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August 31, 2017

SENT ELECTRONICALLY

MN Department of Natural Resources (NorthMetPermitting.DNR@state.mn.us)

ATTN: PolyMet NorthMet Project

500 Lafayette Road North

St. Paul, MN 55155-4045

RE: Comments on Draft PolyMet NorthMet Water Appropriation Permits
(2016-1363, 2016-1364, 2016-1365, 2016-1367, 2016-1369, 017-0260)

Dear Commissioner Landwehr,

The following comments are submitted on behalf of WaterLegacy, a Minnesota non-profit formed in 2009 to protect Minnesota's water resources and the communities who rely on them.

WaterLegacy believes proceeding with draft PolyMet water appropriation permits is premature and inconsistent with Minnesota law. None of the applicable documents – the draft permits released for public comment on August 11, 2017,¹ PolyMet's water appropriation permit applications,² or the PolyMet NorthMet final environmental impact statement (FEIS)³ -- provide the protection of surface and groundwater required by Minnesota law.

The draft PolyMet water appropriation permits should be rejected on the following grounds:

1. The appropriations proposed in the draft PolyMet water appropriation permits far exceed those described in the PolyMet NorthMet FEIS, and their impacts on water resources have not been evaluated.
2. The draft PolyMet water appropriation permits do not assure an adequate supply of water resources. Minn. Stat. §103G.265, Subd. 1.
3. The draft PolyMet water appropriation permits do not ensure that groundwater use will be sustainable, will not harm ecosystems, or will protect surface water from negative impacts. Minn. Stat. §§103G.287, Subd. 3 and Subd. 5; 103G.285, Subd. 2. And Subd. 3.
4. The draft PolyMet water appropriation permits do not meet the requirements of Minnesota law for use of water for mining operations. Minn. Stat. §103G.297, Subd. 3.
5. The draft PolyMet water appropriation permits fail to comply with Minnesota law precluding consumptive use of more than 5,000,000 gallons per day of Lake Superior Basin waters unless specific conditions are met. Minn. Stat. §103G.265, Subd. 4.

¹ Draft PolyMet water appropriation permits 2016-1363, 2016-1364, 2016-1365, 2016-1367, 2016-1369, and 2017-0260, available online at http://www.dnr.state.mn.us/polymet/permitting/water_app.html

² PolyMet Water Appropriation Permit Applications, v.3 (Apr. 2017), p. 38, available online at http://files.dnr.state.mn.us/lands_minerals/northmet/water-approp/water-appropriation-permit-app-v3.pdf.

³ PolyMet NorthMet FEIS (Nov. 2015) available online at <http://www.dnr.state.mn.us/input/environmentalreview/polymet/feis-toc.html>

6. The draft PolyMet water appropriation permits fail to demonstrate that PolyMet is capable of collecting 90 percent of contaminated groundwater as claimed.
7. The draft PolyMet water appropriations permits lack public accountability.
8. The draft PolyMet water appropriations permits fail to limit water use or the term of permits consistent with their stated purpose.

1. Water Use in Draft PolyMet Water Appropriations Permits Far Exceeds any Water Use Previously Analyzed.

The total appropriations proposed from the PolyMet Mine Site Area (Partridge River Headwaters) in the draft PolyMet water appropriation permits are more than an order of magnitude greater than the highest estimated water need described in the PolyMet NorthMet FEIS. Table 1 below illustrates the difference between Mine Site Area (Partridge River Headwaters) potential water appropriation described in the PolyMet NorthMet FEIS and water appropriations proposed in the draft PolyMet water appropriation permits.

Table 1 - Comparison of Mine Site Area (Partridge River Headwaters) Water Appropriations Draft PolyMet Water Appropriations Permits and Final Environmental Impact Statement			
Draft Permit Number Description of Use	Draft PolyMet Water Appropriation Permit (gpm)	FEIS Highest Estimate (gpm)	FEIS (P90)
2016-1363 East Pit Dewatering	2,340	1,750	5-146
2016-1364 Central Pit Dewatering	1,300	55	5-146
2016-1365 West Pit Dewatering	2,640	400	5-146
2016-1367 Cat 1 containment construction	275		
Cat 1 containment operation	14,400	375	5-146
Cat 1 foundation construction	3,375		
Cat 2/3 foundation construction	1,525		
Cat 2/3 liner drainage	430	145	5-146
Cat 2/3 underdrain	50		
Cat 4 foundation construction	850		
Cat 4 liner drainage	130	0	5-146
Cat 4 underdrain	25		
Building construction	50		
EQ and construction water basin	75		
Mine water pond	200		
Misc. Construction	100	65	5-146
Ore surge foundation construction	200		
Ore surge liner drainage	80	25	5-146
Ore surge underdrain	25		
Stormwater pond construction	750		
All Mine Site Infrastructure	22,540		
TOTAL Mine Site Area Water	28,820 gal/minute	2,815 gal/minute	

There is no indication in this record that the Minnesota Department of Natural Resources (DNR) has evaluated the environmental impacts on surface water and groundwater of the proposed 28,820 gallons per minute appropriations from the Partridge River Headwaters watershed, an appropriation more than 10 times the water consumption described in the PolyMet NorthMet FEIS.

