

Water Model and Project Development Tracking 4/17/12						
CDF	CDF Finish Date	Description	General Status and Dependencies	Action Items	Action Item Status	Action Item Finish date
PolyMet CDFs: Mine Site						
001	2/22/2012	WWTF Effluent Concentrations in Closure	First presented on 2/8. Accepted 2/22. The MPCA agreed with the proposed target concentrations in closure if a filter is installed on the WWTF. It was agreed that the filter would not be a part of the proposed project unless needed to meet target effluent concentrations. The actual performance of the WWTF would be monitored during the life of the project to inform closure requirements.	Meeting to be held with Clark, Pint, Schweiss, and Engesser Modify CDF to instruct PolyMet to make changes to the <i>Reporting and Adaptive Management</i> section of the <i>Water Management Plan – Mine</i> to describe the conditions in which a filter would be installed, type of filter, the timing of installation, and its technical feasibility.	Done, Engesser not involved done	
002	2/15/2012	Category 1 Concentration Caps from Dunka Seep	First presented on 2/8. Withdrawn (2/15), more promising path forward identified (solute release rates)			
003	3/28/2012-3/22/2012	Category 1 Stockpile Infiltration	First presented March 7. Under discussion. Liljegren technical lead. PolyMet going with a Geomembrane cover, no longer ET. CDF Withdrawn (2/22/12).	Barr to give more thought to selecting more or different water balance data sets provided by Benson that better reflect the project site's precipitation range. No longer necessary to complete.	done	3/21/2012-3/22/2012
				Water staff to forward comments to Carlson/Liljegren by 3/23/12. Carlson/Liljegren to aggregate action items from 3/21/2012 meeting and re-distribute to group. No longer necessary to complete.	done	3/26/2012
				Barr to respond to agency comments. No longer necessary to complete.	done	3/21/2012
				Barr to give more thought to using another runoff value for the bare soil condition. No longer necessary to complete.	done	3/21/2012-3/22/2012
				Carlson to compile comments on CDF and provide feedback to Barr. No longer necessary to complete.	done	3/21/2012-3/22/2012
004	3/28/2012-4/11/2012	Category 1 Scale-Up Factor	First presented February 29. Under discussion. Olson technical lead. (Comment #20). New method coming 3/28/12 in a CDF. If DNR does not accept CDF, changes will need to be made to Waste Characterization Work Plan. On 3/28/12 Barr presented new method, LAM did not agree to it. On 3/29/2012, DNR thinks it appropriate to take the average reactor data value for the duplicate samples. Another approach would be to weigh the sulfate release rates as a function of percent sulfur and run a T-test to determine if they are statistically different. CDF forthcoming from PolyMet. DNR rejected CDF on 4/11/2012.	Olson/LAM to develop method to replace PRI/SKI laboratory conversion factor method	done	3/13/2012
				Barr to review Olson/LAM memo	done	3/14/2012
				Barr to provide Pogo Mine data developed by Steven Day, first principles approach	done	3/13/2012
				Olson to provide spreadsheet comparing the composite scaling factor distributions between three approaches using different laboratory data 1) using PRI humidity cell data (base model) 2) using SKI reactor data in LAM memo, Mar 13 3) using all reactor data (SKI, PRI, PolyMet) – new method proposed at 3/14 meeting	done	3/15/2012
				Barr to use separate distributions from Olson's work above into the GoldSim model to see their effect to the model outputs. (no longer necessary to complete this task)	done	3/20/2012
				Olson to provide Barr % sulfur distribution data for the Dunka stockpiles from Antonson	done	3/15/2012
				Barr to provide brief summary of proposal and model results that assume a Geomembrane cover, solute release rates options	done	4/9/2012
				Olson to provide brief summary of proposal	done	4/9/2012
				Barr to provide more information on WS003 Watershed Yield and a description of pile construction and hydrology of the stockpile as it relates to watershed yield. Coming in presentation on 3/21/12 (no longer necessary to complete this task)	done	3/19/2012
				Barr to look into NTS sampling locations for WS003 and WS004, and verify data collection years, so as not to be including data from treated water	done	3/14/2012
				Barr to provide Category 1 stockpile vs. Dunka 8013 comparison spreadsheet	done	
				Comments from Liljegren, Clark, Finley, Wenz on comparison spreadsheet above to Olson (no longer necessary to complete this task)	done	3/14/2012-3/19/2012
Barr to provide statistical analysis, specifically the P-value to determine significance/non-significance	done					
005	4/4/2012-3/28/2012	Pit Wall Water Modeling	First presented 3/14/12. Discussed 3/21/12. Accepted 3/28/12	Finley and Kempton to provide feedback on the assumption that the reactivity depth of the setback should be 1/10th of the reactivity depth of a bench.	done	3/21/2012
				Blaha provided paper "Direct Measurement of Sulfide Mineral Oxidation Rates and Acid Rock Drainage in Wall Rock of Open Pit Mines" (not directly related to CDF to follow up with mine manager on blasting techniques)	done	3/26/2012
006		West Pit Lake Water Chemistry	Expected 3/21/12 3/28/12 Withdrawn by PolyMet			
007	2/15/2012	Mine Site Watershed Correction	First presented on 2/8. Accepted 2/15			
