Comments of Water Legacy on

PolyMet Mining Inc. (PolyMet) Application for Clean Water Act Section 404 Permit for PolyMet NorthMet Mining Project

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INTRODUCTION

The Clean Water Act both requires the U.S. Army Corps of Engineers (Army Corps) to follow guidelines for speciation of disposal sites affecting wetlands and designates the authority of the U.S. Environmental Protection Agency (EPA) to prohibit the speciation or withdraw speciation of an area as a disposal site if the discharge will have an unacceptable adverse effect on municipal drinking water, fisheries, wildlife or recreation. 33 U.S.C. §1344(b), (c). The regulations in Chapter 40, Part 230 and Chapter 33, Part 332 referenced in these comments were enacted pursuant to Section 404(b) of the Clean Water Act and apply to the permit for the NorthMet project for which PolyMet filed a Revised Wetland Permit Application on August 19, 2013. (FEIS ref. PolyMet 2013o) They apply to both the Army Corps and the EPA.

These comments identify numerous ways in which the proposed PolyMet NorthMet project violates Section 404 of the Clean Water Act and its implementing regulations. WaterLegacy believes that the facts and law provided herein require the Army Corps to deny PolyMet's application for a permit and that the EPA take action to block this permit to prevent violation of regulations and substantial and unacceptable impacts on aquatic resources of national importance.

I. No Clean Water Act Section 404 permit may be granted for the PolyMet NorthMet project because it is not the least environmentally damaging practicable alternative.

Federal guidelines enacted pursuant to the Section 404 of the Clean Water Act (CWA), 33 U.S.C. §1344, clearly prohibit the U.S. Army Corps of Engineers from issuing permits for activities involving the dredge and fill of wetlands "if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem so long as the alternative does not have other significant adverse environmental consequences." 40 C.F.R. §230.10(a). An alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes, §230.10(a)(2). Where an activity associated with a discharge to wetlands does not require siting within wetlands to fulfill its basic purpose (i.e., is not "water dependent") practicable alternatives that do not involve special aquatic sites are presumed to be available, unless clearly demonstrated otherwise, and all practicable alternatives to the proposed discharge which do not involve a discharge into a special aquatic site are presumed to have less adverse impact on the aquatic ecosystem, unless clearly demonstrated otherwise. §230.10(a)(3).

Under the CWA, the test is not whether a proposed project is "better" than an alternative with less wetlands impact because it would cost less and have less impact on existing and future development. The test is whether the alternative with less wetlands impact is "impracticable," and the burden is on the applicant, with independent verification by the Corps, to provide detailed, clear and convincing information *proving* impracticability. The CWA prevents the Corps from issuing a § 404(b) permit if there is a less damaging practicable alternative. *Utahns v. U.S. Dep't of Transportation*, 305 F.3d 1152 (10th Cir. 2002)

In actions subject to the National Environmental Policy Act (NEPA), where the Corps of Engineers is the permitting agency, the analysis of alternatives required for NEPA environmental documents will in most cases provide the information for the evaluation of alternatives under Section 404 regulations. However it is not presumed that information presented in NEPA documents is definitive. Where the NEPA documents have not considered the alternatives in sufficient detail to respond to the requirements of these regulations, it may be necessary to supplement these NEPA documents with this additional information. 40 C.F.R. §230.10(a)(4). The final environmental impact statement (FEIS) for the PolyMet NorthMet project has not demonstrated that the Proposed Action is the least environmentally damaging practicable alternative (LEDPA) for the NorthMet project.

All PolyMet NorthMet project impacts result from activities associated with dredge or fill of wetlands. The NorthMet mine site would directly destroy 758.2 acres of wetlands (FEIS 5-266, Table 5.2.3-1) and indirectly impact as many as 5,720 additional acres of wetlands. (FEIS, App. C, autop. 2994). The transportation and utility corridor planned for the mine would directly destroy another 7.2 acres of wetlands (FEIS, 5-266, Table 5.2.3-1) and potentially impact up to 543 acres as the result of spillage of ores. (FEIS, 5-314)

The NorthMet tailings site would directly destroy 148.4 acres of wetlands (FEIS, 5-322, Table 5.2.3-8) and potentially impact thousands of additional acres of wetlands as the result of dewatering from seepage collection, sulfate deposition and seepage impacts on water quality. (*See* FEIS, 5-333, Table 5.2.3-10; 5-345, Table 5.2.3-12).

The NorthMet hydrometallurgical residue facility (HRF) would dredge and fill 36.1 acres of wetlands, directly destroying 7.5 acres of marsh wetlands subject to state and federal regulatory jurisdiction. (FEIS, 5-321, Figure 5.2.3-19).

Pursuant to federal regulations, the requirement to demonstrate that the project alternative selected provides the least environmentally damaging practicable alternative applies to each of these facilities as well as to the Proposed Action as a whole.

A. The environmental review process conflated private and public roles, undermining consideration of the LEDPA for the Proposed Action.

PolyMet's revised Section 404 Wetland Permit Application submitted on August 19, 2013 (FEIS ref. PolyMet 2013o) explicitly relied on the environmental impact statements not yet prepared by Minnesota Department of Natural Resources (MDNR), the Army Corps and the U.S.D.A. Forest Service (Forest Service) to provide information needed for a Section 404 permit application, including an analysis of any alternatives other than changes in project configuration to reduce direct wetlands impacts. (*Id*., pp. 7, 14, 31). The Application summarized a process that took place after the release of the draft environmental impact statement (DEIS) in 2009, whereby the Co-Lead Agencies "developed and approved a process to identify and assist PolyMet to develop revisions to its proposal" that responded to concerns raised in comments on the DEIS. This process developed a "draft Project alternative" that would be carried forward in environmental review to meet the requirement of identifying the least environmentally damaging practicable alternative, among other goals. (*Id*., pp. 33-34). The Forest Service Draft Record of Decision similarly explains that, after issuing the DEIS, the Co-lead Agencies, in response to agency and public comments, "developed an alternative proposal in consultation with PolyMet that sought to resolve several major environmental concerns and permitting barriers raised during the DEIS process," which "alternative was subsequently adopted by PolyMet and became the current NorthMet Mining Project Proposed Action."[1]

There need not be any subjective lack of impartiality in this process. The objective record and the SDEIS and FEIS reflect inadequate analysis of environmental impacts and failure to

[1] U.S.F.S., Draft Record of Decision, NorthMet Land Exchange, November 2015, p. 4 available at http://www.fs.usda.gov/wps/portal/fsinternet/!ut/p/c5/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gDfxMDT8MwRydLA1cj72BTUwMTAwgAykeaxRtBeY4WBv4eHmF-YT4GMHkidBvgAI6EdIeDXIvfdrAJuM3388jPTdUvyA2NMMgyUQQAyrgQmg!!/dl3/d3/L2dJQSEvUUt3QS9ZQnZ3LzZfS000MjZOMDcxT1RVODBJN0o2MTJQRDMwODQ!/?project=33908.

analyze less environmentally damaging alternatives once the Co-Lead Agencies' "draft Project alternative" had been adopted by PolyMet. The analysis of impacts and alternatives under NEPA may not be used to justify decisions already made. 40 C.F.R. §1502.2 (g). *Nat'l Audubon Soc'y v. Dep't of the Navy*, 422 F. 3d 174, 199 (4th Cir. 2005); *Davis v. Mineta*, 302 F. 3d 1104, 1120 (10th Cir. 2002). Under Section 404 of the Clean Water Act, similarly, a decision may not be based on a "fixed predetermination" to issue a permit. Sierra Club v. U.S. Army Corps of Eng'rs, 701 F. 2d 1011, 1032 (2d Cir. 1983).

An example of the conflation of private and public purposes is provided by reviewing the purpose and need for the PolyMet NorthMet proposal. As initially defined in the Final Scoping Decision, the Co-Lead Agencies' purpose and need would be broadly applicable to sites that did not require wetlands destruction and degradation. It stated, "The purpose of the NorthMet mining and ore processing project is to produce copper metal, precious metal concentrates, and nickel-cobalt concentrates for sale to the world market by uninterrupted operation of the facility for the life of the mine." (PolyMet NorthMet Draft EIS, App. B, Final Scoping Decision Document, Oct. 25, 2005, p. 2)[2]

This definition of the project purpose would allow consideration of other mine sites for production of metals, particularly since the deposit of copper, nickel and other metals is recognized to be broadly disseminated in the Duluth Complex deposit across significant portions of Northeast Minnesota. (See MDNR, Exploration for Metallic Mineral Resources: Copper, Nickel and Platinum Group Metals, Duluth Complex Map, Exhibit 32).[3] Arguably, such consideration is required under federal regulations.

As described above, when an activity associated with discharge to wetlands does not require siting within wetlands to fulfill its basic purpose -- i.e., is not "water dependent," practicable alternatives that do not involved discharge into wetlands are presumed to be available and are presumed to have less impact on the aquatic system. 40 C.F.R. 230.10(a)(3). "If the activity is not "water dependent," the guidelines require that the Corps apply a presumption that a practicable alternative that has less adverse environmental impact on the wetland is available," and the applicant bears the burden of providing "detailed, clear, and convincing information

[2] The PolyMet NorthMet FEIS reference, MDNR and USACE 2009, does not include the appendices to the Draft EIS. They can be found at http://www.dnr.state.mn.us/input/environmentalreview/polymet/eis_toc.html.
[3] The term "Exhibits," unless otherwise noted, refers to WaterLegacy Exhibits submitted on December 14, 2015 with FEIS and Section 404 Comments. The MDNR map in Exhibit 32 is available at http://files.dnr.state.mn.us/lands_minerals/mpes_projects/mnmin_copper_map_2015.pdf.

proving" that an alternative with less adverse impact in impracticable. *Sierra Club v. Van Antwerp*, 362 Fed. Appx. 100, 106 (11th Cir. 2010) (Vacating Section 404 permits issued without applying presumptions). Cf. *Buttrey v. United States*, 690 F.2d 1170, 1180 (5th Cir. 1982), *cert. denied*, 461 U.S. 927 (1983); *Bersani v. Robichaud*, 850 F. 2d 36 (2nd Cir. 1988), *cert. denied* 489 U.S. 1089 (1989); *Bahia Park v. U.S.A.*, 286 F. Supp. 2d 201 (D. P.R. 2003).

The purpose and need of the Co-Lead Agencies described in the FEIS, however, has become nearly indistinguishable from that of the project proponent. PolyMet's stated purpose is "to exercise PolyMet's mineral lease to continuously mine, via open pit methods, the known ore deposits (NorthMet Deposit) containing copper, nickel, cobalt, and PGEs to produce base and precious metal precipitates and flotation concentrates by uninterrupted utilization of the former LTVSMC processing plant." (FEIS, 1-11). The purpose and need of the Co-Lead Agencies now focuses specifically on PolyMet's leasing interests:

> The Purpose and Need for the Proposed Actions is . . . For PolyMet to utilize its leased mineral rights and recover commercial quantities and quality of semi-refined metal concentrates, hydroxides, and precipitates from the NorthMet ore body in northern Minnesota, and to process the recovered ore by reutilizing the former LTVSMC processing plant. (FEIS, 1-11).

The conflation of private and public purpose would foreclose consideration of alternative mine sites to prevent destruction and degradation of wetlands. The record suggests that this process may have also deprived Co-Lead Agencies of the independence required to consider other less environmentally damaging practicable alternatives to the Proposed Action described below and to assess substantial adverse impacts of the Proposed Action on wetlands, water quality, downstream aquatic ecosystems and human health.

B. The Underground Mining Alternative would have less adverse impact on the aquatic ecosystem, and it has not been shown to be impracticable.

The Scoping Decision for the PolyMet NorthMet proposal required evaluation of underground mining, specifying that underground mining could be eliminated only it were infeasible, but if underground mining merely provided a lower economic return, a detailed assessment must be prepared. (PolyMet NorthMet DEIS Appx. B, Final Scoping Decision

Document, “PolyMet Scoping Decision”, p. 5 of 45).[4]

It is undisputed that the Underground Mining Alternative is available and technically feasible. (FEIS App. B, Co-Lead Agencies, Underground Mining Alternative Assessment for the NorthMet Mining Project and Land Exchange Environmental Impact Statement, Sept. 27, 2013, “Underground Mining Assessment,” p. 4, FEIS autop. 2881 et seq.).

It is also undisputed that the Underground Mining Alternative would offer significant environmental benefits over the proposed open-pit mine. The Co-Lead Agencies have agreed:

> Compared to the proposed open pit mine, the underground mining alternative would offer some significant environmental benefits, including:
> - fewer direct effects on surface resources, including wetlands;
> - less mine dewatering and, therefore, less water to be managed;
> - less waste rock, which would result in:
>   - a smaller surface footprint; and
>   - reduced effects on surface water and groundwater.
> - less ore mined at a slower rate, which would result in:
>   - less tailings and hydrometallurgical residue to be managed;
>   - fewer effects on surface water and groundwater; and
>   - reduced air emissions from mining, transporting, and processing the ore, and constructing the Tailings Basin and Hydrometallurgical Residue Facility.
>
> (*Id*., p. 3, FEIS autop. 2887)

The FEIS, similarly, states that an underground mine would result in a “smaller surface footprint, thus offering environmental benefits over the NorthMet Project Proposed Action through reduced effects on wetlands, vegetation, and wildlife habitat.” The Underground Mine Alternative would also have lower production rates compared to the proposed open pit, resulting in less fugitive air emissions, and less waste rock and processing waste (tailings and hydrometallurgical residue), thus “reducing the scale and duration of potential water quality effects.” (FEIS, 3-160).

The FEIS, like the SDEIS before it, states that underground mining was eliminated as an alternative to the Proposed Action “because it was found to be economically infeasible” in the 2013 analysis provided in Appendix B to the FEIS. (FEIS, 3-184). This analysis included both the Co-Leads’ Underground Mining Assessment and an October 2012 report, "Economic Assessment of Conceptual Underground Mining Option for the NorthMet Project” prepared for

[4] The PolyMet NorthMet SDEIS reference, MDNR and USACE 2009, does not include the appendices to the DEIS. They can be found at http://www.dnr.state.mn.us/input/environmentalreview/polymet/eis_toc.html.

PolyMet by a consultant to Foth Infrastructure & Environment, LLC. ("Foth Report" provided in FEIS, App. B, autop. 2897 *et. seq*.).

On first blush, this statement would seem to suggest that underground mining is impracticable. However, closer scrutiny demonstrates that the analysis of economic feasibility was based on an unreasonably narrow definition of the potential project and failed to assess actual project costs under the Proposed Action, including long-term treatment requirements. This analysis is sufficiently unreliable that it cannot support rejection of the underground mining alternative as the least environmentally damaging practicable alternative for the NorthMet project. 40 C.F.R. §230.10(a).

The Foth Report constrained its analysis of "NorthMet deposit" to include only the measured and indicated resources within the open pit identified by PolyMet. (Foth Report, p. 3, FEIS App. B., autop. 2905), even while acknowledging that this constraint excludes most mineralized rock that could be available for underground mining:

> There is mineralized rock outside of the volume of rock contained within the proposed open-pit. This mineralized rock occurs below the open-pit. While this mineralized rock is excluded from this report, speculatively it may be possible for it to be economically viable to extract decades in the future. Only approximately 10% of the measured and indicated resource is below the open-pit (Poly Met, 2007). The majority of inferred resource defined by Poly Met (2007) is below the open-pit. (*Id*.).

The extent of mineralized rock that occurs below the open-pit is illustrated in slides presented by PolyMet to investors in May 2012 and May 5, 2015.[5] The majority of above average ore grade mineralization in the Unit 1 Main Ore Body is plainly evident outside the open-pit boundary line. PolyMet's official Technical Feasibility Report[6] defines the deposit as 694 million short tons of indicated and measured resources and 230 million tons of inferred resources, or a total of 924 million tons of ore that meets PolyMet's accepted grade within their current lease holdings at NorthMet. (PolyMet 43-101 Report, p. 14-38).

Restriction of alternatives analysis to the mineral resources within the open pit specified by PolyMet (FEIS, 3-159) served the project proponent's interests, while excluding the reasonable alternative of underground mining. This constraint violates NEPA and precludes a

[5] *See* PolyMet, Presentation to InvestMNt Conference, Minneapolis, May 14, 2012, Excerpts, NorthMet Ore Body slide, p. 2 of Exhibit 48 to WaterLegacy SDEIS Exhibits in Appendix – SDEIS Materials and PolyMet, Copper, Nickel & Precious Metals in the U.S., May 2105, slide, p. 2, attached herein as Exhibit 33.

[6] PolyMet 43-101 Technical Report revised January 14, 2013 (no more recent reports filed) is available on SEDAR at http://www.polymetmining.com/wp-content/uploads/2013/02/2013-Updated-43-101.pdf

finding that the Underground Mining Alternative is not the LEDPA. "An agency may not define the objectives of its action in terms so unreasonably narrow that only one alternative from among the environmentally benign ones in the agency's power would accomplish the goals of the agency's action, and the EIS would become a foreordained formality." *Nat'l Parks & Conservation Ass'n v. BLM,* 606 F. 3d 1058, 1070 (9th Cir. 2010). The court found against the BLM on the grounds that the agency had adopted the proponent's "interests as it own" and "As a result of this unreasonably narrow purpose and need statement, the BLM necessarily considered an unreasonably narrow range of alternatives." (*Id*. at 1072). *See also Simmons v. United States Army Corps of Eng'rs*, 120 F.3d 664, 666 (7th Cir. 1997)("If the agency constricts the definition of the project's purpose and thereby excludes what truly are reasonable alternatives, the EIS cannot fulfill its role.").

In addition, the cost assessment provided by PolyMet's consultant and adopted by the Co-Lead Agencies is insufficient to conclude that underground mining is economically infeasible, since it failed to compare Underground Mining Alternative costs to actual costs of the NorthMet proposed action. On May 15, 2012, the EPA cautioned that mine capital and operating cost numbers previously used to determine feasibility were out-of-date and did not consider PolyMet's mitigation and treatment costs. The EPA also noted that the Co-Leads' position paper did not factor into its analysis the potential that the applicant would in the future "mine higher-grade minerals that are located deeper than the proposed mine pit."[7] EPA's letter sent two weeks later stated that this Co-Leads' position paper should be revised so that "updated environmental and economic data that compares costs of both pit mining and underground mining options" could inform the selection of a preferred project alternative.[8]

Despite these concerns, PolyMet's consultant did not include any actual operating or pre-production capital costs from the PolyMet NorthMet mine project in the analysis; all are published cost models. (Underground Mine Assessment, p. 6, FEIS autop. 2890). While adjustments were made from the cost models, such as InfoMine, to account for obvious differences with a possible NorthMet setting, "there is no assurance these adjustments are adequate." (Foth Report, p. 6, FEIS autop. 2908).

[7] M. Sedlacek, EPA Letter to Co-Lead Agencies re underground mining, May. 15, 2012, p. 2, Exhibit 46 to WaterLegacy SDEIS comments contained in Appendix - SDEIS Materials.
[8] K. Westlake, EPA Letter to Co-Lead Agencies re underground mining, May. 31, 2012, p. 2, Exhibit 47 to WaterLegacy SDEIS comments contained in Appendix - SDEIS Materials.

Without a comparison of underground mining to actual NorthMet project, mitigation and long-term treatment costs, there is no way for decision-makers or the public to determine if the Underground Mining Alternative is merely less profitable than the Proposed Action, rather than impracticable or whether the cost calculation favors the Proposed Action due to disregarding or externalizing to the public the long-term costs of the Proposed Action. The FEIS record is insufficient to support a Section 404 determination that the Underground Mine Alternative is not the least environmentally damaging practicable alternative for the PolyMet NorthMet project.

C. Dry stack tailings disposal would have less adverse impact on the aquatic ecosystem, and it is presumed that other sites are practicable and less impactful.

The FEIS for the PolyMet NorthMet project is aberrant in that it fails to assess any alternatives, including mitigation alternatives, not already included the Proposed Action. The record, including WaterLegacy's comments and materials provided by Tribal Cooperating Agencies propose less environmentally damaging alternatives. For many of these alternatives, no demonstration has been made either that they are impracticable or that they would have other significant adverse environmental consequences.

The FEIS does not demonstrate that dry stack tailings disposal would be impracticable or have other significant adverse environmental consequences precluding its adoption as a less environmentally damaging alternative to the Proposed Action's plan to dispose of NorthMet tailings in unlined piles on top of the existing LTVSMC tailings waste storage facility. WaterLegacy's comments on the adequacy of the FEIS and other record evidence indicate that dry stack tailings disposal on a lined facility at an alternative brownfield site would provide less environmental harm as a result of contaminated seepage site. Dry stack tailings disposal is also the best available technology to reduce the potential for catastrophic dam failure with potentially disastrous environmental consequences. Finally, dry stack disposal in a lined facility on an alternative brownfield site would prevent environmental damage from destruction and indirect adverse effects on wetlands.

1. Dry stack tailings disposal would reduce adverse impacts from tailings seepage.

The Proposed Action creates a substantial risk of environmental damage from uncaptured seepage that would be mitigated by use of a lined dry stack tailings waste disposal facility. As explained in WaterLegacy's comments on the FEIS, NorthMet tailings would be deposited in a wet slurry, without a liner, on top of the existing unlined LTVSMC taconite tailings and slimes. (FEIS, 3-104, 3-158, 4-427, 5-5, 5-185, Figure 5.2.14-6). The NorthMet project would produce 110,736 tons of wet tailings slurry per day, of which liquids would be 68.5 percent by weight or 86 percent by volume. (FEIS ref. PolyMet 2015q, autop. 621). The wet slurry tailings waste facility is predicted to produce 3,880 gallons of contaminated seepage minute. (FEIS, 5-179, 5-181), equivalent to 2,041,000,000 gallons of contaminated seepage per year.[9]

PolyMet tailings seepage would be collected from the toe of the tailings heaps and would contain sulfates and heavy metals from copper-nickel processing slurry, effluent from the mine site treatment plant, and LTVSMC tailings. (FEIS ref. PolyMet 2015j, FEIS Figure 3.2-12). Solutes in the seepage, including arsenic, mercury, manganese, and lead are known to impair human health; sulfate is known to be toxic to wild rice and to enhance mercury methylation; and metals and salts including copper, nickel, cobalt, lead, mercury, and specific conductance are known to adversely impact aquatic life.

PolyMet has predicted solute concentrations in tailings toe seepage (PolyMet 2015i, Large table 2) far exceeding water quality standards. For example, at the North Toe, P90 levels of nickel in year 20 are predicted at 893 µg/L -- more than 17 times the water quality standard of 52 µg/L in hardness of 100 mg/L. Lead, a particularly dangerous neurotoxin with no safe level (Saracino, 2015), would reach levels of 58 µg/L -- more than 18 times the water quality standard of 3.2 µg/L in hardness of 100 mg/L.