In addition, draft water appropriations from the proposed Plant Site Area (Embarrass River watershed and Second Creek) are more than double those described in the PolyMet NorthMet FEIS. Water appropriations from groundwater related to the Hydrometallurgical Residue Facility wick drain operations totaling 3,000 gallons per minute are proposed in the draft PolyMet water appropriation permits. The need, scope and impacts of such wick drain water appropriations were not discussed in the PolyMet NorthMet FEIS, other than the statement that water appropriations were “to be determined” in permitting.⁴

Table 2 below compares descriptions of Plant Site Area water appropriations in the FEIS and those reflected in draft PolyMet water appropriation permit 2016-1369.

Draft Permit Number Description of Use	Draft PolyMet Permit (gpm)	FEIS Estimate (gpm)	FEIS Citation
2016-1369			
Colby Lake pipe upgrade	300		
FTB seepage construction dewatering	3350		
FTB seepage capture (surface & groundwater)		2,697	5-52
Misc. construction dewatering	100		
Sewage construction dewatering	100		
Lined & concrete ponds	50		
Hydromet (HRF) wick drain pumping	2850	TBD	5-201
Hydromet (HRF) wick drain gravity	150	TBD	5-201
Hydromet (HRF) liner	250		
TOTAL Plant Site Area Water	7,150	2,697	

As explained in subsequent sections of these comments, Minnesota law requires that the commissioner assure an adequate supply of water resources, that the use of groundwater is sustainable and will not harm ecosystems, that groundwater appropriations be limited to prevent negative impacts on surface water, and that water only be used for mining if such use is necessary and will not impair the interests of the public in lands or waters.

Even if environmental review of the PolyMet NorthMet plan had reviewed these questions,⁵ any conclusions so reached would not apply to Mine Site Area appropriations proposed in the draft PolyMet water appropriation permits, which are more than 10 times those in the FEIS or proposed Plan Site Area appropriations, which are more than double those previously reviewed.

⁴ PolyMet NorthMet FEIS, 5-201.

⁵ WaterLegacy’ position is that the PolyMet NorthMet FEIS is inadequate to evaluate the adverse impacts of water appropriations as well as in other respects.

2. Draft PolyMet Water Appropriations Permits Do Not Assure an Adequate Supply of Water Resources.

Pursuant to Minnesota Statutes, the Commissioner of the Minnesota Department of Natural Resources (DNR) must assure an adequate supply of water when considering the issuance of water appropriations permits:

The commissioner shall develop and manage water resources to assure an adequate supply to meet long-range seasonal requirements for domestic, municipal, industrial, agricultural, fish and wildlife, recreational, power, navigation, and quality control purposes from waters of the state. Minn. Stat. §103G.265, Subd. 1.

The draft PolyMet water appropriation permits would authorize total appropriations of 6.175 billion gallons per year of water for the PolyMet mine project. The draft permits would also authorize removal from the proposed Mine Site Area (Partridge River Headwaters) of 3.7 billion gallons of water per year.

Table 3 -Total Annual Water Appropriations Authorized by Draft PolyMet Water Appropriations Permits	
Draft Permit Number Description of Use	Draft PolyMet Permit (million gallons per year)
2016-1363 (Mine Site Area) East Pit Dewatering	1,000
2016-1364 (Mine Site Area) Central Pit Dewatering	700
2016-1365 (Mine Site Area) West Pit Dewatering	800
2016-1367 (Mine Site Area) All Mine Site Infrastructure	1,200
2016-1369 (Plant Site Area) Mine Processing	675
2017-0260 (Colby Lake) Mine Processing	1,800
TOTAL Water Appropriation Authorized	6,175 million gallons per year

The use for which PolyMet’s proposed consumption of waters in the Partridge River and Embarrass River watersheds in the Lake Superior Basin is intended is a relatively low priority for allocation of water under Minnesota law. Minn. Stat. §103G.261, Subd. 5. It cannot be assumed that such a low priority use should dominate a watershed or watersheds.

Under Minnesota law, prior to issuing the draft PolyMet water appropriation permits, the DNR must demonstrate it has assured an adequate supply of water in the Partridge River and Embarrass River watersheds as well as in Colby Lake, considering long-range and seasonal resources and requirements for fish and wildlife as well as for residential and municipal water use requirements. This assurance must be demonstrated, not merely alleged in a conclusory statement.

3. Draft PolyMet Water Appropriations Permits Do Not Ensure that Groundwater Use is Sustainable and Will Not Harm Ecosystems and Degrade Water.

Minnesota Statutes preclude issuance of water-use permits for appropriation from groundwater unless that appropriation is sustainable:

The commissioner may issue water-use permits for appropriation from groundwater only if the commissioner determines that the groundwater use is sustainable to supply the needs of future generations and the proposed use will not harm ecosystems, degrade water, or reduce water levels beyond the reach of public water supply and private domestic wells constructed according to Minnesota Rules, chapter 4725. Minn. Stat. §103G.287, Subd. 5.

Minnesota law contemplates that the Commissioner will establish water appropriation limits where needed to protect groundwater resources. “When establishing water appropriation limits to protect groundwater resources, the commissioner must consider the sustainability of the groundwater resource, including the current and projected water levels, water quality, whether the use protects ecosystems, and the ability of future generations to meet their own needs.” Minn. Stat. §103G.287, Subd. 3.

To comply with Minnesota law, PolyMet would need to demonstrate and the DNR would need to have a reasonable basis to determine that PolyMet’s appropriations from the proposed Mine Site Area (permits 2016-1363, 2016-1364, 2016-1365 and 2016-1367) would be sustainable for future generations, would protect aquatic ecosystems and would not result in degradation of water in the upper Partridge River. This has not been done.