008	2/22/2012	Mine Pit Inflow Source Identification	First presented on 2/15. Accepted 2/22. The MRC Team agreed that dividing the groundwater flows into the mine pits between surficial and bedrock aquifers needs to be done in the model. The Team agreed that MODFLOW should determine the percent contribution of each aquifer into the mine pits. The decision to make the groundwater input deterministic or probabilistic was not discussed. Liljegren to lead review CDF008 to provide input to Team on CDF008, including whether or not to proceed using a deterministic or probabilistic input for groundwater contributions to pits.	Three comments were provided to PolyMet, responses provided. Responses accepted by DNR.	Done	
009	4/4/2012-3/28/2012	XP-SWMM Update	First presented 3/14/12, Resolves Comment #1 if CDF is accepted. Incorporates accepted change from CDF007. Accepted 3/28/2012	Waiting for feedback from Liljegren and Adams.	done	3/21/2012-3/22/2012
010	3/21/2012-4/11/2012-4/18/2012-5/2/2012	Category 1 Waste Rock Solute Release Rates	DNR agrees that the accuracy of solute release rates for the Cat 1 Stockpile may be able to be improved. Wenz technical lead. Discussions between Wenz and Barr on-going outside MRC forum. Soonest Kramka available is 5/2/2012. Determining if LAM and Barr have agreement and to make recommendation to Managing Sponsors outside of Wednesday's meeting.	Barr and Wenz to determine how to use ProUCL software with available data.	done	3/28/2012
				Develop decision-making criteria	done	3/7/2012
				Barr developing new method using data organized by humidity cell and applying lognormal distribution	done	4/4/2012
				Barr to provide a version 2 of CDF that fully includes Cat 2/3/4 waste rock time/concentration plots in Excel	done	4/9/2012
				Barr will work with Wenz on a distribution and get high level agreement then bring forward a CDF 3/21/12 3/28/12 with a proposed distribution. Barr to look at aggregating all data instead of evaluating it first based upon its original source	done	3/21/2012-3/28/2012
Barr to provide spreadsheet of release rates - current, with statistical handling of non detects and with non detects as zero to Wenz from 3/7/12 meeting	done	3/12/2012				
	TBD	Mine and Plant Site Re-calibration	Expected TBD, resulting from CDF009 and MODFLOW update [Are the issues to the right the correct list of remaining issues?]	Incorporate available new mine site groundwater data	on-going	
				(Comment #35) Barr to provide scatter plots for all constituents. [how and when will they be provided?] (From ERM QAPP Review #1) Barr should present the acceptance criteria used to verify that the model is sufficiently calibrated. Barr should consider using quantitative metrics that assess the goodness of fit for purposes of model calibration. Revised based upon 4/11/2012 discussion that Barr will quantify calibration error and provide professional judgment criteria/rationale for accepting/rejecting calibration. Coming in a memo which will direct changes to calibration documents	on-going	
				(Comment #33) Barr to present method for improving calibration of arsenic, lead, cobalt, and iron 4/18/12. DNR to review results of revised calibration.	on-going	
	5/2/2012	MODFLOW Update	Barr to include new input values and new method for modeling hydraulic conductivity. Expected 4/25/12	(Comment #14A) Barr to provide infiltration values being used for each portion of the tailings basin. This issue is related to the modeling at the tailings regarding the model layers being 2 versus 3 [need status update]	on-going	

			Marinelli has a follow-up question based on the review of the Plant Site Work Plan v 4 and Data Package v 5 stemming for the John Coleman letter. Comments to be provided to Barr to be included in this CDF [need status update]	on-going	
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PolyMet CDFs: Plant Site						
051	2/22/2012	Plant Site Watershed Correction	First presented on 2/8. Accepted 2/22.	Typo in CDF to be corrected	done	
053	5/2/2012	Trace Metal Release Rates--Tailings	Plant Site, Expected 4/18/2012			
054	TBD	Ore Load Model Modification	Plant Site, Expected TBD [is this coming?]			
PolyMet Engineering Controls						
EC02		Category 1 Waste Rock Stockpile Groundwater Containment System Extension	This will address performance (contaminant reduction) that can be achieved with a passive treatment system. Performance assumptions will address the following engineering controls: EC02, EC03, EC04, EC08 and EC054			
EC03		Category 1 Waste Rock Stockpile Groundwater Containment System Passive Treatment				
EC04		East-West Pit Channel Passive Treatment				
EC08		West Pit Overflow Passive Treatment				
EC54		Flotation Tailings Basin Seepage Passive Treatment				
EC05		Additional WWTF Capacity in Closure	The Refined Project will include additional capacity of 1200 gpm. In addition, a 500 gpm MMF (green sand filter) is required to enable the change from operating to closure treatment targets. There are no new performance parameters.			
EC06		East Pit Wall Virginia Formation Mitigation	East Pit Wall Virginia Formation Mitigation will be to construct a hydraulic barrier at the Virginia Formation portion of the wall			
EC07		West Pit Wall Ore Grade Material Mitigation	West Pit Wall Ore Grade Material Mitigation will be to construct a hydraulic barrier at the Ore Grade Material portion of the wall			
EC50		Additional Pumping and Treatment of Tailings Basin Seepage	Will address performance (collection efficiency for wells and trenches) that can be achieved with a properly designed and constructed collection system			
EC01		Category 1 Waste Rock Stockpile Cover System	This addresses performance (percolation rate) that can be achieved with a properly designed and constructed <u>membrane cover</u> .			