PolyMet's modeling of seepage at the tailings toe is also likely to understate actual tailings chemistry. Leachate from copper-nickel *tailings* from MinnAMAX bulk sampling was not considered in modeling of NorthMet tailings seepage. MinnAMAX tailings leachate contained levels of cobalt more than 30 times the tailings seepage concentration predicted for the NorthMet project, levels of nickel more than 21 times the predicted NorthMet concentrations, and sulfate concentrations more than 11 times higher than predicted NorthMet concentrations. (Johnson, 2015).

Dry stack tailings disposal reduces seepage rates, as compared with slurry tailings. The Senior Director of Geotechnical Engineering and Hydrogeology for Newmont Mining Corporation has estimated the seepage rate from slurry tailings at 6.4 gallons per minute per acre,

[9] Conversion site is at http://www.convert-me.com/en/convert/flow_rate_volume/gallon_day.html.

the seepage rate from paste or thickened tailings at 0.06 gallons per minute per acre and the seepage from dry filtered tailings at 0.007 gallons per acre.[10] As compared to dry filtered tailings, this estimate indicates that slurry tailings produce approximately 914 times as much seepage.

The FEIS is insufficient to demonstrate that the significant reduction in tailings seepage that would result from dry stack tailings would not produce a significant environmental benefit. Claims made by the project proponent and adopted in the FEIS of nearly perfect seepage collection fail to consider tailings site hydrogeology, rely on unsubstantiated modeling assumptions and unverified promises of the project proponent, and contradict field experience and its application to the NorthMet tailings site.

Based on the information provided by PolyMet in its Water Modeling Data Package (FEIS ref. PolyMet 2015j) the FEIS claims that, during mine operations, 3,860 gallons per minute of the total 3,880 gpm modeled would be collected. (FEIS, 5-181, Table 5.2.2-37). This would be a nearly perfect collection rate of 99.5%.

To reach this conclusion, the FEIS first assumes that only 200 gpm (0.05%) of total NorthMet tailings seepage will be "surface seepage," since that is the volume that currently seeps out of groundwater at the toe of the existing LTVSMC basin. (FEIS, 5-179, PolyMet 2015j) Increased seepage and hydraulic head created in the tailings piles during NorthMet operations could result in more water being retained deeper into groundwater. In addition, lack of data on bedrock groundwater precludes calculation of how much groundwater is actually flowing in bedrock at the site. (Lee, FEIS tailings opinion, 2015, p. 4).

Next, based on PolyMet's underlying analysis (PolyMet 2015j), the FEIS assumes that 100 percent of tailings surface seepage and groundwater seepage would be captured on both the east side and the south side of the tailings piles (FEIS, 5-8, 5-102) and that 100 percent of the "surface seepage" and 90 percent of seepage retained in groundwater would be captured at the north, northwest and west toes of the tailings storage facility. (FEIS, 5-186).

These assumptions are not based on assessment of hydrogeology and run counter to expert opinions from geologists. The FEIS cross-section of the tailings basin groundwater containment system characterizes the bedrock as an "assumed no flow boundary." (FEIS, Figure 3.2-28). The FEIS also uses mine site Duluth Complex bedrock as an analogy to assume very low hydraulic conductivity at bedrock depths beneath the tailings piles. (FEIS, 4-44). Although

[10] See John Lupo, Ph.D., P.E., Dry Stack Tailings Overview, slide presentation is available at http://www.slideshare.net/Rosemont-Copper/dry-stack-tailings-overview.

the FEIS estimates flow through the top 20 feet of bedrock at 0.14 feet per day (FEIS, 4-113), neither the FEIS nor the PolyMet reports on which it is based dig any deeper. Beneath the top 20 feet, neither the FEIS nor underlying documents provide any information of any kind in the record on the hydraulic conductivity of tailings site bedrock. (See FEIS ref. Barr 2014b, pp. 21-22, Large Figures 1-2). The FEIS also provides *no* investigation of fractures beneath the tailings waste site.

Geologist J.D. Lehr criticized the "simplistic and cursory treatment of the role that bedrock fractures may play in the transmission of groundwater" at the tailings site contained in the PolyMet NorthMet SDEIS. (Lehr, 2014, p. 3). Lehr objected to the assumption of a "no-flow boundary" beneath the tailings piles and the resulting implication that groundwater flow through bedrock at the tailings site "is so insignificant that it can be ignored." (*Id.*). He commented that the failure to identify fractures or assess groundwater flow through fractured bedrock "was a major omission, resulting in unsupported assumptions and inadequate information regarding groundwater flow" at the tailings waste site (*Id*., p. 4) and raised concerns that neither the project proponent nor the Co-Lead Agencies have required any study of bedrock fractures or their hydrogeologic properties. (*Id*., p. 15).

Mr. Lehr also criticized the PolyMet NorthMet SDEIS for failing to include any hydraulic testing of bedrock in the tailings site area. (*Id*., p. 12, p. 15). He explained that analogies between Duluth Complex at the mine site and Giants Range Granite at the tailings site cannot be used to assume hydraulic conductivity of bedrock at the tailings site, since Giants Range Granite is 1,600 million years older than Duluth Complex and "would have experienced a different stress, weathering and erosional history than the Duluth Complex." (*Id*., p. 15).

Mr. Lehr emphasized that, to assess hydraulic conductivity, "What the SDEIS requires is data." (*Id*., pp. 15-16) "Unless a solid scientific basis is provided, the SDEIS' claims – both explicit and implicit – that groundwater flow through bedrock is minimal, cannot be sustained." (*Id*., p. 16). Based on the scientific literature and his professional knowledge of the region's geology, J.D. Lehr concluded, "bedrock fractures will play a significant role in groundwater and contaminant transport" at the tailings site. (*Id*., p. 17).

Anthony Runkel, the Chief Geologist for the Minnesota Geological Survey, echoed these concerns, in a opinion on the PolyMet NorthMet SDEIS attached as Exhibit 14. Mr. Runkel stated that the investigations done for the NorthMet mine and tailings site are not sufficient to support the modeling used for the project. He stated that investigations used in similar hydrogeologic settings support conceptual models that differ substantially from those used for the NorthMet project,

> Of particular significance for solute transport, the conceptual models commonly include key fractures or fracture zones of relatively high hydraulic conductivity, and multiple flow systems within the bedrock at individual sites. These flow systems are variably connected to the surface water system, have variable residence times, can have upward and downward vertical gradients within a local area, and horizontal flow directions that differ from one another. (Runkel, 2014, p.1, Exhibit 14)

Mr. Runkel stated that use of a Duluth Complex analogy to assume conditions in tailings site bedrock "is not valid." (*Id*., p. 2). He noted that faults are known to be common across much of mapped extent of the Giants Range Batholith, including in the plant site/tailings basin area. Mr. Runkel explained that nearby fractures in the same bedrock have had significant environmental effects, reporting, "Hydraulically significant fractures in the Giants Range Batholith are documented to have transported contaminants at the Northwoods Closed Landfill (MPCA reports) several miles north of the Plant Site/Tailings Basin area." (*Id*., p. 3).

The capture efficiencies claimed for the NorthMet tailings site were "provided by PolyMet" (FEIS, A-583) and "justified," "supported," and "assumed" based on the proponent's modeling. (FEIS, A-578, A-612, 5-77). On the south side of the tailings facility, claims of 100 percent seepage capture are based on a vague promise that unspecified future upgrades by PolyMet will achieve perfect collection: "PolyMet has committed to future upgrades to achieve 100 percent capture by this system if the NorthMet Project Proposed Action is approved." (FEIS, 3-120, A-84, A-195, A-197, A-616, 3-120).

Since 2011, the current owner, Cliffs Erie, LLC has installed a seepage collection system on the south side of the existing LTVSMC tailings waste facility at surface discharge location SD026. This system includes a cutoff berm and trench, seep collection sump, pump and pipe system. (PolyMet 2015i). Although neither the FEIS nor PolyMet documents specify what percentage of south tailings seepage is currently collected by Cliffs Erie, water is bypassing the cutoff dam, and improvements in collection would be required to comply with the Cliffs consent decree.[11] "It is acknowledged that there is currently incomplete capture of impacted water at SD026." (FEIS, A-625). The FEIS provides no evidence that any of the

[11] Barr, Water Balance Evaluation of SD026 Seepage Collection System and Cell 1E Pond Water Levels (May 1, 2013); MPCA (John Thomas) letter to Cliffs Natural Resources (Craig Hartmann), April 4, 2013.

possible engineering alternatives would be effective in capturing *all* seepage that comes to the surface on the south side of the tailings piles (FEIS, 3-120, 5-102), and no mechanism to collect groundwater seepage on the south side of the tailings site is identified. Even though no bedrock hydrogeology investigation has been done at the tailings waste site, the FEIS assumes, "groundwater migration is not expected to the east or south." (FEIS, 5-77).

Hydrologist and engineer Donald Lee determined after reading the FEIS and supporting documents on tailings basin performance, "The analytical support for these conclusions is based on assumptions of performance that are not justified or supported by data." (Lee, FEIS tailings opinion, 2015, p. 1).

The tailings performance claimed is not consistent with field experience or site-specific application. The completed NorthMet tailings piles would be 1,735 feet above sea level, the highest elevation on the landscape (FEIS, 3-104; Figure 4.2.2-17), thus creating hydraulic pressure for seepage. The design basis for the containment system is "to reverse the pre-existing hydraulic gradient (and flow direction) across the facility." (FEIS, p. A-547). Responses to comments state, "few capture systems have been built with this degree of pumping to cause a reversal of the pre-existing hydraulic gradients" (FEIS, p. A-548), but research has disclosed no similar systems operating long-term to reverse hydraulic gradient.

Field experience and local geological conditions do not support claims made in the FEIS that a bentonite slurry trench will serve as an impermeable "cut-off wall" (FEIS, p. 5-197) or that it could be "keyed into" the tailings site bedrock. (FEIS, p. 5-185). J.D. Lehr explained that the type of bedrock at the tailings site would not be favorable to allow a keyed in trench, and large boulders and cobbles known to exist at the site would also impede construction of an effective slurry trench. (Lehr, 2014, pp. 17-18). Dr. Lee noted that the proposed slurry wall at a depth exceeding 40 feet in some locations was a significant undertaking, and that claims that a slurry wall would be nearly impermeable for the indefinite future were not justified. (Lee, tailings opinion, 2015, p. 3). These concerns are similar to those raised by Barr Engineering in a 2007 evaluation report of Tailings Basin Modifications to Eliminate Water Release via Seepage. (FEIS ref. Barr 2007f, p. 21).

The only reference in the FEIS record discussing containment system field experience (FEIS ref. PolyMet 2015h, Attach. D) does not substantiate PolyMet's claims for tailings seepage capture efficiency. For most of the Barr's cited examples, no information was available to assess capture success. However, follow-up information was available for one of the two examples highlighted in detail by Barr. Barr had offered the Fort McMurray tailings pond seepage containment system in Alberta Canada as an example of the successful use of slurry walls to isolate mine tailings seepage from downgradient water:

> Another example is the installation of a soil-bentonite cutoff wall around the perimeter of a mine tailings pond located in the province of Alberta, Canada. The cutoff wall is approximately 100-feet deep and 3 feet wide, and has a hydraulic conductivity of less than $1x10^{-7}$ cm/sec. The cutoff wall was used to isolate the tailings pond from downgradient surface water features including wetlands and the Athabasca River. (*Id*., pp. 1-2)

However, information available since 2012 demonstrates that Fort McMurray tar sands tailings seepage containment has been a serious failure. Canadian federal research used chemical profiling to confirm the contaminant source in the Athabasca River and concluded that toxic chemicals from McMurray Formation oil sand tailings ponds are leaching into groundwater and seeping into the Athabasca River, despite ditches, cutoff walls, groundwater interception wells and a system where captured water is pumped back into tailings ponds.[12] One dam has been reported to seep wastewater at a rate of 75 liters per second (625,200,000 U.S. gallons per year) into groundwater feeding the Athabasca River.[13] Industry is working to address the tailings seepage issue, budgeting more than $1-billion in tailings-reduction technology.[14]

WaterLegacy is unaware of any other data on capture of unlined tailings waste seepage that would support PolyMet's modeling assumptions. In Minnesota, MPCA concluded in 2008 that the maximum estimated percentage of seepage to the Sandy River that could be collected from the unlined Minntac tailings waste facility was approximately 55 to 60 percent.[15] In 2013, U.S. Steel confirmed that the dike and pump back system on the east side of the Minntac facility

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[12] Frank et al., *Profiling Oil Sands Mixtures from Industrial Developments and Natural Groundwaters for Source Identification*, Env. Sci & Tech. accepted Jan. 21, 2014. Available at http://www.thetyee.ca/Documents/2014/02/21/Profiling-Oil-Sands-Mixtures.pdf; Bob Weber, *Federal study says oil sands toxins are leaching into groundwater, Athabasca River,* Edmonton Globe and Mail, Feb. 20, 2014. Available at http://www.theglobeandmail.com/news/national/federal-study-says-oil-sands-toxins-are-leaching-into-groundwater-athabasca-river/article17016054/

[13] Andrew Nikiforuk, *Large dams of mining waste leaking into Athabasca River study*, Feb. 21, 2014, http://thetyee.ca/Blogs/TheHook/2014/02/21/Tailings-Waste-Athabasca/

[14] Weber, *supra* note 4.

[15] MPCA (John Thomas) letter to Tom Moe (U.S. Steel Corporation) of Jan. 10, 2008, available at http://waterlegacy.org/sites/default/files/PolyMet_SuppEIS/WL_Ex19_MPCA_MinntacSeepLtr_2008.pdf

was collecting roughly 50 percent of the total seepage volume.[16] After extensive research, the highest rate of seepage capture identified for any unlined facility using slurry walls appears to have been at the Hill Air Force Base in northern Utah, where a combination of the slurry walls, landfill covers, groundwater interception and extraction wells, and treatment succeeded in reducing metals concentrations from a Superfund site by 80 percent.[17]

In the EPA's recent Pebble Mine assessment, the Agency recently concluded, "Water collection and treatment failures are a common feature of mines."[18] EPA stated that the probability of potential *failure* of water collection and treatment during operations is 93 percent, and results include "exceedance of standards potentially including death of fish and invertebrates." Post-closure probability of failure of water collection and treatment was "somewhat higher than operation," and "failures are likely to result in release of untreated or incompletely treated leachates for days or months. If the site were to be abandoned, EPA noted that failure of water collection and treatment was "certain."[19]

The FEIS identifies several likely failures of the proposed tailings seepage collection system: new surface seepage locations may emerge as the tailings basin is developed; tailings pond water quality may be worse than expected; and groundwater or surface water downgradient of the tailings basin may fail to comply with water quality standards. (FEIS, 5-239 to 5-240). Such failures may or may not be revealed by monitoring, may be revealed only after irreparable harm has been caused to fish, wild rice or human beings or may only come to light after mining has ceased and the mining company declares bankruptcy to avoid responsibility.

Based on reasonable tailings seepage rates that consider the uncertainties of unknown hydrogeology, the limits of engineered systems to reverse hydraulic flow over the long term, the permeability of proposed containment mechanisms, and field experience with seepage capture from unlined facilities, the alternative of a lined dry stack tailings facility would reduce adverse environmental effects from tailings seepage.

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[16] U.S. Steel (Chrissy Bartovich) letter to U.S. Army Corps of Engineers, July 9, 2013, letter with attachment excerpt available at http://waterlegacy.org/sites/default/files/PolyMet_SuppEIS/WL_Ex20_U.S.Steel_MinntacLtr_2013.pdf

[17] EPA, *Engineering Bulletin Slurry Walls* (October 1992), p. 5, available at http://nepis.epa.gov/Exe/ZyPDF.cgi/10002DPY.PDF?Dockey=10002DPY.PDF

[18] EPA, *An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska*, Volume 1 – Main Report (EPA 910-R-14-001A (January 2014), p. 8-19, available at http://www2.epa.gov/sites/production/files/2015-05/documents/bristol_bay_assessment_final_2014_vol1.pdf

[19] *Id*., Table ES-4 and Table 14-1

2. Dry stack tailings disposal would reduce the risk of catastrophic tailings dam failure.

The Proposed Action also creates a reasonably foreseeable risk of catastrophic dam failure that would be markedly reduced, if not eliminated, were the best available technology of dry stack tailings in a lined facility used to store NorthMet tailings. International headlines, research reports and expert opinions over the past year and a half underscore the fact that catastrophic failure of mine tailings dams is a significant and foreseeable risk.

On Monday, August 4, 2014, on a sunny summer day, the tailings dam at the Mount Polley copper-mine in British Columbia, Canada collapsed. The breach released an estimated 24.4 million cubic meters (6.3 billion gallons) of tailings and wastewater into Polley Lake, which rose by 1.5 meters. Hazeltine Creek, which flows out of Lake Polley, was transformed from a 2-metre-wide stream to a 50-metre-across "wasteland" and Cariboo Creek was also affected. By August 8, the spill had reached Quesnel Lake, considered until then one of the cleanest deep-water lakes in the world.[20]

One year later, water quality in 70-kilometer once-pristine Quesnel Lake had changed. After the dam collapse, Imperial Metals supplied drinking water and acknowledged that tailings contained arsenic and lead. The Interior Health Authority issued a bulletin not to eat the fish in Quesnel Lake due to mercury.[21]

On November 6, 2015, an iron ore tailings dam collapsed at the Samarco mine in Brazil. The dam collapse started a mudslide that flattened a village of 600 people and killed 17 people. An estimated 60 million cubic meters (nearly 16 billion gallons) of mine waste were released, requiring 600 people to be evacuated.[22] On November 30, 2015, Brazil announced that they would file a $5.2 billion lawsuit against the BHP mine company. A large number of fish have

[20] Gordon Hoekstra, Mount Polley mine tailings spill nearly 70 percent bigger than first estimated, Vancouver Sun, Sept. 3, 2014, http://www.vancouversun.com/Mount+Polley+mine+tailings+spill+nearly+cent+bigger+than+first+estimated/10172302/story.html?__lsa=3d36-42fe#ixzz3VcdRA2uw

[21] Rod Marining, One year later, *Wilderness Committee*, August 1,2015, http://commonground.ca/OLD/iss/289/cg289_MtPolley.shtml; Monica Lamb-Yorski, Mine still supplying drinking water to Quesnel Lake residents, *Williams Lake Tribune*, Jan. 15, 2015, http://www.wltribune.com/news/288759341.html

[22] Brazil dam burst:17 dead, dozens missing as mudslides flatten a village and engulf homes at BHP co-owned site, ABC News, http://www.abc.net.au/news/2015-11-07/brazil-dam-desperate-search-for-survivors/6921062; Kathryn Diss, Samarco mine tragedy: BHP ‘deeply sorry’ for Brazil dam disaster, pledges review of operations, ABC News, Nov. 19, 2015, http://www.abc.net.au/news/2015-11-19/deeply-sorry-bhp-announces-mines-review-after-dam-disaster/6955084

died.[23] Laboratory testing in downstream samples of water from the impacted Rio (River) Doce has detected mercury, aluminum, iron, lead, boron, barium, copper, arsenic and other chemicals. Arsenic in the sampling was 2,639.4 micrograms per liter -- more than 200 times Brazil's 10 micrograms per liter standard.[24]

These may be particularly gripping examples, but they are not uncommon. A July 21, 2015 report by Lindsay Bowker and David Chambers, *The Risk, Public Liability & Economics of Tailings Storage Facility Failures* (hereinafter "TSF Failures," Exhibit 19) analyzed recorded tailings storage facility failures from 1940 to 2010 using statistical tools. They found an emerging and pronounced trend since 1960 toward a higher incidence of Serious failures, i.e. large enough to cause significant impacts or involved loss of life and Very Serious failures, i.e. catastrophic dam failures that released more than 1 million cubic meters of tailings and in some instances resulted in multiple loss of life. In fact, 63% of all incidents and failures since 1990 were Serious or Very Serious. The total cost for just 7 of these 16 large failures was $3.8 billion, at an average cost of $543 million per failure. (Bowker & Chambers, *TSF Failures*, pp. 1-2, Exhibit 19).

The *TSF Failures* report identified factors contributing to the increase in catastrophic dam failures: mining lower grades and falling real prices of metals, pushing older tailings storage facilities to unplanned heights, or stretching the limits of tailings storage facilities that were not built or managed to best practices in the first place. (*Id.*, pp.1, 2,16). These risk factors would all apply to the PolyMet NorthMet tailings facility.

Although the *TSF Failures* analysis did not cover the past few years, the World Information Service on Energy (WISE) has prepared chronology of major dam failures through mid-November 2015, attached as Exhibit 20. Since 2010, WISE has identified 12 major tailings dam failures, including failures in Canada, the United States, and Europe.

David Chambers,' an engineer with decades of experience in mining, provided "Comments on the Geotechnical Stability of the Proposed NorthMet Tailings Basin and Hydrometallurgical Residue Facility in light of the Failure of the Mt Polley Tailings Storage Facility" in April 2015. (Chambers, 2015, attached as Exhibit 21). Dr. Chambers noted that

[23] Esmarie Swanepoel, BHP says Brazil plans $5bn legal suit over Samarco disaster. Nov. 30, 2015, http://www.miningweekly.com/article/bhp-says-brazil-plans-5bn-legal-suit-over-samarco-disaster-2015-11-30.

[24] Paula Stange, Analysis indicates the presence of mercury, arsenic, iron and lead in the water do Rio Doce, GazetaOnline, Nov. 12, 2015, http://agazeta.redegazeta.com.br/_conteudo/2015/11/noticias/cidades/3914468-analise-aponta-presenca-de-mercurio-arsenio-ferro-e-chumbo-na-agua-do-rio-doce.html

tailings dams fail at a rate that is approximately 10 times higher than that of water supply reservoir dams. (*Id*., p.2). He stated that upstream-type dam construction used for the existing LTVSMC tailings and proposed for NorthMet tailings poses the highest risk for both seismic and static failure of tailings dams. (*Id*., pp. 2-3). Dr. Chambers highlighted the presence of a clay layer beneath a portion of the Mount Polley dam as a significant cause of its failure, explaining that the LTVSMC tailings slimes on which PolyMet's tailings dams would be built have a consistency and behavior similar to clays. (*Id*., p. 3).

The FEIS confirms that the LTVSMC dam was built with upstream construction and that PolyMet would use upstream construction for its tailings storage on top of these old dams. (FEIS, 4-439, 5-646). The FEIS also notes that there were times during the operation of the underlying LTVSMC tailings facility where "significant amounts of fine tailings and slimes" settled near the perimeter dams and dams were then built with coarse tailings on top of them. (FEIS, 4-427). This inclusion of "relatively large zones" of fine tailings and slimes in the dam's outer shell "reduces the drainage ability of the shell, increasing the phreatic surface, and reduces the localized shear strength" of the dam. (*Id*.).

