

APPENDIX C1.1 – MEMPR Issues Tracking, ML/ARD (MDAG)

Brule Mine Project - Application Review Stage					
Issues Tracking Document – Government Agencies – MEMPR, Kevin Morin (MDAG)					
Category (ML/ARD; hydrology, groundwater)					
# ID	Submitted by	Issues Raised	Proponent Response	Review Status	Responsible Agency
B.C. Ministry of Energy, Mines and Petroleum Resources (MEMPR)					
1	Kevin A. Morin, Ph.D., P.Geo., MDAG, Contract Reviewer for MEMPR	<p><i>Issue: A portion of the proposed Brule Mine is partially located within the Mink Creek watershed and the effects to hydrology and geochemistry have not been adequately addressed.</i></p> <p><i>Discussion: The Brule Pit, the Blind Pit, and the Maximum Development Perimeter extend up to hundreds of meters into the Mink Creek catchment. This will change the Mink Creek catchment in that perhaps 5% of the surface-water catchment and an unknown percentage of the groundwater catchment will be re-routed into the Blind Creek drainage. However, impacts on Mink Creek were not assessed because the Brule Mine is thought to impact only Blind Creek. Some groundwater from the pits and minesite may move towards Mink Creek, but this is dismissed in the Application solely based on an assumption. The company needs to reassess the potential physical and chemical effects to the Mink Creek catchment and commit to monitoring during operations.</i></p>	<p><i>Response by Jaime Cathcart, Knight Piesold, on behalf of WCCC:</i></p> <p>The pit design will ensure that very little groundwater flow from the pit floor will enter the Mink Creek drainage. Total flow in North Brule Creek (tributary of Mink Creek that contains the majority of pit encroachment) at the flow gauge location is comprised of surface runoff (including shallow subsurface flow) and groundwater discharge, which contribute to the total flow at a ratio of approximately 4 to 1. If one assumes that groundwater flows are directly proportional to contributing drainage area (which is conservative from the perspective of estimating pit water impacts on North Brule Creek water quality), and if one assumes that no seepage from the pit will migrate into the Mink Creek drainage, then based on the reduction in drainage area caused by the pit development, total flow reductions in the North Brule Creek tributary at the flow gauge location are estimated to be approximately 7% of pre-mine flows (i.e. 7% drainage area reduction = 7% reduced surface runoff (4/5) + 7% reduced groundwater (1/5) = 7% reduced total flow (5/5)). See Table 1 and Figure 1, in Appendix D5.2.</p>	Response satisfactory. Issue addressed.	MEMPR MOE

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			<p>However, it was generally agreed in discussions with MEMPR that a small area of the pit, estimated to be approximately 10% of the pit encroachment recharge area, might remain a recharge area with groundwater flow towards the Mink Creek drainage. The remainder of the pit areas within the Mink Creek drainage would have groundwater discharge into the pits rather than remain as groundwater recharge areas. As a result, the total reduction in flows would be less than 7%, and in fact would be approximately $7\% \times 4/5 + 7\% \times (100\% - 10\%) \times 1/5 = 6.86\%$. Correspondingly, the amount of groundwater expected to migrate from the pits to the Mink Creek Drainage represents approximately 0.14% of total flows in North Brule Creek at the gauge location.</p> <p>Furthermore, given that pit encroachment into the North Brule Tributary drainage is expected to be approximately 0.7% during the first few years of operation, affected groundwater migrating from the pits is expected to comprise approximately 0.014% of the flow at the gauging location in the creek during this period.</p>		

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			<p>Consequently, it was concluded that mine effects on water quality in Mink Creek are expected to minimal, and particularly so during the first few years of operations, and there is no valid justification for a water quality monitoring program. However, if a program is in fact required by MOE, details are to be determined through ongoing discussion between WCCC and MOE.</p> <p><i>Response by Alan Martin, Lorax, on behalf of WCCC:</i> Verification of such assumptions can be achieved through infrequent monitoring (maximum quarterly) of indicator parameters (e.g., sulphate and selenium) at Station NBC. This proposed monitoring program is described in the Brule Post-Application Agency Consultation Report.</p>		
2		<p><i>Issue: The potential for ARD has been underestimated through over-averaging of data and errors.</i></p> <p><i>Discussion: The potential for ARD has been minimized in the Application due to incorrect assumptions, erroneous calculations compared to statements in the text, use of partially leached iron data to estimate full acid potential, progressive deletion of rock units of ARD concern through Chapter 4, and averaging of results. For example, 40% of a rock unit or 40% of a core interval</i></p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i> During the course of a meeting on ML/ARD (March 10) (refer to Appendices E1.5 and E1.1) with MEMPR representatives and the ML/ARD working group (March 20), the methods used to calculate NP and AP were clarified, and the low risk of ARD shown by comparison with experience from the BC region and the Appalachian coal mining region. A memorandum was</p>	Response satisfactory. Issue addressed.	MEMPR

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		<p><i>representing several pit benches could be net acid generating, and the average could be net acid neutralizing yet still release ARD. The company needs to update ARD predictions, including estimated percentages and estimated tonnages of all net-acid-generating and net-acid-neutralizing rock/material by year, unit, core interval, and bench height using the block model – averaging is not acceptable. Based on that work, the company should update and provide greater details on how net-acid-generating materials will be managed and placed, sufficient to justify blending and layering as primary mitigation strategies. For contingencies, minimizing strategies like covers and wetlands would likely not handle a significant ARD issue, lime treatment would be required including ARD bypassing the Sediment Ponds, and thus it is important that the company clearly explain why blending/layering will work.</i></p>	<p>distributed on March 16, 2006 (Appendix D1.6) to clarify the calculation of AP. The issue of the best methodology for calculation of AP was not resolved with MDAG, but it was agreed that with either method, the volumes of PAG waste would be the same. It is understood that there are no outstanding issues with respect to test methodology (Refer to Appendix E2.5).</p> <p>With respect to the issue of averaging, Western clarified the basis for the approach at the March 10 and 20 meetings (Appendices E1.2 and E2.2, respectively) and has provided additional detail after the March 20th meeting on the volumes of PAG rock (refer to Appendix D1.13).</p> <p>With respect to the handling of PAG rock and CCR, Western clarified proposed handling methods at meetings on March 10 and March 20, and has provided additional clarification of handling of PAG rock and CCR (refer to Appendices D11, D1.13 and D1.14).</p> <p>WCCC: Appendix D1.13 provides an estimate of rock quantities by rock type and stratigraphic section. Since the weighted averages for NP/AP and ICca/AP for all zones are well above the</p>		

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			limit for acid generation problems, an intensive effort to calculate a breakdown of the rock types by year and bench is not warranted. Appendix D1.14 illustrates management of the Marker CD PAG zone to justify layering as a primary mitigation strategy.		
3		<p><i>Issue: The potential for near-neutral metal leaching has been underestimated for the proposed Brule minesite.</i></p> <p><i>Discussion: Water quality predictions, impact assessment and mitigation requirements need to be re-evaluated in light of the most recent site water quality and data from kinetic testwork. For example, various scales of testwork indicate predicted “reasonable worst case” concentrations of some parameters could be much higher under full-scale conditions than predicted. Also, predicted “reasonable worst case” concentrations for Sediment Pond 1 have already been exceeded by the much smaller Dillon Mine. As with ARD, the company should update and provide greater details on how metal-leaching materials will be managed and placed, sufficient to justify blending and layering as primary mitigation strategies for metal leaching. For contingencies, minimizing strategies like covers and wetlands would likely not handle a significant ML issue, especially for waters bypassing the Sediment Ponds, and thus it is important that the company clearly explain how blending/layering will control metal leaching and</i></p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i></p> <p>Clarifications related to this issue were provided at the March 10 and March 20 meetings (refer to Appendices E1.5 and E2.5)</p> <p>During the meeting on March 20, 2006 (refer to Appendix E2.2) the reasonable worst case source terms were compared with back-calculated waste rock leaching of dissolved metals shown by the Dillon MSP. The method was used to provide revised source terms for manganese and a minor revised source term for copper, and to develop new source terms for several parameters requested by MEMPR. (including barium, iron, manganese and thallium). With minor changes, the proposed source terms were accepted at the meeting of March 20th (refer to Appendix E2.5).</p>	Response satisfactory. Issue addressed.	MEMPR

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		<i>aqueous concentrations.</i>	The company has provided additional clarification of PAG units which may be a source of metal leaching (refer to Appendices D1.13 and D1.14).		
4		<p><i>Issue: Groundwater is a significant pathway for water movement and potential contaminant migration at the minesite and the loadout. Current groundwater modeling is insufficient to estimate flows and pathways of groundwater to the degree required at this point.</i></p> <p><i>Discussion: Current modeling of groundwater is a rather simple spreadsheet model, using endpoint assumptions like no recharge through pit floors and no groundwater movement towards Mink Creek. The standard approach for groundwater modeling is a porous-medium continuum approach, based on site-specific hydrogeologic information. As explained in Chapter 3, there are many major assumptions in the surface-water and groundwater balances, and revised site-specific balances will be required for permitting. However, before EA certification, standard groundwater models for the minesite and its catchments (including Mink Creek) and for the loadout are required, based on the major assumptions made to this point. The results should show groundwater flowpaths in three dimensions, fluxes, and average linear velocities. Chemistry should then be superimposed to calculate groundwater concentrations and loadings to Brule Pit, toes of dumps, the Sediment Ponds, and creeks.</i></p>	<p><i>Response by Rod Smith, Water Management Consultants, on behalf of WCCC:</i></p> <p>Groundwater flow paths were estimated with groundwater equipotential plots based on groundwater levels recorded in wells, topography and surface water features that were related to groundwater conditions. Equipotential plots were constructed for pre-mine and end of mine conditions to examine the approximate impact on groundwater of the proposed mine. A month by month combined surface water groundwater balance was constructed to represent the pre-mine conditions which took into account water sources and water losses. The water balance model was calibrated to Blind Creek monthly flows so that it would reasonably mimic site conditions. This calibrated model was then adapted to the end of mine condition to examine the impact of the mine on the hydrology. We understand that the methodology as described will be adequate to describe the impact on groundwater at the site.</p> <p><i>Response by Stephen Day, SRK, on</i></p>	Response satisfactory. Issue addressed.	MEMPR MOE

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			<p><i>behalf of WCCC:</i> It was agreed at the March 20, 2006 working group meeting (refer to Appendix E2.5) that further evaluation of water quality for the coal stockpile does not need to be considered for the EA because WCCC has committed to ensure that water can be collected if needed, and because the loadout will not be constructed for several years. Operational monitoring of coal pile runoff at the Dillon and Brule mines is and will provide an opportunity to evaluate water chemistry, water collection and monitoring requirements for the loadout.</p>		
5		<p><i>Issue: Drainage, composed mostly of groundwater, by-passing the Sediment Ponds may be problematic, if treatment of ML/ARD is ever needed.</i></p> <p><i>Discussion: Groundwater bypassing the Sediment Ponds and directly entering Blind Creek may not be a concern for suspended solids, but would be a concern for ML/ARD. This bypass, up to 25% from some sources, has likely been underestimated by the basic groundwater modeling by spreadsheet, so passive treatment near the sources and active treatment of Sediment Pond water may not be sufficient to protect the environment. No new groundwater monitor wells and no monitoring of groundwater chemistry are proposed in the Application. Additional monitor wells and chemical monitoring of groundwater bypassing the Sediment Ponds will be required.</i></p>	<p><i>Response by Rod Smith, Water Management Consultants, on behalf of WCCC:</i> Although 25% of net precipitation was estimated to bypass the collection system for the Southeast Ex-pit Dump, only 10% is estimated for the Northeast Ex-pit Dump and no bypass was estimated for the backfills. Small seepage losses from the blind pit will either be collected by or be part of the bypass of the SP-1 collection system.</p> <p><i>Response by Jaime Cathcart, Knight Piesold, on behalf of WCCC:</i> Water quality sampling will be conducted at seep locations near the toes of waste dumps, in the sediment ponds and at</p>	Response satisfactory. Issue addressed.	MEMPR MOE

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			<p>points in Blind Creek. Given that any water quality concerns associated with the mine development will be expressed in the surface water prior to it showing up in the groundwater, there is no valid justification for a groundwater monitoring well near SP2. There is a groundwater well associated with the flocculant plant near the inflow point to SP1, and this will be monitored as placement of CCR is confined to the northeast dump, which is upslope of SP1. However, without any upslope placement of CCR, groundwater quality concerns are less at SP2. If a water quality issue is detected in the surface water, then a groundwater monitoring program can be implemented for the purpose of better identifying the source of the problem.</p>		