Although PolyMet has represented that changes in the average flows of the Partridge River, including those at the Mine Site Area (Partridge River Headwaters) shall be less than 10% during all stages of mine development,⁶ PolyMet has not been required to demonstrate that this condition can actually be met.

In particular, PolyMet has not demonstrated, given actual precipitation and flow conditions, that the impacts of the proposed PolyMet Mine Site Area water appropriation permits authorizing 3.7 billion gallons of water removal each year from the Partridge River Headwaters would not reduce flows in the upper Partridge River by more than 10% at various times.

The draft PolyMet permits propose several new monitoring sites in the upper Partridge River. However, there is no disclosure in permitting documents of existing flows and predicted flows from monitoring at these and other upper Partridge River sites to demonstrate that upper Partridge River flow would not be reduced more than 10% due to PolyMet appropriations.⁷

In addition, neither the draft PolyMet permits nor the PolyMet permit applications identify the

⁶ See PolyMet NorthMet FEIS, 5-139; PolyMet Water Appropriation Permit Applications, v.3 (Apr. 2017), p. 38.

⁷ New monitoring sites SW430, SW431 and SW 432 are identified PolyMet Water Appropriation Permit Applications, v.3 (Apr. 2017) Large Table 3, autop. 180 and in documents attached to draft permits 2016-1363, 2016-1364, 2016-1365 and 2016-1367. However, no justification is provided why monitoring isn’t also required at SW413 as identified in the PolyMet applications Large Figure 11, autop. or why continuous monitoring by PolyMet is not being required at the Partridge River upstream of the confluence with Stubble Creek.

“protective elevation” for the upper Partridge River or low flow periods when consumptive appropriations may not be made. Minnesota law provides that groundwater appropriations that will have negative impacts to surface waters are subject to provisions in Section 103G.285 that protect surface water. Minn. Stat. § 103G.287, Subd. 2.

Minnesota Statutes Section 103G.285, which protects surface waters, requires that the DNR “shall set a protective elevation for the water basin, below which an appropriation is not allowed.” Minn. Stat. § 103G.285, Subd. 3(b). That “protective elevation” must be based on the aquatic vegetation characteristics related to fish and wildlife habitat and the total volume of water within the basin, as well as existing uses of water. *Id.*

Section 103G.285 also provides that, if data are available, consumptive appropriations may not be made “during periods of specified low flows.” Minn. Stat. §103G.285, Subd. 1. Were PolyMet or the DNR to state that data were not available to determine periods of low flows, such a claim would call into question the adequacy of the PolyMet NorthMet FEIS.

The DNR must set a protective elevation for the upper Partridge River that cannot be reduced by PolyMet appropriations and define the periods of low flow in the upper Partridge River during which PolyMet’s appropriations from the proposed Mine Site Area must be prohibited. The DNR has completed neither critical task.

PolyMet draft water appropriations permits pertaining to the Plant Site Area, as well as those for the proposed Mine Site Area, fail to comply with Minnesota law requiring that the sustainability of appropriations, the protection of water quality and the protection of ecosystems must be demonstrated before water appropriations permits can be issued. Minn. Stat. §103G.287, Subd. 3 and Subd. 5.

Although the text of draft permit 2016-1369 states that PolyMet shall augment streamflow in Trimble Creek, Unnamed Creek, Second Creek and Unnamed (Mud Lake) creek to maintain the “mean annual streamflow” in each stream within $\pm 20\%$ of existing conditions, the draft permit admits that there has been no hydrologic model or demonstration by PolyMet that this condition can be met.

The draft permit states “Adaptive management shall be required if monitoring results show that streamflow cannot be maintained within $\pm 20\%$ of average annual tributary streamflow.” The draft permit then states that DNR will review data collected *after* the water appropriations permits have been issued to “determine if a hydrologic model needs to be created,” for the Embarrass River.

DNR’s proposal that developing a hydrologic model and using actual monitoring data to determine whether PolyMet can meet permit conditions limiting streamflow changes in the Embarrass River watershed can be postponed until long after permits are issued and massive quantities of waters consumed fails to protect sustainable water resources. It is also contrary to Minnesota law.

4. Draft PolyMet Water Appropriation Permits Do Not Comply with Requirements of Minnesota Law Pertaining to Water Use for Mining Purposes.

Minnesota law precludes the grant of a permit for the use of waters for copper, nickel or copper-nickel mining unless the proposed use of waters is necessary for the mining and will not substantially impair the interests and benefits of the public in lands or waters. Minn. Stat. §103G.297, Subd. 3(1) and (2). As discussed in the preceding sections, the DNR has not evaluated the quantity of water proposed to be appropriated in environmental review (Section 1), has not determined whether the draft permits would assure an adequate water supply (Section 2), has neither set a protective level nor protected low flows for the upper Partridge River (Section 3) and has not determined that streamflow permit conditions for the Embarrass River watershed are realistic or based on any hydrologic model (Section 3). On this record, the commissioner has an insufficient basis to determine that the draft PolyMet water appropriation permits would not substantially impair the interests and benefits of the public in waters of the upper Partridge River and Embarrass River watersheds.

In addition, the permitting record does not support a determination that the proposed magnitude of water appropriations at either the Mine Site Area or the Plant Site Area are necessary for the mining of copper and nickel ores. At the proposed Mine Site Area, potential treatment of water appropriated through mine dewatering or other mine site activities and immediate return of water to the watershed could reduce water use affecting the Partridge River Headwaters.

