring Wells*



* Note: additional groundwater monitoring wells may be stipulated during permitting

Figure 9: Conceptual Hydraulics for a Lowered East Pit Water Level

Northshore Area 003 East WLE

NorthMet East Pit WLE less than Northshore Area 003 East WLE

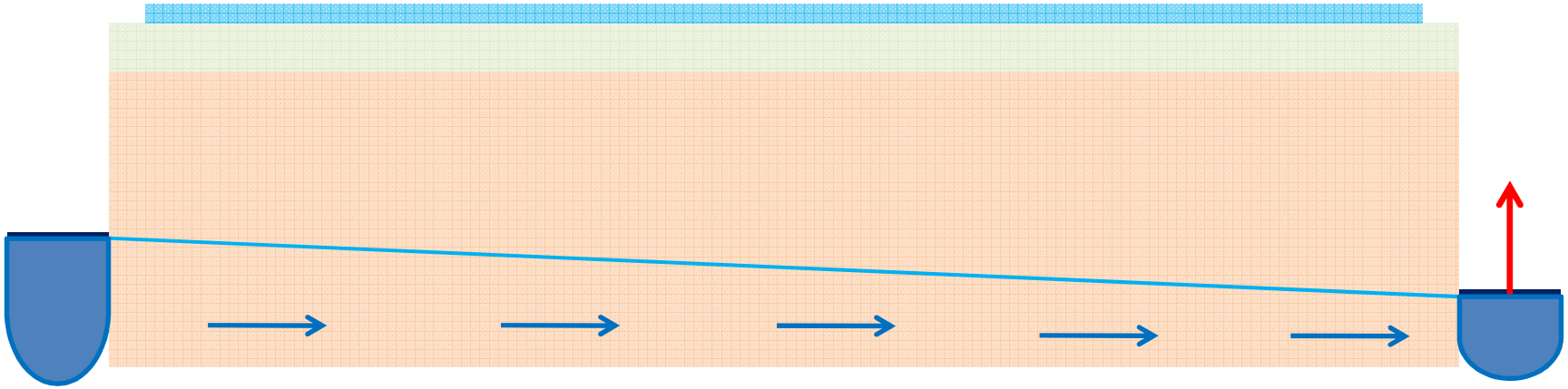


Diagram is not to scale and has extreme vertical exaggeration

100 Mile Swamp surface water

Surficial deposits

Bedrock

WLE — Pit lake water-level elevation in feet (ft) mean sea level (amsl)

Pit lake pumping

Bedrock groundwater flow

Piezometric surface in bedrock

Pit water level

[a] Note: the water level in the East Pit can be temporarily depressed during refill (by pumping) to prevent a north flowpath from developing while other mitigation options are being evaluated and/or implemented

Figure 10: Conceptual Hydraulics for a Groundwater Collection System

Northshore Area 003 East
WLE = 1,300 ft amsl (year 2070)
WLE = 1,500 ft amsl (year 2080+)

NorthMet East Pit
WLE = 1,592 ft amsl (year 2035+)