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6		<p><i>Issue: There are concerns with the surface-water and groundwater balance for the minesite.</i></p> <p><i>Discussion: The Application contains detailed discussions on assumptions for groundwater and for other factors like sublimation, percentage of snow and rain, snowmelt, infiltration into waste rock, percentage of discharge at the toe, and zero recharge on pit floors. As a result, assumed data leads to an assumed water balance. Because aqueous concentrations and ML/ARD depend in part on the water balance, the current surface-water and groundwater balances in the Application must be refined with on-site data. Perhaps the assumed data are the reason that current concentrations from the small Dillon minesite already exceed the predictions of reasonable worst-case concentrations for the larger Brule minesite.</i></p>	<p><i>Response by Jaime Cathcart, Knight Piesold, on behalf of WCCC:</i></p> <p>Assumptions for groundwater and other related factors like sublimation, percentage of snow and rain, snowmelt, infiltration into waste rock, percentage of discharge at the toe and insignificant recharge into pit floors were based on procedures commonly used in the industry and included consideration of existing groundwater and surface water conditions on the site. The water balance model was calibrated to measured flows on Blind Creek, so that site specific conditions were appropriately addressed. Some conditions were indeterminate, but not critical. For example, if the annual precipitation was not correct, sublimation and evapotranspiration would have been adjusted so that the model calibrated to measured streamflow. The estimate of the groundwater component of flow was reliant on the accuracy of base flow measurements, which can be difficult to measure in the winter. However, the procedure adopted provides the most reliable method of using site specific data to define surface water and groundwater flow rates on site.</p> <p><i>Response by Alan Martin, Lorax, on</i></p>	Response satisfactory. Issue addressed.	MEMPR MOE

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			<p><i>behalf of WCCC:</i> Examination of the current concentrations in effluents from the small Dillon mine site has been evaluated (Appendices D1.5 and D2.2). As outlined in Appendix D1.5 of Brule Post-Application Agency Consultation Report, a major point of clarification was that the predicted values reported in the Dillon Effluent Permit were incorrectly reported as “total” levels. These values should in fact have been reported as “dissolved”. Accordingly, comparison of the total levels in MSP discharges to the predicted values is not meaningful.</p> <p>Dissolved metal levels in MSP effluents were underestimated as part of the Dillon predictions for nickel, and to a lesser extent for arsenic and molybdenum. However, these values have been re-visited as part of predictions for Brule, based on a large site-specific data set as well as regional values. Further input from MEMPR into the source term evaluation has also been used to refine predictions.</p>		

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7		<p><i>Issue: There are concerns with the surface-water and groundwater balance for the Falling Creek Flats Loadout.</i></p> <p><i>Discussion: The Application states, “No data were available for calibration of the model, so parameters were estimated on the basis of regional data ...” Non-site-specific data leads to a non-site-specific water balance. As with the minesite, surface-water and groundwater balances must be refined with on-site data.</i></p>	<p><i>Response by Jaime Cathcart, Knight Piesold, on behalf of WCCC: WCCC has committed to sampling and testing the water quality of runoff from existing Dillon Mine coal stockpiles to assess whether or not this water, in its undiluted form, poses a significant risk to the receiving aquatic environment at the Loadout. If a significant risk is determined, the plan is to construct the Loadout coal pad from compacted till and to line the receiving ditches and pond. Coal pile runoff would then be collected by and passed through the lined system, to be discharged directly into the Pine River. If the ditches and pond are unlined, it is agreed by WCCC that at total of one up-gradient and three down-gradient groundwater monitoring wells will be installed at the Loadout and monitored throughout operations. (Cline Resources has installed wells at this site, and WCCC would not establish duplicate wells.)</i></p> <p>With this commitment there is no need for detailed site specific groundwater modelling. The existing model, which is based on site-specific basin characteristics and regional climate and streamflow data, is adequate for determining that water requirements for the Loadout will not have a significant</p>	Response satisfactory. Issue addressed.	MEMPR MOE

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			impact on flow rates in either Falling Creek, Beaudette Creek or the Pine River.		
4. DETAILED ISSUES AND COMMENTS RELATED TO ML/ARD (Author's Comments in Italics)					
8		<i>Local strata include interbedded sandstone, siltstones, conglomerates, mudstones, shale, and carbonaceous partings. Two important carbonaceous marker seams are Marker B, about 1.5 m below the floor of the Lower Seam, and Marker AA, about 15 m below the floor of the Lower Seam. These marker beds have also undergone plastic deformation, and thus Marker B will be removed where its dip exceeds 30°. Note: A visual check of Figure 3.2.1-3 (Stratigraphic Column) revealed that Marker AA was not listed, and that markers are considered "coal". Also, Section 4.5.2.1 (Geology and Geochemical Considerations) considers Marker B, C, and D "distinctive".</i>	WCCC: Markers at Brule: 1.Marker AA is not shown on Figure 3.2.1-3 (stratigraphic column), as it is mainly a carbonaceous shale zone with some thin high ash partings and is not recognized throughout the whole Brule area due to its variability. The zone is 1 to 1.2 m thick. 2.The major markers (D,C,B and A) are mainly coal, although none of them are considered a recoverable mining section due to less than recoverable mining thickness or high ash. 3.The major Markers (D, C, B and A) all have "distinctive" geophysical signatures which have been used to	Response satisfactory. Issue addressed.	MEMPR

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			correlate between drill holes in the Brule area.		
9		<p><i>The Blind Deposit is within the Dillon Coal Lease, north of the Dillon Pit and northeast of Brule. It is similar to Brule in geology, but it has no Measured or Indicated resource classification at this time. Approval for this less characterized deposit is also being sought. Note: In other words, while information on the Blind Deposit is generally lacking compared to Brule, it is considered similar enough by WCCC that approval of Blind is assumed to automatically follow from and be included with approval of Brule. Additional ML/ARD data will be expected on the Blind deposit at permitting.</i></p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i> Further explanation of this was provided at the March 10, 2006 meeting (Refer to Appendix E1.5 and other information in Appendix E1). As noted in the comment, the Blind “Deposit” is not a separate deposit, but is in the same geological sequence as Brule and Dillon pits. It is only identified as a separate deposit because the coal-bearing strata between Brule and Dillon have been eroded. Therefore similar ML/ARD characteristics are expected for Blind and Brule. It was agreed by MEM that operational data available for the Dillon Mine are adequate to characterize the Blind Pit for mine permitting. However, operational monitoring is expected to be required in the <i>Mines Act</i> permit which will provide additional specific data to update this conclusion.</p> <p>WCCC: The Measured or Indicated resource classification refers to the spacing of data points (drill holes, adits etc) used to determine the coal resource (deposit tonnes of coal). This is a requirement of National Instrument 43-101 for securities purposes. The deposit characterization is not affected</p>	Response satisfactory. Issue addressed.	MEMPR

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			by the classification. Appendix D1.8 illustrates that ARD test samples are representative for the Brule and Blind areas.		
10		<p><i>Note: Most of the important contour diagrams to confirm the locations of catchment divides (e.g., Figures 3.2.2-1 and 3.2.1-9) do not have any elevations listed, so it is difficult to outline catchments. Nevertheless, Figure 4.4.3-1 and Cross-section 3.2.1-8 shows that the Mink Creek catchment (northwest of the Brule Pit) will be impacted by the Brule Pit, which will extend several hundred meters into this catchment based on the slope to the north. Apparently, Blind Pit will also physically extend into Mink Creek catchment. The Brule maximum-development perimeter map (Figure 4.4.3-1) suggests the minesite will occupy roughly 5% of the Mink Creek surface-water catchment and will extend to within roughly 700 m of Mink Creek.</i></p> <p><i>The resolution to this apparent discrepancy over Mink Creek catchment lies in the assumed surface-water hydrology, in that the base of the pits will slope towards Blind Creek so that all water remaining on the pit floor will flow that way. However, there will be one clear impact on Mink Creek and a second, potential impact. First, part of the catchment area will be re-routed towards Blind Creek, so there will be less flow towards Mink Creek. This reduction in flow has apparently not been estimated, but reportedly “limiting impacts to a small reduction of drainage area and associated</i></p>	See response to comment #1.	Response satisfactory. Issue addressed.	MEMPR MOE

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		<p><i>flow” (Section 4.4.3.1). Nevertheless, it is incorrect to say that Brule will have no water impact on Mink Creek catchment. Second, some water flowing over the pit floor can be expected to infiltrate and migrate laterally in some direction. If the groundwater flowpath leads north, it will enter the Mink Creek catchment. Figure 4.4.5-6 depicting the mine influence on groundwater flow shows groundwater on the north flanks of the pit entering the pit, but no flow lines confirming that all infiltration into the pit floor will report to the Sediment Ponds with no flow towards the Mink Creek catchment. Table 4.4.5-5 on the annual water balance makes no mention of groundwater movement towards Mink Creek. However, the presence of the Backfill Dump into the Mink Creek catchment by closure (Figure 3.2.3-6), covering more than 75% of the entire Brule Pit (Section 3.2.3.2.3), suggests some water could be driven towards Mink Creek. Physical and chemical effects on Mink Creek should be assessed before EA certification, and monitoring in the Mink Creek catchment will be expected for permitting.</i></p> <p><i>It is not clear if there is an implicit conclusion about groundwater catchments or whether the groundwater assessment and modelling were rudimentary in nature (e.g., Figures 4.4.5-5 and 4.4.5-6) and did not address them. Section 4.4.5.1.5 says, “There are four operational water-quality monitoring wells located on the Mine Site” and “No new groundwater monitoring wells are currently planned for the site” so that only</i></p>			

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		<i>surface water will be assessed for water quality. Section 4.4.5.1.6 succinctly says, “Walls and floors of pits were assumed to be groundwater discharge zones, so recharge in these areas was assumed to be zero”. This seems unusual for the high pit floors near the surface-water divide. It also seem unusual for the lowest section of the Brule Pit, which will be backfilled with groundwater apparently ponding inside it (due to the assumption of recharge only to the pit and no subsurface discharge from the pit). Standard groundwater modeling using a porous-medium, continuum model is needed for the entire minesite and surrounding catchments.</i>			
11		<p>4.3 Phases of Mining</p> <p><i>Note: While these phases from Section 3.2.2.2 are relatively simple and understandable, they are not directly consistent with the Mine Planning and Production Sequence of Section 3.2.3.1.3. For example, Section 3.2.2.2 says Phase 2 begins in Year 2, whereas Section 3.2.3.1.3 says Phase 2 starts in Year 3. As a result, there is some uncertainty in the year-to-year proposed activities. Conceptually, this does not seem to be a problem, but in practice problems could arise such as if mining progressed into the area of Sediment Pond 2 before all the ditches were ready. Overall, Section 3.2.3.1.3 is more detailed on mine and waste management, and could be taken as the more likely scenario when there are discrepancies with Section 3.2.2.2. Mining of the Northwest</i></p>	<p>WCCC: Section 3.2.2.2 is a summary of mining activities listed in detail in Section 3.2.3.1.3. Section 3.2.2.2 states that the start of Phase 2 (production at a rate up to 2,000,000 tpy) is expected during Year 2. Section 3.2.3.1.3 states that mine production increases from the Dillon scale (Phase) of 1 Mtpy during Year 2 and that full production at the Phase 2 level is achieved in Year 3. The descriptions of year-to-year proposed activities are consistent. The 5 year mine plan required for the Mine Permit Application will contain additional detail regarding the phasing of mined coal production and the construction of related facilities and water management structures.</p>	Response satisfactory. Issue addressed.	MEMPR

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		<i>Ridgeline and Blind Pit will begin in Year 8. For EA certification, the company should produce one mining schedule that is consistent.</i>	In addition, as stated in Section 3.2.2.2, there is some uncertainty as to the precise timing of the end of Phase 1 and the beginning of Phase 2. For this reason, mine phasing is primarily linked to certain mine activities, rather than specific timelines. This linkage to activities is expected to be more effective in preventing the type of problem cited in this comment (i.e. water management structure sequencing) than would a straight time sequence. Sequencing of the water management system relative to mine development has been carefully planned and is described in the Water Management Plan (Section 4.4.4). Similar considerations are provided in the other environmental management plans (Section 4).		
12		<i>4.4 Pit Development Sequence and Waste Rock Disposal Water management facilities (Sections 3.2.2.6 and 4.4.5.1) consist of collection ditches and two sedimentation ponds. A flocculent plant will be located at each pond “for contingency use (mainly during freshet)”. Note: This shows that WCCC is anticipating only suspended solids issues and no problems with ML/ARD, which could for example also require lined ditches which are currently not considered (Section 4.4.4.1.1 and Figure 4.4.5-2). Also, this system “is designed to capture all run-off</i>	<i>Response by Jaime Cathcart, Knight Piesold, on behalf of WCCC:</i> There is no specific groundwater capture system. A good portion of the groundwater will collect in the sediment ponds, with the remaining entering Blind Creek upstream of the point of compliance for water quality concerns at BC-01. The water balance model considers both surface runoff and groundwater so the effects of mine development on both flow components can be assessed.	Response satisfactory. Issue addressed.	MEMPR MOE