The FEIS identifies the northern dam in Cell 2E as an area of potential weakness since it is "underlain by a layer of fibrous peat up to approximately 20 ft thick that extends north beyond the toe of the dam into a nearby wetland and due to the presence of interbedded layers of contractive fine tailings and slimes." A deposit of glacial till lies beneath the peat, and the crest of the dam in this area is about 90 feet above the surrounding ground surface and "consists mostly of coarse tailings with some weaker layers of interbedded fine tailings and slimes close to the base of the dam." (FEIS, 4-437). Fully liquefied, this cross-section of the dam (Section F) has a margin of safety at barely the 1.1 minimum required. (FEIS, 5-658, Table 5.2.14-1).

Although the FEIS does not include any dam break analysis (FEIS, 5-628), PolyMet's Flotation Tailings Management Plan (PolyMet 2015n) states that there are 34 homes that could be affected by a tailings dam break, and that the time to first arrival of flood flows at the nearest residence would be about an hour. (*Id*., p. 20, see Exhibit 22 for map).

After the Mount Polley dam failure, an independent panel of experts studied the breach and released a report, The Independent Expert Engineering Investigation and Review Panel *Report on Mount Polley Tailings Storage Facility Breach* (hereinafter "Independent Report") attached as Exhibit 25. The *Independent Report* analyzed the cause of the Mount Polley tailings impoundment failure and concluded, "the dominant contribution to the failure resides in the design." The *Report* made the following key recommendation:

> [T]he future requires not only an improved adoption of best applicable practices (BAP), but also a migration to best available technology (BAT). Examples of BAT are filtered, unsaturated, compacted tailings and reduction in the use of water covers in a closure setting. (*Id.*, at iv)

The *Independent Report* explained, "There are no overriding technical impediments to more widespread adoption of filtered tailings technology." (*Id.*, at 122). Its Expert Panel challenged the practice of maintaining a water cover over tailings to reduce reactivity, stating that so-called water cover runs counter to best available technology principles and that "No method for achieving chemical stability can succeed without first ensuring physical stability." (*Id*., at 124). The *Independent Report* explained the "intrinsic hazards associated with dual-purpose impoundments storing both water and tailings" and identified as the goal of best available technology for tailings management "to assure physical stability of the tailings deposit. This is achieved by preventing release of impoundment contents, independent of the integrity of any containment structures." (*Id*., at 121). To accomplish this objective, the Report continued, "BAT has three components that derive from first principles of soil mechanics: 1. Eliminate surface water from the impoundment. 2. Promote unsaturated conditions in the tailings with drainage provisions. 3. Achieve dilatant conditions throughout the tailings deposit by compaction." (*Id*.).

The *Report*'s expert panel recognized that the chief reason why there isn't wider industry adoption of filtered tailings is that comparisons of capital and operating costs alone favor conventional tailings dam. The *Independent Report* recommended that cost estimates include "risk costs, either direct or indirect, associated with failure potential," emphasizing, "Full consideration of life cycle costs including closure, environmental liabilities, and other externalities will provide a more complete economic picture. While economic factors cannot be neglected, neither can they continue to pre-empt best technology." (*Id*., at 123). The *Report* concluded that "BAT should be actively encouraged for new tailings facilities at existing and proposed mines" and "cost should not be the determining factor." (*Id*., at 125).

The alternative of dry stack tailings was not evaluated at any point in environmental review. The Draft EIS screening process found thickened (not dry stack) tailings would address tailings basin mitigation issues, but "the operational cost of this measure would be high." (MDNR and USACE, 2009, 3-56, Table 3.2-2). Although Co-Lead Agency responses to comments state that after the DEIS a dry tailings alternative was reconsidered and determined not to offer significant environmental benefits (FEIS, A-315), there is no such analysis in the SDEIS, the FEIS or any cited reference.

The FEIS states that the *Independent Report* on Mount Polley was after the SDEIS comment period ended and Co-Lead Agency technical analysis confirmed, "use of dry stacking technology would increase tailings basin stability." Further evaluation of this alternative was rejected, however, on the grounds that use of dry stacking requires a basin liner, which is not feasible on top of the existing LTVSMC tailings basin. Use of a different location and a lined dry stack facility was then rejected on the grounds, "A separate dry stack tailings basin would increase footprint effects of the project" and that "A separate dry stack tailings basin would not address LTVSMC tailings basin legacy issues." (FEIS, A-315).

A separate dry stack tailings basin might increase the "footprint" of the project, but need not have any adverse environmental effects. During the scoping process for the NorthMet project, several brownfield sites in close proximity to the LTVSMC plant were identified as alternative tailings locations. This map of Alternative Sites under Consideration is attached as Exhibit 27. Addressing LTVSMC legacy issues is outside the scope of factors pertinent to a Section 404 permit decision, particularly since Cliffs Erie is already required under applicable law and a consent decree to address legacy issues, irrespective of the PolyMet NorthMet proposal.

3. An alternative dry stack tailings site would prevent adverse impacts to wetlands.

In addition to environmental damage due to uncaptured seepage and the reasonably foreseeable environmental damage from catastrophic dam failure, the proposed use of the LTVSMC site for NorthMet tailings disposal would have substantial direct and indirect impacts on wetlands. The Proposed Action would result in direct destruction of 148.4 acres of wetlands (FEIS, 5-322, Table 5.2.3-8) and potentially impact thousands of additional acres of wetlands as the result of dewatering resulting from seepage collection, sulfate deposition and seepage impacts on water quality. (*See* FEIS, 5-333, Table 5.2.3-10; 5-345, Table 5.2.3-12).

Tailings site wetlands, though degraded as the result of the existing impoundment, are historical wetlands. (Exhibit 13 maps). They are also highly methylating environments, particularly sensitive to changes in hydrology resulting in drying and wetting cycles, as explained in the opinion of Brian Branfireun, an international expert on mercury, methylmercury and wetlands. (Branfireun, 2015).

There are many alternative sites in the vicinity of the LTVSMC processing plant that could be used for PolyMet NorthMet tailings, some of which have been identified on Exhibit 27. Tailings disposal does not require siting within wetlands to fulfill its basic purpose. In fact, siting within wetlands is arguably inimical to the purpose of containing these wastes. Thus, it must be presumed under applicable regulations, that practicable alternatives that do not involve special aquatic sites are presumed to be available, unless clearly demonstrated otherwise, and all practicable alternatives to the proposed discharge which do not involve a discharge into a special aquatic site are presumed to have less adverse impact on the aquatic ecosystem, unless clearly demonstrated otherwise. 40 C.F.R §230.10(a)(3).

The Co-Lead Agencies' arguments for rejecting the alternative of dry stack tailings disposal on a lined facility without any evaluation are spurious. They fail to overcome the presumptions in §230.10(a)(3) by demonstrating that dry stack tailings disposal for NorthMet tailings is impracticable or that this best available technology would have other adverse environmental consequences. Independent of the environmental damage that would result from contaminated seepage and from the reasonably foreseeable risk of catastrophic dam failure, federal regulations presume that location of the NorthMet tailings storage facility on a site that did not directly destroy 148.4 acres of wetland and adversely affect thousands more is practicable and presumed to have less adverse impact, unless proved otherwise. No such proof has been supplied.

D. The West Pit Backfill alternative would have less adverse impact on the aquatic ecosystem and it has not been shown to be impracticable.

The FEIS erroneously minimizes the significance of West Pit Backfill in mitigating environmental damage resulting from the NorthMet mine and stockpiling of Category 1 waste rock. First, the FEIS errs in minimizing the significance of reclamation of its 526-acre surface and the restoration of wetland areas and functions:

> Removal of the Category 1 Stockpile would allow for reclamation of the affected surface footprint, including potential to recreate wetland areas and restore function, and, as noted above, the prior effect would have been offset through mitigation required for the initial

> effect. . . However, because of the temporal effect that the stockpile would have, those effects would be required to be mitigated regardless of future backfilling or not. (FEIS, 3-161 to 3-162)

Although the project proponent may see no value in future wetlands restoration if no mitigation credit is received, this perspective is untenable. There is an environmental benefit to the watershed of long-term reclamation, particularly when such a large site has been removed from the natural ecosystem.

The FEIS identifies additional benefits from improvement of visual aesthetics and a measurable environmental benefit from not having to treat seepage from the Category 1 Stockpile. (FEIS, 3-161).

The FEIS fails to consider an additional aquatic ecosystem environmental benefit of the West Pit Backfill alternative. It would reduce contaminated seepage that would otherwise result from leaving the 526-acre Category 1 copper-nickel waste rock pile permanently in a 280-foot-tall unlined pile at the mine site where seepage could impact the 100 Mile Swamp and the Upper Partridge River. (FEIS, 5-119, Table 5.2.2-21). The hydrogeologic conditions beneath the unlined Category 1 waste rock piles are not discussed in the FEIS. But comparing the Mine Site Plan (FEIS, Figure 4.2.14-1) with figures in the Barr Hydrogeology of Fractured Bedrock report (FEIS ref. Barr 2014b, Figures 1 and 2, Exhibit 3) shows that the majority of the Category 1 waste rock pile would be located on Virginia Formation rock, rather than less hydraulically conductive Duluth Complex rock. There are two faults confirmed by Barr and at least one additional inferred fault transecting the proposed site for the Category 1 waste rock pile. (*Id.*)

The FEIS predicted, based on PolyMet's modeling and assumptions (PolyMet 2015h), that more than 98 percent of affected groundwater seepage from the Category 1 stockpile would be captured by the containment system or would migrate as groundwater into the West Pit and East Pit. (FEIS, 5-7). PolyMet's modeling (PolyMet 2015h), also adopted in the FEIS, predicted that only negligible volumes of uncaptured seepage would flow north. (FEIS, 5-65).

Reference documents undermine these claims for seepage collection. Although the FEIS refers to the containment to be installed to collect seepage as a "low-permeability cut-off wall keyed into bedrock" (FEIS, 5-7), the actual design provides for the use of "compacted soil" as a barrier around the waste rock pile. (FEIS ref. PolyMet 2015h, p. 10). Specifications for the hydraulic conductivity are 1×10^{-5} centimeters per second (*Id.*, p. 13), which is generally classified as "semi-permeable" soil.

The drainage system would consist of pipes and ditches and rely only on gravity for collection. (*Id*., p. 14). PolyMet admits that along the west, north, and east sides of the stockpile, there may be localized areas where the drain pipe cannot be installed at an elevation low enough to ensure that groundwater will not flow beneath the cutoff wall. After reviewing PolyMet's seepage collection plan, Dr. Lee has summarized, "the proposed drainage system is unlikely to work as anticipated." (Lee, Category 1 stockpile opinion, 2015).

Failures of engineering controls for seepage are not counted in PolyMet's modeling. Instead, "PolyMet assumed that water collection performance monitoring points will be defined in SDS permitting to confirm (via monitoring differential hydraulic head) whether or not post-construction seepage loss is occurring beneath the cutoff wall. *If monitoring confirms that seepage losses are occurring to an extent potentially detrimental to water quality*, then groundwater recovery wells can be installed to supplement the containment system. (*Id*., emphasis added)

The FEIS' predictions of minimal Category 1 seepage flow were also based on an assumption that the cover placed on the rock pile would reduce infiltration by more than 99 percent (from 360 gpm to 2.8 gpm). (FEIS, 5-145). PolyMet's document from which this conclusion is drawn admits that geomembranes have not been used for many waste rock stockpile covers and that use is generally limited to projects with an average size of less than 30 acres. (PolyMet 2015d, p. 45). Yet, PolyMet (2015d) and the FEIS calculate infiltration solely on the basis of liner defects per acre of liners, without considering the topography of massive waste rock piles. PolyMet identifies three mine sites where geomembranes have been used as a cover, but does not describe seepage results. One of these featured sites is the Dunka Mine (*Id*., p. 46). Unsurprisingly, the FEIS does not cite the Dunka Mine in its predictions that infiltration and seepage will be prevented. Despite its geomembrane, Dunka Mine waste rock seepage has resulted and continues to result in ongoing violations of Minnesota water quality standards for copper, nickel, hardness and specific conductivity. (See Dunka Mine DMR summaries, provided in Exhibit 34).

Recent documents have also challenged the FEIS' assumption that little seepage would flow north from the Category 1 waste rock pile. As described in WaterLegacy's comments on the FEIS, preliminary MODFLOW modeling by the Great Lakes Indian Fish and Wildlife

Commission (GLIFWC) suggests that contaminants in the NorthMet mine surficial aquifer could flow northward as a result of the increase in pit depth and future closure of the Peter Mitchell Pit, given the proximity of the Category 1 stockpile (0.8 miles) to the Peter Mitchell Pit and the experience with other taconite pits where a cone of depression affecting surficial water can extend 1.4 to 1.5 miles from the pits. (GLIFWC Northward Flowpath Letter, Exhibit 8, p. 5).

Placing Category 1 in the Duluth Complex rock West Pit, after grouting any fractures revealed by mining, may reduce adverse effects from uncaptured release of contaminated seepage to surface and groundwater. Maintaining saturated conditions to reduce oxidation may also be more effective within the West Pit than trying to do so with a cover on a tiered pile. These potential environmental benefits from the West Pit Backfill alternative should have been analyzed to determine the LEDPA for the NorthMet project.

The FEIS suggests that the environmental benefits from the West Pit Backfill alternative do not require its consideration, let alone implementation of this alternative:

> T]he potential environmental benefit is moot or outweighed because encumbrance is not allowed in PolyMet's private mineral leases and because the costs associated with backfilling, additional water treatment (rates), and encumbrance compensation determined in revised lease agreements may affect the ability of PolyMet to secure financing (MDNR et al. 2013b). As such, the option to backfill the West Pit was eliminated from further consideration in the SDEIS and remains so in this FEIS. (FEIS, 3-162)

The referenced 2013 MDNR memorandum cited the conclusion of PolyMet's consultants that the West Pit Backfill alternative "would significantly decrease net return on the project." (FEIS ref. MDNR et al., 2013b, p. 3). PolyMet's consultants have emphasized, "There are known extensions of mineralization outside the mine plan both to the south (down dip) and to the west (along strike). A key consideration in the development of an overall mine plan for the Project, including the ability to backfill open pits, is preserving potential future development of these extensions of mineralization."[25]

The project proponent's interests in a better financial return or avoiding renegotiation of leases do not render the West Pit Backfill alternative impracticable under 40 C.F.R. § 230.10(a)(2). In addition, the "key consideration" relevant to PolyMet in opposing this alternative - preserving future development of extensions of mineralization outside the pit

[25] Foth, Evaluation of Backfilling the NorthMet West Pit, prepared for PolyMet Mining, Dec. 2012. p. 8, provided with WaterLegacy SDEIS Comments as Exhibit 49.

boundary – if it is considered as part of the project purpose for rejecting the West Pit Backfill Alternative, must also serve to define the project purpose for evaluating the Underground Mining Alternative.

E. The Mine Site Reverse Osmosis in Year 1 alternative would have less adverse impact on the aquatic ecosystem and it has not been shown to be impracticable.

Both WaterLegacy and Cooperating Tribal Agencies requested consideration of an alternative to mitigate impacts on wetlands and water quality from mine dewatering and seepage by treating groundwater pumped from mine pits during operations with reverse osmosis to levels that comply with water quality standards and returning that treated water to support wetlands and dilute any seepage released to the Partridge River watershed. The FEIS doesn't mention this alternative. Although the request for consideration of this alternative is mentioned in two responses to comments, neither response substantively addresses the Mine Site Reverse Osmosis in Year 1 alternative. (FEIS, A-134 to A-135, A-313).

The NorthMet Proposed Action currently calls for construction of reverse osmosis (RO) water quality treatment at approximately year 52 (FEIS, 5-142). That RO facility would be scaled to treat overflow discharge from the West Pit. Prior to the predicted filling of the West Pit, at least 52 years away (more if mining is continued for more than 20 years), all water from the Upper Partridge River would be sent to the processing plant nine miles away and removed from the watershed.

The treatment targets for the mine site wastewater treatment plant from year 1 to at least year 52 would not permit discharge of treated water to surface water. Based on current baseline hardness in the proposed West Pit Outlet Creek of less than 50 mg/L (FEIS, 4-91, Table 4.2.2-15), the mine site wastewater treatment facility (WWTF) target for lead (10 µg/L) would be more than 7 times the chronic water quality standard (1.3 µg/L);[26] the WWTF target for nickel (113 µg/) would be nearly 4 times the water quality standard (29 µg/L);[27] and the WWTF target for sulfate would be 250 mg/L, 25 times the 10 mg/L standard applicable in wild rice waters. (*See* FEIS, 5-148, Table 5.2.2-2 for WWTF targets). The predicted mercury concentration in WWTF effluent would be 5.8 ng/L (PolyMet RS66, Mercury Mass Balance Attach. A, Exhibit 4 to WaterLegacy SDEIS Comments), nearly 5 times the Great Lakes Initiative water quality

[26] Minn. R. 7050.0222, Subp. 4
[27] Minn. R. 7052.0100, Subp. 6.

standard of 1.3 ng/L. This low-quality effluent could not be used to augment the aquifer to protect wetlands from water drawdown or to mitigate mine site seepage impacts.

Where wetlands near the tailings site in the Embarrass River watershed are concerned, the FEIS has already proposed that stream augmentation would mitigate effects on wetlands due to the maintenance of surface flows within 20 percent of existing conditions. (FEIS, 5-183). Yet, although wetlands at the plant site are degraded by the existing impoundment (FEIS, 4-186) and wetlands at the mine site are high quality (FEIS, 5-266), the proposed action makes no plan to treat and return water to the mine site watershed.

Indirect impacts on mine site wetlands as a result of mine dewatering are likely to be quite severe. As noted above, mine dewatering could adversely affect 5,720 acres of proximate wetlands. (FEIS, App. C, autop. 2994). PolyMet has recently re-evaluated the hydraulic conductivity of both wetlands and rock formations at the mine site. Although conductivity of Duluth Complex rock was unchanged in this analysis, the conductivity of both wetlands deposits (horizontal conductivity) and Virginia Formation bedrock (both horizontal and vertical conductivity) was calculated at *400 percent* of the conductivity modeled in the 2013 SDEIS. (Comparison is based on SDEIS, 5-27, Table 5.2.2-7 and FEIS, 5-29 Table 5.2.2-7). As a result, peak inflows and dewatering of the Partridge River watershed could be as much as 760 gallons per minute (FEIS, 5-111, Table 5.5.2-19) or 399,700,000 gallons per year removed from mine site groundwater.

Mine Site Reverse Osmosis in Year 1 could return treated, clean water to mine site streams and surficial aquifer mitigating indirect impacts of wetlands drawdown. Reduction in the degree to which mine site wetlands were impacted by hydrologic change would have the potential to mitigate the degree to which mine site wetting and drying cycles enhance mercury methylation. In addition, if PolyMet's modeling of the volume, timing or solute concentrations of polluted seepage at the mine site has underestimated environmental effects, the Reverse Osmosis in Year 1 alternative would allow discharge of clean water to mitigate impacts while additional engineering solutions to prevent seepage are put into place.

Since construction of a reverse osmosis plant at the mine site is already planned post-closure, at a time when PolyMet would have fewer economic resources than during operations, it should be presumed that earlier construction and operation of the plant would be practicable. As with other alternatives that clearly reduce adverse effects on the ecosystem, the burden of proof would be on the project proponent to demonstrate that Mine Site Reverse Osmosis in Year 1 is not a practicable alternative to mitigate some of the impacts to wetlands and water quality of the proposed NorthMet project.

F. Hydrometallurgical waste disposal on an alternative site would have less adverse impact on the aquatic ecosystem, and it is presumed that other sites are practicable and less impactful.

The NorthMet hydrometallurgical residue facility (HRF) would be a relatively small facility, when compared to the NorthMet tailings waste storage facility. However, the NorthMet hydrometallurgical residue facility (HRF) would contain some of the most concentrated and toxic chemicals involved with the project. It is proposed to be located 36.1 acres of wetlands, requiring the destruction of 7.5 acres of marsh wetlands subject to state and federal regulatory jurisdiction. (FEIS, 5-321, Figure 5.2.3-19).

The HRF would receive 313,000 tons per year of hydrometallurgical residue produced by autoclave processing of metals at the Hydrometallurgical Plant and up to a total of 6,170,000 tons of this waste. (FEIS, 1-5, 3-117). During operations, the HRF would also receive filtered sludge produced by chemical precipitation of process water in the West and East equalization ponds. This process water would include the reject concentrate stream from the plant site wastewater treatment plant (WWTP). (FEIS, 5-101, Figure 5.2.2-20). The FEIS also proposes disposal in the HRF of WWTP treatment plant solids, which are primarily gypsum, and of coal ash wastes from the existing LTVSMC site Coal Ash Landfill. (FEIS, 5-178, PolyMet 2014c). These additional and potentially toxic and reactive wastes may represent up to 10 percent of the HRF facility solids volume. (FEIS, 4-445).

The FEIS concludes that HRF waste will not exceed federal RCRA hazardous waste thresholds, without disclosing the mass or concentration of any of the constituent wastes that would be disposed of in this facility. Rather than assessing the contaminant levels actually proposed for the HRF under the current project plan, the FEIS states that, if the project is approved, the residue should be tested to verify that it is not hazardous. (FEIS, 5-609).

No supporting documents fully disclose the chemical constituents of the hydrometallurgical residue facility. However, the little information available confirms that the constituents of the HRF would pose serious risks to the aquatic ecosystem and to human health if they were ever to leak or spill. Co-Lead Agency responses to comments state that 164 pounds of mercury would be deposited in the hydrometallurgical facility each year. (FEIS, A-414). Over a 20-year mine life, up to 3,280 pounds of mercury could be deposited in the HRF.

The February 2007 PolyMet RS33/RS65 Hydrometallurgical Residue Characterization (provided as Exhibit 27 to WaterLegacy SDEIS comments although not included among FEIS references) indicated that tested hydrometallurgical leachate residue would have sulfate levels of 7,347 mg/L. Although we have found no document in the EIS record that provides contaminant levels for filtered sludge, before WWTP reject concentrate is dewatered it would contain levels of arsenic and metals as much three orders of magnitude above applicable limits. At the P90 level, reject concentrate would contain: 1,150 µg/L of arsenic (2 µg/L criterion for drinking water); 16,600 µg/L of manganese (100 µg/L HRL for drinking water); 847 of cobalt (5 µg/L surface water limit); 11,600 µg/L of copper (9.3 µg/L limit in water with 100 mg/L hardness); 1,290 µg/L of lead (3.2 µg/L limit in water with 100 mg/L hardness); 8,230 mg/L of sulfate (10 mg/L limit in wild rice waters). (FEIS ref. PolyMet 2015m, autop. 452).

The FEIS assumes that leakage from the HRF into underlying groundwater or adjacent surface water "would be negligible" due to the double liner proposed and does not evaluate potential environmental impacts from HRF waste facility seepage. (FEIS, 5-179). This assumption is based on a referenced PolyMet document that states, "The double liner system designed for the HRF is impermeable enough so that its effect on the environment can be ignored." (PolyMet 2015j, p. 117). PolyMet assumes a leakage rate of 2 defects per acre in the upper liner of the HRF, that defects are circular with a diameter of 1 centimeter, and that no defects at all will occur in the lower clay liner. (*Id*.). However data in PolyMet's own Residue Management Plan suggests that 40% of installed liners have a defect density from 4 to 10 per acre and 10% a defect density from 10 to 20 per acre. (FEIS ref. PolyMet 2014r, p. 11). Although the hydraulic head between the upper and lower HRF liner may be low, leakage could still occur.