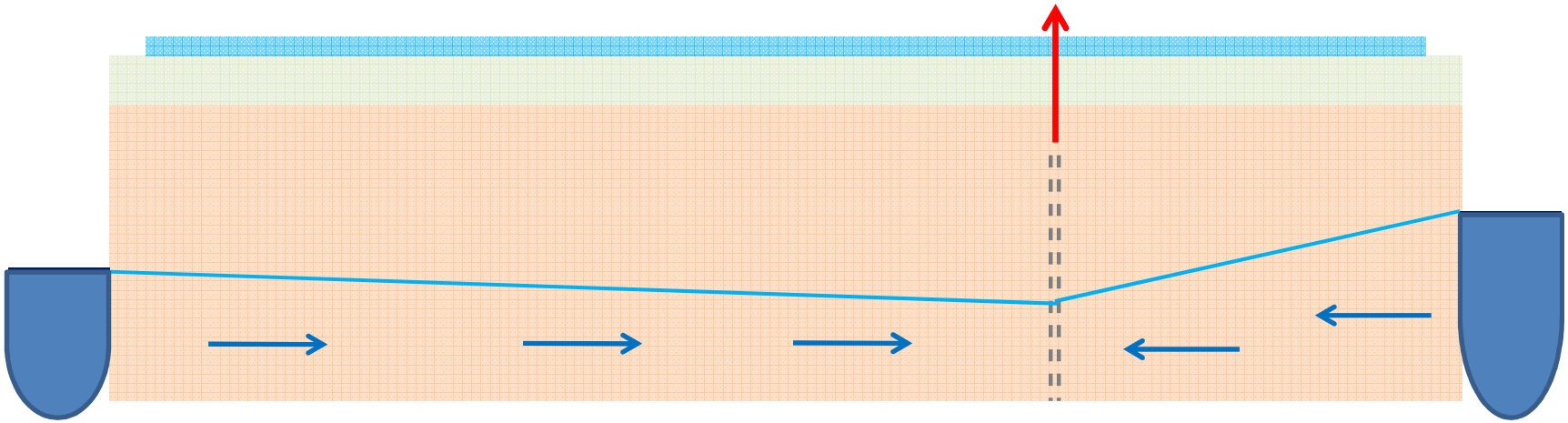


Diagram is not to scale and has extreme vertical exaggeration

100 Mile Swamp surface water

Surficial deposits

Bedrock

WLE — Pit lake water-level elevation in feet (ft) mean sea level (amsl)