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		<p><i>from the minesite”, but runoff is surface water and there was no mention of groundwater capture. This is consistent with the basic groundwater evaluation compared to surface water discussed above. In any case, collection and treatment of surface water for suspended solids is a key aspect of water management for Brule.</i></p>	<p>The water management system was designed specifically for the collection and treatment of surface water for suspended solids.</p> <p>Water quality sampling will be conducted at seep locations near the toes of waste dumps, in the sediment ponds and at points in Blind Creek. Given that any water quality concerns associated with the mine development will be expressed in the surface water prior to it showing up in the groundwater, and given that significant water quality concerns are currently not predicted, there is no valid justification for the need of a groundwater collection system. There is a groundwater well associated with the flocculant plant near the inflow point to SP1, and this will be monitored as placement of CCR is confined to the northeast dump, which is upslope of SP1. However, without any upslope placement of CCR, groundwater quality concerns are less at SP2. If a water quality issue is detected in the surface water, and a groundwater collection program is justified, then it can be implemented if required.</p> <p><i>Response by Stephen Day, SRK, on</i></p>		

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			<p><i>behalf of WCCC:</i> It was confirmed at meetings on March 10 and 20th that loss through groundwater has been evaluated for the assessment of impacts to Blind Creek (refer to Appendices E1.3, E2.3, E1.5 and E2.5). Groundwater quality is assumed to be the same as waste rock dump pore water representing a reasonable worst case for chemistry and evaluation of potential impacts.</p>		
13		<p>The two “main” waste-rock dumps will be the Northeast and Southeast Dumps (Section 3.2.3.2), although Section 3.2.2.3 indicates the Brule in-pit dump will receive most of the waste rock. The sidehill Northeast Dump will be located northeast of Brule, over the Dillon workings and waste-rock dumps. It is designed to contain approximately 35.8×10^6 [35.8 million] loose cubic meters (MLCM), constructed by end dumping in 20-m lifts at angle of repose with 14-m-wide horizontal benches. The face will be reclaimed to 2H: 1 V (27°). All coarse coal rejects (CCR) will be placed in this dump.</p> <p><i>Note: Figure 3.2.2-3 shows that the CCR will be within 8 meters of the dump surface and air at the closest, which means that settlement could provide pathways for air and water into the CCR. This is one reason why additional details and justifications on the waste-management and ML/ARD mitigation plans are needed.</i></p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i> At the March 10 and 20 meetings (refer to Appendices E1.2, E1.5, E2.2 and E2.5) it was clarified that the mitigation strategy for CCR is not to prevent air access. The company is providing additional details on the management of CCR so that the CCR will have the benefit of acid neutralizing capacity of the prime waste.</p> <p><i>WCCC:</i> The Northeast and Southeast Dumps are the two “main” out-of-pit waste dumps active early in the life of the project. The inclusion of the word “Two” in the sentence is not material to the description of the waste dump development. All three major dumps are described in detail in section 3.2.3.2.3.</p>	Response satisfactory. Issue addressed.	MEMPR

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			<p>Figure 3.2.2-3R1 (refer to Appendix D1.11) is a revised illustration of the CCR disposal concept presented in the EA Application. As noted on this drawing, 10 m is the minimum distance between the CCR material and the surface of the dump following dump face re-sloping and 10 m is the minimum distance between the CCR material and the original ground surface. The shallow slope of the dump, construction from the bottom in 20 m thick lifts and progressive reclamation would limit the probability of crest settlement and crack development required to provide direct air and water flow pathways to the CCR material. Since water and air will permeate into the dump structure regardless of surface treatment, the CCR will be mixed with waste rock that provides abundant buffering capacity for any possible acidic discharge from the CCR. Since the CCR is marginally PAG, a 1:1 mix of CCR with prime waste with the lowest IC_{Ca} results in an IC_{Ca} /AP ratio of 6 indicating significant excess buffering capacity at the local dumping scale.</p> <p>The process plant construction and operation would not be required until C60 Seam is being mined (anticipated to July 2010 based on the Mine Permit Application phasing). At that time, the NE Dump is constructed to the 1120 m</p>		

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			<p>level and contains 5,600,000 cubic meters of strongly acid consuming waste (ICca/AP over 25). Annual production of CCR is estimated at 180,000 t or 105,000 cubic meters of material (dump density 1.7 t/LCM). The CCR will be mixed at a minimum 1:1 ratio with mine waste rock in the core of the NE Dump (i.e. CCR would not be dumped within 30 m of the outside perimeter of the dump bench or within 10 m of the original ground surface). Truck loads of CCR would be distributed along the working face of the dump to create a layer with an approximate thickness of 1.0 m as illustrated in Figure 3.2.2-3R1; multiple loads of CCR would not be dumped at the same dump face location. Approximately 3000 lineal meters of dump face would be required annually for CCR disposal. Pit waste rock with high neutralizing potential would then be dumped over the CCR layer and the process repeated as required. A minimum ratio of 1:1 of waste rock to CCR would be maintained on a local basis. The overall ratio of waste rock to CCR on a bench level is expected to be much higher than 1:1. Procedures for dumping CCR will be incorporated in the Brule Waste Dump OMS manual.</p>		

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14		<p>Page 3-54 explains there was significant uncertainty in long-term phreatic surfaces, so sensitivity analyses were conducted by raising the assumed 10% of dump height to 20% of dump height. <i>Note: There was no discussion on how this affects groundwater fluxes and directions, such as toe discharge, which is consistent with the rudimentary groundwater work discussed earlier. Additional, standard modeling of groundwater is needed.</i></p>	<p><i>Response by Rod Smith, Water Management Consultants, on behalf of WCCC:</i> This decision to analyse the stability of the dump with a higher phreatic surface was conservative and provides an additional margin of safety with regard to slope stability. The assumed higher phreatic surface was not the result of any water management study.</p> <p><i>WCCC:</i> The assumed location of the phreatic surface has a direct impact on the calculated factor of safety for the waste dump. A surface at 10% of the dump height is the standard assumption for phreatic surface for calculations. The 20% value is only used for sensitivity analysis and has a low probability of occurrence. Under typical dump subsurface conditions, the phreatic surface is expected to follow the original ground surface. Water tables in the dump toe will be monitored and remedial action will be taken if an increase in the phreatic surface impacts dump stability.</p>	Response satisfactory. Issue addressed.	MEMPR MOE
15		<p><i>Note: There was no description of the overburden (topsoil) dump to be located between the Brule Pit and the Northeast Dump (Figure 9.1.1-1). Also, there were no details provided of the in-pit “backfill” dump in this Section on Waste Rock Dumps,</i></p>	<p><i>WCCC:</i> Western has collected till samples for ARD testing in support of the mine permit application. This testing is in progress.</p>	Details at permitting.	MEMPR

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		<p><i>presumably because this section focussed on geotechnical issues. It is discussed in other sections (e.g., 3.2.3.2.3, Arrangement and Development), where one argument put forward for the in-pit dump is “a lake is avoided” in the pit. However, filling the pit with waste rock does not mean the water does not still accumulate in the pit and then enter the surrounding and underlying groundwater system. It just means this can no longer be seen when the in-pit dump exists - an “underground” lake will still develop. Also, saturated and low-redox zones can develop (Section 4.4.6.1) which can become anoxic and affect leaching of selenium and other elements, which was not tested or predicted.</i></p>	<p>Analytical results for soil samples collected for reclamation planning purposes (refer to Appendices D-2 and D-3 of the EA Application) also provide information on soil metal concentrations and pH.</p> <p>Overburden in the mine plan refers to all unconsolidated material located above the bedrock and that can be typically removed without drilling and blasting. Topsoil is the upper layer (A and B horizons) of organic rich overburden that provides a growth medium for vegetation. The soil stockpile layout and volumes indicated on the Brule plans will be re-evaluated as part of the detailed design for the Mine Permit Application. The existing Dillon Mine soil stockpile will also be expanded for storing Brule soils. Progressive reclamation where soil recovered from mining areas will be placed directly on reclaimed slopes will be maximized.</p> <p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i> Ponding of water beneath the backfill is a minor feature, and was described in the Application. It is agreed that parameters such as iron and manganese may become more mobile</p>	Response satisfactory. Issue addressed.	

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			<p>under reducing conditions at these locations. The new source terms accepted at the March 20th meeting incorporate elevated concentrations of these parameters (refer to Appendices D1.12 and E2.5).</p> <p>Saturation of wastes is well known to be a reliable preventative measure to limit oxidation of sulphide minerals.</p> <p>Selenium is expected to become less mobile under these conditions by reduction to the elemental state. Reducing conditions would not be expected to result in greater dissolution of selenium from the backfill.</p>		
16		<p><i>Groundwater ponding is supported by Section 4.4.3.1 which explains that, “Almost all of the [rock] bedding [which influence groundwater flow directions] that will be intersected by the Brule Pit daylights at the southeast end of the pit.” In this case, if the southeast end of the pit is a major groundwater discharge area, then the water table will rise in this area, flush the waste rock on a regular basis, and spill over the pit rim or change groundwater flowpaths. Such changes to groundwater movement by the pit water table have not been addressed, other than 100% of water leaving will report to Sediment Pond 2, but should be. Groundwater flow is recognized as one transport pathway that will bypass the sedimentation ponds (Section 4.4.3.1) from the ex-</i></p>	<p><i>Response by Rod Smith, Water Management Consultants, on behalf of WCCC: Brule Pit is excavated so that there is limited ponding in the pit within the backfill. In addition, the backfill is expected to be relatively free draining, so the thick sections are not expected to become saturated. Significant changes to the water table within the backfill are therefore not expected. Seepage is expected to bypass SP2 collection ditches. Some water originating from Brule Pit backfill will be present in the SP2 collection ditches and is therefore included in the estimate of underseepage from the SP2 collection</i></p>	<p>Response satisfactory. Issue addressed.</p>	<p>MEMPR MOE</p>

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		<i>pit dumps (Figures 4.4.5-10 and -11), but not from the backfilled pits (Figures 4.4.5-8 and -9).</i>	system. The geometry of the backfill precludes losses similar to those estimated for the SP2 collection system		
17		<p>4.5 Waste Types (Section 3.2.3.2.2)</p> <p>1. Unconsolidated Waste. This unconsolidated waste above rock will apparently be removed by hydraulic excavators and delivered to all three dumps. This will no doubt create suspended-solid concerns, which presumably will be handled at the Sediment Ponds. <i>Note: This overburden is said to “not pose any geochemical environmental concern”, based on the argument that it is weathered. However, if it physically weathers, it is important to confirm that its rates of chemical weathering remain low. Even slow past weathering could create a quick release of accumulated metals upon hydraulic excavation. ML/ARD problems from overburden have been encountered at other minesites in British Columbia. However, there was not ML/ARD testing of overburden at Brule, but there should be testing to resolve this matter.</i></p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i> It is acknowledged that overburden has been an issue at some metal mines in BC but it is very unlikely to be a source of leachable metals for overburden derived from a calcareous sedimentary sequence with low levels of sulphide minerals compared to metal mines.</p> <p>However, WCCC has collected samples of overburden and will provide the results as part of the <i>Mines Act</i> Permit application.</p> <p>WCCC: Unconsolidated waste (primarily till) was sampled in two pit locations and sent for static ABA tests. Results indicate strongly neutralizing potential (NP/AP of 75 and 125). From a geotechnical prospective based on rock properties, waste rock would be mixed with till at a 70% rock to 30% till ratio to minimize impact on the overall dump stability. This mixing would stabilize the till and reduce potential for washing fines into sediment pond inflow. Excess till would be placed into the Dillon Pit as backfill and into containment in the SE dump. An</p>	Details at permitting.	MEMPR MOE

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			outside face of 30 m of rock will be required to prevent instability problems with the till on the SE dump lift. Details of till disposal will be provided in the Norwest Dump Design Report for the Brule Mine Permit Application.		
18		<p>3. Marker B Waste. This incompetent carbonaceous material is found within the Brule and Blind Pits. It will be delivered to the low levels of the in-pit waste dump or within the central core of the ex-pit dumps, and represents 0.2% of all waste moved. It has localized potential for “acid generation”, which will be encapsulated within Prime Waste to “ensure that its ARD potential is mitigated by the carbonate content”. <i>Note: This wording implies the ARD mitigation strategy is layering or blending, which is not considered reliable without abundant site-specific evidence. Also, the use of “acid generation” probably refers to net acid generation, as there is no reason to believe that net-neutral rock with sulphides will not oxidize and thus generate acidity. The placement in the lower levels of the in-pit dumps may lead to saturation or submergence of this material, which would minimize oxidation. However, groundwater modeling to assess this has not yet been conducted, but is required before EA certification.</i></p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i> During the March 10 and 20, 2006 meetings (refer to Appendices E1.2 and E2.2) it was explained that mixing of thin layers of PAG coal waste of this type with the prime waste during mining will result in waste rock with excess acid neutralizing potential. This mixing will occur as a natural course of mining, and is accepted as a management strategy, given very high ratios of PAG to non-PAG material.</p> <p><i>WCCC:</i> In the worst case scenario, Marker B coal would be mined together with the Marker B parting (waste located between the Lower and Marker B seams). The parting ranges from generally the same thickness to several times the thickness of Marker B coal and has an ICca/NP of 5.3. The mixed waste would be net acid consuming.</p> <p>In some areas where the footwall of Marker B Seam is mined for geotechnical stability</p>	Response satisfactory. Issue addressed.	MEMPR