At the proposed Plant Site, appropriations of 3,000 gallons per minute related to wick drains at the Hydrometallurgical Residue Facility appear to be required as a remediation measure due to the inadequacy of the foundation where PolyMet has proposed to locate the facility. A consulting expert report prepared for the DNR in May 2017 stated, “The soft ground beneath the proposed residue facility consists of up to 30 feet of slimes, peat and tailings concentrate. This will not be an adequate foundation for the 80 foot high basin.”⁸ The DNR consultants’ review did not consider alternative locations for the Hydrometallurgical Residue Facility that might avoid the need for wick drains or otherwise conserve water resources. Until such alternative locations for the Hydrometallurgical Residue Facility are evaluated, the DNR cannot determine whether the level of Plant Site Area appropriations is in fact *necessary* as the law requires.

5. Draft PolyMet Water Appropriations Permits Fail to Comply with Minnesota Law Limiting Consumptive Use Exceeding 5,000,000 Gallons per Day.

Minnesota law precludes consumptive use of Great Lakes public waters exceeding 5,000,000 gallons per day average in any 30-day period unless the commissioner has notified and solicited comments on the proposed diversion or consumptive use from the offices of the governors of the Great Lakes states and premiers of the Great Lakes provinces, the appropriate water management agencies of the Great Lakes states and provinces, and the international joint commission and the consumption has also been approved by the legislature. Minn. Stat. §103G.265, Subd. 4. The draft PolyMet water appropriation permits reflect consumptive use of waters of the Lake Superior Basin. Minn. Stat. § 103G.005, Subd. 8.

⁸ Dick Van Zyl, Steve Gale, Cecilio Olivier, Stuart Grubb, *PolyMet Dam Safety Permit Application Review* (May 15, 2017), p. 6. This review memo, without its attachments, is enclosed with these comments.

Neither the draft PolyMet water appropriations permits nor PolyMet’s most recent water appropriation permit applications disclose whether the combined PolyMet permits would exceed the 5,000,000 gallons per day average in a 30-day period -- the threshold provided in Minnesota law.

However, an illustration of estimated consumptive use in PolyMet’s most recent water appropriations permit application suggests that it is likely that the 5,000,000-gallon per day average threshold would be exceeded. This illustration (Figure 8-1)⁹ shows the temporal overlap of appropriations from various PolyMet water appropriation permits during mine operations. In this illustration, it appears that appropriations from PolyMet’s permits aggregated together would exceed 5,000,000 gallons per day during various mine years.