Ground water pumping

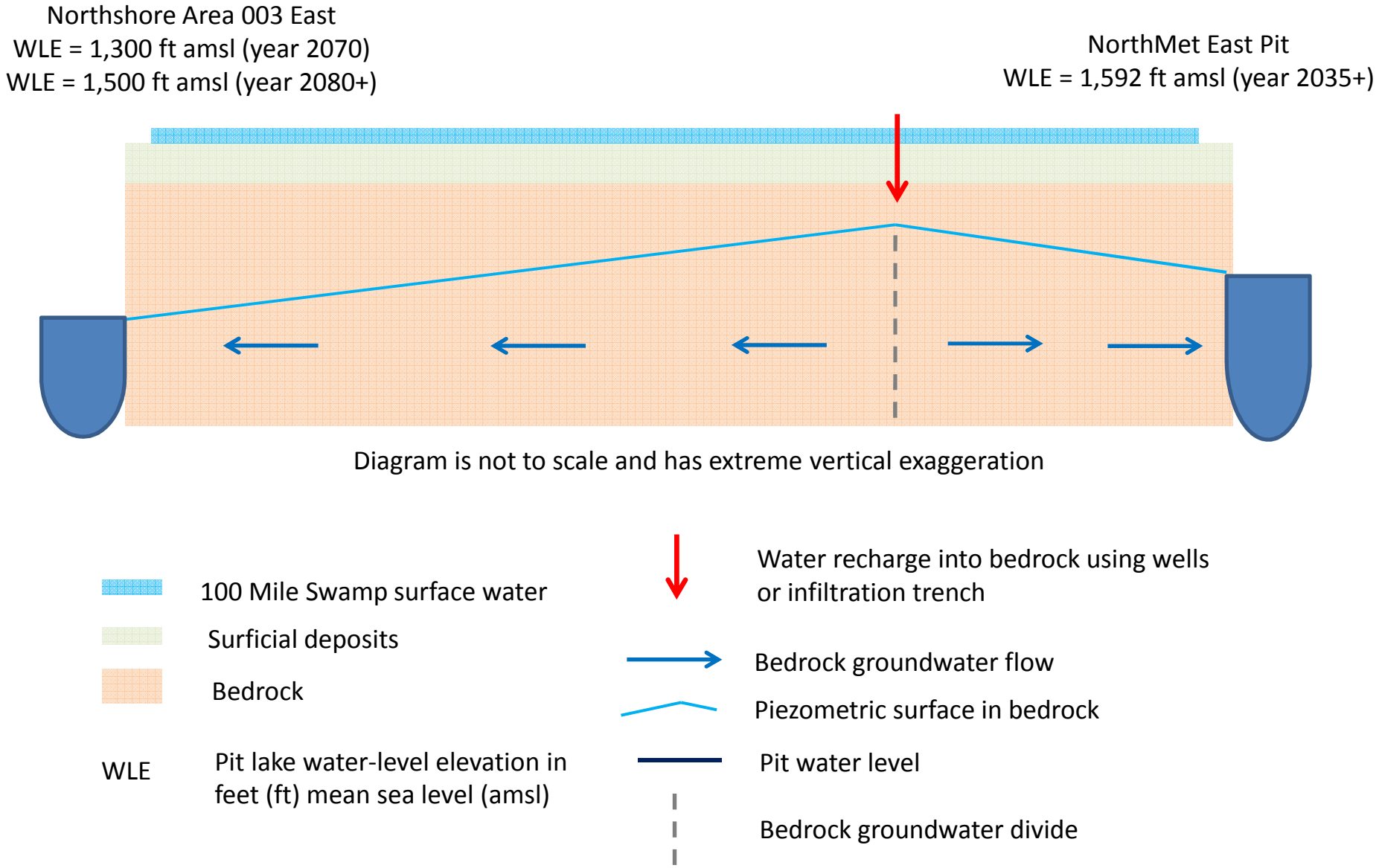
Bedrock groundwater flow

Piezometric surface in bedrock

Pit water level

Series of bedrock extraction wells

Figure 11: Conceptual Hydraulics for an Artificial Groundwater Mound



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

DEC 21 2015

REPLY TO THE ATTENTION OF:

Brenda Halter
Forest Supervisor
U.S. Forest Service – Superior National Forest
8901 Grand Avenue Place
Duluth, Minnesota 55808

Colonel Dan Koprowski
Commander
U.S. Army Corps of Engineers – St. Paul District
180 5th Street East, Suite 700
St. Paul, Minnesota 55101-1678

Tom Landwehr
Commissioner
Minnesota Department of Natural Resources
500 Lafayette Road
St. Paul, Minnesota 55155-4040

Re: Final Environmental Impact Statement for the NorthMet Mining Project and Land Exchange, Hoyt Lakes, St. Louis County, Minnesota - CEQ No. 20150317

Dear Ms. Halter, Colonel Koprowski, and Mr. Landwehr:

The United States Environmental Protection Agency (EPA) has reviewed the Final Environmental Impact Statement (FEIS) for the NorthMet Mining Project and Land Exchange. This FEIS was developed by the U.S. Army Corps of Engineers (Corps), U.S. Forest Service (USFS), and the Minnesota Department of Natural Resources (MDNR). These agencies are collectively referred to as the "co-lead agencies." The Corps and MDNR are also among the permitting agencies for the proposed project. EPA conducted its review pursuant to its authorities and responsibilities under the National Environmental Policy Act (NEPA), Council on Environmental Quality regulations (40 CFR Parts 1500-1508), Section 309 of the Clean Air Act (CAA), Section 404 of the Clean Water Act (CWA), and its June 27, 2011 agreement to participate as a cooperating agency.

The proposed project is the first non-ferrous hard rock mine on the Mesabi Iron Range. It includes three new surface mine pits, permanent and temporary waste rock stockpiles, an overburden storage and laydown area, a wastewater treatment facility, a water collection and conveyance system, a central pumping station, and a rail transfer hopper. Two processing

facilities, one for beneficiation and one for hydrometallurgical processing, would be located on the old LTV Steel Mining Company site, and the existing LTV tailings basin would be expanded during use. The proposed land exchange anticipates the exchange of 6,650 acres of Superior National Forest for 6,690 acres of privately-owned lands. The proposed project is within lands ceded by certain Chippewa tribes under the Treaty of La Pointe, September 30, 1854 (10 Stat. 1109), for which these tribes retain reserved hunting, fishing, and gathering rights.