EC51		Cell 1E/2E Enhanced Cover System	Will address performance (percolation rate) that can be achieved by enhancing the current <u>bentonite</u> amended tailings cover and pond bottom			
EC52		Cell 2W ET Cover System	Will address performance (percolation rate) that can be achieved by adding an <u>ET cover (planting trees)</u> .			
EC53		Pumping Excess Cell 1E/2E Pond Water to Mine Site	Includes adding temporary pumping of excess Cell 1E/2E pond water to the Mine Site while the tailings basin beaches are fully reclaimed.			

DNR Unresolved Issues						
	4/25/2012	Plant Site Percolation Rate	Moved from internal review process to MRC for discussion 3/21/12.(Comment #3). Conclusions to be recorded as a CDF if change is needed or in Co-lead comment spreadsheet if there is no change.	Barr to produce a list of the all of the K-values at the plant and mine site for the agency to review against the distribution that was created. Barr to provide location maps. Dave to check with Marinelli to see if he needs more data, if yes Liljegren can get more from Pint	on-going	
				Marinelli to evaluate field data to determine if it generally fits percolation distribution.	on-going	
	TBD	Humidity Cell Test All Available Data Not Incorporated into Model	There is approximately a year's worth of data that is not included in the model. DNR to determine if this data and what data should be included in the SDEIS modeling. DNR requests a document justifying why data is not included in the model.	Scott to provide table with average concentrations of HCT data with and without additional data not in model	done	4/10/2012
				PolyMet to produce a document describing what data is not in model and justification of why it is not in model	on-going	TBD
				Carlson to schedule a meeting with Colvin, Kramka, Engstrom, Kunz, Foss optional. Will put on agenda for next Wednesday	done	4/11/2012
		Plant Site Calibration--use of constants	The work plans specified using a constant. Barr has chosen to use a distribution instead of constant in some cases for calibration. This could be seen as calibrating the data to fit the model instead of calibrating to model to fit the data.	The calibration was changed so that no constant concentrations are used (see "Calibration of the Existing Natural Watershed at the Mine Site – NorthMet Project", version 3, January 2012).	done	
???	4/25/2012	Scale up Factor for Cat 1 Stockpile Only	DNR Proposal for Scale-Up Factor as a result of rejecting CDF004. To be presented on 4/25/2012 to communicate approach to Barr.	LAM to produce CDF describing its proposal. Barr to fill in part of CDF that describes what sections of what documents will be changed.	on-going	4/20/2012
	TBD	Percent Sulfur Block Model Analysis	Working on data practices issues. Ball in PolyMet's court to determine best path forward on providing block model to contractor [need status update]		on-going	
	4/18/2012	Cat 2/3/4/ Stockpile non-acidic concentration caps	A range in pH from 6.0-7.5 is proposed for use when determining an appropriate concentration cap using the AMAX data set (WC data package, Large Table 13). LAM does not recall this range being discussed in the geochem groups and would like some details as to how this range was decided upon.	Kunz following up with Barr. Barr: The original method for modeling non-acidic Category 2/3/4 concentration caps was to use a distribution fit to the highest 5% of the AMAX data over the pH range from 6-8 (WCDP version 4, 7/22/11). The decision was made by the Lead Agencies to model uncertainty in pH for the Category 1 stockpile and use a lookup table to select concentration caps from the highest 5% of the AMAX data, where available (changed in WCDP version 7, 1/10/12). For modeling consistency the method for the non-acidic Category 2/3/4 caps was changed in WCDP version 8 (2/14/12) to match the Category 1 method (use of a pH-based lookup table rather than a fit distribution). The pH range was set to the previous lower bound (pH 6) and the upper bound selected for the Category 1 stockpile (pH 7.5). A change to the non-acidic Category 2/3/4 concentration caps was necessary because some solutes used the same methods as proposed for the Category 1 waste rock (i.e. SMWMP data). For those solutes that had been previously proposed to use the AMAX data, this change does not materially affect the range of modeled concentration caps for the non-acidic Category 2/3/4 rock, since the data source is still the upper 5% of the AMAX data.	done	4/16/2012
	4/18/2012	Waste Characterization Data Package (Comment #21 #22)	Are the DNR proposed concentration caps being used? Will the alternative PolyMet concentration caps been (being) removed from the Waste Characterization Data Package?	Kunz following up with Barr. Barr: Yes, the DNR concentration caps are being used as stated in WCDP Sections 8.3.1 & 8.3.2 and shown in Large Tables 12 & 13 of the WCDP and in Tables 1-30 and 1-31 of the Water Modeling Work Plan. The WCDP documents the alternative concentration caps that PolyMet/Barr/SRK believe are valid as well as the decision to use the concentration caps proposed by the DNR. We are not modifying the WCDP except by CDF, and do not see a need for modifying what is documented there, as the document is consistent with the modeling method that will be used going forward.	done	4/16/2012
	4/18/2012	Waste Characterization Data Package (Comment #23 and #24)	Is the DNR proposed pH range being used? Have the SWMMP data been removed from the Waste Characterization Data Package?	Kunz following up with Barr. Barr: Yes, the DNR pH range is being used as stated in WCDP Section 8.3.1.6 and as shown in Table 1-1 of the Water Modeling Work Plan (see the variable named "Cat1_pH" on pg. 23 of the Work Plan pdf). The WCDP documents the alternative concentration caps that PolyMet/Barr/SRK believe are valid (including the SMWMP data) as well as the decision to use the concentration caps proposed by the DNR. We are not modifying the WCDP except by CDF, and do not see a need for modifying what is documented there, as the document is consistent with the modeling method that will be used going forward.	done	4/16/2012