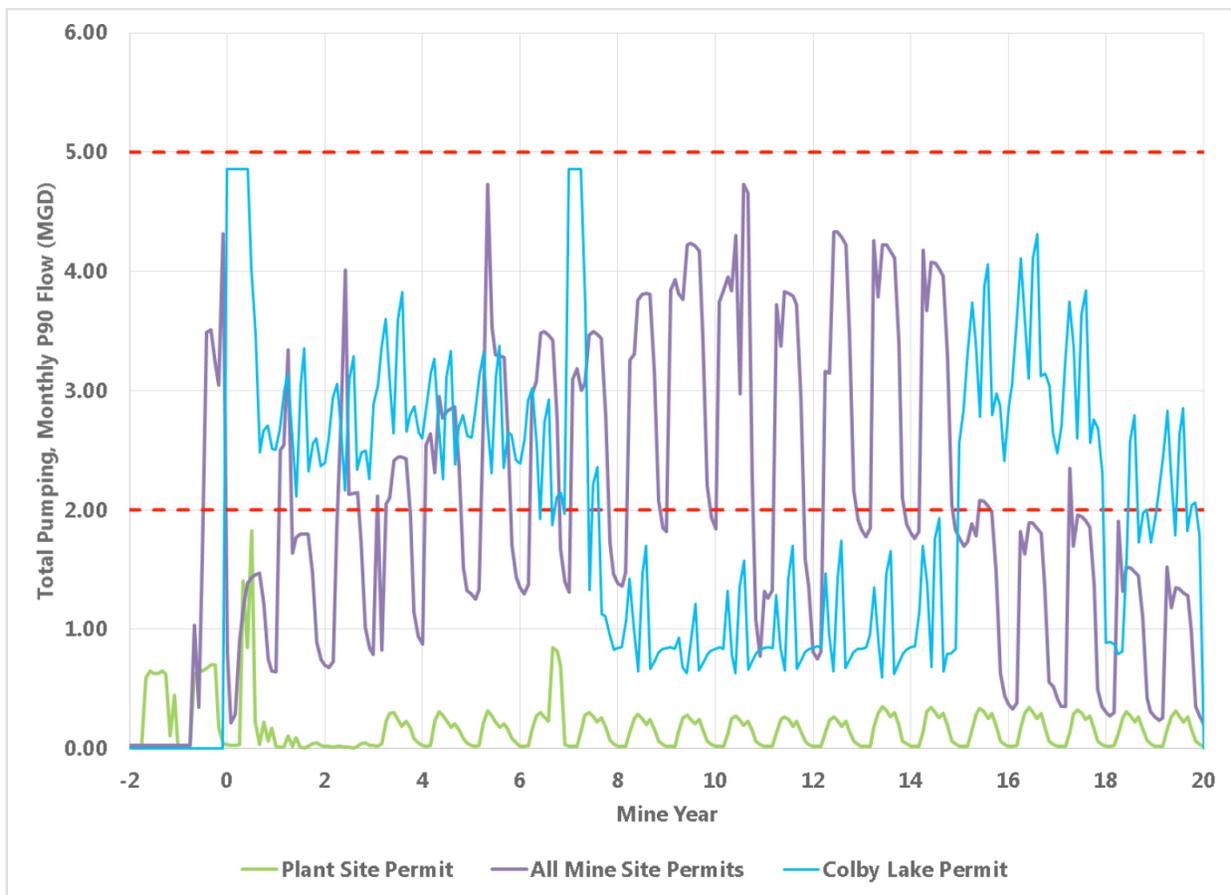


Figure 8-1 Monthly Total Pumping

Since PolyMet’s most recent water appropriations permit applications were filed in April, proposed appropriations have increased 17 percent as illustrated in Table 4 below. As a result, the draft PolyMet water appropriations permits would authorize *56.7 million gallons per day* of water usage.

⁹ PolyMet Water Appropriation Permit Applications, v. 3 (Apr. 14, 2017), Figure 8-1, p. 46.

Table 4 - Comparison of Appropriations in PolyMet Applications (Apr. 2017) and Draft PolyMet Water Appropriations Permits				
Draft Permit Number Description of Use	Draft PolyMet Permits		PolyMet Permit Applications	
	gal/minute	million gal/day	gal/minute	million gal/day
2016-1363 East Pit Dewatering	2340	3.370	2,340	3.370
2016-1364 Central Pit Dewatering	1300	1.872	1,300	1.872
2016-1365 West Pit Dewatering	2640	3.802	2,640	3.802
2016-1367 All Mine Site Infrastructure	22540	32.460	20,250	29.160
2016-1369 Mine Processing	7160	10.310	3,750	5.400
2017-0260 Mine Processing	3,400	4.896	3,400	4.896
TOTAL Water Appropriations	39,380 gal/min	56.7 mil. gal/day	33,680 gal/min	48.5 mil. gal/day

PolyMet’s allowable water usage under its draft water appropriation permits is more than ten times the threshold of 5 million gallons per day set in Minnesota law. Minn. Stat. §103G.265, Subd. 4.

Thus, it is incumbent on the DNR to demonstrate that, at no time in future decades of operations or reclamation would PolyMet’s water appropriations exceed the limit set in law to protect the Lake Superior Basin. If the DNR cannot provide such assurance, the commissioner must notify and solicit comments from governors and premiers or Great Lakes states and provinces, consider those comments, and secure legislative approval of the proposed consumptive use before granting PolyMet’s water appropriations permits.

6. Draft PolyMet Water Appropriation Permits Fail to Demonstrate that PolyMet is Capable of Collecting 90 Percent of Contaminated Groundwater as Claimed.

PolyMet has repeatedly represented that the collection systems planned for both the NorthMet Plant Site tailings basin and at the Mine Site Category 1 waste rock stockpile will achieve collection of at least 90 percent of the groundwater seepage at these permanent facilities.¹⁰ This representation was also repeated in the DNR Water Appropriation Permit fact sheet released to the public on August 11, 2017 with the PolyMet draft water appropriation permits, as follows:

The proposed NorthMet project would not have a substantial effect on water quantity or stream flow . . . PolyMet would install and operate a system to capture at least 90 percent of the groundwater seepage at the tailings basin and the permanent waste rock stockpile at the Mine Site.¹¹

¹⁰ See e.g., PolyMet NorthMet FEIS, 5-52 Table 5.2.2-12, 5-181.

¹¹ DNR, NorthMet Mining Project Permitting, Water Appropriation Permit Fact Sheet (Aug. 11, 2017), p. 2 available online at http://files.dnr.state.mn.us/lands_minerals/northmet/water-approp/water-appropriation-draft-permit-fact-sheet.pdf.

It appears that the DNR has relied on this representation in proposing the draft PolyMet water appropriation permits and in asserting that the NorthMet project would not have a substantial adverse effect on water quality and stream flow.

However, neither the PolyMet NorthMet FEIS nor PolyMet's water appropriation permit applications provide any evidence based on actual performance of similar systems under similar conditions anywhere in the world that the collection of at least 90 percent of groundwater seepage is feasible, let alone likely. In addition, PolyMet draft water appropriation permit conditions neither require continuous and demonstrated compliance with PolyMet's promised 90 percent seepage collection rate nor provide any means to provide appropriate monitoring, disclosure and public accountability if PolyMet were to (predictably) fail to achieve anything approaching a 90 percent seepage collection rate from the unlined tailings basin and Category 1 waste rock stockpile.

In connection with collection of contaminated seepage, as with water appropriations of unexamined magnitude, issuance of the draft PolyMet water appropriation permits would allow a massive and uncontrolled experiment, rather than the careful determinations before permit issuance needed to comply with law and protect Minnesota waters.

7. The draft PolyMet water appropriations permits lack public accountability.

The proposed monitoring plan in the draft PolyMet water appropriation permits exacerbates WaterLegacy's concerns that water appropriations would be authorized that conflict with applicable Minnesota laws and fail to protect waters of the Lake Superior Basin in the Partridge River Headwaters, Embarrass River watershed and Second Creek. The DNR proposes in the draft PolyMet permits that monitoring results would only reported be annually, rather than monthly, and no results would be posted for public access and review. If such a discontinuous and secretive monitoring plan were to be adopted, seasonal stream impacts, massive groundwater seepage contamination and/or exceedance of the 5,000,000 gallon per day average water use would all be concealed from public accountability.