EPA previously reviewed the Draft Environmental Impact Statement and rated it as *Environmentally Unsatisfactory – Inadequate (EU-3)* on February 18, 2010. EPA commented on the Supplemental Draft Environmental Impact Statement on March 13, 2014, and rated it as *Environmental Concerns – Insufficient Information (EC-2)*.[1] EPA also reviewed the Preliminary FEIS, and provided comments to the co-lead agencies on August 5, 2015.

The FEIS adequately resolves EPA's comments on the Preliminary FEIS pertaining to base flow and cumulative impacts, model calibration, and contradictory information. EPA's remaining comments (see attached) can and should be addressed in the USFS Record of Decision (ROD), in the Corps permit evaluation process which culminates in a ROD, and/or in the context of other permitting reviews as appropriate. EPA retains oversight authority for permitting discharges under the CWA's National Pollutant Discharge Elimination System and air emissions under the CAA. EPA also retains regulatory authority, along with the Corps, under CWA Section 404.

We look forward to discussing these comments as needed before issuance of the RODs and to ongoing dialogue throughout the permitting processes. Please contact me at (312) 353-8894 or Kenneth Westlake of my staff at (312) 886-2910 to schedule this discussion.

Sincerely,

Alan Walts, Director
Office of Enforcement and Compliance Assurance

Enclosure: Detailed Comments on the NorthMet Mine Final Environmental Impact Statement

[1] See EPA's comment letters at: https://cdxnodengn.epa.gov/cdx-enepa-public/action/eis/search. EPA's rating criteria are defined at: http://www.epa.gov/nepa/environmental-impact-statement-rating-system-criteria.

cc: Doug Bruner, U.S. Army Corps of Engineers – St. Paul District (email copy)
Tamara Cameron, U.S. Army Corps of Engineers – St. Paul District (email copy)
Barb Naramore, Minnesota Department of Natural Resources (email copy)
Steve Colvin, Minnesota Department of Natural Resources (email copy)
Randall Doneen, Minnesota Department of Natural Resources (email copy)
Lisa Fay, Minnesota Department of Natural Resources (email copy)
Bill Johnson, Minnesota Department of Natural Resources (email copy)
Michael Jimenez, U.S. Forest Service – Superior National Forest (email copy)
Richard Periman, U.S. Forest Service – Superior National Forest (email copy)
Andrew Horton, U.S. Fish and Wildlife Service (email copy)
Ann Foss, Minnesota Pollution Control Agency (email copy)
Shannon Lotthammer, Minnesota Pollution Control Agency (email copy)
Esteban Chiriboga, Great Lakes Indian Fish and Wildlife Commission (email copy)
John Coleman, Great Lakes Indian Fish and Wildlife Commission (email copy)
Darren Vogt, 1854 Treaty Authority (email copy)
Tyler Kaspar, 1854 Treaty Authority (email copy)
Bill Latady, Bois Forte Band of Lake Superior Chippewa (email copy)
Nancy Schuldt, Fond du Lac Band of Lake Superior Chippewa (email copy)
Margaret Watkins, Grand Portage Band of Lake Superior Chippewa (email copy)

Detailed Comments on the NorthMet Mine Final Environmental Impact Statement

Potential Mine Site Pollutant Migration Northward in the Bedrock Aquifer

The FEIS acknowledges that a northward flow path in bedrock cannot be ruled out as a possibility. It proposes monitoring during construction, operation, closure, and post-closure to more accurately determine the potential for a northward flow path. It also proposes four contingency mitigation measures to address any future northward flow path associated with the project. Those measures are:

1. Create a pit lake cone of depression (maintain the East Pit water level at the same elevation as the NorthShore Mining Company's Peter Mitchell Pit (PMP));
2. Grout pit walls to seal fractures and faults, as needed;
3. Install a groundwater extraction system north of the Mine Site; and
4. Recharge groundwater to create an artificial groundwater mound that prevents groundwater pollutants from flowing north.

We agree that a northward flow path is a possibility. In our PFEIS comment letter, we recommended that the FEIS analyze and assess the impacts of implementing the proposed contingency mitigation measures. The FEIS includes basic qualitative estimates and presents a general description of the proposed contingency mitigation measures in Section 5.2.2.3.5. This is adequate for purposes of the FEIS. However, further impact assessment is needed during the permitting process, including information on water quality and quantity impacts that may occur as a result of a northward flow path and/or contingency mitigation measures.