	4/25/2012	Covariance/Correlation of Constituents	(Comment #28). Conclusions to be recorded as a CDF if change is needed or in this spreadsheet if there is no change. Expected 4/4/12.	Liljegren to check to see what justification is in the record for excluding covariance and correlation of constituents in model (done, found nothing). Blaha and Trippel to double check. The decision to include or exclude these dependencies in the model needs to be revisited. Carlson provided documents to Blaha for review 3/29/2012. Blaha reviewing issue.	on-going	4/17/2012
	4/11/2012	Recharge Rate Used for GW Flow Path Modeling	(Comment #9) Conclusions to be recorded as a CDF if change is needed or in this spreadsheet if there is no change. Expected 4/4/12.	Barr to evaluate K values, consider using regional percolation values, and evaluate ET as a possible method to validate predicted percolation. Blaha to confirm Marinelli is comfortable with recharge rate done 04/03/2012). If yes, need better documentation in Plant Site data package and work plan. Marinelli is comfortable with recharge rates. Comments past to Barr via comments on Plant Site Work plans and Data packages	done	
Comprehensive Model Results Review						
	5/9/2012	Excel Spreadsheet: Barr-produced model results generation tool	Draft tool developed, improvements forthcoming	Barr to explain why it chose to show some plots and not others during presentation of initial results. Barr to err on the side of presenting too many constituents and to provide model results on water quantity at surface water evaluation points. Barr to allow plotting of pH DNR and PCA to use the tool and gain comfort with it	on-going	
	5/23/2012	Co-Lead Results Review	The DNR is to discuss what solutes they would like to see for initial modeling results, if they would like to see other model results such as liner leakage rates, and if using the draft EIS would help in checking model results. Solute Co-leads may want to see potentially informed by Phase II QA/QC which will identify "solute of concern" Start of task pending completing CDFs on mine or plant site.			

PolyMet Project Refinement						
	TBD	Proposed Project Review	Review of Proposed Project with mitigation and the performance of the Proposed Project to determine if additional mitigation is needed	Incorporate available new mine site groundwater data		
QA/QC (periodic implementation throughout process)						
	TBD	Procedure Development Mine Site and Plant Site	Phase I Model Input Review QA/QC Phase II Model Computational Review QA/QC	ERM Version 1 development Co-lead review ver. 1, Liljegren, Schwanz, Clark, Olson. Carlson review lead. DNR/PCA/USACE meeting scheduled for 3/26/12, then to report back to ERM. ERM version 2 development Co-lead review ver. 2	done done done on-going	1/25/2012 3/6/2012 3/29/2012 4/10/2012
		Procedure Implementation Mine Site and Plant Site	Phase I Mine Site (Round 1) Phase I Plant Site (Round 1) Phase II Mine and Plant Site (Round 1) and Phase I Mine and Plant Site (Round 2), pending completion of Comprehensive Model Results Review. Phase II Mine and Plant Site (Round 2) and Phase I Mine and Plant Site (Round 3), pending completion of Project Refinement process, which includes project mitigation	Report production and review Files being developed for hand off, start date 4/23 (Comment #2) ERM to check mass balance (From ERM QAPP Review #4) The complete source code for the model should be provided to the Co-Leads. Calibration of the LTVSMC tailing release rates for the existing basin. (Comment #18, #19). ERM to review constituent specific correction factor used to adjust the modeled constituent concentrations. (From ERM QAPP Review #3) The Mine Site Data Package contains many of the equations used in the GoldSim model, but it is not complete. Conditional programming ("if this, then that") is commonly described verbally, but not mathematically. It is in our interests for Barr (Comment #4) Barr to generate tornado diagrams generated by GoldSim to identify the most sensitive model inputs and the corresponding calculation pathways impacted by these inputs. The review of tornado diagrams is to determine if some inputs can be made deterministic Report production and review Report production and review	done on-going done on-going	2/3/2012 TBD
	3/8/2012-3/16/2012-3/29/2012	QAPP- like document Mine Site	Co-leads, EPA have reviewed document. ERM has reviewed EPA comments and provided feedback.	ERM to provide feedback of EPA comments to guide possible improvement of document. DNR provided feedback to PolyMet	on-going	3/29/2012
	TBD	QAPP- like document Plant Site	Barr distribution pending Co-lead feedback on Mine Site QAPP. EPA has no desire to review document.	Co-lead review	on-going	
Spreadsheet Notes						
			Green, Comments carried over from "Un-resolved comments that may lead to proposed CDFs"			
			Blue, Erik's questions			
			Orange, from ERM Mine Site QAPP Review			

Un-resolved comments that may lead to agency proposed CDF's, March 1, 2012

Comment Table for NorthMet Project SDEIS Water Modeling Work Plans (Mine Site V5) and (Plant Site V3), Waste Characterization Data Package V7 and Mine & Plant Site Calibration Memos, Ver 2

Commenters: Mike Liljegren, John Adams, Jim Finley, Fred Marinelli, Zack Wenz, Mike Olson, Mike Berndt

Comment #	Document Name	Location (Page, Figure, or Table)	Number	Comment/Concern	Barr Response	Agency response	Agency Process Path Forward as of 3/5/12	Updated Agency Process Path Forward as of our 3/7/12 meeting with Barr and then follow up email with Tina	Issue Status as of 3/29/12
1	Water Modeling Work Plan - MinSite v5	Table	1-20a to 20l	Similar interpretation as Table 1-18. The total % for all stations SW-001 thru SW-006 = 100%, so how does "Colby Lake" incremental watershed (I'm assuming upstream of CL to SW-006) contribute 20% of the predicted flow at SW-006? Also, some of the numbers in these tables don't seem realistic, e.g., how does the incremental watershed for SW-005 (about 22% of the SW-006 watershed) contribute a reasonable 21% to 23% of the January/February flow at SW-006, drop to about 10% for March, then jump to about 31% for April? Monthly flow distribution for SW-006 also seems questionable.	The watershed between SW-006 and Colby Lake contributes flow of magnitude 20% relative to SW-006. Total flow into Colby Lake is therefore 120% of SW-006 flow. Changes in flow percentages for March/April reflect watershed differences in snowmelt modeling and snowmelt timing. SW-006 flow distribution was discussed as part of the IAP process and will not be considered further at this time.	1) Suggest explaining first answer in a footnote to the tables. 