Appendix 11-A

Summary of Consultation Feedback on Surface Water Quality

Table 11-A.1: Summary of Consultation Feedback on Surface Water Quality

Tania		Feedback	Received*:		F II I. O		Dogranda or Astigue Identified
Topic	IG	G	P/S	0	Feedback Source	Consultation Feedback	Response or Actions Identified
Surface Water Quality Sampling Sites		√			Comment received from the B.C. Ministry of Environment (MOE) during the initial Project meeting on May 16, 2012.	The B.C. MOE recommended that an upper site on Alexander Creek should be sampled.	Site A5 in upper Alexander Creek was included in the surface water quality baseline program beginning in 2012.
Surface Water Quality Sampling Frequency		✓			Letter from the B.C. MOE to NWP dated September 30, 2015.	The B.C. MOE agreed that the 2015 mid-term analysis of the surface water quality data from May 2012 to June 2015 demonstrated that the potential temporal and spatial variability of water quality parameters was accounted for in the collection of 53 surveys over the span of 3.5 years in accordance with the Guidelines for Designing and Implementing a Water Quality Monitoring Program in British Columbia and Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators.	The sampling frequency was reduced from monthly to quarterly in 2015 and is ongoing at the time of submission.
Surface Water Quality Reference Sites	✓				Comment received from the Ktunaxa Nation Council (KNC) during the June 6, 2019 Aquatics Working Group Meeting.	Determine and confirm reference sites for the surface water quality sampling, and if needed, add reference sites as part of the sampling program going forward.	Reference sites A5 and G1 were selected based on accessibility and proximity to anticipated effects to surface water environments from other activities in the Aquatic Local Study Area (LSA). An assessment of detailed site LiDAR data confirms that with anticipated surface flow conditions during site development/operations, both locations are suitable reference sites.
							As part of mine permitting process, the positioning of additional sites farther upstream on both Alexander Creek and Grave Creek will also be considered during site development in consultation with regulators and the KNC.
Surface Water Quality Reference Sites	✓				Comment received from the KNC during the June 6, 2019 Aquatics Working Group Meeting.	Provide mapping and relevant information to demonstrate proximity of surface water quality station A5 to the Project and potential areas of impact.	Modelling was used to demonstrate surface water flow at the end of mine life, which in general terms will be from the northern area of the Project to the south. It is not anticipated that surface flow from the Project area will affect or reach A5.
Surface Water Quality Sampling Frequency	√				Comment received from the KNC during the June 6, 2019 Aquatics Working Group Meeting.	Conduct intensive water quality sampling (5 consecutive weeks) during freshet and low-flow in 2020.	The data collected to date include 2 years (2014 and 2015) of high/low-flow data sampling, which provides representative data to characterize how water quality can potentially vary during spring freshet and low-flow summer conditions. Based on the data collected to date, no additional intensive sampling was conducted.
Water Quality Model		✓			Comment received from ENV during the June 29, 2020 Water Quality Working Group Meeting.	Follow up with the groundwater modelling team to reevaluate the potential for lateral flow in the waste rock piles.	The design is intended to operate in an unsaturated state. The potential for lateral flow within the mine rock storage facility will be influenced by variability in construction practice and material deposition. Potential for localized lateral flow exists, but is not expected to occur at the scale of the overall dump. The overall saturated K of the dump is estimated >1x10-4 m/s in the waste rock, which is placed on ground surface. The edges of the dump (at least) are effectively a drain, and any lateral flow from the sides would not be expected to enter the dump; it would flow through the base.