In addition, limited site-specific data is currently available to assess the potential for a northward flow path, and to design effective contingency mitigation measures should northward flow occur. The permitting agencies have proposed to begin routine groundwater monitoring when active operations begin. EPA continues to recommend that the permitting agencies collect and analyze additional site-specific data during the permitting review process as the project design is being further developed. It appears that technology is currently available to implement contingency mitigation measures. However, the selection of any measures determined to be necessary must be informed by data that sufficiently support refining their design and assessing their impacts in the context of the project as a whole (e.g., by determining the rate of downward water leakage at the One Hundred Mile Swamp).

> *Recommendation 1:* Given the possibility of a northward flow path, analyses of environmental impacts associated with this possibility should be conducted and evaluated during the permitting process. These analyses should include anticipated direct and indirect environmental impacts that may occur if one or more of the proposed contingency mitigation measures are implemented.

Preparing for Permitting

We understand that the monitoring program outlined in the FEIS will be refined and implemented in greater detail during the permitting process. We share the goal of the permitting agencies to ensure that pollutant migration from the site and impacts to surface waters are

minimized and meet the requirements of the CWA. We also want to ensure that a robust monitoring program is put in place to identify pollutant migration pathways in a timely manner, so that permitting and contingency mitigation-related decisions can be made as quickly and effectively as possible. To this end, the following points and recommendations related to monitoring and the contingency mitigation measures should be addressed during the permitting process to inform permit decisions:

1. The trigger(s) for implementing contingency mitigation measures should be defined.
2. Because each contingency mitigation measure, if implemented, would result in other impacts to the project and/or to the environment, each measure requires additional study before approval.
3. In the event that the requirement for one or more contingency measures is triggered, time will be required for additional study, permitting, planning, design and construction. This possibility should be considered in further project development to avoid or minimize any period of noncompliance before such measures are in place.

> *Recommendation 2:* A robust and sufficient monitoring program should begin as soon as possible to establish adequate baseline data that help to identify pollutant migration pathways in a timely manner and can detect a potential northward flow. Monitoring data should be collected and analyzed before any major grading or excavation of soils or conveyance or pumping of water is carried out at the site for any purpose other than to install monitoring equipment.

> *Recommendation 3:* Any contingency mitigation measures implemented in a permit must include measureable and enforceable outcome-based requirements. The permit applicant should also be required to demonstrate that the proposed contingency mitigation measures will be an effective means to return the project to compliance should non-compliance occur.

The potential for water transfer from the Lake Superior watershed to the Rainy River watershed needs to be further evaluated and addressed.

> *Recommendation 4:* Potential inter-basin water transfers should be quantified. Inter-basin transfers from the Great Lakes watershed are subject to approval under the Great Lakes-St. Lawrence River Basin Water Resources Compact.

A comprehensive surface water/groundwater monitoring and modeling approach would satisfy the requirements of various permit programs by evaluating the hydrology and pollutant migration from the site during all phases of the project (construction, mining and post-mining). This could avoid duplication by enabling use of the same sampling points for various purposes during further project design and permitting. It would also provide PolyMet with a full understanding of the monitoring that will be expected during the project to meet various permit requirements. We strongly encourage the permitting agencies for this project to involve a specialized expert who can inform the permitting agencies' review of this comprehensive monitoring and modeling approach. Any such review should consider the influence of other nearby mining operations

(such as NorthShore's PMP). It should also establish a process that provides for refinement of modeling as additional data become available, and adjustments to the monitoring regime when necessary.

> *Recommendation 5:* The permitting agencies should involve a specialized expert to inform the permitting agencies' review of a comprehensive monitoring and modeling program at the Mine Site. Information gathered through such a program should inform permitting conditions and requirements.
>
> *Recommendation 6:* EPA also recommends initiating a community environmental monitoring program as part of further project development. This would provide ongoing information about the project's environmental performance to the community, including assessments of water quality and quantity near the NorthMet site.[2]

In addition, EPA would like to continue our constructive engagement with the permitting agencies going forward.