Neither the FEIS nor its underlying PolyMet documents address the difference between the HRF proposal and modern landfill siting and performance. Modern landfills, on which the optimistic expectations of HRF leakage performance are based, cannot be sited on locations like the one proposed in the FEIS. As summarized on the EPA website, municipal solid waste landfills must comply with the federal regulations in 40 C.F.R. § 258 (Subtitle D of RCRA), or equivalent state regulations. Federal standards for solid waste landfills include: "Location restrictions—ensure that landfills are built in suitable geological areas away from faults, wetlands, flood plains, or other restricted areas."[28] Minnesota law similarly precludes the siting of either a hazardous or a solid waste facility in a wetland or in a location where the topography, geology, hydrology or soil is unsuitable for the protection of the ground water and the surface water. Minn. R. 7045.0460, Subp. 2, Minn. R. 7035.1600.

The FEIS and supporting documents demonstrate that the proposed hydrometallurgical residue facility would be sited in an unsuitable location for either a hazardous or an industrial waste landfill. The HRF would be located on approximately 36.1 acres of wetlands, affecting the foundation of the disposal facility as well as implicating Section 404 regulations. In addition to the wetlands, the HRF would be located on top of as much as 50 feet of fine tailings and slimes in the existing LTVSMC Emergency Basin. (FEIS, 5-664, Figure 5.2.14-9). Although the FEIS proposes that a preload could be placed on these materials to compress them in order to reduce stress deformation and strain on the liner system, it is expected that the material would rebound to some degree after the preload is removed. (FEIS, 5-667). Differential settlement of foundation materials is known to create longitudinal strain for liner materials. (FEIS, 5-661).

The FEIS and Minnesota Geological Survey maps show the existence of a fault directly beneath the proposed HRF location. (FEIS, 4-435, Barr 2014b Large Figures 1 and 2, Exhibit 3). The FEIS has identified yet another risk to liner deformation and integrity. Seeps along the southern edge of the existing LTVSMC tailings basin Cell 2W have been observed with the potential to create phreatic build-up below the HRF liners. The HRF would require a collection drain beneath the proposed embankment and liner systems to transmit the collected seep to the exterior of the HRF facility and reduce this risk. (FEIS, 5-662 to 5-663).

Although the degree to which leakage and seepage of concentrated and toxic chemicals would adversely affect aquatic ecosystems is difficult to quantify given the lack of information in the FEIS, there is a clear environmental benefit to locating the hydrometallurgical residue facility on a site with a level, stable and dry foundation, where predictions of infrequent leakage are much more likely to be realized. More effectively containing mercury, arsenic, manganese, cobalt, copper, lead and sulfate so that they are not released to surface water and groundwater would reduce impacts on the aquatic ecosystem and human use characteristics, pursuant to Subparts C and F of Chapter 40, Part 230 in these rules.

[28] EPA, Landfills, available at http://www3.epa.gov/epawaste/nonhaz/municipal/landfill.htm. See also 40 C.F.R. §257.9 for restrictions on location of new or expanding non-municipal, non-hazardous waste facilities on wetlands.

The FEIS contemplates that "liquefaction of the hydrometallurgical residue" may occur, but states that the embankment dam is "sufficiently designed so that containment would not be lost." (FEIS, 5-664). The liquefaction and failure of containment at the hydrometallurgical residue facility may or may not be a likely occurrence. But it would be a catastrophic occurrence that can be readily avoided by siting the HRF on an appropriate site that is not located on wetlands.

Disposal of hydrometallurgical residue and other wastes is not an activity that requires siting within wetlands. In fact, it is an activity generally *prohibited* in wetlands. Thus it is presumed that sites for the HRF that do not involve wetlands are available and would have less adverse impact on the aquatic ecosystem, unless clearly demonstrated otherwise. 40 C.F.R. §230.10(a)(3). There are many sites that do not involve wetlands in the vicinity of the proposed NorthMet processing plant (see for example, brownfield sites identified in Exhibit 27) that could accommodate the small footprint of the proposed NorthMet HRF facility.

II. No Section 404 permit may be granted for the PolyMet NorthMet project because analysis and proposed compensation for adverse impacts on wetlands fails to comply with applicable law.

A. The applicant and the FEIS failed to meet Section 404 permit requirements for determination of secondary impacts on wetlands.

Section 404 permit regulations require that certain factual determinations be made to evaluate whether a project complies with restrictions on discharge, including the requirement that the project be the least environmentally damaging practicable alternative. 40 C.F.R. §§ 230.11, 230.12(b). "Determination of secondary effects on the aquatic system" is among the determinations required prior to permit issuance. "Secondary effects" are defined as "effects on an aquatic ecosystem that are associated with a discharge of dredged or fill materials, but do not result from the actual placement of the dredged or fill material." 40 C.F.R. §230.11(h).

The applicant's Revised Wetlands Permit Application in August 2013 (PolyMet 2013o) identified *potential* indirect impacts on wetlands, but provided no basis to determine the extent of foreseeable secondary effects on wetlands or to evaluate a LEDPA to minimize those effects. The FEIS states, "The indirect effects analyses performed for the EIS were not performed to characterize impacts but were done to inform where monitoring should take place for those areas that were identified as having a potential for indirect wetland effects." (FEIS, 5-259). This phrase was repeated numerous times in responses to comments, along with the corollary statement that "the identification of specific mitigation for indirect effects . . .is not a requirement for an EIS. (*see e.g*. FEIS, A-116, A-295, A-343, A-481, A-482).

As discussed in WaterLegacy's comments on the FEIS, although NEPA has no substantive requirements for mitigation, the regulations do require an analysis of both direct and indirect potential adverse effects. 40 C.F.R. §1502.16(a), (b). EPA recommended in its 2014 response to the PolyMet NorthMet SDEIS,

> Recommendation: The FEIS should quantitatively assess all indirect impacts. The FEIS should more clearly describe the proposed mitigation plan, including mitigation for indirect impacts. The monitoring and mitigation plans in the CWA Section 404 permit should clearly explain proposed measures to minimize and mitigate indirect wetland impacts during the project. (USEPA SDEIS Comment, 2014, p.11, Exhibit 1).

However, the consequences of failure to quantify or determine secondary wetlands impacts are more definitive in the context of a Section 404 permit. As Morgan Robertson, an expert on wetlands compensation policy under the Clean Water Act explained in an opinion provided with these comments, "the indefinite characterization does not suffice for the 404 permit review: where there is insufficient information to conduct a full alternatives analysis, the LEDPA for a proposed wetlands dredge and fill activity cannot be determined and a permit cannot be issued." (Robertson, 2015, p. 4).

The preceding section, which described less environmentally damaging practicable alternatives not evaluated in the FEIS, demonstrates the importance of determining secondary effects on wetlands prior to LEDPA analysis.

Environmental benefits of the dry stack tailings alternative include reducing secondary impacts on wetlands and wetlands water quality functions resulting from sulfate air deposition, sulfate and mercury seepage, and hydrological changes due to seepage capture. The FEIS identified 4068.3 acres of wetlands within plant site flowpaths (FEIS, 5-333, Table 5.2.3-10), but did not determine secondary effects on any of these wetlands or discuss any of the ways in which the proposed NorthMet tailings storage facility would affect production and export of methylmercury.

The environmental benefits of the West Pit Backfill alternative include reducing secondary impacts of seepage to mine site wetlands. The FEIS identified 515.9 acres of wetlands within mine site groundwater flowpaths (FEIS, 5-320, Table 5.2.3-7) and stated that "all downgradient minerotrophic wetlands located within the five Mine Site surficial aquifer flowpaths may have potential indirect wetland effects related to water quality changes as a result off leakage/seepage from mine features." (FEIS, 5-313, 5-319). However, the FEIS did not assess the impact of reasonably foreseeable mine site leakage/seepage on any wetlands. Since PolyMet's water quality model "assumed that the leakage/seepage from mine features releases directly to the Partridge River; *therefore, it is assumed that groundwater would not emerge in surface water or wetlands along intermediate portions of the flowpaths*." (FEIS, 5-320, citing PolyMet 2015m, emphasis added). The FEIS advised, "The water quality model cannot be used to quantify the amount of leakage/seepage from mine features that discharge directly to individual wetlands." (*Id*.).

The Mine Site Reverse Osmosis in Year 1 alternative was proposed to provide a method of mitigating drawdown of high quality mine site wetlands as a result of mine dewatering. Had the FEIS determined secondary effects on wetlands hydrology from mine dewatering, including potential effects on methylmercury production and export, analysis of this potential LEDPA would have been prioritized.

As a result of the failure to determine secondary impacts on wetlands from the proposed PolyMet NorthMet project, not only is the FEIS inadequate, but LEDPA analysis hasn't been done to determine the unavoidable effects remaining after all practicable alternatives have been applied. The conditions for permit issuance in §230.10(a) have not been met.

B. The application and the FEIS fail to comply with Section 404 requirements requiring compensation for unavoidable secondary impacts on wetlands.

Requirements for compensatory mitigation for losses of aquatic resources are set forth in Part 332 of Chapter 33 of the Code of Federal Regulations. These standards and criteria apply to issuance of Section 404 permits, along with the requirements of Chapter 40 Part 230 of the Code. 33 C.F.R. §332.1(1)(a), (c). Under these regulations, "Compensatory mitigation for unavoidable impacts may be required to ensure that an act that an activity requiring a section 404 permit complies with the Section 404(b)(1) Guidelines." §332.1(c)(2). During the Section 404(b)(1) analysis, a determination may be made that a permit for the proposed activity "cannot be issued because of the lack of appropriate and practicable compensatory mitigation options." §332.1(b)(3). "Compensatory mitigation" does not distinguish between direct and secondary effects; it is based on offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved. §332.2.

A December 4, 2015 email between Army Corps staff and management, obtained under the Freedom of Information Act (FOIA) and included as Attachment 2 to Dr. Robertson's opinion, reflects the concern that mitigation be provided for secondary effects of the NorthMet project on wetlands. The memo asks:

> Since potential indirect impacts can only be estimated for purposes of the FEIS -- the range is from a low number of acres to over 7,000 acres -- … what would be considered sufficient compensatory mitigation for potential indirect impacts for purposes of the FEIS and permit decision? A combination of credits in excess of that needed to offset direct impacts could be established/purchased prior to permitting with a contingency plan to establish/purchase additional credits if/when monitoring post-permitting shows adverse indirect impacts to wetlands. The question is how many credits would be sufficient to address the indirect impact issue at the time of permitting. (Robertson, 2015, Attach. 2)

Although the FEIS suggests that potential secondary impacts on wetlands cannot be quantified or even reasonably estimated because the information is "unavailable" (FEIS, 5-260), the record doesn't support this claim. Under NEPA, if information is needed to make a reasoned choice among alternatives, it is only considered to be unavailable if "overall costs of obtaining it are exorbitant or the means to obtain it are not known." 40 C.F.R. §1502.22(b). If information is on secondary impacts is available, failure to provide it violates NEPA. *Sierra Club v. Van Antwerp*, 709 F. Supp. 2d 1254, 1271-1272 (S.D. Fla. 2009) (By failing to include in the EIS analysis costs of water treatment upgrades - a secondary effect of mining activity needed to evaluate alternatives, the Corps did not comply with NEPA's regulations).

As explained above, the FEIS neither quantifies nor justifies its failure to quantify the effects of polluted seepage on wetlands. The FEIS merely cites the assumptions in PolyMet's modeling of flowpaths that led to an assumption of no effects on wetlands. For the critical impact of mine dewatering on wetlands, the FEIS makes no claim that modeling to predict wetlands drawdown would be exorbitant or beyond the state of the art. The FEIS merely states a preference for using the analog method to evaluate wetlands drawdown rather than a model such as MODFLOW (FEIS, 5-257, 5-260) and a preference for using the analog approach rather than a hydrological study, pump test and/or laser test to assess potential groundwater drawdown. (FEIS, A-489 to A-499).

In his comment on the PolyMet NorthMet SDEIS, wetlands expert Brian Branfireun opined that reliance on an analog case to evaluate the potential extent and magnitude of the cone of depression and dewatering impact of surface wetlands and streams is unsatisfactory, "given the availability of robust hydrogeological models that could reasonably evaluate potential impact scenarios." (Branfireun, 2014, p. 14). Hydrologist Donald Lee stated both that an analog approach would need to be validated, which hadn't been done in the SDEIS, and that "MODFLOW has the capability to calculate the effects of pit dewatering providing the appropriate input is incorporated into the model." He pointed out that selectively rejecting MODFLOW for the purpose of wetlands assessment could call into question the legitimacy of all other EIS analysis of hydrology and water quality. (Lee, 2014, p. 12).

MODFLOW has recently been used to update predictions highly relevant to the assessment of the nature and cone of depression. As described in more detail in WaterLegacy's comments on the FEIS, PolyMet recently updated its assessment of the hydraulic conductivity of wetland deposits and of Virginia Formation bedrock (FEIS, 5-19. 5-29, Table 5.2.2-7) and revised its estimates of groundwater inflow to the west and east mine pits. (FEIS, 5-111, Table 5.2.2-19). The Co-lead Agencies also recently used MODFLOW to predict the number of inches of downward leakage through wetlands necessary to prevent northward flow as a result of the downhill hydraulic gradient of the Northshore Mine Peter Mitchell Pit. (FEIS, 6-41, MDNR et al 2015c). There is every indication that MODFLOW is a robust, practicable and readily available model for analysis of conductivity, hydrology and flow through mine pits, bedrock, and surficial materials at the NorthMet mine site, the parameters most relevant to determine secondary wetlands drawdown impacts.

Even if one were to assume that an analog method is preferable to using MODFLOW or another hydrological model, there is no logical reason why this would make an evaluation of wetlands drawdown impacts "unavailable." Nothing would have prevented the project proponent or Co-Leads from calibrating the analog approach and providing a quantitative estimate of mine drawdown impacts sufficient for NEPA and the Section 404 process. They chose not to do so.

However, this record *does contain* a quantitative assessment of wetlands drawdown impacts using the Co-Leads' preferred analog approach. An Analysis of Indirect Wetland Impacts from Groundwater Drawdown using a calibrated analog approach was provided by GLIFWC prior to the preparation of the SDEIS in November 2013 and is included in Appendix C of the FEIS. (FEIS, App. C, autop. 2985-3025). Neither the SDEIS nor the FEIS challenged the methodology or conclusions of this analysis.

Calibrating the analog method to other pits on the Iron Range, using the three zones of proximity to mine pits proposed by the Co-Leads, and specifying the level of drawdown, acreage and types of wetlands that would be affected, GLIFWC concluded that wetlands likely to be severely impacted by dewatering totaled 3,188.62 acres in Zone 1 (0 to 1,000 feet), 2,458.12 acres in Zone 2 (1,000 – 2,000 feet) and 273.01 acres in Zone 3 (2,000 – 5,000 feet). Severe indirect impacts to wetlands from mine pit drawdown would total 5,719.75 acres. (FEIS, App. C, autop. 2994). This calibrated analog model provides a reasonable and usable estimate of mine site secondary effects on wetlands.

The FEIS proposes wetlands mitigation for 26.9 acres of mine site wetlands predicted to be lost as the result of fragmentation. (FEIS, ES-37). Making the conservative assumption that mine site wetlands subject to other secondary effects are likely to also be within the cone of depression for dewatering effects, the FEIS, thus, proposes to provide compensatory mitigation for *less than half of one percent* of the wetlands subject to mine site secondary effects. This level of failure to provide compensatory mitigation precludes issuance of a Section 404 permit for the proposed PolyMet NorthMet project.

C. Promises made to monitor and potentially provide future compensation do not comply with Section 404 requirements.

Both the proponent's Revised Wetland Permit Application (FEIS ref. PolyMet 2013o, pp. 84-88) and the FEIS make vague promises of monitoring, adaptive management such as more monitoring, and potential, unspecified, future compensatory mitigation. The FEIS states,

> If the NorthMet Project Proposed Action were to be permitted, wetland monitoring for hydrology and vegetation would be conducted to identify if future indirect effects to wetlands would occur. Wetland hydrology and vegetation would be monitored, and additional monitoring locations may be considered during permitting. A component of the monitoring plan would be based on those wetlands that would have a high likelihood of indirect effects as a result of groundwater drawdown. If the monitoring were to determine that indirect wetland effects had occurred, additional compensation could be

> required if determined necessary by the permitting agencies. In the event that the required wetland monitoring identified additional indirect effects, permit conditions would likely include a plan for adaptive management practices to be implemented, such as expanded monitoring and hydrologic controls. Additionally, compensatory mitigation may be required if additional impacts are identified during annual reporting. Permit conditions would likely include an adaptive management plan to account for any additional impacts that may be identified in the annual monitoring and reporting. (FEIS 5-257 to 5-258)

Applicable regulations under the Clean Water Act do not support this approach. Compensatory mitigation requirements for a Section 404 permit "*including the amount and type of compensatory mitigation*, must be clearly stated in the special conditions of the individual permit." These special conditions "must be enforceable." 33 C.F.R. §332.3(k)(1) (emphasis added). The timing for implementation of compensatory mitigation also does not support the damage-now, calculate-compensation-later promise of the application and FEIS. The regulations state that to the maximum extent practicable, implementation of the compensatory mitigation project shall be in advance of or concurrent with the activity causing the authorized impacts. §332.3(m).

Federal regulations also require that the public notice for a Section 404 permit contain a statement explaining how impacts associated with the proposed activity are compensated for, including "proposed avoidance and minimization and the amount, type, and location of any proposed compensatory mitigation." 40 C.F.R. §230.94(b). For an activity that requires a permit pursuant to Section 404 of the Clean Water Act, mitigation rule regulations also require, "the public notice for the proposed activity must contain a statement explaining how impacts associated with the proposed activity are to be avoided, minimized, and compensated for" and that this explanation include "the amount, type, and location of any proposed compensatory mitigation." 33 U.S.C. §332.4(b). None of the public notices issued for the PolyMet NorthMet Section 404 permit application identify any secondary effects on wetlands or describe any plan for how such secondary effects are to be avoided, minimized or compensated for.[29] No notice received by the public to date for the NorthMet project complies with this basic requirement of Section 404 regulations.

Based on his review of the PolyMet NorthMet files, Dr. Robertson concluded, "PolyMet is proposing to offer compensatory mitigation to make its project palatable before committing to

[29] U.S. Army Corps of Engineers, Notice of Availability of Final /Environmental Impact Statement and Supplemental Notice for Section 404 Permit Application, Nov. 13, 2015, available at http://www.mvp.usace.army.mil/Portals/57/docs/regulatory/PolyMet/1999005528P.pdf

an estimate of the full extent of its secondary impact, even though doing so is practicable and in fact implicit in their FEIS." (Robertson, 2015, p. 7). Reflecting his experience in developing and applying the mitigation rule, he stated,

> Acknowledging the likelihood of significant impacts and then proposing to measure and compensate for them after permit issuance is not in conformance with regulation. Allowing the full characterization of impact to be discovered later, and compensation proposed later, is to relieve PolyMet from the duty of finding the LEDPA, and therefore relieve them of some of the risk associated with proposing the impact. This is not the role of regulators. (*Id*., p. 8)

Courts have found that unsupported belief in the success of post-issuance compensatory mitigation provided insufficient protection of water resources from coal-mining waste to comply with Clean Water Act Section 404. *Ky. Riverkeeper, Inc. v. Rowlette,* 714 F. 3d 402, 411-412 (6th Cir. 2013). *Cf. Ohio Valley Environmental Coalition v. Hurst,* 604 F. Supp. 2d 860, 887-889 (S. D. W. Va. 2009) (The mere listing of mitigation measures and processes cannot support a determination that stream loss impacts of coal mining would be minimal).

For the PolyMet NorthMet project, the failure to provide compensatory mitigation for secondary wetlands impacts clearly violates federal regulations. In addition, PolyMet's proposed monitoring plan would be designed to avoid recognition of secondary wetlands impacts, particularly in the wetlands of greatest concern, the high value difficult-to-replace ombrotrophic bogs that would be impacted by drawdown at the NorthMet mine site.

In his report on mercury, methylmercury and wetlands, Brian Branfireun analyzes in detail the FEIS' discussion of ombrotrophic bogs and monitoring for secondary impacts. (Branfireun, 2015, pp. 16-19). Dr. Branfireun concludes that the FEIS' alleged reclassification of ombrotrophic bogs as areas of "low likelihood" of effects, rather than "no likelihood" of effects misrepresents not only the peer-reviewed scientific literature cited in Dr. Branfireun's prior opinion on the SDEIS (Branfireun, 2014), but the analysis of Army Corps' staff (Eggers, 2015).

Dr. Branfireun explains that monitoring proposed in the FEIS would be based on wetlands considered to have a "high likelihood" of indirect effects, thereby excluding ombrotrophic wetlands, so "The FEIS not only minimizes the risk of drawdown effects on ombrotrophic bogs, but proposes no method to prevent or detect these impacts." (Branfireun, 2015, p. 18, referencing FEIS, 5-303, 5-361) Since even monitoring is conditioned on a later determination that the Proposed Action would cause future wetland effects, Dr. Branfireun concludes, "This sentence absolves the NorthMet project proponents from taking even the proactive action of monitoring." He summarizes, "This and other similar text in the FEIS suggests that there is, in fact, no plan for proactive monitoring to address incremental direct or indirect impacts of the proposed project on wetlands in the area of impact." (Branfireun, 2015, p. 18, referencing FEIS, 5-355).

WaterLegacy's comments on the FEIS describe the ways in which the FEIS first describes each potential secondary effect of the NorthMet project on wetlands and then denies that the effect has been recognized or modeled. The bottom line of this analysis is that even the monitoring of secondary wetlands effects proposed by PolyMet and adopted in the FEIS comes with a catch. Potential risks to wetlands are rated based on a system devised by PolyMet, where each different impact factor (several of which have been categorically excluded in the corresponding FEIS discussion) is given a point from 1 up to a maximum of 6 (FEIS, 5-361, PolyMet 2015b). Monitoring is generously proposed, "within all wetlands containing a potential indirect wetland impact factor rating of 3 to 5 and a sampling of those wetlands with factor ratings of 1 or 2." (FEIS, 5-390).

A quick look at the effects of PolyMet's rating system data reveals that PolyMet's monitoring plan for secondary wetlands effects would place only 3% of the 7,694.2 acres of potentially impacted wetlands in a zone where they would be thoroughly monitored. (FEIS, 5-361, Table 5.2.3-15, PolyMet 2015b) Other wetlands would be sampled "based on those wetlands that would have a high likelihood of indirect effects as a result of groundwater drawdown," (FEIS, 5-397). This constraint excludes both ombrotrophic and minerotrophic bogs, which are classified in the FEIS as having a "low likelihood" of impact. (FEIS, 5-279).