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			<p>considerations, the mixed footwall/ Marker B waste would have much higher ICca/NP ratio.</p> <p>Areas of Marker B coal with relatively low ash could be mined and processed in plant to create a clean coal product. This reduces the PAG Marker B waste quantity.</p> <p>In all cases mining of high NP waste in other areas of the active benches would be occurring concurrent with mining of material below the Lower Seam footwall. This bulk waste would be 5 to 10 times the volume of the Marker B coal being mined and would be mixed on a truck load scale with Marker B coal during disposal on the waste dumps. The weighted average ICca/NP for the mixed waste will be high (ICca/NP over 25).</p>		
19		<p>4. Carbonaceous Parting Waste. Carbonaceous splits in the Upper and Lower Seams represent 0.3% of all waste moved, and have localized potential for acid generation. It will be placed within the three dumps and “it is envisioned that no carbonaceous waste will be on the external periphery of the waste dumps”. Its disposal is thus not as carefully planned as for Marker B waste.</p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i></p> <p>During the March 10 and 20, 2006 meetings (refer to Appendices E1.2 and E2.2) it was explained that mixing of thin layers of PAG coal waste of this type with the prime waste during mining will result in waste rock with excess acid neutralizing potential. This mixing will occur as a natural course of mining.</p> <p><i>WCCC:</i> In all cases waste mining in other</p>	Response satisfactory. Issue addressed	MEMPR

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			areas of the active benches would be occurring concurrently with mining carbonaceous parting waste. This bulk waste would be 5 to 10 times the volume of the partings being mined and would be mixed on a truck load scale with parting waste during disposal on the waste dump. The weighted average ICca/NP for the mixed waste will be high (ICca/NP over 25). The final designs for the Southeast and Northeast dumps call for an engineered outer shell with a construction constraint where the outer face of the shell may not contain mudstones, shales or other poor quality rock including carbonaceous partings.		
20		5. Coarse Coal Reject Waste (CCR). CCR is the result of coal washing will be a combination of out-of-seam material and reject off-specification coal. All will be placed in the central core of the Northeast Dump. Table 3.2.2-1 shows that ultimately there will be 1.773 MBCM of CCR in the Northeast Dump, or 6.4% of the total waste rock. One reason for disposal in the Northeast Dump was that it would be “above topographic level, and as such there will not be any circulating, and potentially leaching, groundwaters within the dump”. <i>Note: This apparently means (1) such conditions will in fact exist in the other dumps and (2) the Dillon pit is not below topographic levels and is dry which is apparently incorrect. Also, ML/ARD does not require circulating groundwaters to be generated; simple infiltration of snowmelt and rainfall would be</i>	<i>Response by Stephen Day, SRK, on behalf of WCCC:</i> During the meeting of March 10, 2006, and subsequent description (refer to Appendix E1.5) the company clarified that prime waste will be scheduled to be placed in the NE Dump so that intimate mixing of prime waste and CCR occurs during dumping. The mitigation strategy is to ensure that the neutralization potential of the prime waste is available for the CCR. Calculations of small scale-mixing on the dump face presented at the March 10 and 20 meetings showed that the acid potential for the year with the most PAG CCR (Year 7) would be significantly offset by	Response satisfactory. Issue addressed	MEMPR

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		<p>sufficient to release ML/ARD if enough air reached or was entrained in the CCR. Therefore, disposal of CCR “above topographic level” is not a mitigating factor for ML/ARD, and may enhance it if air can reach the material. Finally, the Northeast Dump does not have a central core, because it is a sidehill dump (Figure 3.2.2-3). So, if 6.4% of the waste rock entering the Northeast Dump is CCR until the last year of operation, it is hard to see how it will be placed in the “central core” or be thoroughly isolated. “Very fine particles”, which may increase its unit-weight reaction rates, may be added to the CCR “depending on quality” (Section 3.2.4.2.4). The company must clarify and provide details of the ML/ARD disposal and mitigation plans, because their current concepts are not sufficient to understand and determine if ML/ARD will be mitigated.</p>	<p>the neutralization potential of the prime waste. Proposed CCR management is shown in Appendix D1.11.</p> <p>WCCC: Table 3.2.2-1 shows 1.773 million tonnes of CCR. Conversion at 1.7 tonnes per loose cubic meter (LCM) shows 1.04 million cubic meters of CCR in the Northeast dump (1.04 MLCM). Since all waste rock quantities are reported on a volumetric basis, the Northeast dump contains 46.9 MLCM of waste of which 2.2% would be CCR.</p> <p>Extrapolating the Northeast dump attribute regarding the “above topographic level” to other waste dumps is absolutely wrong.</p> <p>The Northeast dump central core is defined as the area on each 20m thick lift that is located a minimum of 10 m above the dump foundation (original topographic surface) and at least 10 m below the final reclaimed surface of the dump. For example the 1160 Bench has capacity for 5.4 MLCM of waste/CCR in the core.</p>		
21		<p>6. Higher Sulphur Waste. Approximately 444,000 BCM (0.3% of all waste) of mudstone containing up to 0.7%S, from the base of the Lower Seam, will be “well mixed by dumping in the pit backfill” with prime waste. This higher-sulphur mudstone is not</p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i></p> <p>It is expected that operational ABA monitoring will be required by the <i>Mines Act</i> permit for this material to ensure</p>	<p>Response satisfactory. Issue addressed</p>	MEMPR

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		<p>considered “potentially acid generating”. For a contingency plan, “if monitoring indicates that this material is potentially acid generating, it can be contained within the central core of the Northeast Dump. <i>Note: First, although it is not “potentially acid generating”, its sulphide will likely oxidize and generate acidity, and aqueous sulphate at least will be released. Second, there is apparently no special monitoring of this higher-sulphur mudstone within the in-pit dump, so the only way to know if it becomes a problem is if the entire pit drainage turns acidic, in which case most of the prime waste would have been turned acidic through NP consumption. Third, if ARD is detected, how will all the mudstone be pulled out of the in-pit dump and placed into the Northeast Dump? Fourth, the Northeast Dump does not have a central core, because it is a sidehill dump (Figure 3.2.2-3). Therefore, there is no viable contingency plan. Again, the company must provide clarification and details of the ML/ARD mitigation plan before EA certification.</i></p>	<p>that this rock is appropriately managed if needed to address potential for ARD. Given small volumes, it can be appropriately managed by placement such that it is contact with prime waste.</p> <p>The proposed geometry of the Northeast Dump was reviewed at the March 10 meeting (refer to Appendix E1.1), and the availability of a “core: was confirmed.</p>		
22		<p>7. Coal Loss Waste: Approximately 735,000 tonnes (3% of the coal seams and 0.36% of all waste) is expected to be lost to waste and “may be weakly acid producing”. “It is assumed that the coal loss is mixed into the prime waste adjacent to the seam” and “will be intimately mixed with prime waste resulting in natural neutralization of any potential acid generation”. <i>Note: Again, the assumption and simplified description are not sufficient to understand and agree with the mitigation strategy.</i></p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i> Calculations were provided in the March 10 meeting (refer to Appendix E1.2) to show that mixing with prime waste during the natural course of mining will offset the acid potential of thin coal waste layers.</p> <p><i>WCCC:</i> The 735,000 tonnes of coal at a conversion of 1.37 t/cubic meter yields</p>	Response satisfactory. Issue addressed	MEMPR

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			536,000 BCM coal. This is 0.35% of all waste volume.		
23		<p>4.6 Hydrologic Site Characterization and Water Management – Minesite</p> <p>The monitoring plan for sediment-pond decants appears to involve semi-annual sampling for detailed water chemistry, with data reported annually (Section 4.4.4.1.2.). These results will also assist the ML/ARD program. <i>NOTE: In the first three years of operation, as Sediment Pond 2 is being commissioned, sampling from both pond decants should be monthly, with results submitted to MEMPR semi-annually. This should include full ICP scans of dozens of elements, for both dissolved and total concentrations. After that, if no increasing trends of concentrations are seen, monitoring can be adjusted.</i></p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i></p> <p>WCCC and SRK believe quarterly sampling of the pond should be adequate to capture seasonal variation in pond chemistry. It is expected that final monitoring frequency and parameter selection will be set at the time of effluent permitting.</p>	Details at permitting.	MEMPR MOE
24		<p>Section 4.4.5.1.6 (Site Water Balance):</p> <p>Despite the intention of not adding any new monitor wells for groundwater to the four operations ones and the intention of monitoring only surface-water quality (Section 4.4.5.1.5), this section on site water balance involves large discussions on assumptions for groundwater and for other factors like sublimation, percentage of snow and rain, snowmelt, infiltration into waste rock, percentage of discharge at the toe, and zero recharge on pit floors. <i>Note: If groundwater is so important to the Site Water Balance and there is little information available on groundwater at Brule, the Site Water Balance must have a large degree of uncertainty. In turn, the predicted effects on Blind Creek must</i></p>	<p><i>Response by Rod Smith, Water Management Consultants, on behalf of WCCC:</i> Assumptions for groundwater and other related factors like sublimation, percentage of snow and rain, snowmelt, infiltration into waste rock, percentage of discharge at the toe and insignificant recharge into pit floors were based on procedures used in the industry and included consideration of existing groundwater and surface water conditions on the site. The water balance model was calibrated to measured flows on Blind Creek, so that site specific conditions were</p>	Response satisfactory. Issue addressed.	MEMPR MOE

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		<i>also have this large uncertainty. Figures 4.4.5-5 to 4.5.5-7 suggests rudimentary groundwater simulations.</i>	appropriately addressed. Some conditions were indeterminate, but not critical. For example, if the annual precipitation was not correct, sublimation and evapotranspiration would have been adjusted so that the model calibrated to measured streamflow. The estimate of the groundwater component of flow was reliant on the accuracy of base flow measurements, which can be difficult to measure in the winter. However, the procedure adopted provides the most reliable method of using site specific data to define surface water and groundwater flow rates on site.		
25		Tables 4.4.5-5 and 4.4.5-6 contain end-of-mine water balances with and without reclamation. There are relatively minor differences in values with and without reclamation (a brief visual estimate is perhaps 10-20% difference), so reclamation does not appear to greatly affect the end-of-mine water balance. For the reclaimed Northeast and Southeast Dumps, direct precipitation onto the dump surfaces is the main source of water. Approximately 55% of the precipitation is expected to be lost to evaporation and sublimation based on non-site-specific rates and experience. The remaining water (called “net precipitation” here) will either runoff (approximately 20-25% of the remaining water) or infiltrate into the waste rock (75-80% of the remaining water). The waste-rock	<i>Response by Rod Smith, Water Management Consultants, on behalf of WCCC:</i> The pits are excavated so that there is limited ponding within the backfill. In addition, the backfill is expected to be relatively free draining, so that thick sections are not expected to become saturated. Significant changes to the water table within the backfill are therefore not expected. Seepage is expected to bypass SP2 collection ditches. Some water originating from Brule Pit backfill will be present in the SP2 collection ditches and is therefore included in the estimate of underseepage from the SP2	Response satisfactory. Issue addressed. Details of any Mink Creek monitoring requirements to be determined at permitting.	MEMPR MOE

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		<p>infiltration will then:</p> <ul style="list-style-type: none"> - discharge at the toe based on assumed proportions and report to a Sediment Pond (44-53% of net precipitation), - discharge beyond the toe and report to a Sediment Pond (6-7% of net precipitation), - discharge into the Brule, Dillon, and Blind Pits (Northeast Dump only), or - bypass the Sediment Pond and discharge into Blind Creek directly (10% for the Northeast Dump and 25% for the Southeast Dump). <p><i>Note: Therefore, 10-25% of ex-pit-dump net precipitation will not pass through the Sediment Ponds. The proposed lack of water-quality monitoring in groundwater means that there will be no warning of impacts on Blind Creek from this infiltration, until impacts are detected by Blind Creek monitoring. According to Table 4.4.5-5, this amounts to approximately 105,000 m³/yr, which is 3.3 L/s. This might be the 3 L/s of “base flow” into Reach 2 discussed under Summary of Predicted Hydrograph Effects. Total waste-rock infiltration both reporting to, and bypassing, the Sediment Ponds will be 1,709,000 m³/yr, or 54 L/s. Table 4.4.5-13 contains predicted end-of-mine flows in Reach 2 of Blind Creek “includes surface flows and groundwater underflows” and “excludes contributions from groundwater in flows in Reach 2”. In any case, 3.3 L/s of bypass, which presumably will continue throughout winter months, and 54 L/s of total water passing through waste rock can represent large percentages of total predicted flows in Table 4.4.5-13 (monthly average</i></p>	<p>collection system. The geometry of the backfill precludes losses similar to those estimated for the SP2 collection system.</p> <p><i>Response by Jaime Cathcart, Knight Piesold, on behalf of WCCC:</i> The pit design will ensure that very little groundwater originating from within the pit will enter the Mink Creek drainage. Total flow in North Brule Creek (tributary of Mink Creek that contains the majority of pit encroachment) at the flow gauge location is comprised of surface runoff (including shallow subsurface flow) and groundwater discharge, which contribute to the total flow at a ratio of approximately 4 to 1. If one assumes that groundwater flows are directly proportional to contributing drainage area (which is conservative from the perspective of estimating pit water impacts on North Brule Creek water quality), and if one assumes that no seepage from the pit will migrate into the Mink Creek drainage, then based on the reduction in drainage area caused by the pit development, total flow reductions in the North Brule Creek tributary at the flow gauge location are estimated to be approximately 7% of pre-mine flows (i.e. 7% drainage area reduction = 7% reduced surface runoff (4/5) + 7% reduced groundwater (1/5) =</p>		