The draft PolyMet water appropriation permits further undermine PolyMet's potential to be held accountable by denying the public notice and an opportunity to comment prior to any proposed transfer or assignment of permits and prior to the DNR's potential future decisions to modify permit conditions. In addition to requiring that PolyMet demonstrate its ability to prevent harm to Minnesota water resources prior to permit issuance, the DNR must require permit conditions and provide public notice to ensure that PolyMet does not cut corners and adversely impact water resources.

8. The draft PolyMet water appropriations permits fail to limit water use or the term of permits consistent with their stated purpose.

The most valuable resource in Minnesota's Lake Superior Basin is not copper or nickel. It is the fresh water that that sustains plants, fish, wildlife and human communities.

The draft PolyMet water appropriations permits would relinquish this water resources to the foreign shell corporation, PolyMet Mining, Inc. without explicitly limiting the use of Minnesota

waters to the purpose for which they are ostensibly being exploited, the purpose of mining and processing of copper, nickel and/or platinum group metals, and without providing that all permits must terminate if that specific use is not continuously maintained.

These draft PolyMet permits, thus, would allow a foreign corporation the indefinite right to appropriate 6.175 billion gallons per year of water from Minnesota's Lake Superior Basin. Such a transfer of public rights in public waters is neither consistent with Minnesota law nor consistent with the public interests and public benefits of future generations.

Conclusion

As detailed in these comments, WaterLegacy believes that proceeding with draft PolyMet water appropriation permits is premature and inconsistent with Minnesota law. The DNR must first conduct an analysis of the impacts on water supply, groundwater, surface water and use of Great Lakes waters based on the appropriations proposed in the draft PolyMet permits, which far exceed appropriations previously described in the NorthMet FEIS. The DNR must also set conditions to protect upper Partridge River elevation, average and low flows. Then the DNR must require PolyMet to demonstrate that it can and will comply with conditions to protect the Partridge River Headwaters, the streamflow conditions proposed to maintain Embarrass River creeks and Second Creek within $\pm 20\%$ of existing flows, and with PolyMet's promised 90% rate of contaminated groundwater seepage collection at the NorthMet tailings basin and Category 1 waste rock stockpile.

The DNR must further analyze whether the magnitude of PolyMet's water appropriations are in fact "necessary" or are only preferred by PolyMet in order to externalize its costs to the greatest extent possible. Finally, before deciding whether to grant PolyMet water appropriation permits, the DNR must determine what permit conditions, monitoring and reporting requirements, public review mechanisms and permit term limits could be sufficient to ensure that PolyMet, even if it has the capacity to meet conditions that protect Minnesota water resources, will in fact choose to do so during operations, reclamation and long-term closure.

WaterLegacy opposes issuance of the draft PolyMet water appropriations permits noticed for public review and believes that they should be rejected. Minnesota law requires additional analysis and protections before any PolyMet water appropriation permits could be granted.

Sincerely yours,



Paula Goodman Maccabee
Counsel/Advocacy Director for WaterLegacy

cc: Minnesota Pollution Control Agency
U.S. Army Corps of Engineers
U.S. Forest Service
U.S. Environmental Protection Agency
Fond du Lac, Grand Portage and Bois Forte Bands of the Lake Superior Chippewa

Enclosure

Project Name	PolyMet Dam Safety Permit Application Review	Date	05/15/17
To / Contact info	Jason Boyle (DNR)		
Cc / Contact info	Joe Henderson (DNR) and Mike Kunz (DNR)		
From / Contact info	Dick Van Zyl, Steve Gale (Gale Tec Engineering, Inc.), Cecilio Olivier (EOR) and Stuart Grubb (EOR)		
Regarding	Review Team Comments		

Background

PolyMet submitted two permit applications to the DNR for Dam Safety Permits for the NorthMet project. One application was for the Flotation Tailings Basin and the other was for the Hydrometallurgical Residue Facility (HRF).

To supplement the review process, the DNR requested that a team of top experts (EOR Review Team) be assembled to assess and comment on the proposed design, operation and maintenance of the facilities. The review approach focused on key elements similar to tailings basin review panels required by law in Montana and other western states. The review process included the following tasks:

- Documents Review – Including PolyMet’s Dam Safety Permits applications, related technical documents, and comment tracking sheets.
- Site Visit and Discussion - Trip to Hoyt Lakes to develop observations and take field notes at the LTV/PolyMet tailings basin and proposed HRF sites. Meet with PolyMet and the tailings basin hydro designers to ask questions and discuss the different design elements.
- Review Meetings – Internal review meetings between EOR Review Team and DNR to discuss initial findings, need for additional information and develop final comments and recommendations. Meeting with PolyMet, DNR and the EOR Review Team to discuss final findings.
- Draft and Final Report - Present a Draft Report of findings to DNR and PolyMet. Prepare a Final Report including a response to comments on the Draft Report.

EOR Review Team

EOR assembled a Review Team of experienced experts in mining geotechnical engineering. The Review Team included:

- **Dirk van Zyl, PhD, PE.** Dirk is on the faculty of the University of British Columbia and consults with mining companies worldwide on tailings basin design. He was formerly on the faculty of the University of Nevada – Reno, and he has worked for several consulting companies. Dr. van Zyl has authored or co-authored over 120 papers on mining topics, including tailings basin management. He currently serves on several review panels in Montana and on the review panel that previously investigated the Mt. Polley dam failure.