2) Answer still leaves me puzzled. I can explain some of the monthly variations by probable differences in time of travel, but the large March-to-April contribution drop (52%, during a time of little snowmelt) from subwatershed SW-005, while all other subwatersheds (except SW-001) slightly increase their contribution, remains unexplained. I would expect the opposite trend, i.e., that the % contribution from the closest subwatersheds would slightly increase during initial snowmelt, while more upstream subwatersheds would slightly decrease. Given the relatively short time of travel for delivery of snowmelt from any subwatershed, and short travel distance down the main channel to SW-006, I wouldn't expect any large swings in % contribution from month to month for any of the subwatershed. 3) Monthly flow contribution from subwatershed SW-006 was not discussed during the surface water IAP, but its peak contribution to location SW-006 in March may be explained, at least partially, by snowmelt time of travel.	Further discussion needed with Barr. Should be handled under a Barr/Polymet CDF updating the XP-SWMM model	Comment 1, included in CDF009	Resolved in CDF009
2	Plant Site Work Plan V3	General		Overall Approach: In my opinion, there are no fatal flaws with Barr's overall approach. GOLDSIM is capable of performing the probabilistic calculations. If not done so already, I would encourage Barr to include algorithms that perform local and global mass balance checks to insure that water and/or chemical mass is not artificially lost or created in the calculations.	Reviewer is correct that mass balance checks will be important. Please review to the QAPP for details on the planned checks.	OK	Plant site QAPP has not been submitted to date. Also the Mine site QAPP will be reviewed and commented on. This review will also happen in the Agency QA/QC plan	OK	Barr has agreed to this in the Barr QAPP and this issue is also in the Phase II of the agency QA/QC document. Issue moved to MRC tracking spreadsheet.
3	Plant Site Work Plan V3	General	41 fig 5-5	Groundwater Flow: I agree with Barr that the only groundwater parameters to be treated as uncertain inputs should be hydraulic conductivity (K) and distributed recharge or net infiltration (R and I). Barr will need to provide justification for the probability distributions used to define these inputs. For K, this will likely come from a combination of field testing and generic values for similar geologic materials. This is no easy task because there is little hard data to draw upon.	GW parameter distributions were discussed as part of the IAP process and will not be considered further at this time.	Okay, topic will be discussed during the model results check	According to the GW IAP final memo, "Several groundwater-related input assumptions will be included as probabilistic distributions including hydraulic conductivity of the surficial aquifer at the Mine Site and Tailings Basin." It also says that "Hydraulic Conductivity at Toe of Tailings Basin - A probabilistic range of hydraulic conductivity values for the surficial aquifer should be used at the toe of the tailings basin within the GoldSim model; this is because this value is variable and uncertain. The range of hydraulic conductivity used will be defined in a manner similar to what was proposed for the Mine Site in the NorthMet Project Water Modeling Package Version 5." To be discussed in our 3-7-12 meeting with Barr	Barr to add more clarification to the text. Barr will also produce a list of all of the K-values at the plant and mine site for the agency to review against the distribution that was created. Also a location map is to be provided by Barr to go along with the list of k-values.	Issue moved to MRC tracking spreadsheet
4	Plant Site Work Plan V3	General		Geochemistry: I have a concern with the number of chemical parameters that are treated as uncertain inputs. Assuredly, many or most of these are insensitive parameters that could be treated as deterministic without affecting the probabilistic nature of the model results. With so many uncertain parameters, it will be difficult to interpret the model output. During the initial runs of GOLDSIM, Barr can generate "tornado" diagrams to identify insensitive inputs to the model. I would then encourage Barr and the Agencies to consider making many of these deterministic for future GOLDSIM runs. Reducing the number of uncertain inputs will reduce the number of realizations required to generate reasonable and reproducible cumulative probability plots of the model results. My overall advice to Barr and the Agencies is to continually push to reduce the number of uncertain variables (with justification) rather than increase them. Further, the issue of covariance between the uncertain chemical inputs will need to be technically addressed.	Geochemistry parameter distributions were discussed as part of the IAP process and will not be considered further at this time.	Okay, topic will be discussed during the model results check	With so many uncertain inputs, results from the Mine Site and Plant Site GoldSim models will be difficult to interpret. It is recommended that "tornado diagrams" be generated during the initial model runs to identify insensitive parameters. Then Barr should consider converting many of the insensitive parameters to deterministic inputs. To be discussed in our 3-7-12 meeting with Barr	OK - Barr to produce tornado diagram on a determined number of constituents during the model results.	Issue moved to MRC tracking spreadsheet