The contingent and uncertain nature of future compensation and monitoring proposed would neither trigger post-permit compensatory mitigation nor protect vulnerable wetlands and peatlands. They fail to satisfy requirements for issuance of a Section 404 permit. Even the public notices issued for the NorthMet project are deficient under Clean Water Act Section 404 permit rules, since they have neither disclosed secondary wetlands effects nor their avoidance, minimization and compensation.

D. The compensatory mitigation proposed for direct impacts of the NorthMet project on wetlands fails to comply with Section 404 permit requirements.

The compensatory mitigation proposed for NorthMet project direct impacts violates both the letter and the spirit of regulations implementing the Clean Water Act applicable to Section 404 permits, including the Federal Mitigation Rule. (Robertson, 2015). There is no excuse for this deficiency, since Applicant's revised Section 404 wetland permit application was filed on August 19, 2013, many years after the Rule was enacted. (PolyMet 2013o).

Dr. Robertson's opinion details the history of wetlands guidance and policy to demonstrate that the Army Corps had a long-standing obligation to require that compensatory mitigation occur within the same watershed when practicable. (Robertson, 2015, pp. 11-13). This interpretation is supported in the Rule itself, which references these prior mitigation policies. 33 C.F.R. §332.1(f)(1), (2). In locating most of the proposed mitigation across the Continental Divide from impacted wetlands and providing out-of-kind compensation where a watershed approach to compensation has not been used, the applicant's proposed mitigation violates the Federal Mitigation Rule.

1. Location of the majority of proposed compensation on a different side of the Continental Divide from impacted wetlands does not comply with Section 404 permit requirements.

As explained in Dr. Robertson's opinion, permittee-responsible mitigation through off-site and/or out-of-kind mitigation is the least favored approach to compensatory mitigation in the Federal Mitigation Rule applicable to Section 404 permits. 33 C.F.R. §332.3(b)(1), (b)(2-6). The Rule states that compensation sites "should" be located within the same watershed as the impact site, and "should" be located where they are "most likely to successfully replace lost functions and services. §332.3(b)(1). To the extent appropriate and practicable, the Army Corps "must use a watershed approach to establish compensatory mitigation requirements" in a Section 404 permit. §332.3(c). Dr. Robertson summarizes,

> Thus, although there is some discretion built into the Rule, it is also clear that the Corps *must* work their way deliberately through compensation options in the prescribed order. To recommend the least-preferred option (permittee-responsible mitigation without a watershed approach) requires a demonstration that the prescribed preferable mitigation alternatives have been "considered", and are not available, to avoid the conclusion that mitigation resulted from an arbitrary disregard of the hierarchy and the requirement that a watershed approach be used. (Robertson, 2015, p. 9)

Dr. Robertson explains that, in his experience, while out-of-watershed compensation is not uncommon, the question of its appropriateness is usually considered at the scale of 8-digit Hydrologic Unit Codes (HUCs), or 6-digit HUCs at most. In the PolyMet NorthMet case, 66.5 percent of the compensatory wetlands acreage and 71 percent of the proposed wetlands credits are provided by the Aitkin and Hinckley sites (FEIS, 5-387, Table 5.2.3-17). These sites are within the Mississippi River Basin, not the Lake Superior Basin in which the NorthMet project would be located. (FEIS, 3-28). There is no watershed that includes both the impact site and the Aitkin or Hinckley sites.[30]

Dr. Robertson emphasizes, "two thirds of the proposed compensation for impacts at the NorthMet site is located out of the 2-digit HUC basin of the impact, across the continental drainage divide, crossing the highest-scale watershed boundary defined by the US Geological Survey."[31] (Robertson, 2015, p. 9). Although the rules allow for some discretion in the watershed approach, since they do not prescribe the scale of watershed to use in determining whether a compensation site is out-of-watershed, "in this case there is no scale of watershed that encompasses both the impact site and the Aitken and Hinckley sites, as they drain to different oceanic bodies of water." (*Id*., p. 10). "With respect to location, therefore, the PolyMet compensation proposal not only occupies the lowest spot on the hierarchy, but also represents the most extreme case of out-of-watershed compensation." (*Id*., p. 10).

Such an extreme out-of-watershed proposal could only be permitted if it were clearly demonstrated that compensation within any relevant watershed was impracticable using a watershed approach. A watershed approach "means an analytical process for making compensatory mitigation decisions that support the sustainability or improvement of aquatic resources in a watershed." It requires consideration of watershed needs and using a landscape perspective "to identify the types and locations of compensatory mitigation projects that will benefit the watershed and offset losses of aquatic resource functions and services." 33 C.F.R. § 332.2.

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[30] Even the St. Paul District Guidance for Siting Compensatory Mitigation in Northeastern Minnesota, Attachment 7 to Dr. Robertson's opinion, which allows mitigation in the Rainy River Basin (BSA 2) under certain circumstances, does not contemplate including Mississippi River Basin (BSA 6) sites for mitigation of Lake Superior Basin (BSA 1) wetlands impacts.

[31] The term "2-digit HUC code" is rarely used, since it applies to continental drainage to different oceanic bodies, in this case the difference between Lake Superior Basin drainage to the Atlantic Ocean and Mississippi River Basin to the Gulf of Mexico.

Documents obtained from the Army Corps under the FOIA establish the contrary proof. Internal "Comments on Compensatory Mitigation Proposal for PolyMet" dated August 2009 (Robertson, 2015, Attachment 15) indicate that wetlands mitigation for the PolyMet NorthMet project within the St. Louis River watershed is likely to be practicable and that PolyMet's previous failure in establishing the Floodwood site for mitigation (see PolyMet 2013o, p.70) does not preclude other in-kind and in-watershed mitigation:

> "[P]racticable" is the standard used in conjunction with the fundamental goal of compensatory mitigation -- replace lost wetland functions in-place and in-kind to the extent practicable. Potential compensation sites are not limited to those that are least difficult and/or least expensive. Sites that have some greater difficulty and/or cost may be practicable particularly if they are the optimal sites, or the only sites, that would meet the fundamental goal of compensatory mitigation. In the subject case, that goal is to replace approximately 1,488 acres of wetland impacts within the St. Louis River watershed or the larger Great Lakes watershed in Minnesota. Further, the majority of the compensation should consist of coniferous and open bog wetland types to meet the in-kind criterion (e.g., approximately 73% of the wetlands impacted at the Mine Site are composed of these wetland types). (Robertson, 2015, Attachment 15, p. 1)

In a July 9, 2014 email with attached maps, also obtained under the FOIA (Robertson, 2015 Attachment 9), Army Corps staff Steve Eggers identified a number of potential mitigation sites for the PolyMet NorthMet project within not just the Lake Superior Basin, but within the St. Louis River watershed, the same relatively small 8-digit HUC code as the proposed NorthMet project impacts. Eggers' email and maps describe potential compensatory mitigation sites adjacent to the St. Louis River, including hydric soils in agricultural use that could receive potential credit as restoration, privately-owned lands that could be suitable as wetland preservation, and potential upland buffers that would directly benefit the water quality of the St. Louis River, which Eggers notes is an MPCA-listed impaired water.

Among other sites, Eggers identifies "a contiguous 1,600-acre expanse of hydric soils in ag[ricultural] use immediately adjacent to the St. Louis River." He suggests that use of this or other in-watershed sites for compensatory mitigation would be practicable, "Restoration could be straightforward: grade the 'mounds' and fill the swales to recreate the original topography as close as feasible. Then re-plant to native hydrophytes." Eggers notes that the sites mapped and attached with his memorandum are "only a sampling, not a thorough inventory of potential compensatory mitigation sites within the St. Louis River watershed." (Eggers St. Louis River Mitigation Email, July 9, 2014, provided as Robertson, 2015, Attachment 9).

Eggers' email also directly addresses the question of availability of mitigation and its relationship to adequate financial compensation:

> One argument I've heard is that there may not be willing sellers of these privately-owned agricultural lands. If landowners are offered fair market value as hay fields -- perhaps $2000/acre -- they indeed might not be interested in selling. But if they are offered the value of those lands as mitigation sites -- in 2013 bank credits sold for an average of $13,000/credit in one NE Minnesota county -- then I suspect there would be willing sellers. (Id.)

Based on his experience with wetlands mitigation policy and practice, Dr. Robertson notes that even if actual costs in the St. Louis River watershed were higher than out of watershed, this factor could not justify providing out-of-watershed mitigation as a subsidy for the project. (Robertson, 2015, pp. 14-15). He concludes, "PolyMet has not demonstrated that in-watershed wetlands compensation cannot be achieved, let alone that compensation on the Lake Superior Basin side of the continental drainage divide is impracticable." (*Id*., pp. 15-16)

Neither the applicant nor the FEIS have demonstrated that in-watershed compensation on the Lake Superior Basin side of the Continental Divide could not be done. In fact, documents prepared by Army Corps staff from 2009 through 2014, obtained under the FOIA although absent from the FEIS record, suggest that compensatory mitigation in the St. Louis River watershed is practicable and attainable, if perhaps less convenient than out-of-watershed mitigation. The extreme form of out-of-watershed compensatory mitigation proposed, coupled with the lack of any analytic watershed approach used to develop the plan, requires that the application for a Section 404 permit be denied. 33 C.F.R. §332.1(3.)

2. Out-of-kind compensatory mitigation for NorthMet wetlands impacts is prohibited since a watershed approach was not used for mitigation.

Regulations applicable to Section 404 permits specify the type of compensation that is required for a permitted impact, stating "the required mitigation shall be of a similar type to the affected aquatic resource." §332.3(e)(1). The only exception to this requirement, provided in §332.3(e)(2), is where a watershed approach (described at §332.3(c)) has been used to propose compensation. In cases where a watershed approach has been used, the basis for authorizing out-of-kind compensation must be documented in the permit action. There are no other exceptions. Since PolyMet has not used a watershed approach in proposing compensation, no out-of-kind compensation can be used.

The meaning of "in-kind" is provided at §332.3(e)(1) where the level of similarity required is indicated with two examples:

> For example, tidal wetland compensatory mitigation projects are most likely to compensate for unavoidable impacts to tidal wetlands, while perennial stream compensatory mitigation projects are most likely to compensate for unavoidable impacts to perennial streams.

As Dr. Robertson explains in his opinion, "in-kind" does not mean just wetland-for-wetland, or stream-for-stream, but rather replacement within wetland type, where hydrologic similarity is emphasized. (Robertson, 2015, p. 17). In the state of Minnesota, it has been Board of Water and Soil Resources (BWSR) practice to use the U.S. Fish and Wildlife (USFWS) Circular 39 classification (USFWS 1956)[32] to describe wetlands as falling into eight types, designated Types 1-8, which are differentiated by hydrology and vegetation. The wetlands permit application explicitly adopts this Circ 39 classification system (PolyMet 2013o, p. 70), which is then used in the FEIS to describe types of wetlands impacted and proposed for compensation.

The Co-Lead Agencies stated in response to comments that, "to the extent practicable, the same types of wetlands affected are to be replaced in the same watershed, before or concurrent with the actual alteration of the wetland." (FEIS, A-484). However, there is no provision for practicability in the in-kind provision of the 2008 Federal Mitigation Rule. The requirement to use a watershed approach is subject to practicability. However, if a watershed approach is *not* used, 332.3(e) makes it clear that out-of-kind compensation must not occur. Even if the requirement for in-kind mitigation did have a "practicability" qualification, PolyMet has not made such a demonstration. (Robertson, 2015, p. 17).

As explained in more detail in Dr. Robertson's report, 537.6 acres of NorthMet direct wetlands impact are to coniferous bogs (Type 8). Coniferous bogs are considered difficult-to-replace aquatic resources, which are identified for special protection in the Federal Mitigation Rule. For such difficult-to-replace resources, if further avoidance and minimization of impacts is

[32] See e.g. BWSR, Wetlands in Minnesota, http://www.bwsr.state.mn.us/wetlands/wca/Wetlands_in_MN.pdf

not possible, in-kind rehabilitation, enhancement or preservation, should be provided (rather than restoration) "since there is greater certainty that these methods of compensation will successfully offset permitted impacts." 33 C.F.R. §332.3(e)(3).

The Zim Sod site plan is the only proposal that provides for any coniferous bog restoration, promising to provide 439.9 federal wetlands compensation credits if all goes well. (FEIS, 5-389, Table 5.2.3-18). However, the uncertainty in this restoration is shown in PolyMet's Zim Sod Wetland Mitigation site proposal (FEIS ref. PolyMet 2014j). This proposal states in section 3.0,

> Restoration methods will be designed to restore a coniferous bog community; however, developing a bog community is highly dependent on soil and groundwater parameters that are difficult to control. Therefore, a coniferous swamp community will be the contingent community if the soil and groundwater conditions are not adequate for bog regeneration. Where trees do not successfully establish, the target community will be an open bog or sedge meadow.

PolyMet's Zim Sod plan cites many barriers to the restoration of coniferous bog wetlands:

- The restoration of coniferous bogs and swamps are somewhat experimental in nature as few such projects have been successfully completed in Minnesota, making it difficult to determine realistic goals and performance criteria.
- Sphagnum moss is difficult to establish and will be a limiting component for the restoration of a true bog community.
- Restoration of these and other bog dominants is difficult, because the species are difficult to propagate and many are not available commercially.
- In order to restore sphagnum, the moss must be harvested from a donor site by shredding and collecting the upper 4 to 6 inches of sphagnum and applying the materials to the restoration site, which is still an unreliable practice.
- Furthermore, the accumulation of the sphagnum can be slow when applied to a heavily disturbed agricultural site, especially a site in which the soil has been regularly stripped for sod farming. (Zim Sod Plan, PolyMet 2014j, 3.1.1)

Dr. Robertson explains that the Zim Sod contingency plan suggests that most or all of the compensation could actually be Type 7 (coniferous swamp) or Type 2 (sedge meadow). The replacement of coniferous bog with coniferous swamp and shrub-carr is not only out-of-kind, but out-of-kind compensation for a "difficult to replace" (DTR) aquatic resource. He notes both that the Federal Mitigation Rule requires a careful and deliberate approach to compensation of DTR resources and that without the use of a watershed approach, the only allowable response to the failure of coniferous bog restoration is to determine that the compensation has failed. (Robertson, 2015, pp. 17, 21).

In the relatively unlikely case that coniferous bog restoration were successful, the compensation proposal overall would still result in significant losses of Type 8 (coniferous bog) wetlands, which would be replaced with far more Type 6 (shrub carr) and Type 7 (hardwood/coniferous swamp) wetlands than impacted at the NorthMet site. Furthermore, the considerable impacts to Type 4 wetlands (deep marsh) would not be replaced by wetlands of the same type at all, since no Type 4 compensation is proposed form any site. The losses of bog and its replacement with swamp is particularly important in light of the fact that these two wetlands differ primarily in their hydrology – bogs being rainwater-fed or ombrotrophic and nutrient-poor, swamps being groundwater-fed and nutrient-rich. Hydrologic differences are the factor that the Federal Mitigation Rule suggests should guide the distinction between what is in-kind and out-of-kind. (*Id.*, pp. 19-20).

The table below, taken from Dr. Robertson's opinion, reflects this "best case" scenario, which includes a 0% replacement of Type 4 (deep marsh) wetlands impacted at the NorthMet site and a 754.71% overrepresentation of Type 7 (hardwood/coniferous swamp) as well as an 18.17% failure of compensation for Type 8 (coniferous bog) wetlands.

Wetland Type (Circ 39)	**NorthMet Impacts (acres)**	**Compensation Acres**	**Compensation Credits**	**% Compensated Best Case**
Type 2	39.7	51	51	**128.46%**
Type 3	77	39.3	32.5	**42.21%**
Type 4	74.3	0	0	0.00%
Type 5	0	8.3	8.3	NA
Type 6	114.5	262.9	244.6	**213.62%**
Type 7	97.6	740.5	736.6	**754.71%**
Type 8	537.6	499.9	439.9	**81.83%**
Upland	0	197.1	49.3	NA
	940.7	1799	1562.2	

Based on the Rule's recommendation against bog restoration (§332.3(e)(3)) as well as the barriers to restoration identified in the Zim Sod plan, it is likely that if this plan were to be approved it would result in an outcome where *none* of the 537.6 acres of the direct impacts on coniferous bog are compensated for in-kind with wetlands of a similar hydrology. In this likely scenario, hardwood/coniferous swamp would dominate the mitigation, resulting in a 100% failure to compensate for project impacts on coniferous bog wetlands. (Robertson, 2015, p. 20).

Dr. Robertson's opinion describes several ways in which the PolyMet wetlands compensation package fails to meet the requirements of the Federal Mitigation Rule. 33 C.F.R. §332.4(c)(2)-(14);(Robertson, 2015, pp. 22-28). These comments are incorporated by reference.

Perhaps most troubling among these adequacies in the PolyMet plans is the failure to provide the type of adaptive management required in §332.2. The "adaptive management" proposed in the FEIS does not select specific actions that must be taken in the event that wetlands restoration, particularly restoration of coniferous bog wetlands, does not achieve performance success. The FEIS merely provides a plan to make a plan: "If wetlands mitigation did not meet performance standards after three years or the wetland community has not developed as planned after five years, the status of credits and the community would be analyzed to determine if additional mitigation or changes in ratios are required." (FEIS 5-396).

The problem of indefinite management is compounded by the suggestion in the FEIS that the Federal Mitigation Rule requirement for financial assurance (§332.3(n)) may be waived for PolyMet compensatory mitigation, if wetland mitigation is "well enough established." (FEIS, ES-37, 3-140, 5-256, 5-368, 5-369). The better practice under the Rule is to require financial assurance of performance and only phase out that assurance once the compensatory mitigation project has been determined by regulators to be successful in accordance with its performance standards. 33 C.F.R. §332.3(n)(4).

Dr. Robertson summarizes the results of a wetlands mitigation plan that avoided the requisite watershed approach to wetlands compensation, proposed the vast majority of compensation outside the Lake Superior Basin, failed to provide in-kind replacement of wetlands and set up conditions for additional loss of difficult-to-replace aquatic resources. Briefly, "This proposal is impermissible and no agency discretion stretches far enough to allow this result." (Robertson, 2015, p. 22).

III. No Section 404 permit may be granted for the PolyMet NorthMet project because it would have substantial and unacceptable adverse impacts on wetlands.

Section 404 regulations are substantive as well as procedural. They begin with the precept that "dredged or fill material should not be discharged into the aquatic ecosystem, unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact either individually or in combination with known and/or probable impacts of other activities affecting the ecosystems of concern." 40 C.F.R. §230.1(c). In addition, the regulations state,

> From a national perspective, the degradation or destruction of special aquatic sites, such as filling operations in wetlands, is considered to be among the most severe environmental impacts covered by these Guidelines. The guiding principle should be that degradation or destruction of special sites may represent an irreversible loss of valuable aquatic resources. 40 C.F.R. § 230.1(d).

Based on these principles, Section 404 regulations prohibit discharge into wetlands that will "cause or contribute to significant degradation of the waters of the United States." 40 C.F.R. §230.10(c). Effects contributing to significant degradation can include the discharge of pollutants that affect human health, aquatic life, wildlife or loss of aquatic ecosystem diversity, including loss of fish and wildlife habitat. §230.10(c)(1)-(3).

A permit must be rejected as failing to comply with regulatory requirements if the project would result in significant degradation of the aquatic ecosystem. §230.12(a)(3). Factual determinations of compliance or non-compliance must consider secondary and cumulative impacts on the impairment of water resources and of the productivity and water quality of existing aquatic ecosystems. §230.11(g), (h).

Where wetlands are involved, potential impacts that can lead to a determination of non-compliance with the restrictions on discharge include the "possible loss of values" as follows:

> The discharge of dredged or fill material in wetlands is likely to damage or destroy habitat and adversely affect the biological productivity of wetlands ecosystems by smothering, by dewatering, by permanently flooding, or by altering substrate elevation or periodicity of water movement. The addition of dredged or fill material may destroy wetland vegetation or result in advancement of succession to dry land species. It may reduce or eliminate nutrient exchange by a reduction of the system's productivity, or by altering current patterns and velocities. Disruption or elimination of the wetland system can degrade water quality by obstructing circulation patterns that flush large expanses of wetland systems, by interfering with the filtration function of wetlands, or by changing the aquifer recharge capability of a wetland. Discharges can also change the wetland habitat value for fish and wildlife as discussed in subpart D. When disruptions in flow and circulation patterns occur, apparently minor loss of wetland acreage may result in major losses through secondary impacts. 40 C.F.R. §230.41.

The quality and location of wetlands in the Partridge River watershed that would be affected by discharge of pollutants, dewatering, and otherwise altering wetlands hydrology and values as a result of the PolyMet NorthMet project demonstrates that they are aquatic resources of national importance. The direct, secondary and cumulative impacts of the NorthMet project are substantial and unacceptable, particularly in the Partridge River watershed.

A. Wetlands in the Partridge River watershed that would be adversely impacted by the NorthMet project are aquatic resources of national importance.

The EPA made a preliminary determination in its comments on the PolyMet NorthMet draft environmental impact statement (DEIS) that the wetland acres within the Partridge River watershed that would be adversely impacted by the NorthMet project are aquatic resources of national importance (ARNI):

> EPA finds this project may have substantial and unacceptable adverse impacts on aquatic resources of national importance (ARNI). EPA believes the coniferous and open bogs, comprising a large percentage of the approximately 33,880 total wetland acres, within the Partridge River Watershed to be an ARNI due to the values they provide in terms of unique habitat, biodiversity, downstream water quality, and flood control specifically, to the Lake Superior Watershed and the Great Lakes Basin.
> (EPA DEIS Comments, Feb. 18, 2010, Attachment 20 to Robertson, 2015)

Aquatic resources in the Partridge River watershed that would be adversely affected by the NorthMet mine are aquatic resources of national importance. The proposed mine site is located within the 100 Mile Swamp and the Upper Partridge River Site. Indirect project impacts on wetlands on and near the NorthMet mine site would affect the 100 Mile Swamp, the Upper Partridge River Site, and the Partridge River Peatlands, all of which have been identified by the Minnesota County Biological Survey (MCBS) as sites of high biodiversity significance. MDNR's Minnesota Biological Survey determined the high biodiversity significance rank of the Hundred Mile Swamp and Partridge River Peatlands sites based on high quality peatlands, while the rank of the Upper Partridge River site was based on the numerous rare species recorded in the site. (See MCBS Map in WaterLegacy SDEIS Comments, Exhibit 30).

On the proposed NorthMet mine site, there are 1,298 acres of wetlands, covering approximately 43 percent of the mine site. (FEIS, 4-177). The vast majority (92 percent) of these mine site wetlands are high quality, and the remaining wetlands (8 percent) are moderate quality. (FEIS, 4-181). The vegetation types at the mine site are indicative of pre-settlement conditions and lack hydrologic disturbance. (FEIS, Co-Lead Dispositions, autop. 3,114).