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		<p><i>flows of 34-1080 L/s). Thus, waste-rock chemistry can greatly influence or dominate Blind Creek chemistry.</i></p> <p><i>Although the ex-pit dumps have water bypassing the Sediment Ponds, the three pits (two of which will be mostly or fully backfilled with waste rock) are not allotted such pathways. If 25% of Southeast Dump water bypasses Sediment Pond 2, then at least some water from the Brule in-pit dump should do so also. In fact, a higher proportion of net infiltration on the Brule and Dillon backfill is predicted to pass through the waste rock (81-88%) compared to 75-80% for the Northeast and Southeast Dumps. However, the text explains, "Walls and floors of pits were assumed to be groundwater discharge areas, so recharge in these areas was assumed to be zero", although earlier text allowed for some recharge greater than zero, "... relatively little of the 'surface water' in the pit goes back to groundwater as recharge". So, based on the assumption of zero recharge, potential effects on Mink Creek catchment and on Blind Creek beyond the Sediment Ponds are not modelled or estimated.</i></p>	<p>7% reduced total flow (5/5)). See Table 1 and Figure s1, attached.</p> <p>However, it was generally agreed in discussions with MEMPR that a small area of the pit, estimated to be approximately 10% of the pre-mine pit encroachment recharge area, might remain a recharge area with groundwater flow towards the Mink Creek drainage. The remainder of the pit areas within the Mink Creek drainage would have groundwater discharge into the pits rather than remain as groundwater recharge areas. As a result, the total reduction in flows would be less than 7%, and in fact would be approximately $7\% \times 4/5 + 7\% \times (100\% - 10\%) \times 1/5 = 6.86\%$. Correspondingly, the amount of groundwater expected to migrate from the pits to the Mink Creek Drainage represents approximately 0.14% of total flows in North Brule Creek at the gauge location.</p> <p>Furthermore, given that pit encroachment into the North Brule Tributary drainage is expected to be approximately 0.7% during the first few years of operation, affected groundwater migrating from the pits is expected to comprise approximately 0.014% of the flow at the gauging</p>		

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			<p>location in the creek during this period.</p> <p>Consequently, it was concluded that mine effects on water quality in Mink Creek are expected to be minimal, and particularly so during the first few years of operations, and there is no valid justification for a water quality monitoring program. However, if a program is in fact required by MOE, details are to be determined through ongoing discussion between WCCC and MOE</p>		
26		<p>After closure (Section 4.4.6.1), there will be saturated zones within the Brule backfilled waste rock. Water from the lowest saturated zone at the southern end of the Brule Pit “will eventually daylight as seeps from the toe of the Southeast Dump at the low point of the pit wall”. <i>Note: Low-redox conditions can form, affecting leaching of selenium and other elements. All pit water is said to flow from the Southeast Dump toe, whereas Table 4.4.5-5 shows that these daylighting seeps at the toe are not included in the Sources for the Southeast Dump, and must therefore be the 1,132,014 m³/yr discharging from backfill in the Brule Pit and flowing to Sediment Pond 2. However, if 25% of the Southeast Dump water infiltrates deeper and bypasses Sediment Pond 2, the same should be expected of this pit-backfill water. This would increase Sediment Pond Bypass from 3 L/s (“base flow”?) to 12 L/s.</i></p>	<p><i>Response by Rod Smith, Water Management Consultants, on behalf of WCCC:</i></p> <p>Water will pond in three locations within the Brule Pit backfill. This water will discharge from the toe of the waste at a low point in the pit wall immediately adjacent to the Southeast Ex-pit Dump and flow into the South Ditch</p> <p>Seepage is expected to bypass SP2 collection ditches. Some water originating from Brule Pit backfill will be present in the SP2 collection ditches and is therefore included in the estimate of underseepage from the SP2 collection system. The geometry of the backfill precludes losses similar to those estimated for the SP2 collection system</p>	Response satisfactory. Issue addressed.	MEMPR MOE

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27		<p>4.7 Hydrologic Site Characterization and Water Management - Falling Creek Flats Loadout Site</p> <p>The Falling Creek Flats Loadout Site is upgradient of the existing CN Rail line, on an alluvial fan of the Pine River between Beaudette Creek to the west and Falling Creek to the east (Section 4.4.3.2). Put simply, the loadout site is surrounded on three sides by creeks and a river. The loadout is underlain by coarse sand and gravels. Runoff from the loadout will be collected by perimeter ditches and directed into two settling ponds (east side and west side). The ponds will be unlined, but there is no specification for lining of the ditches in Figure 4.4.3-3. Berms along the two creeks will provide some flood protection on two sides.</p> <p>Groundwater under the loadout is reportedly recharged by rainfall and snowmelt, valley-wall runoff, and potentially from the two creeks. On the other hand, there may be some regional groundwater discharge into the loadout area. Also, groundwater moves laterally to the north to discharge into the Pine River and the lowest reaches of the two creeks. This is based on no groundwater monitoring wells, although two are proposed for the future. <i>Note: In light of the coarse materials underlying the loadout area, groundwater flow and potential contaminant migration could be substantial and the major pathway for any ML/ARD release as a plume. This scenario is enhanced by the unlined ponds and by the ditches that apparently will also be unlined. The problem is</i></p>	<p><i>Response by Jaime Cathcart, Knight Piesold, on behalf of WCCC:</i> WCCC has committed to sampling and testing the water quality of runoff from existing Dillon Mine coal stockpiles to assess whether or not this water, in its undiluted form, poses a significant risk to the receiving aquatic environment at the Loadout. If a significant risk is determined, the plan is to construct the Loadout coal pad from compacted till and to line the receiving ditches and pond. Coal pile runoff would then be collected by and passed through the lined system, to be discharged directly into the Pine River. If the ditches and pond are unlined, it is agreed by WCCC that at total of one up-gradient and three down-gradient groundwater monitoring wells will be installed at the Loadout and monitored throughout operations. (Cline Resources has installed wells at this site, and WCCC would not establish duplicate wells.)</p> <p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i> It was agreed at the March 20, 2006 Working Group meeting (Appendix E2.5) that evaluation of water quality for the coal stockpile does not need to be considered for the EA because the company has committed to ensure that</p>	Details at permitting.	MEMPR MOE

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		<i>groundwater flow and chemistry at the loadout, even for current (baseline) conditions are undefined, although groundwater movement is thought to be downwards from recharge, upwards from regional discharge, and laterally towards the Pine River. Only two monitor wells are proposed in the future to predict and monitor future changes. With sensitive aquatic habitats on three sides, this ambiguity now and in the future represents a high environmental risk, although Chapter 5 did not consider any risk from ML/ARD at the loadout. This is not acceptable, and initial groundwater modeling will be required before EA certification, followed by modeling based on site-specific data and site-specific water balances. A minimum of five groundwater nests, each containing at least two depth-specific piezometers will be needed, with two located on the upgradient and downgradient of the coal-stockpile area.</i>	water can be collected if needed and the loadout will not be constructed for several years. Operational monitoring of coal pile runoff at the Dillon and Brule mines provides an opportunity to evaluate water chemistry, water collection and monitoring requirements for the loadout.		
28		The monitoring plan appears to involve semi-annual sampling (Section 4.4.2), although this is not clearly stated. <i>NOTE: Initial monitoring of chemistry and water levels in the piezometers will be monthly, as will be monitoring of flow and chemistry in all ponds at the loadout.</i>	See response to Issue #27.	Details at permitting.	MEMPR MOE
29		“The objective of water management at the Falling Creek Flats Loadout facility is to minimise potential impacts to groundwater and surface water systems ...” (Section 4.4.5.2) “Sediment ponds at the Loadout facility will reduce particulates, contaminants and turbidity of runoff from the site. ... These ponds will be constructed in high	See response to Issue #27.	Details at permitting.	MEMPR MOE

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		permeability alluvial sands and gravels, and therefore most collected runoff will exfiltrate through the substrate [to groundwater]”. <i>Note: How does allowing contaminants to enter groundwater minimize impacts to groundwater? If a plume forms to one of the creeks or river, the undiluted concentrations in that plume will determine toxicity to benthic organisms and any fish eggs.</i>			
30		<i>For the water balance, “No data were available for calibration of the model, so parameters were estimated on the basis of regional data ...” Note: A completely non-site-specific water balance is unacceptable. Additional information including porous-medium groundwater modelling, no doubt based mostly on assumptions, will be needed before EA certification. Site-specific modeling and balances for surface water and groundwater will then be needed for permitting.</i>	<i>Response by Jaime Cathcart, Knight Piesold, on behalf of WCCC: Refer to the response to Issue #7.</i>	Response satisfactory. Issue addressed.	MEMPR MOE
31		<i>Based on approximate lateral dimensions and net precipitation of 0.344 m (Table 4.4.5-18), total net precipitation is around 4 L/s which presumably mostly infiltrates into the coarse sands and gravels. Stockpiles represent around ~15% of total area, so their infiltration would be ~0.6 L/s on average, fluctuating with precipitation and dust suppression.</i> <i>To meet water requirements including potable water, a well will be pumped during summer months with a yield of 1.26 L/s. Because groundwater discharge off-site is 2.9 L/s, this well will have to be located in the lower (northern) half of the loadout to maintain the require yield. As a</i>	<i>Response by Rod Smith, Water Management Consultants, on behalf of WCCC:</i> It is anticipated that this well will be located upgradient of the facility to reduce the risk of contamination by site facilities. Although drilling has not been completed, it is possible that simultaneous accretion of Pine River alluvium and the bounding alluvial fans has resulted in thicker sand and gravel sequences closer to the valley walls. This would provide an adequate thickness of saturated aquifer so that	Details at permitting.	Northern Health Authority

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		<i>result, this well upon extended pumping could draw water from the coal storage area and the unlined ponds. Therefore, there is a potential pathway to human health that has not been considered. A monitoring plan for potable water is needed, plus a contingency should the well provide unacceptable concentrations.</i>	the drawdown would intercept adequate recharge from precipitation and creek flow that recharge from the coal storage areas and the unlined ponds is of limited concern. Should the well water be used as a drinking water supply, regular sampling and analyses would be implemented. Should the well water not be suitable for drinking, bottled drinking water would be provided.		
32		<p>5. DETAILED DISCUSSION OF ML/ARD PREDICTIONS AND MITIGATION</p> <p>Prediction is not mentioned in the title of Section 4.5, (ML/ARD Prevention, Management and Monitoring Plan), but this section does contain the predictive information. “The relevant project components include the mine workings (open pits), external waste rock dumps, open pit back fill (internal waste rock dumps), coarse coal rejects, coal fines, and coal stockpiles. The road alignment is considered as a separate component.”</p> <p>Therefore, ML/ARD potential of the roads is not assessed in this document.</p>	A geological review of the road was completed (Refer to Appendix D1.9).	Response satisfactory. Issue addressed.	MEMPR
33		<p>5.2 Acid-Base Accounting</p> <p>To calculate NPR (NP/AP) values (Section 4.5.3.1.2), “the following rules were used:</p> <ul style="list-style-type: none"> - Acid potential (AP) was calculated from total sulphur unless the calculated sulphide sulphur from iron content was less than total sulphur, in which case, the calculated sulphide sulphur was used to obtain AP. - A measurement of neutralization potential associated with calcium carbonate (referred to as 	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i></p> <p>The comment is correct that total sulphur less sulphate was used to calculate AP for the coal rather than the total sulphur used for the majority of samples. AP for a limited number of samples was calculated using iron from aqua regia analysis. The Application Report did not fully explain and justify</p>	Response satisfactory. Issue addressed.	MEMPR

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		<p>IC_{Ca} NP) was calculated from inorganic carbon calculated from the proportion of inorganic carbon associated with calcium.”</p> <p>It is important to look closer at these two rules for calculating surrogate AP and NP.</p> <p>The first rule, for AP, says total sulphur was considered. Actually, this is wrong, as Appendix B-2 shows that “S as non-SO4” (total sulphur minus measured sulphate) was used. This is not a serious problem, because (1) measured sulphate was 0.04%S or less and (2) measured sulphide was normally less than “S as non-SO4”. More important, solid-phase iron was converted to a %S equivalent, by assuming all iron occurred as FeS₂. Because iron can occur as other minerals, this should “conservatively estimate the maximum possible sulphur associated with pyrite”. In reality, only aqua regia digestion was used for the ICP analyses, instead of the four-acid digestion, and thus it is unlikely most of the iron was released and analyzed. Therefore, this approach does not provide a conservative estimate, but may actually underestimate total iron and pyritic iron substantially. This is critical because, whenever this iron-based sulphide was less than “S as non-SO4”, it was used to estimate AP. This was done even if the iron was less than both measured and calculated sulphide, which would actually suggest the iron was underestimated, and an inexpensive XRF analysis would have resolved this. Also, organic sulphur was assumed to be non-acid-</p>	<p>this method therefore a memo (Appendix D1.6) was provided for clarification. In summary, the memorandum provided confirmation from labs that iron determined by aqua regia is a good surrogate for pyrite.</p>		