- **Steve Gale, PE.** Steve is the President of Gale-Tec Engineering Inc. in Minneapolis, Minnesota. He has over 30 years of experience working as a geotechnical engineer. Mr. Gale and his company provide consulting services on all aspects of tailings basin design, management, and closure, including dam safety analysis and permitting. He has worked on many of the tailings basins on Minnesota's Iron Range.

Resumes are included in Attachment 1.

Review Process

The EOR Review Team went through the following documents:

- Technical Memorandum: NorthMet Geotechnical Data Package – Volume 1 (Flotation Tailings Basin) – Version 4 Modeling Outcomes Summary. Barr Engineering, April 2, 2013.
- NorthMet Dam Safety Permit Application: Flotation Tailings Basin. Barr Engineering, July, 2016.
- NorthMet Dam Safety Permit Application: Hydrometallurgical Residue Facility. Barr Engineering, July 2016.
- 2015 Tailings Basin Dam Safety Inspection Report. Barr Engineering, August 2016
- Technical Memorandum: DNR Review of PolyMet's Dam Safety Permit Application – Tailings Basin Comment 9 – LTVSMC Coarse Tailings Strength. Barr Engineering, December 30, 2016.
- Technical Memorandum: Tailings Basin Cell 2E North Dam – Modified Buttress as Alternative to Cement Deep Soil Mix Zone. Barr Engineering, December 30, 2016

The EOR Team (along with the DNR, PolyMet and Barr Engineering) conducted a site visit to the LTV tailings basin site and proposed HRF facility in September 29th, 2016. The EOR Review Team also met with PolyMet and Barr Engineering to discuss comments and questions on the proposed NorthMet project. A follow up meeting to discuss and review comments was held with the same participants at DNR headquarters on December 5th, 2016. The EOR Review Team and DNR met on several occasions to discuss the review's status .

Review Comments

The detailed EOR Review Team comments are presented in the review tables of Attachment 2. The columns on the tables include:

- *Comment/Concern* - These initial comments were written by the EOR Review Team, reviewed by DNR, and submitted to PolyMet in December, 2016.
- *PolyMet Response* - PolyMet provided these written and/or verbal responses to the initial comments.
- *Final Comments* - After considering PolyMet's response, the EOR Review Team prepared these comments contained in this column.
- *Recommendations* - The EOR Review Team recommends that the comments and issues be addressed as follows:
 - *Address Pre-Permit* - These issues will require additional information before a permit can be issued. This may require resubmittal of the complete permit application.

- *Address Post-Permit & Make Condition of Permit* - These issues require additional information, but they are not likely to have a bearing on the DNR's decision to grant or deny the permit. They may affect future construction and operation of the facilities. Some of these comments can only be addressed while the facilities are operating. PolyMet must address these comments if the permit is granted.
- *Address Pre-Construction* - These issues also require additional information, but they are not likely to have a bearing on the DNR's decision to grant or deny the permit. PolyMet must provide more information before beginning construction of the facility if the permit is granted.
- *Condition of Permit Recommendation* - The EOR Review Team provides elements and recommended language to be incorporated into the permit, either pre-permit or as a condition of the permit.

Comments on PolyMet's Design, Approach and Redevelopment of the LTV Tailings Basin

Observational Method (Comments #1, #4, #5 and #7 in Attachment 2)

The Observational Method is a well-documented and often-used approach to tailings dam construction and maintenance. The Observational Method steps are:

- 1) Predict behavior with detailed calculations,
- 2) Design with contingencies,
- 3) Construct with monitoring and
- 4) Compare measurements with predictions and redesign if necessary.

The EOR Review Team agrees that the Observational Method can and should be used during construction, but it is not a substitute for careful initial design. The EOR Team concluded that the permit application lacks the detail and description of contingencies for the Observational Method to be effective. If monitoring data indicate a potentially unsafe condition during construction, then the alternate construction methods and designs (contingencies) must be already in place so that they can be implemented immediately.

Peat Layers and Slimes Layers (Comments #3, #4 and #7 in Attachment 2)

The former LTV tailings basin was constructed over layers of peat in some areas. Layers of slimes (very fine-grained taconite tailings) were also included in the construction of the tailings basin dam. Both peat layers and slimes layers have very low shear strength, which could potentially contribute to a dam failure. The tailings basin can be designed to safely mitigate for these conditions, but the areas with peat and slimes must be well-defined and tested. The EOR Team commented that additional data should be gathered on the peat layers and slime layers, and that the design may need to be modified in the future in accordance with the Observational Method.

Cement Deep Soil Mixing (CDSM) & Dam Toe Buttressing (Comments #2 and #11 in Attachment 2)

In the permit application, PolyMet proposed constructing the dam with both CDSM and dam toe buttressing (reinforcement usually using waste rock). CDSM uses large-diameter drills to drill into the base of the tailings basin dam and mix Portland cement with the existing materials. Placing of these CDSM "pillars" close together in a line creates a kind of shear wall that increases the shear strength of the material. The construction needs to be carefully monitored in the subsurface to make

sure that the pillars are constructed as designed. CDSM is often used in the construction of embankments and dams, but to our knowledge has not been used in a tailings basin.

Dam toe buttressing places heavy materials at the toe of the tailings basin dam to prevent the toe of the dam from sliding and causing a dam failure. The required size and weight of the buttress increase as the height of the dam increases.