On the mine site, 71 percent of the wetlands or approximately 869 acres are coniferous bogs (FEIS, 4-178, Table 4.2.3-2), which are classified under Section 404 regulations as difficult to replace aquatic resources. 33 C.F.R. §332.3(e)(3). Among the wetlands that would be directly destroyed by the NorthMet mine, 67 percent are coniferous bogs and another 9 percent are coniferous swamp wetlands. (FEIS, 5-266, Table 5.2.3-1). Ecological services valuation of the land use types within the St. Louis River watershed found that wooded wetlands, such as those at the PolyMet NorthMet mine site, provided the highest ecological services value of any land type, ranging from $60,187 to $83,048 per acre.[33]

The 100 Mile Swamp and the Upper Partridge River Site are immediately adjacent to the Headwaters Site, and together these important ecological locations form the headwaters of the St. Louis River, the largest United States tributary to Lake Superior. This spatial relationship is shown in Exhibit 35, a map obtained from the MDNR's report, *An Evaluation of the Ecological Significance of the Headwaters Site*.[34] This MDNR report explains the significance of this headwater stream region to national and international waters,

> The Headwaters Site straddles the continental divide, with water from the Site flowing both east through the Great Lakes to the Atlantic Ocean and north to the Arctic Ocean. Paradoxically, the divide runs through a peatland. Although the peatland appears flat, water flows out of it from all sides, forming the ultimate source of rivers that eventually reach two different oceans. The Site is the headwaters of four rivers: Stony River, Dunka River, South Branch Partridge River, and the St. Louis River, which is the second largest tributary to Lake Superior. (*Id.,* p. 1)

Mine site impacts would affect Partridge River headwaters flowing from this unique Site along the Continental Divide. The NorthMet project would shift maintenance of water quality in the Partridge River "from natural systems (i.e., essentially an ecosystem service) to mechanical systems (e.g., the NorthMet Project Proposed Action WWTF and WWTP)." (FEIS, 6-83).

The peatlands and wetlands at and near the mine site provide unique habitat and biodiversity, and have an important function to sequester carbon and sequester mercury, all of which functions would be impacted by the proposed mine site. These functions operate holistically and affect the St. Louis River watershed and Lake Superior water quality, aquatic life and the wildlife and human beings who drink downstream water and consume downstream fish and plants.

Understanding the ecological context of the mine site as well as the ecological services performed by coniferous bogs and other high quality wooded wetlands, it is clear that the Partridge River wetlands that would be adversely affected by the NorthMet project should be considered aquatic resources of national importance.

[33] Earth Economics, The Value of Nature's Benefits in the St. Louis River Watershed, June 2015, p. 63, Exhibit 36.
[34] MDNR, *An Evaluation of the Ecological Significance of the Headwaters Site* (March 2007) http://files.dnr.state.mn.us/eco/mcbs/evaluations/lmf/headwaters/headwaters.pdf

B. Direct, secondary and cumulative impacts of the NorthMet project on wetlands are substantial and unacceptable, particularly in the Partridge River watershed.

Even the direct effects of the PolyMet NorthMet project on wetlands are substantial and unprecedented in Minnesota's modern history. Neither WaterLegacy nor any regulatory staff we've asked have identified any single project approved by the St. Paul District of the Army Corps since the Clean Water Act was enacted with a direct wetland destruction approaching the 913.8 acres that would result from the NorthMet project. Given the fact that this project will immediately destroy 508.3 acres of high-quality difficult-to-replace coniferous bogs (FEIS, 5-266, Table 5.2.3-1) with uncertain likelihood of compensatory mitigation, direct impacts of the NorthMet project, alone, should be deemed unacceptable.

Section 404 regulations require consideration of secondary and cumulative impacts of a proposal as well as direct impacts. The FEIS acknowledges that indirect effects on wetlands would result from wetland fragmentation; alteration of wetland hydrology resulting from changes in watershed area, groundwater drawdown, seepage containment at the tailings facility and changes in stream flow at the mine and plant site; and water quality changes related to deposition of dust, ore spillage and leakage and seepage and leakage from mine pits, waste rock storage and other mine features. (FEIS, 5-319, 5-347).

The FEIS acknowledges that the proposed sulfide mine project could indirectly affect up to 7,694.2 acres of wetlands located within and around project sites (FEIS, 5-251), a total of 8,608 acres combining direct and indirect project wetlands. When compared with *existing* wetlands, the potential impacts of the PolyMet NorthMet project on wetlands in the Partridge and Embarrass River watersheds could affect up to 13 percent of the 65,567 remaining acres of wetlands in the two watersheds combined. (FEIS, 6-57, Table 6.2.3-3).

EPA comments on the PolyMet NorthMet SDEIS in March 2014 recommended, "The FEIS should include indirect impacts in the analysis of cumulative impacts to wetlands." (EPA Comment on the SDEIS, 2014, Exhibit 1).

FEIS' tables only describe the cumulative losses to wetlands resulting from *direct* destruction of wetlands by the NorthMet project. (See FEIS, 6-58, Table 6.2.3-4). For indirect effects, the FEIS says that, "based on the amount of potential indirect wetland effects that could occur from the NorthMet Proposed Action, there could be 0.1 to 12.0 percent cumulatively lost, in addition to the direct wetland impacts assessed, within the Partridge and Embarrass River watersheds." (FEIS, 6-60). Read quickly, the FEIS seems to suggest that the upper bound of cumulative impacts on wetlands from the NorthMet project would be 12.0 percent. This is not the case.

If both the Partridge and Embarrass River watersheds are aggregated and indirect impacts are considered, the upper bound of cumulative impacts on wetlands is *17 percent*. This is calculated by dividing 11,693 acres of cumulative losses (3,085 acres under the no action alternative and 8,608 acres of loss from the NorthMet project) by the 68,251 pre-settlement wetland acres of both watersheds combined. (See FEIS, 6-56, Table 6.2.3-2; 6-59, Table 6.2.3-5 for pre-settlement and no action alternative wetlands acreage).

However, since most of the losses resulting from both NorthMet project and cumulative impacts are in the Partridge River watershed, this calculation understates the impacts to high quality wetlands in the Partridge River watershed. The FEIS has provided the very lowest bound of Partridge River watershed cumulative impacts on wetlands since pre-settlement days. If the NorthMet project resulted in *no indirect impacts at all* on mine site wetlands, that cumulative impact would be 10 percent. (FEIS, 6-58).

The FEIS does not segregate indirect impacts in the Partridge River watershed from those in the Embarrass River to allow a calculation of the upper bound of the cumulative effects of the NorthMet project on high quality wetlands on and near the mine site. However as explained previously in Section IIB, GLIWFC has provided a reasonable estimate of NorthMet mine dewatering impacts on wetlands which can be used to calculate secondary and cumulative impacts on wetlands in the Partridge River watershed.[35]

Combining GLIFWC's wetland drawdown estimate (5,720 acres), direct wetlands impacts on the Partridge River watershed (768 acres)[36] and losses to the Partridge River watershed under the no action alternative (2,557) and dividing by the pre-settlement acreage of wetlands in the Partridge River (33,601 acres) provides the likely upper bound of cumulative wetlands loss in the Partridge River watershed based on evidence in this record. Under the NorthMet action, cumulative direct and secondary wetland loss and degradation in the Partridge River watershed since pre-settlement days could reach *26.9 percent*.

Adverse effects of NorthMet cumulative effects on coniferous bogs, wooded wetlands

[35] WaterLegacy's calculation assumes that other indirect impacts at the mine site would also occur within the acreage where drawdown impacts were modeled by GLIFWC, so it may slightly understate impacts.
[36] This direct effects number is used in FEIS, 6-58, Table 6.2.3-4 and 6-59 Table 6.2.3-5; it appears to include 10 acres of direct wetlands impacts in the transportation and utility corridor (see FEIS, 5-266, Table 5.2.3-1).

and headwaters streams that are aquatic resources of national importance within the Partridge River watershed are substantial and unacceptable

IV. No Section 404 permit may be granted because mercury and methylmercury from the PolyMet NorthMet project would degrade downstream waters and violate water quality standards.

Clean Water Act Section 404 permit regulations prohibit discharge of dredge and fill material into waters of the United States if the action will cause or contribute to violations of any applicable State water quality standard. 40 C.F.R. §230.10(b)(1). Such activities are also prohibited if they will cause or contribute to significant degradation of the waters of the United States. Effects contributing to significant degradation "considered individually or collectively," include significant "adverse effects of the discharge of pollutants on human health or welfare, including but not limited to effects on municipal water supplies, plankton, fish, shellfish, wildlife, and special aquatic sites," (§230.10(c)(1)) and "adverse effects of the discharge of pollutants on life stages of aquatic life and other wildlife dependent on aquatic ecosystems, including the transfer, concentration, and spread of pollutants or their byproducts outside of the disposal site through biological, physical, and chemical processes." §230.10(c)(2).

Both Minnesota water quality standards and downstream water quality standards of the Fond du Lac Band, adopted pursuant to Section 518 of the Clean Water Act, 33 U.S.C. §1377, contain numeric water quality standards limiting the concentration of mercury in the water column. Minnesota's water column mercury limit in Lake Superior Basin waters, pursuant to the federal Great Lakes Initiative, is 1.3 nanograms per liter (ng/L). Minn. R.7052.0100, subp. 2. The Fond du Lac Band has set a mercury water column standard of 0.77 nanograms to protect Tribe members who have a higher daily human consumption of fish (0.060 kilograms per day) than that assumed in the Great Lakes Initiative methodology used to develop of water quality standards. Fond du Lac Water Quality Standards, Ord. #12/98 as amended, Sect. 301e.1; Appx. 1, Standards Specific to Designated Use.

Both Minnesota water quality standards and the downstream water quality standards of the Fond du Lac Band also include narrative standards to prevent degradation of water quality as a result of new sources of pollution. Minnesota nondegradation standards apply to new or expanded point and non-point sources of bioaccumulative chemicals of concern in the Lake

Superior Basin. Minn. R. 7052.0300, 7052.0185. Mercury is both a bioaccumulative chemical of concern and a bioaccumulative substance of immediate concern. Minn. R. 7052.0010, Subp. 4, Subp. 5.

In addition to setting a numeric limit for water column mercury, Fond du Lac water quality standards require that "Reservation waters shall be free from substances entering the waters as a result of human activity in concentrations that are toxic." Fond du Lac water quality standards also prohibit "further water quality degradation which would interfere with or become injurious to existing or designated uses." Fond du Lac Water Quality Standards, Ord. #12/98 as amended, Sect. 105a.1; Sect 301e.

In addition to prohibiting significant degradation or the violation of applicable water quality standards, Section 404 regulations specify the findings needed to determine compliance or non-compliance with regulatory Guidelines. Pertinent to the discussion of mercury and methylmercury, permits must be specified as failing to comply with Section 404 requirements, either if the proposed discharge "will result in significant degradation of the aquatic ecosystem under §230.10(b) or (c)" or if there "does not exist sufficient information to make a reasonable judgment as to whether the proposed discharge will comply with these Guidelines." 40 C.F.R §230.12(a)(3)(ii), (iv).

Methylmercury is the form of mercury that bioaccumulates in the food chain, including edible fish tissue. Minnesota has a standard for mercury that bioaccumulates in edible fish tissue, applicable across the range of waters used for fishing and drinking water, of 0.2 micrograms per kilogram (μg/kg). Minn. R. 7050.0220, subp. 3a, 4a, 5a. This standard is based on the EPA's methylmercury criterion for fish tissue to protect human health and the particular pattern of fish consumption in Minnesota. Because of the higher fish consumption rate in the state, Minnesota has a lower fish tissue mercury criterion than the EPA's rate of 0.3 mg/kg.[37] Findings that Minnesota water bodies are impaired due to mercury in fish tissue are based on application of the 0.2 μg/kg health-based standard.

[37] MPCA, Minnesota Statewide Mercury Total Maximum Daily Load (TMDL), approved by U.S. EPA March 27 2007, p. 5, available at http://www.pca.state.mn.us/index.php/view-document.html?gid=8507

A. Increased methylmercury resulting from the NorthMet project would cause or contribute to significant degradation of downstream waters, including the Partridge, Embarrass and St. Louis Rivers.

International mercury, methylmercury and wetlands expert, Brian Branfireun, has provided the only analysis in this record of the potential for increased methylmercury production and transport as a result of the PolyMet NorthMet project. Dr. Branfireun concluded:

> Based on the relatively high concentrations of methylmercury, and more importantly the high percentage of total mercury that is methylmercury in mine tributary streams and in the Partridge and Embarrass Rivers as well as the scientifically accepted mechanisms of methylmercury production and transport, it is clear that the watersheds impacted by the proposed development contain significant sites of methylmercury production, and therefore are sensitive to changes presented above that would result in enhanced methylmercury production.
>
> It is my opinion that the NorthMet development could create a substantial risk of ecologically significant increases in water column and fish methylmercury concentrations in downstream waters, including the St. Louis River. (Branfireun, 2015, p. 27)

In his detailed opinion, Dr. Branfireun explained the site-specific data and peer-reviewed literature that have led him to that conclusion. First, he explained, the methylmercury data collected since the SDEIS demonstrates that the ratio of methylmercury to mercury in the Partridge and Embarrass Rivers surface water sampling sites and in Longnose, proposed West Pit Outlet and Wetlegs Creeks are all indicative of a highly methylating environment. This data shows the fraction of methylmercury in the Partridge River as 2.2% at SW-001, increasing to 14.6% at SW-004a and remaining at about 10% at the next two stations. For the two surface water sampling sites on the Embarrass River, mean percentages of methylmercury are 10.4% and 8.8%. Although Wyman Creek, which is impacted by mining has the highest percentage of methylmercury (12.5% at PM-5), the relatively unimpacted mine site creeks also have high methylmercury ratios of 6.0% at Longnose Creek, 5.5% at proposed West Pit Outlet Creek and 9.6% at Wetlegs Creek. (*Id.*, pp. 3-4).

This finding is significant, Dr. Branfireun explained, because it highlights the role of ombrotrophic bogs in the production of methylmercury and the fact that, "Even relatively small changes in water table position and wetting and drying frequency in the ombrotrophic wetlands at the NorthMet mine site have the potential to impact sulfate and methylmercury concentrations of receiving waters." (*Id.,* p. 19) He stated that the indirect effects of changes in hydrology on vegetation community which the FEIS proposes to monitor is "perhaps the least significant consideration in terms of water quality impacts and cumulative effects on aquatic and human health in receiving waters of small tributaries, the Partridge and Embarrass Rivers, and the St. Louis River." (*Id*.). Of greater importance, "considering the potential for mercury methylation, bog wetlands around the proposed mine site must be considered to have a *very high likelihood of indirect impacts* from the proposed NorthMet development." (*Id.*, emphasis added).

Dr. Branfireun also emphasized, "The high percentage of methylmercury in these surface waters speaks to sensitivity of their watersheds to both a) hydrological impact from a change in either surface or subsurface hydrology, and b) deposition of any additional sulfate either from surface water flows, or wet/dry atmospheric deposition." (*Id*., p. 4) The data also shows that "surface waters in the small tributaries at the proposed mine site, the Partridge, and the Embarrass Rivers are all strongly influenced by the presence of wetlands in their watersheds." In fact, Dr. Branfireun stated that he is not professionally aware of any other surface waters where the fractions of methylmercury as a percentage of total mercury are as high as the waters reported in the FEIS. (*Id*., pp. 15-16).

Thus, the data confirms that both the proposed NorthMet mine site and tailings site are highly methylating environments and that the methylation that takes place in wetlands in these watersheds is exported to surface waters. Mine site ombrotrophic bogs are not wetlands with a "low likelihood" of impacts from mine dewatering where the critical function of water quality is concerned. They must be considered wetlands with a "very high likelihood" of indirect effects on mercury methylation, whether or not there is a detectable change in plant communities. Finally, based on the sensitivity of the surrounding aquatic ecosystem to impacts of sulfate and hydrologic impacts, the NorthMet mine site and tailings site locations seem particularly ill-suited for a copper-nickel sulfide mine and tailings storage facility.

Dr. Branfireun reviewed recent peer-reviewed literature that found in wetlands exposed to sulfate loading, "prolonged water table drawdowns lead to greater sulfate release in all treatments." As a result of the natural drought in experimental wetlands, the drawdown increased methylmercury desorption and flux from peatlands, drove sulfate-reducing-bacteria activity that increased mercury methylation, and made sulfate "available for export to downstream aquatic systems (e.g. lakes and other wetlands) that could be equally susceptible to *in situ* net methylations." (*Id*., p. 20, quoting Coleman-Wasik *et al*. 2015).

Based on his field experience and this recent peer-reviewed study, Dr. Branfireun concluded for the NorthMet site that "a significant proportion of bog wetlands that are within the zone of drawdown from the proposed mine proposed development will also exhibit sulfate regeneration and increased export of methylmercury, under natural rewetting cycles as well as storm events." (*Id.*, p. 20). Hydrologic changes at both the mine site and tailings site would increase mercury and methylmercury and release sulfate to downstream waters:

> [D]evelopment-induced change in hydrology, such as those proposed at both the NorthMet mine site and tailings basin, could amplify those drought-rewetting cycles (in terms of magnitude, frequency, or both). These implications should not be understated. Independent of any additional releases of uncaptured sulfate or mercury from the proposed NorthMet development, dewatering of wetlands surrounding the tailings basin through seepage collection and even modest impacts on water table position by underdrainage of mine site peatlands through open pit dewatering could increase total mercury, methylmercury and sulfate in the Partridge, Embarrass, and ultimately the St. Louis River. (*Id.*, pp. 21-22).

In addition to mine site and tailings site dewatering, Dr. Branfireun raised concerns about the proposed storage of peat overburden in the NorthMet unlined laydown area for 11 years. He stated that this storage would "result in repeated flushes of methylmercury as well as inorganic mercury." Dr. Branfireun noted that the FEIS suggests that the impact of stored mercury on loading of inorganic mercury has been considered as part of its mercury mass balance (FEIS 5-227), but provides no data from which he could determine if the FEIS assumptions were reasonable. In addition, Dr. Branfireun noted that the FEIS does not consider the effect of the peat overburden storage on methylmercury formation and export. Based on the Coleman-Wasik (2015) research, Dr. Branfireun cautioned, "The continuous process of drying and rewetting of overburden peat stockpiled in laydown areas may not only continue to release inorganic mercury, but may also continuously regenerate sulfate, and in anaerobic locations, promote methylmercury formation." (*Id.*, p. 21).

Dr. Branfireun also explained that there is clear evidence, most of which is from Minnesota, that the addition of sulfate either from high-sulfate water or from direct atmospheric deposition to bogs increases mercury methylation in wetlands. He referenced the insufficiently substantiated assumptions in the FEIS regarding seepage collection and found the FEIS "insufficient to discount the potential for seepage of sulfates and associated impacts to wetlands in the vicinity of both the project mine site and tailings basin." (*Id.*, p. 24)Dr. Branfireun also noted that, "Such seepage would enhance methylmercury production in the project area and could also contribute directly to water quality impairments in sulfate-poor sediments downstream of the project site." (*Id*.).

Dr. Branfireun also explained that even if sulfate concentrations in discharge did not exceed the 10 milligrams per liter (mg/L) level that protects wild rice, increased sulfate can increase mercury methylation when added to sulfate-poor waters. He noted, "the small tributaries that are more proximal to the proposed NorthMet mine site location clearly demonstrate sulfate-limited conditions. The mean sulfate concentrations in Longnose Creek, West Pit Outlet Creek and Wetlegs Creek are 0.91, 2.6 and 3.9 mg/L respectively." (*Id*., p. 11)

Although Dr. Branfireun did not have sufficiently reliable data to quantify NorthMet effects on mercury methylation from sulfate seepage, he performed a quantitative analysis based on the atmospheric loading of sulfate as a result of dry deposition of dust at the mine site. (*Id.*, pp. 22-23). He explained that the Barr documents underlying the FEIS use an invalid assumption that bog wetlands will contain a foot of standing water, and that sulfate deposition should be calculated as a true load to the surface. Using PolyMet's numbers for sulfate background deposition (after validating them with a comparison to peer-reviewed literature) and expressing both the background and NorthMet sulfate deposition numbers in the same units, Dr. Branfireun calculated that the sulfate load from dust deposition from the proposed mine site would be 12.6 kilograms per hectare per acre (kg/ha/yr) as compared to the background rate of 4.58 kg/ha/yr. Sulfate load would, thus be 3.76 times or 376% of the background deposition rate.

Comparing this additional loading with several peer-reviewed studies measuring methylmercury export after adding sulfate to experimental wetlands, and using the conservative assumption in the FEIS that all sulfur in dust is converted to sulfate, Dr. Branfireun calculated that methylmercury export from sensitive mine-site peatlands may be *increased up to 1.88 times as a result of sulfate air deposition alone*. Given the magnitude of this potential impact, he explained, even if less than the total sulfate deposited is liberated to the environment, "there will still be a substantial stimulatory effect on peatland methylmercury production." (*Id*., p. 23).

The results of the increased production and export of methylmercury would affect downstream water quality:

> The potential near-doubling of methylmercury export from methylating peatlands receiving an additional sulfate load from the proposed PolyMet development would be

> reflected in methylmercury concentrations in the upper tributaries, and the Embarrass and Partridge Rivers, given the role these wetlands play in supplying water to these streams and rivers. Increased methylmercury would also be expected to impact the upper St Louis River, given the direct hydrological connection and known methods of methylmercury transport. (*Id*., p. 23)

Based on the finding in the Coleman-Wasik *et al*. study that portions of the experimental wetland recovering from high sulfate loading had methylmercury levels intermediate between those of unimpacted and current experimental treatments, Dr. Branfireun opined that sulfate loading impacts would continue even after deposition stops. "It can be expected that effects of elevated sulfate deposition on peatlands will persist to some degree even after additional sulfate loading has ceased." (*Id.*)

Explicitly challenging the assumption that impacts of the NorthMet project on mercury and methylmercury would not affect the St. Louis River, Dr. Branfireun detailed the process by which methylmercury is exported to surface waters and transported downstream. (*Id*., pp. 26-27). Methylmercury from wetlands near the NorthMet site would be exported to tributaries of the Partridge and Embarrass Rivers by baseflow in a continuous supply to streams and by flow during snowmelt and rainstorms. Much of the methylmercury derived from wetlands would be bound to dissolved organic matter derived from the decomposition of wetland soils, so the methylmercury would remain stable, even under oxygenated stream conditions and would have lower demethylation rates from light.

Methylmercury would be transported in the Partridge and Embarrass Rivers dissolved in water, sorbed to particles, bound to plant matter and algae, and bioaccumulated into aquatic organisms including fish. Methylmercury dissolved in water and in suspended inorganic and organic particles, as well as biological media, would flow into the St. Louis River as well as continuing to cycle through sorption and the aquatic food chain. Although there are numerous lakes, reservoirs and other sources and sinks for methylmercury in the 12-15 miles from NorthMet site features to the St. Louis River, Dr. Branfireun explained that there is no physical or chemical basis to discount contributions of methylmercury from tributaries of the Partridge and Embarrass Rivers to the St. Louis River. In addition, there are no barriers to fish movement, so entry of methylmercury into higher organisms and fish could occur upstream in the Partridge and Embarrass Rivers and the fish could migrate downstream to the St. Louis River.