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		generating which is apparently site dependent and not confirmed for Brule, but perhaps “S as non-SO4” is the correct value for AP calculations. Several samples of coal and mudstone, which had elevated levels of both measured and calculated sulphide, were assigned much lower AP values because iron was lower. For example, Sample “E” (Marker C) had measured and calculated sulphide levels of 0.44%S and 0.61%S, respectively, but was given a default AP of only 0.3 kg/t based on the iron-based sulphide of only 0.05%S. Based on a visual check of Appendix B-2, this does not seem to be a major problem, because none of the samples significantly affected by this problem would change from net-acid-neutralizing to net-acid-generating. However, it is misleading for some samples, because it leads to inaccurate statements like, “acid potentials in the dataset are less than 10 kg/t corresponding to sulphur concentrations less than 0.3%S.”			
34		The second rule on calculating NP from calcium appears generally safe, because for most samples the value of IC _{Ca} NP was less than NP. However, for three samples, IC _{Ca} NP was greater than NP, perhaps because these samples had other minerals with calcium. For example, one sample of Lower Footwall mudstone in BR2004-3C had an IC _{Ca} NP of 41 kg/t, but an NP of only 21 kg/t. As a result, the NP/AP ratio was a net-acid-generating 1.6 (< 2.0), but IC _{Ca} NP/AP was a net-acid-neutralizing 2.9. As a result, this approach categorized a net-acid-generating sample as net acid neutralizing.	<i>Response by Stephen Day, SRK, on behalf of WCCC:</i> During the March 10, 2006 meeting (materials attached) it was clarified that NP was not calculated from calcium, but rather calcium carbonate content. This is conservative because the magnesium part of ankerite was not included in the calculation. As noted in the comment, a few samples have higher calcium carbonate NP than total NP, but the vast majority have much lower calcium carbonate than NP (see next response)	Response satisfactory. Issue addressed.	MEMPR

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35		<p>A problem in the IC_{Ca} NP and NP evaluations is that 100% of measured NP is assumed to be fully reactive. In reality, many sulphidic sites find a certain amount of Sobek NP, often around 5-15 kg/t, is unavailable. This is seen in kinetic tests where samples with measured NP become acidic quickly, and in scatterplots of NP and paste pH only for well oxidized samples which show paste pH falls towards acidic values below a certain NP value. This can be seen for Brule and Dillon also, where data for mostly fresh samples suggest unavailable NP is around 5-10 kg/t. Horizontal lines at 5-10 kg/t for IC_{Ca} NP in Figure 4.5.3-2 would show that several more samples become net acid generating, including some sandstone.</p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i> The reactive portion of carbonate was calculated from the calcium provided by calcite and ankerite, This method resulted in removal of an average of 27 kg CaCO₃/t from NP which is greater than the 5-10 kg/t suggested in the comment. Furthermore, the NP of coals was effectively assumed to be negligible due to the assumption that carbonate occurs mainly as siderite and contributes very little NP.</p> <p>All paste pHs of sample results provided in the EA were near neutral or alkaline and are not useful to evaluate unavailable NP. The site specific carbonate calculation method is appropriate and as noted in the comment and the response to comment 64 provides a conservative estimate of available NP</p>	Response satisfactory. Issue addressed.	MEMPR
36		<p>The importance of samples with IC_{Ca} NP/AP between 1.0 and 2.0 are minimized by saying, “these are not extensive zones and are surrounded by rock with high NP/AP”. Samples with ratios less than 1.0 “were dominantly from Lower Seam footwall”. However, Figure 4.5.3-3 (mis-labeled as another 4.5.3-2 in the report) shows that a net-acid-generating zone about 7 m thick, including a value near 1.0, lies far from coal in BR2004-2C. Results are further minimized by averaging (e.g., Table</p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i> During the March 10, 2006 meeting (refer to Appendices E1.2 and E1.5), calculations were provided to show that narrow zones will become mixed with prime wastes during the natural course of mining, resulting in a large excess of NP.</p>	Response satisfactory. Issue addressed.	MEMPR

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		4.5.3-3), which implicitly means all rock will be intimately mixed over the entire interval prior to disposal and thus “the potential for acid generation in the waste rock is negligible” (Section 4.5.4.4.1). Blending is not a simple and easy mitigation for net-acid-generating rock, especially a 7-m-thick interval in BR2004-2C which may represent more than one pit bench during mining. Also, kinetic-tests results show that sulphate was being produced on a regular basis from sulphide oxidation so that acid generation was not negligible as stated.	<p>WCCC has calculated the volume of a 2.8-5.3 m (not an about 7 m layer, as indicated in the comment) PAG layer (refer to Appendix D1.13).</p> <p>For clarification, a bench is 15 m so the largest PAG layer would represent up to 35% of one bench, and be mixed at a 3:1 ratio or better during mining.</p>		
37		A simple approach for indicating ARD potential is the number of samples out of the total that can generate net acidity at some point. Based on the data in Appendix B-2, the basic NP/AP approach indicates 14 of 148 samples (9%) are net acid generating (< 2.0) the IC _{Ca} NP/AP approach indicates 18% of samples are net acid generating, and the “adjusted” IC _{Ca} NP/AP approach with 10 kg/t subtracted from IC _{Ca} NP indicates 27% of samples are net acid generating. A weighted approach based on the length of hole represented by each sample would likely show less than 18-27% was net acid generating, but this was not provided in the Application except as long-interval averages. Nevertheless, intervals at least a few meters thick, perhaps the height of a few pit benches, can be found in some holes, even remote from coal seams. Thus, simple numerical averaging of entire intervals (Table 4.5.3-3), implicitly simulating intimate blending, minimizes the potential for ARD in “hot spots”, pit benches,	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i></p> <p>During the March 10 meeting (refer to Appendices E1.2 and E1.5) it was explained that the number of samples is not an appropriate measure of PAG volume because sampling was not based on a fixed interval. Using interval weighting, the volume of PAG waste rock is between 6 and 10% rather than the 9% to 27% value shown in the comments.</p> <p>In the March 10 and 20 meetings (refer to Appendices E1.2, E1.5, E2.2 and E2.5) it was explained that the volume weighting approach is consistent with practice developed in the Appalachian coal mining region to assess ARD potential from ABA. This experience shows that if the NP/MPA is less than 2,</p>	Response satisfactory. Issue addressed.	MEMPR

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		and at least local acidic seeps at Brule. For example, the placement of CCR in the “core” of the Northeast Dump does not mean the CCR is intimately mixed with the waste rock, some of which will be net acid generating itself according to Appendix B-2. Nevertheless, this is all summarized in Section 4.5.5 as “limited weak potential for ARD”.	ARD is possible, Similar calculations for Brule show that NP/MPA is between 11 and 120 (range for different seams footwall, interburden and rock overburden) demonstrating that the rock has large excess neutralization potential that will offset		
38		Marker C is said to have a low AP of 0.3 kg/t and thus “the potential for acid generation is very low” and “indicates it is unlikely to generate acid in practice”. In reality, Marker C contains 0.61%S calculated sulphide (second highest value in Appendix B-2) with an AP of 19 kg/t, the highest of all the Marker B, C, and D samples discussed in the text. So, Marker C is likely to generate and release ARD upon disturbance, which contradicts the prediction in the Application.	<i>Response by Stephen Day, SRK, on behalf of WCCC:</i> Clarification of the pyritic sulphide calculation method is provided in Appendix D1.6. It is agreed that some waste coal has potential to release ARD, but at low levels. During the March 10, 2006 meeting (refer to Appendices E1.2 and E1.5), calculations were provided to show that narrow zones will become mixed with prime wastes during the natural course of mining resulting in a large excess of NP.	Response satisfactory. Issue addressed.	MEMPR
39		“... the majority of mudstones have IC_{Ca} NP/AP well above 2”. While true, 28% of pure mudstone samples have IC_{Ca} NP/AP values less than 2.0. Thus, more than one-quarter of the mudstone samples can be classified as eventually net acid generating. This again highlights the problem with averaging in the Application.	<i>Response by Stephen Day, SRK, on behalf of WCCC:</i> It is acknowledged that mudstones (and waste coals) are the source of PAG material, but the number of samples of mudstone is not the appropriate measure of the proportion of PAG. See response to Issue # 37.	Response satisfactory. Issue addressed.	MEMPR
40		5.3 Total Solid-Phase Metals and Other Elements Section 4.5.3.1.2 briefly discusses solid-phase	<i>Response by Stephen Day, SRK, on behalf of WCCC:</i> As discussed during the March 20	Response satisfactory. Issue	MEMPR

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		metal and elemental levels. However, it fails to compare values to crustal abundances as recommended in the provincial draft prediction manual. This comparison shows that many samples exceeded three times the maximum crustal abundances for: silver, bismuth, cadmium, and selenium, with maximum Brule levels at least one order of magnitude above maximum crustal abundances of those elements. Strangely, the text says that the maximum selenium level is 19 mg/kg, but Appendix B-2 shows a maximum of only 7.8 ppm. Therefore, there are apparently samples with elevated selenium missing from Appendix B-2.	meeting, comparison of solid phase metal concentrations with crustal averages is a screening technique with limited value at the EA stage. Since regulated parameters are subsequently evaluated through kinetic tests and used for water quality predictions, the former step does not need to be presented in the EA Application.	addressed.	
41		<p>5.4 Kinetic Tests</p> <p>Laboratory kinetic testing involved thirteen 1-kg flood-leached humidity cells, with 0.5 L added each week, and four 5-kg columns trickled leached with 1 L/wk which corresponded to the on-site kinetic tests. The cells used discrete-interval samples of various intervals and lithologies (including CCR), whereas three columns contained composites from three holes (Lower-Upper interburden, Upper 60 interburden, and 60 overburden) and the fourth contained historical Upper Seam spoil more than 20 years old but not stated whether it was oxidized prior to testing (Table 4.5.2-3). The column samples were notably low in total sulphur (0.06-0.10%S) compared to the cell samples. Seven in-field “barrel” kinetic tests contained up to 365 kg of the four samples in the laboratory columns, plus a Blank, Seam 60 Overburden, and Lower Seam</p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i></p> <p>The 20-year old sample was obtained from surface and would therefore expected to be weathered.</p>	Response satisfactory. Issue addressed.	MEMPR

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		Footwall.			
42		<p>Section 4.5.3.1.3 discusses humidity-cell results, but fails to say in the text that these tests were only operated for 13 weeks and others for only 26 weeks, short of the minimum of 40 weeks now in practice in British Columbia. Perhaps the tests continued, but this is not stated. In any case, there were various ongoing trends, so it is not clear how these trends would have stabilized with further testing. Temporal trends in pH suggested a few samples with NP values up to 5 kg/t were becoming acidic, indicating unavailable NP was at least 5 kg/t. Also, cadmium and zinc leaching were accelerating rapidly in one sample. Selenium leaching rates were variable, but seemed to average around 0.005 mg/kg/wk over the short span of testing.</p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i> There is no standard for minimum duration for operation of humidity cells in British Columbia.</p> <p>The duration of testing was discussed during the March 20 meeting. All tests were operated for at least 26 weeks. Six humidity cells are continuing of which the two coals and two CCR samples have now been continuing for a year.</p> <p>For clarification, the coal samples were assumed to have negligible NP using the calcium carbonate calculation and were therefore expected to produce weak acidic leachate,</p> <p>The sample showing accelerating zinc and cadmium leaching contained the highest zinc concentration in the database, which was used as the source term concentration</p> <p>Western agreed at the March 20 meeting to provide a confirmatory update on humidity cell results as an Addendum to the EA by April 30 (i.e. not required for review process to proceed) (refer to Appendices E2.5 and E2.6).</p>	Response satisfactory. Issue addressed.	MEMPR
43		The humidity-cell section also presents the	<i>Response by Stephen Day, SRK, on</i>	Response	MEMPR