9	Plant Site Data Package	Page	29, 5th para. 40, 2nd para.	Recharge Rate Used for GW Flow Path Modeling: Net infiltration (Recharge) of 0.62 in/yr represents about 2.2% of mean annual precipitation (MAP). For this area of the US, I would expect R to be more like 12 to 25 percent of MAP. Note that this range is more consistent with net infiltration being assumed for reclaimed stockpiles. Dividing baseflow by catchment area represents "typical" net infiltration <i>minus</i> water loss from areas of enhanced ET such as wetlands and lakes. While the baseflow-related value may represent average net recharge over the watershed, it likely underestimates net infiltration in local areas outside of wetlands and lakes.	Aquifer recharge rates were discussed as part of the IAP process and will not be considered further at this time.	Okay, topic will be discussed during the model results check	Recharge Rate Used for GW Flow Path Modeling: Net infiltration (Recharge) of 0.62 in/yr represents about 2.2% of mean annual precipitation (MAP). For this area of the US, I would expect R to be more like 12 to 25 percent of MAP. Note that this range is more consistent with net infiltration being assumed for reclaimed stockpiles. Dividing baseflow by catchment area represents "typical" net infiltration <i>minus</i> water loss from areas of enhanced ET such as wetlands and lakes. While the baseflow-related value may be used for watershed yield to a stream , it likely underestimates net infiltration in local areas outside of wetlands and lakes, and local net infiltration is what's needed for quantifying the groundwater flow paths. More clarification needed from Barr. To be discussed in our 3-7-12 meeting with Barr	Barr to add more clarification to the text after the agency looks into the k-value values and distributions.	Issue moved to MRC tracking spreadsheet
14A	Plant Site Data Package v4	Section	6.1.3.1	Tailings Basin Infiltration: Several methods are used to estimate infiltration (recharge) into different portions of the tailings basin. For Cell 2W, a fixed value of infiltration is based on MODFLOW calibration results without consideration of uncertainty. Regardless of how well the MODFLOW model is calibrated, there is inherent uncertainty in the calibrated infiltration and this uncertainty should be carried into the GoldSim model. For other portions of the tailings basin, infiltration is back-calculated from statistically sampled values of rainfall, runoff, and evapotranspiration. Barr needs to demonstrate that this back-calculation approach provides reasonable values of infiltration. In addition, infiltration is not allowed to have a value greater than saturated hydraulic conductivity. Since saturated hydraulic conductivity is uncertain, the maximum allowed infiltration should be treated as a range, rather than a single value.			Barr should systematically present the values of infiltration being used for each portion of the Tailings Basin. A table should be prepared showing fixed values if deterministic or mean values if back-calculated from other (uncertain) parameters. Where infiltration is not a fixed value, Barr should use the current version of GoldSim to develop frequency distributions of calculated infiltration to demonstrate that the values being used in the model are reasonable. To be discussed in our 3-7-12 meeting with Barr	OK - Barr to follow agency path forward from 3/5/12 comment response	Issue moved to MRC tracking spreadsheet
18	Waste Characterization Data Package (Version 5)	Page	97	Last paragraph discusses the application of a constituent-specific correction factor to adjust the modeled constituent concentrations to values that are "reasonably close" to the observed field water quality data. This is a very subjective measure, especially with respect to trace metals concentrations where the condition could arise that a reasonably close value could be either above or below a water quality standard. Does this approach provide suitable resolution in calibrating the water quality model when the objective might be in the ppb range?	Topic to be addressed as needed as part of the Realistic Results Review process.	OK, topic will be discussed during the model results check	This can be incorporated into ERM's phase II QA/QC analysis	OK - Barr to follow agency path forward from 3/5/12 comment response	Issue moved to MRC tracking spreadsheet
19	Waste Characterization Data Package (Version 5)	Page	97	Further discussion will be needed on methods and values of these specific correction factors once this analysis has been finalized.	Topic to be addressed as needed as part of the Realistic Results Review process.	OK, topic will be discussed during the model results check	This can be incorporated into ERM's phase II QA/QC analysis	OK - Barr to follow agency path forward from 3/5/12 comment response	Issue moved to MRC tracking spreadsheet
20	Waste Characterization Data Package (Version 7)	Page	57, Sec 8.2	Discussion/values for Cat 1 scaling factor using "first principles" should not be included in text when inputs into the model are from the MNDNR composite scaling factor analysis. Suggest removal.	Values will be retained in the document as PolyMet's proposed method, to be further discussed in the model "realistic results" check. The individual sub-factors are needed for modeling other waste rock categories and will remain regardless.	OK, topic will be discussed during the model results check	This will be covered under the Barr/PolyMet CDF	OK - Barr to update as to which CDF, Comment 20 = Deals with scale-factor. This will either be addressed in CDF004 or will be dropped	New Method to be proposed in an upcoming CDF004
21	Waste Characterization Data Package (Version 7)	Page	73 Sec. 8.3.1.1 para 3	A pH range of 7.1 to 7.7 is high if $P_{CO_2}=10^{-2}$. It is high because the modeled pH value of 7.7 is for a sulfur content of about 0.01%. The projected average concentration for the Category 1 waste rock pile is about 0.06%. There is no supporting evidence to use values from such a low sulfur content.	As stated in the text: "This uncertainty reflects the potential for processes that may increase or decrease the mean pH from the modeled value of 7.4, which represents CO2 enrichment at the mean sulfur content." Supporting evidence for processes that increase the pH will be provided when this is discussed in the model "realistic results" check.	This issue will be addressed during the model results check.	This will be covered under the Barr/PolyMet CDF	Barr: This one currently doesn't relate to a CDF. I think it would only be addressed as part of the agencies review of the model.	These unresolved comments are not of concern as long as the alternate PolyMet concentration cap method and the SWMMP data are not being used. It is LAM understanding, that they are not being used and the DNR proposed concentration caps and pH range are currently being used for the Category 1 Waste Rock...so just need to re-verify that with Barr/PolyMet.