> *Recommendation 7:* EPA recommends that we continue to engage in a close dialogue with the permitting agencies about the details of modeling, monitoring, and project design (including contingency mitigation measures), as relevant to project construction and permitting decisions. EPA will seek expert input as needed to support this process.

Wetland Impacts

The FEIS describes the proposed compensatory mitigation for direct wetland impacts and wetland fragmentation impacts. This mitigation includes wetland restoration, upland buffer, and wetland preservation. Two of the wetland mitigation sites are outside of the St. Louis River Watershed and include some out-of-kind wetland replacement. Greater credit ratios are required for out-of-kind and out-of-watershed compensatory mitigation. Based on the credit ratios outlined in the FEIS, if performance standards are met, the three sites would provide sufficient mitigation for direct impacts (Table 5.2.3-17).

The FEIS identifies uncertainties in estimating the extent of indirect wetland impacts (pp. 5-257 – 5-260). EPA agrees with the FEIS' statement that an indirect impact monitoring plan, adaptive management plan, and a plan to provide compensatory mitigation are needed to assess and mitigate for indirect wetland impacts if the project moves forward. The descriptions of indirect impact monitoring, adaptive management, and compensatory mitigation within the FEIS should be further developed during the permitting process to sufficiently assess, avoid, minimize, and compensate for indirect impacts to wetlands.

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[2] This approach is discussed in Jarvie-Eggart, M. (Ed.). (2015). *Responsible Mining: Case Studies in Managing Social & Environmental Risks in the Developed World* (pp. 151-230). Society for Mining, Metallurgy, and Exploration. For an example of such a program and two case studies that are included in this chapter, see <http://eaglemine.com/approach/community/community-environmental-monitoring-program/>.

Recommendation 8: EPA recommends that the Corps require PolyMet to establish additional wetland monitoring sites, develop a detailed impact assessment method, and plan for the contingency of additional indirect wetland loss as part of an adaptive management strategy that identifies sufficient wetland mitigation opportunities and compensates for all indirect impacts. This could be incorporated into the comprehensive plan called for in Recommendation 5. Because of the importance of these indirect impact plans and any permit conditions outlining them, EPA requests an opportunity to review the Corps' final permit evaluation and draft CWA Section 404 permit – including the indirect and direct wetland impact monitoring, adaptive management, and mitigation plans – in order to assess compliance with the CWA Section 404 Guidelines before permit issuance.

Mineral Fibers

The FEIS notes the current lack of scientific consensus regarding health risks associated with exposure to non-asbestiform varieties of amphibole minerals; and an "ongoing effort" to develop the "scientific tools and expertise" to establish health-based standards for these mineral fibers (p. 5-515). Part of this ongoing effort is a study currently undergoing peer review, which examines the relative cancer potency of various elongated mineral particles based on dose characterization data collected at EPA's Duluth laboratory between 1978 and 1986.

Recommendation 9: To address uncertainties regarding health risks, the permitting agencies should consider this research and any further credible scientific evidence that becomes available during the permitting process. The most current scientific understanding of health risks should continue to be considered as appropriate in project design and implementation, in order to minimize worker and public health risks related to mineral fibers. EPA will provide this study and other relevant research it identifies to all agencies with relevant permitting responsibilities.

Impacts to Moose

We are glad to see additional analyses in the FEIS relating to impacts to moose, particularly given the significance of this species to the Chippewa peoples. As the FEIS points out, the decline in the moose population in northern Minnesota is likely due to multiple factors.

Recommendation 10: During the permitting process, the permitting agencies should require avoidance or minimization strategies that reduce impacts to moose to the greatest extent possible. Examples may include avoiding wetland impacts, preserving known wildlife corridors, and constructing appropriately-placed wildlife crossings at new and existing roads and railroads. Constructing one or more wildlife crossings along the roads and railroads within the project area should be considered as a strategy to reduce collisions between vehicles and wildlife.