The EOR Review Team commented that additional monitoring would be required during CDSM construction and during operations and closure to assess the effectiveness of the CDSM. Since then, PolyMet has removed CDSM from the design plans in favor of using larger dam toe buttresses. The design plans with additional buttresses will have several advantages:

- The technology is better understood on tailings basin dams,
- Construction and maintenance are above ground, so critical observation and monitoring can be done with greater confidence, and
- The buttress can be constructed incrementally over an extended period of time, whereas the CDSM must be fully completed prior to placing the basin into service.

Peat deposits should be removed near the toe of the existing tailings basin dam so that the new buttress will have a solid footing. If peat deposits are not fully removed, the EOR Review Team commented that additional analysis should be required to evaluate the stability of the buttress toe that may be constructed over localized soft soils. PolyMet indicated that buttress construction will specify the complete removal of peat soils. The EOR Review Team also recommended performing additional analysis for other potential impacts due to additional wetland fill or the geochemistry of the buttress material.

Water Ponding (Comment #5 in Attachment 2)

As currently designed, a pond of water will be maintained on top of the tailings basin in perpetuity. During mining operations, the residue from the processing plant (tailings) is pumped to the pond as slurry, and water is returned to the plant after the tailings settle out. PolyMet developed stability analysis models that show the volume and location of the pond at various times during the operating life of the tailings basin. This stability analysis was based on maintaining a beach length of 625 feet between the inside crest of the dam and the edge of the water within the tailings basin. This would minimize the potential for the water to rise and cause erosion at the edge of the basin.

The EOR Review Team commented that some of the model runs did not seem to correctly account for a potential rise in water levels, the location of the beach around the pond, and the distance to the edge of the tailings basin. PolyMet indicated that the design included a 4 feet head increase while still keeping the water pond at a 625 feet distance from the crest of the perimeter dike. The EOR Review Team recommended that a water pocket distance of less than 625 feet (or in direct contact with the tailings dam) be analyzed as an event/condition of the Observational Method approach.

Existing Structures (Comment #6 in Attachment 2)

The EOR Review Team commented that some of the existing structures associated with the existing tailings basin had not been specifically addressed in the plan for future construction. The EOR Team

recommended that the permit includes language that requires all existing structures to be investigated and properly abandoned before construction to ensure that dike stability is maintained.

Bentonite Addition (Comment #8 in Attachment 2)

To minimize water seepage from the tailings basin, bentonite will be added to the soils at the top of the basin during the closure and reclamation process. The permit application only lists alternatives for placing the bentonite that will be pilot tested and field tested later. The EOR Review Team commented on specific elements that should be included in the field testing that would impact the permeability of the bentonite amended tailings. Once the preferred bentonite application method is selected, the EOR Review Team recommended developing material and installation specifications and a detailed protocol for both a laboratory and a field pilot study.

Statistical Analyses (Comment #9 in Attachment 2)

Geotechnical tests were performed to determine the shear strength of the tailings at hundreds of locations around the existing tailings basin. Statistical analyses are used to calculate the overall strength and stability of the basin. EOR Review Team commented that some of the geotechnical test results (i.e. low coarse tailings friction angles) were excluded from the statistical analyses. Because of their importance in the overall stability of the basin, the EOR Review Team recommended that coarse tailings friction angles be considered as a variable condition in the Observational Method process. This would also provide a consistent and proper procedure for future analyses.

It should be noted that including all the geotechnical results in the statistical analyses did not significantly reduce the global factor of safety. Nevertheless, the EOR Review Team recommended using the Observational Method to enhance instrumentation and monitoring at those discrete cross sections where lower friction angles could occur. If lower friction angles are observed, the statistical analysis must be rerun to verify that this localized factor of safety is still acceptable.

Wet Closure vs. Dry Closure (Comment #10 in Attachment 2)

Wet closure of the tailings basin is currently proposed, meaning that the top of the tailings basin will have a permanent pool of water on top of the basin. Wet closure has ongoing costs like; maintaining water levels to prevent flooding and drying out, erosion repair, treatment of discharged water and on-going monitoring. Dry closure (no water ponding) requires a greater initial investment, but has much lower ongoing maintenance costs and less long-term environmental risk.

The EOR Review Team did not proposed dry closure as a permit requirement at this time. The EOR Review Team recommended that if the wet closure is permitted, the DNR should require PolyMet to continually review the current state-of-the-practice for dry closure techniques prior to starting any tailings basin closure activities.

General Discussion of Issues – HydroMet Residue Facility

Stability of Underlying Soils (Comment #1 and #2 in Attachment 2)

The soft ground beneath the proposed residue facility consists of up to 30 feet of slimes, peat and tailings concentrate. This will not be an adequate foundation for the 80 foot high basin. Three potential remediation alternatives have been considered:

- Pre-loading the existing material with 50 feet of rock and soil to compress and consolidate the underlying material. This is the method currently proposed by PolyMet.
- Installing wick drains that will allow water to flow out of the existing material, thereby increasing its shear strength.
- Removing the existing material and any soft soils before constructing the basin.

The basin will have a geomembrane or geosynthetic liner. The liner could deform and fail if the existing underlying material cannot support the material added to the basin.

The EOR Review Team commented that the proposed pre-load design should be re-evaluated to determine if it will adequately surcharge and compress the existing material.

Geomembrane (Comment #3 in Attachment 2)

The EOR Review Team commented that more information was required in the permit application to evaluate the geomembrane liner system. Barr Engineering provided the information, so this issue has been closed.