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		equation for calculating rates (“loadings”) in mg/kg/wk. However, it fails to consider the number of elapsed weeks. Appendix B-3 shows that some cells were analyzed every second week (factor of two difference in the loading equation), although figures show symbols every week. Thus, there could be a factor-of-two error in the rates.	<i>behalf of WCCC:</i> There is no “factor-of-two error” in the calculations. This was considered.	satisfactory. Issue addressed.	
44		Cell interpretations in this section did not include Carbonate Molar Ratios [CMR = (Ca+Mg)/SO ₄], which represents the rate that NP and fast-reacting carbonate is being consumed relative to the rate of sulphide oxidation. For example, a CMR value of 3.5 means that NP and fast-reacting carbonate is consumed 3.5 times faster than sulphide is oxidized. Thus, the initial NP/AP ratio has to be greater than 3.5 to ensure no net acidity indefinitely. Brule predictions of net-acid-generating rock was based on a criterion of 2.0 (Section 4.5.3.1.2), and thus a CMR value above 2.0 from a near-neutral cell suggests the criterion of 2.0 is incorrect and too low. This issue is raised in Section 4.5.4.4.1, but dismissed as relatively unimportant, although Figure 4.5.4-4 shows that most CMR values after Week 14 were greater than 2.0.	<i>Response by Stephen Day, SRK, on behalf of WCCC:</i> It was explained in the EA Application that rapid flushing of carbonate NP from humidity cells is artificial compared to field conditions due to the high volume of water relative to solids used in humidity cells. The results therefore do not provide reliable estimates of the site-specific NP/AP except when acid generation from sulphide oxidation becomes more significant and results in carbonate leaching. This phenomenon has been known for over 10 years (as referenced in the EA) and recently described by B. Mattson in 2005 at the annual BC ML/ARD workshop. (refer to Appendix D1.10; The criterion is certainly not above 2, which is the maximum indicated by theory) and is nearer the value of 1.3 shown by the humidity cells.	Response satisfactory. Issue addressed.	MEMPR
45		Also, rock with NP/AP of 1.3 is said to have a “very marginal potential for acid generation”, showing a progressive downgrading of ARD potential through Chapter 4.	<i>Response by Stephen Day, SRK, on behalf of WCCC:</i> ARD potential has not been downgraded through Chapter 4; rather	Response satisfactory. Issue addressed.	MEMPR

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			appropriate refinements have been made in interpretation for site specific conditions. In fact, major assumptions remain conservative - such as not considering magnesium carbonate (response to Issue #67) and the inclusion of organically-bound sulphur which was not considered for the majority of samples but is nonetheless likely to be present (refer to Appendix D1.6).		
46		For the on-site kinetic tests (“barrels”, Section 4.5.3.1.4), the empty “blank” barrel produced aqueous concentrations of some parameters like antimony and cadmium that rivalled or exceeded many of the rock-barrel concentrations. This was attributed to “dustfall” near the Dillon minesite, and suggests such concentrations will be easily achieved at many locations around Brule.	<i>Response by Stephen Day, SRK, on behalf of WCCC:</i> At the March 20 meeting, it was clarified that the barrels are located near a road, which would be the major source of dustfall. The barrel experiment was not designed to evaluate the effect of dust, and extrapolation of results to other parts of the site is not appropriate.	Response satisfactory. Issue addressed.	MEMPR
47		5.5 Process Materials Characterization (coal and coarse coal rejects) In section 4.5.3.2, coal is said to have a low acid potential (Section 4.5.3.2). However, it suffers from the same flaws noted for rock, in that total iron from a weaker aqua-regia digestion was used, without a corresponding XRF value to confirm. Unlike the rock samples, an independent sulphide analysis was not provided to confirm the calculated sulphide includes some organic sulphur. However, organic sulphur was assumed to be non-acid-generating, which is apparently site dependent	<i>Response by Stephen Day, SRK, on behalf of WCCC:</i> The method used to calculate pyritic sulphur from iron was clarified in the memo dated March 16, 2006 (refer to Appendix D1.6). The memo also presents review comments on papers provided by MDAG to support its position that organically-bound sulphur in coal should be included in the calculation. The papers did not provide this support. One of the papers showed	Response satisfactory. Issue addressed.	MEMPR

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		and not confirmed for Brule. In any case, for cleaned coal, “the very low sulphur content [calculated as 0.32-0.61%S] indicates that oxidation rates are expected to be extremely low”. However, these are not very low sulphur contents, and thus oxidation rates should be detectable and not extremely low. It is possible that by “low sulphur content” the text intended to refer to the calculated iron-based sulphur of 0.09%S, but again this value suffers from the aqua-regia digestion without XRF confirmation. In any case, only 13 weeks of kinetic testing were available, so this was not sufficient for sulphides to accelerate after an initial lag and to produce stable rates. Nevertheless, sulphate production rates were still detectable and not “extremely low”. In fact, Section 4.5.4.4.1 explains that, “The CCR and coal samples are probably releasing sufficient acidity ... by acid release from pyrite oxidation”.	that organic sulphur made an insignificant contribution to acidity. WCCC has agreed to evaluate the reactivity of organic S in coal (See Appendix D1.6) as part of the ML/ARD Prediction and Prevention Plan,		
48		Unlike the coal samples, the CCR AP values were based on calculated sulphide and thus better reflect actual Acid Potential. Nevertheless, there is a convoluted discussion how iron is greater than sulphide and thus shows that all sulphide occurs as iron sulphide, but not all iron is sulphide and thus AP should be adjusted but was not. In any case, “the current NP/AP implies that CCR from the Lower and Upper Seams are PAG”, although this morphs in Section 4.5.4.4.1 into “some CCR has weak theoretical potential to generate acid due to uncertainty about sulphur speciation”.	<i>Response by Stephen Day, SRK, on behalf of WCCC:</i> The CCR are being managed as PAG material. The company has provided clarification of the management method (refer to Appendix D1.11).	Response satisfactory. Issue addressed.	MEMPR

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49		<p>5.6 Prediction of Aqueous Concentrations - Minesite</p> <p>Table 4.5.4-7 in Section 4.5.4.4.2 is apparently the key prediction table for ML/ARD, because it is a “Summary of Reasonable Worst Case Water Quality Predictions” and “all concentrations are average annual”. The predictions are considered worst case because they use “maximum observed concentrations for potential contaminants” (see also Table 4.5.4-6). There are several observations that can be made about these predicted concentrations in the waste-rock porewaters (the “source” of all the predicted downstream water-quality effects), which show they are not worst case and may not be reasonable.</p> <p>First, if the predicted concentrations are “average annual”, then seasonal concentrations must logically range from below, to above, these “worst case” values. Therefore, predicted seasonal concentrations would include higher concentrations than shown in Table 4.4.4-7. However, the seasonal variability is not addressed, although seasonal effects on downstream Sediment Pond chemistry are discussed later in Sections 4.5.8.</p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i></p> <p>The EA Application incorrectly described the metal concentrations as average annual. It was clarified at the March 10 and 20 meetings (refer to Appendix E1.2), The values are “reasonable worst case”. Seasonal effects are considered in the downstream residual impact assessment.</p>	Response satisfactory. Issue addressed.	MEMPR MOE
50		<p>Second, aqueous concentrations in various scales of testwork can increase as scale and solid: water ratio increases. At some point, aqueous concentrations achieve a maximum “equilibrium” level due to factors like thermodynamic stability, site-specific solubility, pseudo-equilibrium, and meta-stable equilibrium. While Table 4.5.4-7</p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i></p> <p>It was clarified at the March 10 meeting (refer to Appendix E1.2) that the predictions are based on reasonable maximum values indicated by tests results and monitoring for all scales</p>	Response satisfactory. Issue addressed.	MEMPR

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		<p>shows “maximum observed concentrations”, the more important question is: does the increasing scale of testwork show that equilibrium had been achieved by the “maximum observed concentrations”, or could concentrations go higher as scale increased to the full minesite? Appendix B-8 shows pH scatterplots that explain to some extent the predicted maximum observed concentrations” of Table 4.5.4-7. As scale increased from shake flasks to columns to on-site barrels, trends of generally increasing concentrations can be seen for:</p> <ul style="list-style-type: none"> - sulphate, - antimony, - arsenic, - cobalt, - nickel, - selenium, and - sodium. <p>As a result, there is no evidence that the next largest scale of testwork and the full-scale minesite could not have even higher concentrations.</p>	<p>(shake flasks, columns, barrels, operational monitoring of other mines), and then applied to the full waste rock volume at Brule. This approach ensures that the reasonable worst value is applied to Brule for impact predictions. The exception to this rule is selenium for which discussion was provided in the EA and full scale operational values were used due to apparent attenuation effects seen at full scale.</p> <p>At the March 20 meeting (refer to Appendix E2.2), a back-calculation of source chemistry for Dillon was presented based on MSP monitoring results. This calculation showed that the source terms used in the Brule EA were consistent with the back-calculated concentrations for the majority of parameters. A minor adjustment was made for copper.</p>		
51		<p>Third, Table 4.5.4-7 is missing predictions for pH (a critical factor of the earlier sections on ARD), hardness (important for toxicity calculations), sulphate (except for a few predictions for pit water), manganese, aluminum (except for a few predictions of pit water), barium, mercury, and thallium. According to Appendix B-8, maximum concentrations for some of these parameters would be:</p> <ul style="list-style-type: none"> - at least 100 mg/L for sulphate but could be higher at larger scales, 	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i></p> <p>The approach used to re-evaluate source terms and provide predictions for additional parameters was agreed at the March 10 meeting (Appendix E1.5) and presented at the March 20 meeting (Appendix E2.5). The re-evaluation of source terms is provided in Appendix D1.12.</p>	Response satisfactory. Issue addressed.	MEMPR

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		<ul style="list-style-type: none"> - 1.0 mg/L for aluminum based on barrel tests, - around 0.6 mg/L for barium based on columns, <ul style="list-style-type: none"> - possibly higher than the predicted 0.0002 mg/L for cadmium, but high detection limits precludes a better assessment, - at least 75 mg/L for calcium but could be higher at larger scales, - around 0.007 mg/L for chromium based on Brule shake flasks and barrels, which is higher than the predicted and “maximum observed” 0.0012 mg/L in Table 4.5.4-7 from another coal minesite in southeastern British Columbia [Section 4.5.4.3.3 argues that the higher chromium exceeds solubility limits in a generic model and was thus adjusted downward, but chromium is known to ignore such generic solubility values], - around 0.2 mg/L for iron based on shake flasks, which is greater than the zero prediction of “0.000” mg/L in Table 4.5.4-7, at least 20 mg/L for magnesium based on shake flasks and barrels, -at least 0.08 mg/L for manganese based on Brule testwork, compared to the prediction of 0.17 mg/L based on a sample from another coal minesite in southeastern British Columbia, which ignored a even higher one of nearly 1 mg/L from the same site, - around 5 mg/L for potassium based on a barrel, - at least 0.32 mg/L for selenium from a barrel but could be higher at larger scales, compared to the “maximum observed” and predicted for Brule of 0.15 mg/L from another coal minesite in southeastern British Columbia, and 			

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		- at least 190 mg/L for sodium from barrels but could be higher at larger scales. Predictions for some parameters like pH and sulphate show up later in Section 4.5.8 for the Sediment Ponds.			
52		Fourth, some predictions were adjusted based on generic mineral-solubility model, MINTEQA2. For example, aqueous concentrations for manganese and iron and aluminum were adjusted based on the solubilities of rhodocrosite (manganese carbonate) and ferrihydrite (although site-specific iron solubilities span several orders of magnitude), and basic aluminum sulphate (Al ₄ (OH) ₁₀ SO ₄). However, there is no mineralogical evidence presented for Brule to show these particular minerals are the ones that form and that their site-specific solubilities match those in a generic model. Thus, they are simply assumptions.	<i>Response by Stephen Day, SRK, on behalf of WCCC:</i> The only use of MINTEQA2 adjustments in the revised source term predictions is for parameters predicted by MINTEQA to be greater than the highest values indicated by monitoring and testing.	Response satisfactory. Issue addressed.	MEMPR
53		Fifth, pit predictions were based on assuming a fracture layer only 10 cm thick is only 10% reactive but 100% flushed on all pit walls. In reality, there is a federal MEND method for estimating pit-wall effects, based on surface area exposure, fractures, and unit-area reaction rates. This was not applied to Brule. Nevertheless, that work shows that the use of unit-weight humidity-cell rates cannot be applied to pit walls, but that pit-wall rates are higher than suggested by cells. Based on this, the predictions for pit concentrations should be considered “assumed” as stated and possibly underestimations, despite being labelled “reasonable worst case”.	<i>Response by Stephen Day, SRK, on behalf of WCCC:</i> As discussed at the March 20 Working Group ML/ARD meeting, monitoring results for the Dillon Pit floor were used as an analogue for Brule Pit floor in the revised predictions developed for MOE and presented in Appendix D2.5.	Response satisfactory. Issue addressed.	MEMPR MOE