22	Waste Characterization Data Package (Version 7)	Page	77 Sec. 8.3.1.5	This approach appears to only consider a solubility and pH relationship. This approach does not appear to consider sorption effects over the projected pH range. For instance the sorption efficiency above a pH of about 7 can result in releasing previously sorbed species such as Co.	Comment noted. Values will be retained in the document as PolyMet's proposed method, to be further discussed in the model "realistic results" check.	This issue will be addressed during the model results check.	This will be covered under the Barr/PolyMet CDF	Barr: There is no plan at this time to further pursue this topic with a CDF	These unresolved comments are not of concern as long as the alternate PolyMet concentration cap method and the SWMMP data are not being used. It is LAM understanding, that they are not being used and the DNR proposed concentration caps and pH range are currently being used for the Category 1 Waste Rock...so just need to re-verify that with Barr/PolyMet.
23	Waste Characterization Data Package (Version 7)	Page	80 Sec. 8.3.2 para 1	Due to the large measurement error for the SMWMP data it is not clear whether or not a correlation of solutes to sulfate concentration can be determined. In addition, it is not clear if using low sulfur concentration caps is appropriate for higher sulfur rocks. Perhaps using the Whistle data for anything not included in the AMAX data set would be more appropriate.	Comment noted. Values will be retained in the document as PolyMet's proposed method, to be further discussed in the model "realistic results" check.	This issue will be addressed during the model results check.	This will be covered under the Barr/PolyMet CDF	Barr: There is no plan at this time to further pursue this topic with a CDF	These unresolved comments are not of concern as long as the alternate PolyMet concentration cap method and the SWMMP data are not being used. It is LAM understanding, that they are not being used and the DNR proposed concentration caps and pH range are currently being used for the Category 1 Waste Rock...so just need to re-verify that with Barr/PolyMet.

24	Waste Characterization Data Package (Version 7)	Page	80 Sec. 8.3.2 para 1	Using the low sulfur SMWMP data for significantly higher sulfur content rock for elements not correlating with sulfur does not seem to be appropriate. In addition, there is still no criteria that provides justification for which elements from the SMWMP test correlate with sulfur.	Comment noted. Values will be retained in the document as PolyMet's proposed method, to be further discussed in the model "realistic results" check.	This issue will be addressed during the model results check.	This will be covered under the Barr/PolyMet CDF	Barr: there is no plan at this time to further pursue this topic with a CDF	These unresolved comments are not of concern as long as the alternate PolyMet concentration cap method and the SWMMP data are not being used. It is LAM understanding, that they are not being used and the DNR proposed concentration caps and pH range are currently being used for the Category 1 Waste Rock...so just need to re-verify that with Barr/PolyMet.