In closing, as quoted at the beginning of this section, Dr. Branfireun not only concluded that the NorthMet development "could create a substantial risk of ecologically significant increases in water column and fish tissue methylmercury concentrations," but that this impact could not be addressed by adaptive management:

> Finally, even if appropriate monitoring for biogeochemical changes in wetlands and sediments near the development were to be designed and implemented (a difficult and complex undertaking requiring collection of baseline data not supplied in the FEIS), it is highly likely that lag times for expression of methylmercury increases, multiple mechanisms of transport, and the likelihood of legacy regeneration of sulfate stored in the watershed would preclude effective adaptive management prior to irreversible impairment of downstream waters. (*Id*., p. 27)

The FEIS recognized that increased methylmercury downstream of the NorthMet site could harm fish, inhibiting reproduction, (FEIS, 5-467) although it failed to discuss the human health risks of consuming fish contaminated with methylmercury. Margaret Saracino, a child and adolescent psychiatrist in Duluth, has summarized the effects of consumption of fish contaminated with methylmercury:

> In terms of methylmercury, exposure is largely due to ingestion of fish with high mercury content. Methylmercury builds in the food chain. 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. (Saracino, 2015, p. 2).

Adverse effects from methylmercury in fish could disproportionately impact members of the Fond du Lac and Grand Portage Bands who are known to consume substantially more fish than the assumed statewide average. (FEIS, 5-591 to 5-592). Cumulative adverse effects of increasing methylmercury export, transport and bioaccumulation would also affect waters where mercury in fish already exceeds regulatory limits and levels safe for human consumption.

The Embarrass River chain of lakes downstream of the proposed NorthMet tailings site - Sabin, Wynne, and Embarrass Lakes -- are impaired due to excessive mercury in fish tissue. Colby Lake, into which the Partridge River flows downstream of the proposed mine site, is also impaired due to excessive mercury in fish tissue. (FEIS, 4-29, Table 4.2.2-2). Based on the sampling done for the NorthMet project, the Partridge River and Embarrass River may also be impaired for aquatic consumption due to excessive mercury. Mean concentrations of mercury at surface water sites in the Partridge River (2.3 to 5.4 ng/L) and mean concentrations in the Embarrass River (4.3 to 5.1 ng/L) are two to four times higher than Minnesota's water column standard of 1.3 ng/L. (FEIS, 4-41, Table 4.2.2-4).

Most of the St. Louis River downstream of the proposed NorthMet sulfide mine project is impaired for the designated use for aquatic consumption as a result of excessive mercury in fish tissue. (FEIS, 4-285). Exhibit 28 to WaterLegacy's comments identifies segments of the St. Louis River that are on Minnesota's Section 303(d) impaired waters list due to excessive mercury in the water column or mercury in fish tissue.

Increased production and export of methylmercury as a result of the PolyMet NorthMet project would cause or contribute to a significant degradation of downstream waters, including the Partridge and Embarrass Rivers and lakes along these rivers downstream of the NorthMet project that already exceed fish tissue limits. Despite the artificial line drawn in the FEIS to limit analysis of cumulative impacts, methylmercury increases would be transported downstream to and along the St. Louis River, including fisheries, the Fond du Lac Reservation waters and the estuary at the base of the river where fish for both the St. Louis River and Lake Superior are spawned.

B. A determination could not be sustained that mercury and methylmercury increases resulting from the NorthMet project would comply with Section 404 rules prohibiting water quality degradation or violations.

1. FEIS denial of mercury and methylmercury impacts is based on scientifically unsupportable analysis

The FEIS uses several constructs to deny the adverse effects of mercury and methylmercury on downstream waters. First, the FEIS adopts a mechanistic model that it characterizes as a "mass balance" model to claim that any increases of mercury in the Embarrass River from mercury loading would be offset by corresponding decreases in mercury loading in the Partridge River. Next, the FEIS misrepresents the well-accepted peer-reviewed science in an effort to deny the potential for increased methylmercury production and transport. Finally, the FEIS omits, distorts and in some cases misrepresents information needed to evaluate the effects of the PolyMet NorthMet proposed action.

Dr. Branfireun reviewed new data on background mercury and methylmercury used for the FEIS (Barr 2014d) and found numerous errors and internal inconsistencies in the data demonstrating a lack of quality assurance, what appeared to be arbitrary changes in non-detect levels in the process of making calculations, and a practice he criticized of substituting values for non-detect findings. He concluded that the manner in which mercury summary data is calculated, interpreted and subsequently presented remained incorrect. (Branfireun, 2015, pp. 2-6, 8-9).

Dr. Branfireun then focused on the explanatory power in the data set and the EPA's request that an uncertainty range be established for estimated concentrations of solutes. He expressed concern that no uncertainty analysis at all was done for the data on mercury and methylmercury, apparently because "only solutes included in the water modeling" were assessed. (*Id*., p. 7, citing Barr 2012p).

The uncertainty analyses done by PolyMet's consultants for geogenic elements, which are likely to be less variable than reactive elements such as mercury and methylmercury, did not provide a basis for confidence in FEIS data. On reviewing underlying Barr documents, Dr. Branfireun found that for many elements reported in the FEIS, even those with total sample numbers in excess of 150, the standard deviations (variations) were greater than the means, and in some cases much more variable than plus or minus 100% of the mean reported. The FEIS reported mean concentrations without bracketing a margin of error even where variability was 100% or even 150% of mean levels for solutes of ecological concern, such as arsenic, chromium, copper, nickel and cobalt. (*Id*., pp. 7-8).

Dr. Branfireun opined that an estimate of potential environmental effects that "fails to identify statistical uncertainty and the margin of error in the data" would not be considered "acceptable when assessing the potential for downstream water quality impairments that could impact aquatic life and human activities." (*Id*., p. 9). "If an analysis of the margin of error in projections of sulfate and mercury releases had been performed," he emphasized, "it is my opinion that that the FEIS statements of certainty based on grams of sulfate or mercury released could not be supported." The "uncertainty that would bracket the model output" alone would preclude conclusions from this asserted mass balance that the proposed development will not have appreciable impacts on water quality. (*Id*., p.14).

Dr. Branfireun summarized the "cumulative errors embedded within the estimates that cast serious doubt on the extremely small gains or losses used in the FEIS to claim that the NorthMet impact would have no net impact on downstream loading of inorganic mercury." The underlying mercury concentration data is "fraught with errors, fails to apply an uncertainty analysis to mercury or methylmercury, and fails to report chemical data in a consistent and scientifically standard way." He criticized the FEIS for continuing to rely on a mass balance model that "even if its underlying discharge assumptions were reasonable (which they do not seem to be) in the absence of a modeled cumulative error, presents us with mass loadings of sulfate, mercury and methylmercury to the Partridge and Embarrass Rivers that are unusable." (*Id*., p. 24).

Dr. Branfireun also rejected the mechanistic mass balance model that PolyMet and the FEIS use as the principal tool to deny mercury increases in waters downstream of the proposed project. Although Dr. Branfireun had stated in his review of the SDEIS that models were available to model mercury dynamics (Branfireun, 2014, p. 11), mercury was not included in the GoldSim modeling for the NorthMet mine site or the plant site (FEIS, 5-223, 5-228) and no other model was applied. Dr. Branfireun emphasized that "a mass balance model *cannot* by definition incorporate mechanistically the input and removal processes for mercury, and *cannot* address the biogeochemical aspects of mercury methylation across the landscape which are at the root of the potential impacts associated with the PolyMet proposal." He criticized the FEIS' continuing reliance on this "cheaper and easier" method that "can be presented as definitive to a non-expert" when much more defensible approaches exist, including models for stream-watershed mercury dynamics. (*Id*., p. 13).

Dr. Branfireun also challenged, one by one, the statements used in the FEIS to deny the relationship between the PolyMet NorthMet project and increased methylation and bioaccumulation of mercury in downstream aquatic systems. He disagreed with the implication in the FEIS (FEIS, 5-231-232) that there is no established relationship between methylmercury and sulfate, explaining that the lack of direct correlation is the result of sulfate consumption in the reduction reaction that produces methylmercury. (*Id*., p. 10). He criticized the inconsistency between the FEIS' argument "that there is insufficient scientific knowledge to develop a mechanistic model to evaluate the risk to surface waters from enhanced methylation in the impacted watersheds," and the FEIS' comfort in "speculating about the future geochemical environment in a flooded pit 55 years from now in order to dismiss the potential for enhanced methylation." (*Id*., p.12). On the latter point, Dr. Branfireun also referenced peer-reviewed literature finding that stratification in a flooded pit was likely to support methylmercury production in anaerobic bottom sediments. (*Id*.).

Dr. Branfireun rejected the FEIS' assumption of proportionality between atmospheric deposition of mercury and mercury in fish tissue as "an archaic approach to this problem" that "does not reflect current scientific thought or the best available tools." He cited research in Minnesota's Voyageur's National Park published in 2014 demonstrating that fish tissue mercury will vary under the same atmospheric deposition, based on hydrology and other characteristics of that specific water body. (*Id*. pp. 14-15). He criticized the FEIS' misrepresentation of the potential for ombrotrophic bogs to be adversely effected by under-drainage from mine dewatering and noted that the monitoring proposed in the FEIS would both avoid bogs and be ineffectual to detect or evaluate methylation effects on wetlands. (*Id*., pp. 16-19). Dr. Branfireun underscored the inadequacy of the FEIS to support a finding of a lack of water quality impairment resulting from mercury and methylmercury.

> There are no modifications to the FEIS from the SDEIS that change my opinion that the likelihood of downstream water quality impairments from mercury and methylmercury as a result of the proposed NorthMet development is not scientifically or rigorously evaluated in the EIS . . . In conclusion, I reject as unsupported and without scientific justification, any statement or implication in the FEIS that the proposed NorthMet development would not increase risks of methylmercury production and transport in the Partridge and Embarrass River watersheds, particularly in ombrotrophic wetlands near the mine site and wetlands affecting by tailings site seepage collection, changes to hydrology or atmospheric deposition. (Branfireun, 2015, pp. 25, 27)

WaterLegacy's comments on the FEIS identify numerous omissions, inconsistencies and misrepresentations that preclude the use of the FEIS to support findings that a Section 404 permit would comply with applicable Guidelines prohibiting actions that degrade the aquatic ecosystem or result in violations of water quality standards. Significant concerns are summarized below.

2. The FEIS provided inadequate and misleading information regarding mercury loading.

First, although the FEIS asserts that it is performing a mercury mass loading analysis, it fails to disclose mass balance information needed to verify the accuracy of its model, omits salient information that would contradict its calculations, and misrepresents important information about mercury seepage, sequestration and treatment.

The FEIS asserts with incomprehensible precision that mercury loading in the Partridge River would decrease from 24.2 to 23 grams per year as a result of the PolyMet NorthMet mine project, more offsetting the 0.2 gram increase (from 22.3 to 22.5 grams per year) in mercury loading to the Embarrass River. (FEIS, ES-36, 5-462).

However, the FEIS failed to provide basic data regarding mercury loading. The FEIS does not disclose its assumptions as to the mass or concentration of mercury in potential project sources of contamination, including peat, overburden, ore, waste rock, process water, tailings, reject concentrate, filtered sludge, hydrometallurgical residue or coal ash, or any other potential sources of mercury release from the project. Responses to comments state that estimates for major mercury sources was based on studies done for PolyMet in 2004 and 2005 (FEIS, A-414), but these studies are not included in the FEIS reference documents and neither their methodologies nor numeric values are disclosed. Thus, the FEIS does not permit any verification that mercury projections prepared by PolyMet and adopted by the FEIS (FEIS, 5-226, Table 5.2.2-49, PolyMet 2015m) are consistent with good scientific practice and local geology.

Despite the minute scale of differences in mercury loading claimed in the FEIS, the FEIS failed to analyze mercury air deposition, much of which would be locally deposited, as a potential source of mass loading to either the Partridge or Embarrass River. The FEIS states, "Mercury air emissions and subsequent mercury deposition were not assessed for the Mine Site because potential emissions are less than 1.0 lb/yr." (FEIS, p. 5-462). Although 1.0 pound per year may not be significant for Minnesota's statewide mercury TMDL, it is equivalent to 453.6 grams per year. This is an astronomical number when compared to the FEIS' mercury loading calculations. If far less than one percent of NorthMet mine site mercury deposition found its way into the Partridge River, the net effect of the NorthMet project, with no other revisions or corrections, would increase mercury loading to the St. Louis River.

Similarly, the FEIS failed to quantify mass loading to the Embarrass River from the 4.6 pounds of mercury that will be emitted each year from the plant site. The underlying reference for the FEIS analysis states that under the more conservative assumption that only 25% of mercury from the plant is elemental, up to 3.68 pounds or 1,669.2 grams of NorthMet plant site mercury emissions may be deposited locally each year, within a 10-kilometer radius of the plant site. (PolyMet 2015e, Appendix C to Attachment U, p. 2, autop. 1091). Yet, as with the mine site mercury deposition, the FEIS does not evaluate the effects if even a small portion of the potentially 1,669.2 grams of mercury locally deposited were included in the mercury loading to the Embarrass River.

The FEIS also mischaracterized applicable data to claim that mercury in tailings would be adsorbed. (FEIS, 5-229). The FEIS omits key data from the NTS bench study in reporting that the 2006 NTS bench study reduced mercury concentrations by 73 percent (from 3.3 ng/L to 0.9 ng/L) after 480 minutes. The FEIS fails to disclose either that the plain water in a *control* flask reduced mercury concentrations by 22 percent in that timeframe or that the trend in the experiment, when it was discontinued after eight hours, was that the mercury was *desorbing* from the tailings and may have doubled since the fourth hour of the experiment when mercury was beneath the detection limit of 0.5 ng/L. (FEIS ref. Barr 2007d, autop. 157, 160).

The assertion that adsorption of mercury by the existing LTVSMC tailings has been demonstrated (FEIS, 5-229) is inconsistent with the data and assertions in Section 4.0 of the FEIS itself. The FEIS explains that comparison of the existing Cell 2E pond water quality with water quality at the toe of the Tailings Basin reveals the effect that passage through the existing LTVSMC tailings has on seepage water quality. Some parameters decrease in passage through the tailings and others increase as they seep from the tailings pond to the toe of the Tailings Basin. (FEIS, 4-127).

The FEIS narrative does not state how seepage through LTVSMC tailings affects mercury concentrations, but the data are clear. Mercury in the existing Cell 2E pond has a mean concentration of 1.4 ng/L. Mercury in the toe of the existing tailings facility has a mean concentration of 4.9 ng/L. (FEIS, 4-126, Table 4.2.2-23). Using simple arithmetic, the FEIS has shown that in passing through the existing LTVSMC tailings mean mercury *more than triples*.

If bench study data and field experience at the LTVSMC tailings facility were presented in a fair and rigorous way, assertions in the FEIS that mercury concentrations in untreated tailings basin seepage will be 1.1 ng/L (FEIS, 5-230, Table 5.2.2-51) could not be supported. Given that more than two trillion gallons a year of tailings seepage are predicted for the NorthMet project,[38] plant site mercury impacts on water quality could significantly affect mercury loading.

The FEIS also understates potential impacts from mercury in the West Pit in assuming a 92 percent "burial" rate for the total mercury load in the West Pit. (FEIS, 5-226, Table 5.2.2-49). The cited literature estimates actual mercury sedimentation rates at 80 to 90%. (FEIS ref. PolyMet 2015m, p. 325). More important, sedimentation does not render mercury permanently unavailable. The FEIS fails to discuss the well-established processes by which mercury concentrated in lake sediments can cycle in and out of suspension, can become methylated and can bioaccumulate, affecting fish and wildlife.[39]

3. The FEIS provided inadequate and misleading information regarding sulfate loading.

As discussed in more detail in WaterLegacy's comments on the FEIS and in Section I *supra*, FEIS claims regarding sulfate loading to proximate wetlands and streams are based on unsubstantiated assumptions regarding collection of seepage at the tailings waste storage facility and the Category 1 waste rock pile as well as uncertain and unreliable hydrologic modeling at the mine site. In addition, the FEIS' claims that the NorthMet project will reduce sulfate loading to the Embarrass River are based on an inappropriate "continuation of existing conditions" baseline that neither includes natural attenuation of contaminants nor legally-required improvements resulting from the Cliffs Erie Consent decree and compliance with Minnesota water quality standards. (FEIS, ES-49, 5-94).

As discussed in Section II, *supra*, the FEIS provided no data regarding sulfate loading to wetlands from mine site leakage or seepage, since PolyMet's model assumed that all leakage/seepage released directly to the Partridge River. (FEIS, 5-320, citing PolyMet 2015m). Sulfate seepage impacts on methylation at NorthMet mine site wetlands could be significant. At

[38] Conversion of 3,880 gallons per minute of tailings seepage (FEIS, p. 5-179) to 2,039,000,000 gallons per year using a standard conversion chart.
[39] *See e.*g. U.S. Geological Survey Fact Sheet FS-216-95, *Mercury Contamination of Aquatic Ecosystems*, available at http://pubs.usgs.gov/fs/1995/fs216-95/pdf/fs21695.pdf, last visited Nov. 22, 2015.

the mine site, even as compared to continuation of existing conditions scenario, P90 sulfate is predicted to more than triple along the overburden storage and laydown flowpath and along the West Pit flowpath. (FEIS, 5-129, Table 5.2.2-23). There are 516 acres of wetlands within mine site surficial aquifer flowpaths. (FEIS, 5-320; Table 5.2.3-7).

Although the FEIS discussed various forms of sulfur-containing air emissions, these were disaggregated. (FEIs, pp. 5-509 to 5-511). Even with Dr. Branfireun's analysis of underlying data, it was not possible to construct a loading analysis cumulating *all* forms of sulfur air deposition from the NorthMet project that would result in sulfate loading.

The FEIS discussion of sulfur deposition as a result of spillage and dust assumed a 97 percent reduction from the original calculation of 6.14 tons per year potential spillage from each car. (FEIS, 5-164, citing PolyMet 2014a). As with other marked reductions in potential sulfate loading, the FEIS relies on PolyMet's unsubstantiated assumptions, and requires no proof of the efficacy of the proposed rail car refurbishment. The FEIS states that surface water quality in the mine site Upper Partridge tributary streams (sulfate-limited Wetlegs Creek, Longnose Creek, proposed West Pit Outlet Creek) "would be affected by ore spillage from the rail cars," but fails to analyze this effect or impacts of ore spillage on wetlands and mercury methylation. (FEIS, 5-164) Approximately 543 acres of wetlands along the railroad corridor could be affected by releases of solutes resulting from rainfall contacting spilled ore and fines. (FEIS, 5-314).

4. The NorthMet project has no plan for wastewater treatment to reduce mercury concentrations.

Dr. Branfireun's opinion states that reading the comments of environmental consultant Daniel Pauly led him to question the assumption in the FEIS that reverse osmosis at the tailings basin and, eventually, at the mine site would remove mercury and methylmercury from the waste stream. After reviewing the underlying pilot test referenced in the FEIS (FEIS ref. Barr 2013f), Dr. Branfireun concluded, "When combined with the uncertainty of other FEIS estimates concerning mercury inputs to treatment plant influent, I have no confidence that these proposed strategies will succeed in meeting water quality guidelines." (Branfireun, 2015, p. 24).

On closer review, the FEIS' references to a pilot test for NorthMet wastewater treatment is somewhat of a misnomer. The single pilot test cited in the FEIS was conducted on water from a seep and a shallow well at the existing LTVSMC taconite tailings facility, not on leachate similar to that for the NorthMet project. (Barr 2013f, p. 11). Mercury was below detectible levels in the *influent* for the test. (*Id*., autop. 64-69, Table 1, Table 2). The only conclusions regarding mercury in Barr's report were based on literature and asking the membrane supplier. Barr reported, "Mercury removal by RO membranes is highly dependent on the type of membrane used. Mercury rejections [the percentage removed by treatment] ranging from 22 to 99.9% have been reported." (*Id*., p. 39). The report continued, "Mercury removal by RO is highly variable and dependent upon its speciation and the membrane selection. For these reasons, its removal is difficult to quantify." (*Id*., p. 41).

Should mercury influent to the plant site wastewater treatment plant (WWTP) exceed 1.3 ng/L, the FEIS does not provide any basis to conclude that water quality treatment will result in compliance with the GLI and Minnesota water quality standard for mercury. Instead, the FEIS assumes that there will be no need for mercury treatment, since combined *inflows* to the WWTP are predicted to be precisely 1.3 ng/L. (FEIS, 5-230, Table 5.2.2-51). This assumption is problematic given the data on mercury in existing LTVSMC tailings seepage and the limits of adsorption discussed above in Section IV.B.2. It is even less credible considering the input of high-mercury Colby Lake water to the tailings facility and the WWTP.

Colby Lake water mercury concentrations substantially exceed the Great Lakes Initiative and Minnesota water quality standard of 1.3 ng/L. FEIS data indicates mercury concentrations in Colby Lake are between 4.6 and 8.7 ng/L, averaging 6.0 ng/L. (FEIS, 4-37 to 4-38). During operations, maximum plant site water appropriation of water from Colby Lake would be 15.1 million gallons per day (MGD) or 1,300 million gallons per year (MGY). (FEIS, 5-201, Table 5.2.2-40). This maximum is equivalent to 10,486 gallons per minute (gpm) from Colby Lake, which is *more than four times* the 2,425 gpm total combined stream flow to the WWTP predicted in the FEIS. (FEIS, 5-230, Table 5.2.2-51). Yet, despite the substantial volume and concentration of mercury in Colby Lake waters, the FEIS neither changes its claim that the concentration of mercury in inputs to the WWTP will be 1.3 ng/L nor justifies this assumption.

The FEIS' mechanistic construct for mercury loading is scientifically indefensible and unsupported by review of the potential sources of mercury loading resulting from the PolyMet NorthMet project. The FEIS relies on unsubstantiated assumptions of seepage collection to minimize likely adverse effects of sulfate loading on wetlands and uses a model that explicitly denies the potential discharge to wetlands, the sites where most methylation of mercury is likely to occur. The FEIS disaggregates and minimizes sulfate loading through deposition and spillage. Although assurance is provided that reverse osmosis will result in compliance with all water quality standards, including the mercury standard, treatment plant inflow assumptions are contrived to require no treatment and there is neither a pilot test nor plan for mercury removal from wastewater. Finally, despite the clear significance of methylmercury production and transport to downstream water quality, aquatic life and human health, the FEIS has avoided any analysis of the impacts of mercury discharge, sulfate loading or hydrologic changes from the NorthMet project on increased production and transport of methylmercury.

The FEIS is not only inadequate under NEPA, but inadequate to demonstrate that mercury and methylmercury increases will not significantly degrade downstream waters, increase exceedances of both water column and fish tissue mercury, and increase violation of both narrative and numeric water quality standards. On the basis of this issue alone, no Section 404 permit can be issued.