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54		Sixth, “reasonable worst case” concentrations are predicted at downstream points like ditches, the Sediment Ponds, and the creek. However, since the water balance is based on so many assumed factors, it is not clear how worst case and reasonable these predictions are. Also, the water balance failed to include detailed groundwater assessments that would likely increase unmonitored, uncontrolled seepage with elevated concentrations. As a result, the predictions are as reliable as the assumptions in the water balance, and that reliability is not known but is required by permitting.	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i> The response to Issue #50 clarifies that the source term geochemical predications are reasonable worst case.</p> <p><i>Response by Rod Smith, Water Management Consultants, on behalf of WCCC:</i> Assumptions for the water balance were based on procedures commonly used in the industry and included consideration of existing groundwater and surface water conditions on the site. The water balance model was calibrated to measured flows on Blind Creek, so that site specific conditions were appropriately addressed. Some conditions were indeterminate, but not critical. For example, if the annual precipitation was not correct, sublimation and evapotranspiration would have been adjusted so that the model calibrated to measured streamflow. The estimate of the groundwater component of flow was reliant on the accuracy of base flow measurements, which can be difficult to measure in the winter. However, the procedure adopted provides the most reliable method of using site specific data to define surface water and groundwater flow rates on site.</p>	Response satisfactory. Issue addressed.	MEMPR MOE

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55		<p>WCCC provided a spreadsheet entitled, “Copy of Brule WQ Summary_Lorax_Memo.xls”, which was received in January 2006. It contained water analyses for selected locations at the minesite, with some analyses dated December 2005. The 2005 analyses for Sediment Pond 1 were compared to predicted “reasonable worst case” concentrations for Sediment Pond 1 (Table 4.5.8-1), which as “worst case” would reflect total and well as dissolved levels. Some concentrations from 2005 (average and maximum worst case) were already similar to, or exceeded, the predicted worst-case concentrations for the much larger Brule site. These under-predicted parameters included: aluminum, cadmium, chromium, copper, iron, lead, nickel, silver, and zinc. There were no predicted concentrations for current elevated levels of barium (up to 0.58 mg/L), manganese (up to 0.48 mg/L), ammonia (up to 0.33 mg/L), and phosphorus (up to 10.6 mg/L). There were no analyses for mercury, which is also a shortcoming.</p>	<p><i>Response by Alan Martin, Lorax, on behalf of WCCC:</i> The current concentrations in effluents from the small Dillon mine site have been evaluated (Appendices D1.5 and D2.2). As outlined in Appendix D1.5 of the Brule Post-Application Agency Consultation Report, a major point of clarification was that the predicted values reported in the Dillon Effluent Permit were incorrectly reported as “total” levels. These values should in fact have been reported as “dissolved”. Accordingly, comparison of the total levels in MSP discharges to the predicted values is not meaningful.</p> <p>Dissolved metal levels in MSP effluents were underestimated as part of the Dillon predictions for nickel, and to a lesser extent for arsenic and molybdenum. However, these values have been re-visited as part of predictions for Brule, based on a large site-specific data set as well as regional values. Further input from MEMPR into the source term evaluation has also been used to refine predictions. As well, additional parameters have been added to the list of elements modeled (Mn, Ba, F, and Tl). All predictions for on-site water chemistry, including the sediment pond, are for dissolved concentrations.</p>	Response satisfactory. Issue addressed.	MEMPR MOE

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			Given the considerations described above, and the refinements to the source term evaluation, metal leaching for the Brule project has not been underestimated.		
56		<p>5.7 Prediction of Aqueous Concentrations - Loadout</p> <p>Predicted concentrations of the porewater in the coal stockpiles at the loadout are based on water chemistry from the coal washability tests (Table 4.5.4-8). This implicitly assumes (1) the coal is 100% unreactive and (2) the coal will not react during the average two-day residence time on the stockpiles. First, the coal is reactive, has a high Acid Potential (despite statements to the contrary based on faulty iron assumptions), and should be considered net acid generating. Second, while the coal may have an average residence time of two days, it will occasionally be longer. Additionally, trucking time and disturbance will add to the time and exposure of fresh surfaces, and time on the on-site stockpile before shipping will add reaction time. As a result, there could a week or more of reaction products flushed off some of the coal stockpiles at the loadout. In this case, a better estimate would be the concentrations in the washability test (Table 4.5.4-8) plus aqueous concentrations from the coal kinetic tests (Appendices B-3 to B-7). Therefore, the predicted concentrations of Table 4.5.4-8 should be taken as minimum with currently unknown maximum</p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i> It was agreed at the March 20, 2006 Working Group meeting (Appendix E2.5) that evaluation of water quality for the coal stockpile does not need to be considered for the EA because the company has committed to ensure that water can be collected if needed and the loadout will not be constructed for several years. Operational monitoring of coal pile runoff at the Dillon and Brule mines provides an opportunity to evaluate water chemistry, water collection and monitoring requirements for the loadout.</p>	Details at permitting.	MEMPR MOE

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		concentrations for the loadout.			
57		<p>While an argument can still be made about substantial dilution in the Pine River for any stockpile concentrations, in reality toxicity to benthic organisms and any fish eggs takes place at the interface of the groundwater and surface-water systems. Undiluted coal-stockpile seepage, moving as a groundwater plume into the creeks or river, could result in benthic toxicity or habitat impact. For the loadout, there is currently no groundwater information, and two wells in the future will provide little more. Nevertheless, the potential is high for an undiluted groundwater plume extending from the stockpile area to one of the creeks or river. Therefore, modeling of the groundwater system, albeit with assumed data, is needed before EA certification, and this modeling plus a monitoring plan will be needed for permitting.</p>	<p><i>Response by Jaime Cathcart, Knight Piesold, on behalf of WCCC:</i> Refer to response to Issue #7.</p> <p><i>Response by Alan Martin, Lorax, on behalf of WCCC:</i> The potential for effects to aquatic receptors in receiving water courses has been re-evaluated as part of the Brule Post-Application Agency Consultation Report, The scope of the revised impact assessment has been changed to reflect updated source concentrations and input from MOE.</p>	Response satisfactory. Issue addressed.	MOE
58		<p>5.8 ML/ARD Prediction, Prevention and Monitoring Plan</p> <p>Although the ARD potential is described as “limited weak potential” (Section 4.5.5), the previous sections of the Application show at least 18% of samples can be classified as net acid generating, suggesting the potential may not be weak or limited. Section 4.5.5 explains “Good practice will include ensuring that marker horizons, seam cleanings and CCR are deposited so that they are relatively thin layers of pods (no more than a few metres), are encapsulated within calcareous waste rock, and are not at the base of waste rock</p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i></p> <p>It was agreed during the March 10 meeting (refer to Appendix E1.5) that ARD can be managed at the project. The company has provided additional clarification on the management of specific materials (CCR and a 5.3 m PAG interval) (refer to Appendix D1.11). Information was provided at the March 10 and 20 meetings to show that excess buffering capacity in prime waste will address potential for ARD in thin mudstones and coal waste during the natural course of mining (refer to</p>	Response satisfactory. Issue addressed.	MEMPR

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		<p>dumps where these materials might be exposed to fluctuating water tables”. However, Section 4.6.5 only mentions CCR requiring “specific management”. In any case, traffic surfaces have been invoked as retarding and redirecting infiltration, and these can cause “fluctuating water tables”, so an additional condition is that net-acid-generating materials should not be near traffic surfaces laterally or vertically. Furthermore, in addition to markers and CCR, intervals of interburden at least up to 7 m long will be net acid generating and thus all rock from all locations will require an ABA sampling program. Due to the few holes with ABA data and the downplay of ARD potential in the Brule Mine Application, additional information will be needed to fill in the data gaps throughout the Brule and Blind Pits before EA certification and through permitting. This will include estimated percentages and estimated tonnages of all net-acid-generating and net-acid-neutralizing rock/material by year, unit, core interval, and bench height using the block model. More details on layering/blending will also be needed.</p>	<p>Appendices E1.2 and E2.2).</p> <p>Comparison with information from other coal mines both in the Appalachians and other coal mines in the NE and SE coal mining areas of BC shows that the risk of ARD is very low (refer to Appendices E1.2 and E2.2).</p> <p>WCCC: Refer to Appendix D1.13.</p>		
59		<p>Metal leaching of selenium is considered an issue, although concentrations of other elements have been underpredicted or not predicted at all. Predicted selenium concentrations warranted a special section (4.6) on management, which condenses to only the special management of only CCR material in the Northeast Dump, which was also incorrectly concluded for ARD. In any case, closure mitigation also includes the ole story of “the</p>	<p><i>Response by Stephen Day, SRK, on behalf of WCCC:</i></p> <p>The source term water chemistry predictions have been re-evaluated using the methodology agreed at the March 10 and 20 meetings. Revised source terms are provided in Appendix D1.12.</p>	<p>Response satisfactory. Issue addressed.</p>	<p>MEMPR MOE</p>

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		[dump] surface can be re-sloped and capped if necessary to reduce infiltration and selenium loadings". If a metal leaching problem arises, the simple capping of a dump, which may reduce infiltration somewhat, will not resolve the problem. Therefore, mitigation will be collection and treatment.	As indicated above, the risk of ARD is very low for this site. However, it is prudent to consider measures that could be used for mitigation if needed. Capping is logical possibility because it can reduce infiltration and potential contaminant loadings.		
60		For Brule, this is not a major change in the current proposal as the Sediment Ponds and flocculant systems already represent collection and treatment. In this situation, however, the groundwater bypassing the Sediment Ponds could lead to collection and treatment on Blind Creek itself. During low flows, uncontrolled groundwater bypass is already likely around 10% of flow. This percentage is probably higher, because bypass has likely been underestimated with the approach taken to groundwater modelling and by not considering the potential of bypass seepage from the backfilled Brule Pit.	<i>Response by Rod Smith, Water Management Consultants, on behalf of WCCC:</i> Seepage is expected to bypass SP2 collection ditches. Some water originating from Brule Pit backfill will be present in the SP2 collection ditches and is therefore included in the estimate of underseepage from the SP2 collection system. The geometry of the backfill precludes losses similar to those estimated for the SP2 collection system	Response satisfactory. Issue addressed.	MEMPR MOE
61		5.9 Risk Assessment and Management Section 5.1.4 (Effect and Frequency Tables) and Table 5.1.4-2 explain the effect-and-frequency rating system. For example, a frequency/probability of 5 (certain) and an impact/consequence of 1 (insignificant) produce a Low Level of Risk. Surprisingly, Table 5.1.2.1 (Brule Project Major Failure Modes Assessment and Risk Management Based on Information Based on Design as of May 2005) for ML/ARD at the minesite shows this combination is sometimes	<i>WCCC:</i> It is acknowledged that there are some errors in Table 5.1.2.1, and WCCC apologizes for the confusion. However, the error in terms of ML/ARD was to over-estimate the risk. The mistake rates low risk as moderate.	Response satisfactory. Issue addressed.	MEMPR MOE

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		labelled Low and sometimes labelled Moderate. This is confusing.			
62		In any case, the risk of ML/ARD for the minesite is considered Low to Moderate (but should all be Low according to Table 5.1.4-2) and contingency measures do not change any of these rankings. The exception is site-wide metal leaching to aquatic habitat (High risk falling to Low upon a one-value change in frequency/probability after contingencies). Management of CCR material is emphasized, although the Application shows that other materials are also ML/ARD concerns.	<i>Response by Stephen Day, SRK, on behalf of WCCC:</i> WCCC has provided clarification of management of CCR and one other 5 m unit PAG layer (Refer to Appendices D1.11 and D1.14). Materials provided at the March 10 and 20 meetings (Appendices E1.2 and E2.2) show that thin PAG layers will be naturally combined during the course of mining to result in large excess neutralization of ARD. The risk of ARD is low.	Response satisfactory. Issue addressed.	MEMPR
63		The contingency of capping and passive treatment above/at the Sediment Ponds does not change the risk ratings at all. However, the amount of infiltration that caps would have to prevent, and to carry securely to perimeter ditches, is not calculated and may not be possible without HDPE layers across all the dumps. Also, passive treatment, which is not sufficient for most flows at minesites as would be encountered in places at Brule, is based on the statement that all ML/ARD will report to the Sediment Ponds. The water balance shows this is wrong. Uncontrolled seepage bypassing the Ponds is expected and should thus raise the risk to Blind Creek and the environment. As a result, this risk rating of Low after mitigation and contingency for ML/ARD is based on partial information. Therefore, the risk may be greater than estimated in this document.	<i>Response by Stephen Day, SRK, on behalf of WCCC:</i> Clarifications of the water balance and source term predictions have been provided (refer to Appendices E1, E2 and D1.12). The effect of capping will, as noted by the comment, depend on the type of cap used. The effect of uncontrolled seepage bypass has been further assessed for very low flow conditions as requested by MOE. Results are presented in Appendix D2.5.	Response satisfactory. Issue addressed.	MEMPR MOE
64		The risk evaluation for the Loadout did not include	<i>Response by Stephen Day, SRK, on</i>	Response	MEMPR

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		ML/ARD.	<p><i>behalf of WCCC:</i> It was agreed at the March 20, 2006 working group meeting (refer to Appendix E2.5) that evaluation of water quality for the coal stockpile does not need to be considered for the EA because the company has committed to ensure that water can be collected if needed and the loadout will not be constructed for several years.</p> <p>Operational monitoring of coal pile runoff at the Dillon and Brule mines provides an opportunity to evaluate water chemistry, water collection and monitoring requirements for the loadout.</p>	satisfactory. Issue addressed.	MOE