28	Water Modeling WorkPlan - MinSite v5			Surficial Aquifer Background Water Chemistry: To what extent is covariance and correlation considered in developing the probability distributions for these chemical inputs? This comment also applies to the assumed chemistry of chemical sources.	For the surficial aquifer background water chemistry, covariance and correlation is not considered. This was discussed as part of the IAP process and will not be considered further at this time.	OK	Need clarification/justification from Barr. To be discussed in our 3-7-12 meeting with Barr	Mike L to check out the GW IAP memo and the Impact Criteria memo to see if a decision was made on covariance. If not a discussion needs to take place to determine if covariance needs to be addressed in the model	Issue moved to MRC tracking spreadsheet
31	Calibration of the NorthMet Plant Site Existing Conditions Water Quality Model V2 dated Jan2012	1.1	1	Last paragraph. Model calibration will involve three steps. Steps 1 and 2 are as described in the paragraph. Step 3 is further optimization of model inputs by matching simulated and measured surface water concentrations at PM-13. Step 3 is critical, because Plant-related impacts will be assessed downstream of the Plant Site. Therefore, it is required that the model adequately simulate the existing downstream water quality.	The model's ability to match conditions at PM-13 will be assessed as part of the Realistic Results Review process.	OK	Based on discussion in meeting on 2/21/12, Barr will validate the plant site model calibration using PM-13 during the model results review. Need to include in Plant Site Calibration that PM-13 represents downstream effects. This needs to be stated in the text	Based on discussion in meeting on 2/21/12, Barr will validate the plant site model calibration using PM-13 during the model results review. Barr to add clarification to the text. Comments 31, 32 and 34 have been addressed in the updated V4 of the Plant Site Calibration.	Resolved in the Calibration of Existing Natural Watershed at the Plant Site V4 dated March 2012
32	Calibration of the NorthMet Plant Site Existing Conditions Water Quality Model V2 dated Jan2012	1.1	1	What about the calibration process at PM 13? Is Barr saying that the model is calibrated to the upstream existing conditions at PM 12 and calibrated to WQ data at the toe of the TB and that the model will be optimized to see if the existing WQ data at PM 13 match the modeled predictions? I am not following the process. Will another document explain the calibration process at PM 13?	The model's ability to match conditions at PM-13 will be assessed as part of the Realistic Results Review process and not as part of calibration.	OK	Based on discussion in meeting on 2/21/12, Barr will validate the plant site model calibration using PM-13 during the model results review. Need to include in Plant Site Calibration that PM-13 represents downstream effects. This needs to be stated in the text	Based on discussion in meeting on 2/21/12, Barr will validate the plant site model calibration using PM-13 during the model results review. Barr to add clarification to the text. Comments 31, 32 and 34 have been addressed in the updated V4 of the Plant Site Calibration.	Resolved in the Calibration of Existing Natural Watershed at the Plant Site V4 dated March 2013
33	Calibration of the NorthMet Plant Site Existing Conditions Water Quality Model V2 dated Jan2012	2.3.1.2	14	For arsenic the model under predicts the single measured value (0.53 mg/L) about 30% of the time. Depending on the actual arsenic concentrations for 60% of the data the model could under predict the surface water measurements about 60% of the time. This does not appear to be an acceptable fit.	We disagree with this comment. The issue will be addressed as part of the Realistic Results Review process.	Please recognize that as presented there is no explanation as to what represents an "acceptable calibration". Without some criteria or error threshold for calibration fit an "acceptable calibration" is undefined and opinion based.	This can be checked during the model results review to determine it's significance in the model	OK - Barr to follow agency path forward from 3/5/12 comment response	Issue moved to MRC tracking spreadsheet
34	Calibration of the NorthMet Plant Site Existing Conditions Water Quality Model V2 dated Jan2012	General		Given that good model fit to existing conditions at PM-13 will be essential for impact assessment, it would be beneficial for Barr to produce a brief document outlining the process for validation/calibration at that location.	The model's ability to match conditions at PM-13 will be assessed as part of the Realistic Results Review process.	OK	Based on discussion in meeting on 2/21/12, Barr will validate the plant site model calibration using PM-13 during the model results review. Need to include in Plant Site Calibration that PM-13 represents downstream effects. This needs to be stated in the text	Based on discussion in meeting on 2/21/12, Barr will validate the plant site model calibration using PM-13 during the model results review. Barr to add clarification to the text. Comments 31, 32 and 34 have been addressed in the updated V4 of the Plant Site Calibration.	Resolved in the Calibration of Existing Natural Watershed at the Plant Site V4 dated March 2013
35	Calibration of the NorthMet Mine Site Existing Conditions Water Quality Model V2 dated Jan2012	Page	7	For figures 57, 60, and 61 a significant proportion of the model results are outside of the natural data range. In particular, it appears the model is predicting much higher concentrations for flow rates above about 25 cfs. Please explain why the model results significantly deviate from the natural data range. Furthermore, it would be useful to have similar figures for the remaining solutes to determine how representative the model results are of the existing data. Please provide.	The observed data represents a relatively small data set when compared to the model results, and there is a limited amount of observed data above 25 cfs from which comparison may be made (not all water quality data was collected concurrently with flow data). The previously included scatter plots of concentration versus flow have been updated based on the latest calibration, but additional constituents have not been modeled based on Comment 7.	The lack of overlap for the model results and observed data may be due to the limited data available for high flow rates. An alternate explanation is that the model does not accurately reflect natural conditions. Which of these explanations (or parts of both) is correct could possibly be determined by looking at the same flow vs. concentration type of plot (figs. 56-62) for the other elements. To properly address this issue plots for the remaining solutes need to be presented. This issue will be addressed during the model results check.	DNR would like to see these scatter plots for all constituents prior to the model results review process	OK - Barr to follow agency path forward from 3/5/12 comment response. Barr will provide scatter plots for all constituents prior to the model results review process.	Issue moved to MRC tracking spreadsheet

1 **Group B7: Calibration. First bullet. "acceptance criteria"** - Barr should present the acceptance criteria used to verify that the model is sufficiently calibrated. Barr should consider using quantitative metrics that assess the goodness of fit for purposes of model calibration.

2 **Group B9: Non-direct Measurements. Third bullet. "Method(s) of identifying and acquiring data"** - Should be more specific in identifying the references for acquired data. In addition to the report citation, should provide page, table, and or figure numbers. If the data are dispersed within and between reports, should produce an appendix with all issue-specific data compiled in one place.

3 **Group B10: Requirements Documentation** - The Mine Site Data Package contains many of the equations used in the GoldSim model, but it is not complete. Conditional programming ("if this, then that") is commonly described verbally, but not mathematically. It is in our interests for Barr to present all of the equations and conditionals used in GoldSim programming. This will allow every line in the program to be traceable to a technical document.

4 **Group B10: Hardware/Software Configuration – Source Code** - The complete source code for the model should be provided to the Co-Leads.