V. No Section 404 permit may be granted because discharge of pollutants from the PolyMet NorthMet project would degrade downstream waters and violate water quality standards.

As explained in Section IV, *supra*, Clean Water Act Section 404 permit regulations prohibit discharge of dredge and fill material into waters of the United States if the action will cause or contribute to violations of any applicable State water quality standard. 40 C.F.R. §230.10(b)(1). Such activities are also prohibited if they will cause or contribute to significant degradation of the waters of the United States. §230.10(c). Effects contributing to significant degradation "considered individually or collectively," include significant "adverse effects of the discharge of pollutants on human health or welfare, including but not limited to effects on municipal water supplies, plankton, fish, shellfish, wildlife, and special aquatic sites," (§230.10(c)(1)) and "adverse effects of the discharge of pollutants on life stages of aquatic life and other wildlife dependent on aquatic ecosystems, including the transfer, concentration, and spread of pollutants or their byproducts outside of the disposal site through biological, physical, and chemical processes." §230.10(c)(2).

The FEIS contains data regarding pollutants in the mine site surficial aquifer which, if read carefully suggest that it is likely Minnesota water quality standards will be violated at the nearest point where seepage daylights to surface water. Although the FEIS discounts the impacts of wastewater discharge, replacing the natural aquatic systems in the Partridge River headwaters and in Embarrass River tributaries with a wastewater stream would significantly degrade water quality, particularly with reference to metallic mining pollutants.

Even where the data does not conclusively prove violations, the various unsupported assumptions and modeling inadequacies of the FEIS prevent a determination pursuant to 40 C.F.R. §230.12(a)(3) that the project will comply with the regulatory Guidelines precluding violation of water quality standards or significant degradation.

Particular concerns are raised regarding specific conductance, a combination of ionic pollutants that are a signature mining pollutant known to persist downstream for many miles in the St. Louis River watershed. Specific conductivity increases, among other mining pollutants, would have the potential to violate narrative water quality standards of the Fond du Lac Band applicable in St. Louis River Reservation waters. Fond du Lac Water Quality Standards, Ord. #12/98 as amended, Sect. 105a.1; Sect. 301e.

A. The PolyMet NorthMet project would cause or contribute to violation of water quality standards and significant degradation.

The FEIS makes the following statement that the NorthMet project would not cause any significant water quality impacts:

> With the proposed engineering controls, the water quality model predicts that the NorthMet Project Proposed Action would not cause any significant water quality impacts because: 1) exceedances of the P90 threshold did not occur, 2) the NorthMet Project Proposed Action concentrations were no higher than concentrations predicted for the Continuation of Existing Conditions scenario, 3) the frequency or magnitude of exceedances for NorthMet Project Proposed Action conditions was within an acceptable range, or 4) the effects were not attributable to NorthMet Project Proposed Action discharges. (FEIS, 5-9)

However, a closer look at even the limited data in the FEIS suggests that it is likely the NorthMet project would cause or contribute to several violations of surface water quality standards and to significant degradation of water quality.

For the NorthMet mine site, there are no predictions for the closest point at which surficial aquifer will daylight to surface water. Previously available data specifying solute levels where East Pit Category 2/3 Surficial Flowpath reaches the Partridge River, which was presented in the SDEIS (SDEIS, 5-109, Table 5.2.2-22) has been removed from the FEIS.

Data at the mine site property boundary (FEIS, 5-129, Table 5.2.2-23) shows a level of contamination from mine site seepage sufficient to result in water quality violations. For the East Pit Category 2/3 Flowpath, aluminum is predicted at 339 µg/L, a 576% increase over the modeled continuation of existing conditions (CEC) scenario and nearly three times the 125 µg/L water quality standard. Cobalt is predicted at 10.5 µg/L, a 1,117% increase over the modeled CEC scenario and more than twice the 5 µg/L water quality standard.

For the Overburden Storage and Laydown Area at the old property boundary, aluminum is predicted at 139 µg/L, a 236% increase over the CEC, also above the 125 µg/L water quality standard. For the West Pit Flowpath at the property boundary, a cobalt concentration of 33.1 µg/L is predicted - a 3,521% increase over the modeled CEC scenario and more than six times the 5 µg/L water quality standard. Lead concentrations in the West Pit Flowpath are predicted at 5.2 µg/L - a level 800% of the modeled CEC scenario and four times the applicable 1.3 µg/L water quality standard for lead.[40]

If the concentrations of solutes modeled for the CEC in the flowpaths when they reach the Partridge River are the same as CEC levels modeled for the same flowpaths at the property line,[41] applying the ratios of relative differences provided in the FEIS (FEIS, 5-130, Table 5.2.2-24), *cobalt, aluminum, and lead would still violate applicable water quality standards at the point where they reach the Partridge River*. Cobalt reaching the Partridge River from the West Pit Flowpath is predicted at 24.3 times the CEC level, thus estimated at 22.8 µg/L - four times the 5 µg/L water quality standard. Aluminum from the East Pit Category 2/3 Flowpath is predicted to be 2.9 times the CEC level, thus estimated at 171 µg/L – considerably above the 125 µg/L water quality standard. Lead from the West Pit Flowpath is predicted at 5.8 times the CEC level, thus estimated at 3.8 µg/L – nearly three times the 1.3 µg/L chronic water quality standard for the Partridge River.

Mine site data in the FEIS also shows a likelihood of significant degradation of water quality both from seepage through surficial flowpaths to surface water and as a result of the conversion of the mine site segment of the Partridge River headwaters to a system dominated by mine site wastewater, rather than a natural system. (FEIS 6-83).

[40] Reflecting existing baseline levels of hardness in the Partridge River near the mine site of 37 mg/L (FEIS, 4-87, Table 4.2.2-13), the chronic water quality standard for lead at the mine site would be 1.3 µg/L. Minn. R. 7050.0222, subp. 4.
[41] The FEIS does not allow more precise confirmation of modeled CEC levels.

Mine site seepage to the Partridge River would reflect substantial increases in flowpath concentrations of chloride, sulfate, beryllium, cadmium, selenium, and zinc, as well as additional loading of cobalt, aluminum and lead. (FEIS, 5-130, Table 5.2.2-24). It is unknown whether the volume of seepage predicted in the FEIS would result in significant degradation.

However, at surface water site SW-004a where the impacts of mine site discharge are best represented, levels of several signature mining chemicals that affect aquatic life and wildlife are predicted to markedly increase as compared both to existing levels and to the modeled continuations of existing conditions.[42] Waters that now have low concentrations of metals would have levels approaching the maximums prohibited by water quality standards.

Copper concentrations at Partridge River surface water site SW-004 are predicted to reach 5.79 µg/L for the NorthMet project. Under baseline hardness conditions, this level of copper would violate the chronic water quality standard of 5.2 µg/L.[43] This copper concentration would be an increase to 386 % of existing mean water quality (1.5 µg/L) and 166% of predicted CEC levels.

Nickel concentrations are predicted at 26.7 µg/L for the NorthMet project, a level of nickel (slightly below water quality standard of 29 µg/L) that is 2,225 % of the existing mean nickel concentration of 1.2 µg/L, and 612% of CEC levels. Cadmium is predicted at 0.93 µg/L (water quality standard of 1.4 µg/L), which would be an increase to 1,033% of existing mean cadmium concentrations of 0.09 µg/L and an increase of 547% compared to CEC levels. Zinc is predicted at 48.7 µg/L (water quality standard of 67 µg/L), which would be an increase to 1059 % of existing mean zinc concentrations of 4.6 µg/L and 192% of CEC levels. Cobalt is predicted at 3.11 µg/L (water quality standard of 5 µg/L), which would be an increase to 740 % of existing 0.42 µg/L mean cobalt concentrations and 192% of modeled CEC levels.

Based on FEIS data alone, without addressing any of PolyMet's assumptions challenged in these comments or in WaterLegacy's comments on the FEIS, changing Partridge River headwaters to a stream dominated by wastewater effluent would significantly degrade water quality.

At the plant site, FEIS data also reflects reduction in water quality at tailings site tributaries and in the Embarrass River due to the fact that treated wastewater from the

[42] For this section, mean existing concentrations of solutes at SW-004a are obtained from FEIS 4-88 to 4-89, Table 4.2.2-14. Proposed action and CEC scenario information is from FEIS 5-151, Table 5.2.2-31.
[43] Minn. R. 7052.0100, subp. 6 provides chronic water quality standards for baseline hardness of 50 mg/L.

NorthMet WWTP would have higher concentrations of solutes than tributary water containing untreated LTVSMC tailings basin seepage. Treated NorthMet wastewater would result in higher concentrations of various metals, including antimony, cobalt, lead, nickel, selenium and zinc in tributary streams and in the Embarrass River. (FEIS, 5-205, Table 5.2.2-42).

At Trimble Creek-1, a tailings site tributary surface sampling site, zinc concentrations for the NorthMet project are predicted at 100 µg/L (water quality standard of 120 µg/L in 100 mg/L hardness), which is 1,163% of the existing maximum detected of 8.9 µg/L and 2,222% of the existing mean of 4.5 µg/L.[44] Predicted zinc represents an increase to 719% of the modeled CEC conditions. Cobalt would be elevated to 5.0 µg/L (equal to the water quality standard of 5.0 µg/L), which is 357% of the existing maximum concentration of 1.4 µg/L and 806% of the existing mean of 0.62 µg/L, as well as an increase to 175% of CEC conditions.

For each of the other four solutes we reviewed, data for existing conditions is reported incorrectly. For nickel, the existing mean concentration is reported above the highest range detected and for antimony, selenium, and lead, current levels fell below detection limits. Though the FEIS said it had adopted the Barr practice (criticized by Dr. Branfireun as inaccurate) of reporting non-detects at half the detection limit, each of these important metals were reported at the detection limit although no metals had been detected.

Under the proposed NorthMet project at P90 antimony at Trimble Creek-1 would be elevated to 20.3 µg/L (water quality standard of 31µg/L). If antimony non-detect sampling were reported as half the detection limit (0.13 µg/L), antimony would 15,615% of the existing antimony level and an increase to 4,060% of CEC conditions. Nickel is predicted to reach 50 µg/L (water quality standard of 52 µg/L in 100 mg/L hardness) under the proposed project. If existing nickel concentration is calculated at the top of the range detected (0.25 µg/L), predicted P90 nickel at Trimble Creek TC-1 would be 20,000% of the existing maximum concentration as well as 849% of modeled CEC conditions.

Lead concentrations are predicted at 3.0 µg/L (water quality standard of 3.2 in 100 mg/L hardness) under the Proposed Action.). If lead non-detect sampling were reported as half the detection limit (0.13 µg/L), predicted lead levels would be at least 2,308 % of the existing maximum and an increase to 265% of CEC modeled conditions. Selenium is predicted reach

[44] For this section, data on existing concentrations of solutes at Trimble Creek are obtained from FEIS 4-155, Table 4.2.2-37. Data for the proposed action and CEC scenario are obtained from FEIS, 5-205, Table 5.2.2-42.

5.0 µg/L, which is also equal to the water quality standard of 5.0 µg/L. Existing sampling found no detection of selenium despite four samples with a detection level of 0.50 µg/L. If selenium levels were reported at half its detection limit (0.25 µg/L), predicted NorthMet concentrations would increase to 2,000% of existing levels and 633% of CEC conditions.

Similar increases in predicted solute concentrations and ratios are predicted at PM-19 (Trimble Creek) and PM-11 (Unnamed Creek) tributary sites. Elevations persist, with some dilution, in the Embarrass River at PM-13, further downstream of NorthMet wastewater treatment discharge. (FEIS, 5-207, Table 5.2.2-43).

Even if the appropriate water quality based effluent limits were set for solutes in an NPDES permit and PolyMet complied with these limits (contingencies which the current state of permits in Minnesota may not allow one to assume) predicted changes to NorthMet tailings site receiving waters would significantly degrade waters that were previously substantially less impacted by mining metals. The differences between water quality in the existing Trimble Creek and conditions after the Creek is inundated with sulfide mining wastewater are huge.

B. Inadequacies in the FEIS prevent a determination that the PolyMet NorthMet project would not cause or contribute to violation of water quality standards and significant degradation.

Data in the preceding sub-section demonstrates that the PolyMet NorthMet project does not comply with Clean Water Act Section 404 regulations since discharge will result both in violation of water quality standards and in significant degradation of the aquatic system. 40 C.F.R. §§230.10(b); 230.10(c) and 230.12(a)(3)(ii). In addition, Section 404 regulations require that a permit must be denied where insufficient information has been provided to make a reasonable judgment whether the proposed discharge will comply with regulatory Guidelines. §210.12(a)(3)(iv). Even under the most charitable interpretation of the proponent's underlying documents and the FEIS, the NorthMet project must be rejected under this test.

Neither PolyMet's consultants nor the FEIS have predicted concentrations at the point when seepage through mine site aquifers would first reach wetlands or the nearest stream. At the most basic level, the FEIS reflects a decision not to model the point where the Clean Water Act requires compliance with water quality standards. The FEIS reports that a decision was made in the modeling that would preclude evaluation of the locations where mine site or tailings seepage first surfaced to wetlands: "Several decisions were made while setting up the GoldSim models. An approach was taken not to represent in those models the interactions between bedrock groundwater and surficial deposits groundwater, or between groundwater and wetlands." (FEIS, 5-53).

The GoldSim model used in the FEIS also excluded northward surficial aquifer flow (FEIS, 5-55). This deficit is significant since Yelp Creek is closer to East Pit and Category 1 waste rock contaminant sites than the Partridge River (see FEIS, Figure 5.2.2-23), and the FEIS has admitted that Yelp Creek, along with the Partridge River "act as hydrologic sinks for surficial groundwater and surface water originating at the Mine Site. Surface runoff or surficial groundwater seepage leaving the Mine Site would flow into Yelp Creek or the Partridge River." (FEIS, 5-5). Recent GLIFWC analysis based on Northshore Mine hydraulic gradient predicts northward flow through the surficial aquifer to surface waters. (GLIFWC Northward Flowpath Letter, Exhibit 8, p. 5).

Although the FEIS labeled the locations where mine site surficial flowpaths discharge to the Partridge River as locations of "groundwater discharge to surface water" (FEIS, Figure 5.2.2-4), and although PolyMet's consultants clearly modeled surficial flowpath concentrations at these locations (see ratios in FEIS, 5-205, Table 5.2.2-24), the FEIS did not disclose the concentrations of solutes at these locations where seepage would indisputably report to surface water. This information should have been provided in the FEIS.[45] Estimating from available data, WaterLegacy's best analysis shows several areas of non-compliance with water quality standards even at the point when seepage will reach the Partridge River. Under the most charitable interpretation, the FEIS has not supported a determination that NorthMet activities at the mine site will comply with water quality standards.

The brief review of data in the preceding sub-section calls into question the way in which sampling results were handled by PolyMet's consultants. WaterLegacy did not set out to find errors in the reporting of data on existing conditions in Trimble Creek. But, in simply checking existing solute levels for six metals, we found conspicuous errors in reporting for four of them. In each case, these errors overstated the existing level of the metal in Trimble Creek waters. In addition, even this modest review raises questions about PolyMet modeling that created such

[45] Part of this data, showing concentrations where the East Pit Category 2/3 Flowpath reported to the Partridge River was contained in the SDEIS, Table 5.2.2-22 on page 5-109, although groundwater "evaluation criteria" were listed for the data.

huge discrepancies between actual existing maximum detection levels and the "continuation of existing conditions" scenario. For nickel, the magnitude of difference between actual existing conditions at Trimble Creek and the modeling used in the FEIS to compare project outcomes with "existing" conditions was more than an order of magnitude. Both the data reporting errors and the CEC model construct serve to minimize the comparative impact of the NorthMet proposed action in comparison to a no build scenario.

Whether only the CEC model is considered or both the CEC and actual existing conditions reviewed, the magnitude of increases in metallic metals levels does not allow a conclusion that degradation resulting from the NorthMet project's displacement of an aquatic ecosystem with a sulfide mine wastewater system is insignificant. Substantial degradation would result from the project even if permits were issued with enforceable limits and regulators required compliance with them.

Mine site seepage to the Partridge River will reflect substantial increases in flowpath concentrations of chloride, sulfate, beryllium, cadmium, selenium, and zinc, as well as additional loading of cobalt, aluminum and lead described previously. (FEIS, 5-130, Table 5.2.2-24). Whether or not these increases would further violate water quality standards and significantly degrade water quality depends on assumptions regarding seepage chemistry, seepage flow and seepage collection, all of which have been challenged in detail in WaterLegacy's comments on the FEIS and in Section I of these comments.

Similarly, at the tailings site, solute concentrations in tailings toe seepage (PolyMet 2015i, Large table 2) are predicted to far exceed water quality standards. For example, at the North Toe, P90 levels of nickel in year 20 are predicted at 893 µg/L -- more than 17 times the water quality standard of 52 µg/L in hardness of 100 mg/L. Lead, a particularly dangerous neurotoxin with no safe level (Saracino, 2015), would reach levels of 58 µg/L -- more than 18 times the water quality standard of 3.2 µg/L. Comparing PolyMet's predictions to MinnAMAX copper-nickel mine tailings seepage, even these predictions may be underestimates of contamination by as much as an order of magnitude. (Johnson, 2015).

The FEIS assumes that no tailings seepage will be released to surface waters from any part of the tailings waste facility. (FEIS, 5-7 to 5-8). WaterLegacy comments on the FEIS, the analysis in Section I of these comments, the expert opinions of Donald Lee, and field experience with collection of seepage from other unlined tailings storage facilities indicates that

PolyMet's unsubstantiated assumptions of nearly perfect collection are likely to be erroneous. Given the highly concentrated toxic metals in tailings toe seepage, it would not take much uncaptured release to violate water quality standards and degrade water quality in the wetlands and creeks adjacent to the tailings site.

As discussed in the previous Section IVA, the FEIS failed to analyze impacts of the PolyMet NorthMet project on methylmercury, perhaps the most significant adverse effect of the proposed action on water quality.

The FEIS also failed to analyze specific conductivity, a signature mining pollutant that has resulted in impairments of fish and macroinvertebrates in Northern Minnesota waters. (see Section VII of WaterLegacy's comments on the FEIS). Specific conductivity ionic pollution is likely to degrade aquatic life for fish and invertebrates in surface water downstream of the NorthMet project.

An Evaluation of a Field-Based Aquatic Life Benchmark for Specific Conductance ("Conductivity Evaluation," Nov. 2015, Exhibit 16), prepared by Bruce Johnson and Maureen Johnson applies EPA protocols in *A Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams,*[46] to Northeastern Minnesota ecoregions, including the ecoregion where the NorthMet project is proposed. This *Conductivity Evaluation* examined data on water chemistry and macroinvertebrate populations from Minnesota's Regional Copper-Nickel study and the files of several state and federal agencies as well as several studies evaluating conductivity and stressors for aquatic life. The *Evaluation* found that the median specific conductivity level in Minnesota waters is lower than the background level in EPA studies and that existing data demonstrates impacts on benthic invertebrates from elevated specific conductance in mining-impacted waters, including the St. Louis River watershed. (*Id*., pp. 31-32, 39-42) The *Conductivity Evaluation* concluded that, in the Minnesota ecoregion where the NorthMet project is proposed to be located, discharge of specific conductance above the 300 µS/cm level established as EPA guidance for Appalachian streams is highly likely to result in extirpation of 5% or more of invertebrate genera and thus should be prohibited under Minnesota narrative standards preventing degradation and toxic pollution. Additional investigation was

[46] U.S. Environmental Protection Agency, *A Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams,* Office of Research and Development, National Center for Environmental Assessment, Washington, DC., 2011 EPA/600/R-10/023F. (hereinafter "EPA Conductivity Benchmark Study")

recommended to determine whether a more stringent limit would be required in Northeastern Minnesota to protect aquatic life. (*Id*., p. 42).

Since the FEIS hasn't assessed the effects of specific conductance, no demonstration can be made pursuant to 40 C.F.R. §230.12(a)(3)(ii) that the NorthMet project will not result in violation of narrative water quality standards or significant degradation of receiving waters for aquatic life as a result of specific conductance pollution. The FEIS also cannot support a determination that specific conductance from the NorthMet project will not degrade Fond du Lac Reservation waters in violation of approved Band water quality standards. Regression analysis performed as part of the Tribal Cooperating Agencies Cumulative Effects Analysis suggested that concentrations of specific conductance were highest near mine discharge sites, and tended to gradually decrease downstream, remaining above 150 µS/cm at 203 kilometers (126 miles) downstream of the nearest upstream mine discharge site. (FEIS, App. C. Tribal CEA, p. 16, FEIS autop. 3041). Elevated concentrations of specific conductance could persist far downstream in the St. Louis River, as illustrated in Exhibit 29, a map of cumulative mining discharge impacts on specific conductance included as part of the Tribal CEA.

Multiple inadequacies, gaps and distortions in PolyMet underlying documents carried forward in the FEIS, in and of themselves, preclude a determination that the PolyMet NorthMet would comply with water quality standards. They include:

- Unsubstantiated and unreasonable assumptions regarding mine site seepage collection;
- Unsubstantiated and unreasonable assumptions regarding tailings site seepage collection;
- Unsubstantiated assumptions of no leakage from the hydrometallurgical residue facility;
- Failure to model a range of probabilities for the efficacy of performance of engineered systems to control mine site and tailings site seepage;
- Understatement of seepage volumes and solute concentrations from Category I waste rock;
- Understatement of seepage volumes and solute concentrations from tailings;
- Failure to disclose concentrations of solutes in the hydrometallurgical residue facility;
- Failure to consider mine site and tailings site fractures in evaluating seepage transport;
- Failure to consider interactions between bedrock and surficial deposits in evaluating seepage transport;
- Inadequate hydrogeological testing at both the mine site and tailings site;
- Unreasonable modeling of mine site base flow and the potential for northward flow through groundwater and the surficial aquifer;
- Use of an inappropriate baseline to determine whether project releases will cause or contribute to exceedances;
- Reliance on uncertain and unverified future contingency management options rather than predicting impacts to water quality from project failure to perform "as expected."

These deficiencies in the FEIS, in addition to violating NEPA regulations, require a determination under 40 C.F.R. §230.12(a)(iv) that neither PolyMet, its consultants nor the FEIS have provided sufficient information to make a reasonable judgment as to whether the proposed discharge will comply with these Guidelines. PolyMet's application for a Section 404 permit must be denied under applicable law.

CONCLUSION

On the basis of the foregoing analysis, and the expert opinions, exhibits and other materials cited herein, including WaterLegacy's Comments on the PolyMet NorthMet Final Environmental Impact Statement, it is respectfully requested that the U.S. Army Corps of Engineers deny and the U.S. Environmental Protection Agency veto the Clean Water Act Section 404 permit requested by PolyMet Mining, Inc. (PolyMet) and that the information provided herein be relied upon by state and tribal agencies to deny and object to any Clean Water Act Section 401 certification for the proposed PolyMet NorthMet Section 404 permit.

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