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Water Quality Model		✓		Comment received from ENV during the June 29, 2020 Water Quality Working Group Meeting.	Follow up on the potential to conduct a range sensitivity or uncertainty analysis on the assumed 5% infiltration rate used in the water quality model.	The infiltration through the covered waste rock using reject was assumed at 15% of mean annual total precipitation (MATP at 717 mm) based on experience for similar covers. The closure cover was assigned a net infiltration value of 5% of MATP as its design is expected to reduce further the net infiltration relative to the coal reject. Additional simulations were performed with the 2.5 m thick reject cover (1.5 m of coal reject over a 1 m layer of "breaker reject") and using a surface boundary condition based on climatic data (precipitation and potential evapotranspiration) and with adjustments to emulate the frozen winter conditions with a freshet period. These simulations indicated net infiltration values of about 10% of MATP and runoff values in the range of 1 to 4% of MATP. The closure cover is expected to achieve a better performance in terms of net infiltration, thus the reason for the assumed 5% net infiltration.
Water Quality Model	✓			Comment received from the KNC on July 15, 2020 as a follow-up to the June 29, 2020 Water Quality Working Group Meeting.	The KNC requested a Water Quality Model Report for review to evaluate the underlying structure and assumptions. The Water Quality Model Report should include projections for the Order constituents (i.e., cadmium, nitrate, selenium, and sulphate) and mine-related constituents in the Elk valley (i.e., alkalinity, cobalt, lithium, nickel, uranium, TDS (including major ions)). In addition, the Water Quality Model Report should include scenarios to assess the incremental effects of Crown Mountain consistent with their proposed Cumulative Effects Assessment (i.e., base case, application case, RFD case; all with and without climate change).	All requested information is presented in the Water Quality Prediction Model in Appendix 11-E and discussed in Chapter 11, Sections 11.5 and 11.6.
Water Management Flow Diagrams	✓			Comment received from the KNC on July 15, 2020 as a follow-up to the June 29, 2020 Water Quality Working Group Meeting.	Provide water management flow diagrams for key phases (e.g., construction, Years 1-5, etc) to Working Group.	See Figure 2 (Conceptual Flow Diagram) of the Water Quality Prediction Model (Appendix 11-E). Interim flows are delineated with dashed lines, indicating water supply from the North Pit and Interim Sediment Pond until Year 5, and portions of West Alexander Creek below the Interim Sediment Pond (i.e., noncontact water) flow to Alexander Creek.
Model Conservatism	✓			Comment received from the KNC on July 15, 2020 as a follow-up to the June 29, 2020 Water Quality Working Group Meeting.	Introduction to the water model is promising, however the results of the model appear to be much more optimistic than what we are seeing elsewhere. Is the model adequately precautionary? Absent KNC confidence, the precautionary assessment scenario should likely assume failure of the technology.	 NWP simulated the water quality of the project under a number of scenarios, both optimistic and conservative. Results are provided in the Water Quality Prediction Model (Appendix 11-E) for: Layering approach succeeds, water quality source terms based on 50th percentile values; Layering approach succeeds, water quality source terms based on 95th percentile values; Layering approach Fails, water quality source terms based on 50th percentile values; and Layering approach Fails, water quality source terms based on 95th percentile values. NWP also notes that the success or failure of the layering approach will become evident during the first 5 years of Operations, as will the actual effluent water quality from the waste rock dump and pit

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							walls. During this initial 5 year period, water from the Interim Sediment Pond is recycled back to the process plant, limiting the release of water to Alexander Creek.
							This 5 year period will allow NWP to identify and implement mitigation measures, should it become apparent the water quality predictions were not adequately precautionary
Modelling of West Alexander Creek Impacts	√				Comment received from the KNC on July 15, 2020 as a follow-up to the June 29, 2020 Water Quality Working Group Meeting.	Model appears not to address the majority of impacts in Wes Alexander - which are a major concern based on Westslope Cutthroat Trout, and important downstream areas within the Alexander valley.	As presented in Table 2 (SWWQ Reporting Nodes) of the Water Quality Prediction Model (Appendix 11-E), the water and load balance model reported flow and water quality predictions at 17 nodes all along the Alexander valley and in Grave Creek, Harmer Creek, Elk River, and Lake Koocanusa. Within the water and load balance model, flow and water quality are calculated at every flow node, but are not reported for the sake of brevity.
Modelling of Grave Creek Drainage Impacts	✓				Comment received from the KNC on July 15, 2020 as a follow-up to the June 29, 2020 Water Quality Working Group Meeting.	Impacts on water in the Grave Creek drainage (haul roads, conveyor, bridges, coal load out, etc.) above and below Harmer confluence, are unclear - this area is critically important culturally and already heavily impacted by the Baldy Ridge Extension Project, Line Creek Operations, and other projects.	As shown in Figure 2 (Conceptual Flow Diagram) of the Water Quality Prediction Model Report (Appendix 11-E), the water management plan compartmentalizes the contact water from the Grave Creek drainage as much as possible. Facilities located within the Grave Creek drainage include the rail loadout areas, coal handling process plant site, clean coal transfer area, and the lower haul road. No mine rock storage facilities are located in this drainage. Runoff from these facilities is captured in sediment ponds, where it can be monitored prior to release to Grave Creek.
Hydrogeological Model Influence on Findings	✓				Comment received from the KNC on July 15, 2020 as a follow-up to the June 29, 2020 Water Quality Working Group Meeting.	Would the findings of the hydrogeological model influence or change the water quality model results? Do we expect the end of pipe concentrations to be updated once the hydrogeological model is finalized? This was briefly discussed in the June 2020 meeting and is also a follow up to Waterline's action items from June 6, 2019 where it was discussed that West Alexander was a "loosing creek" and therefore infiltrated water from the rock dump could/would seep into the surficial sediments and be conveyed downgradient past the sediment ponds and / or potential water treatment system.	Results of the hydrogeological modelling will not have a significant effect on end of pipe water quality predictions. There is no plan to update the water quality model. The water quality model conservatively assumed that all catchment yield reports to the surface water monitoring points; any upstream groundwater losses.

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Drainage Patterns	✓				Comment received from the KNC on July 15, 2020 as a follow-up to the June 29, 2020 Water Quality Working Group Meeting.	· ·	Interim Sediment Pond (prior to Year 5) or Main Sediment Pond. These sediment ponds capture all flow in West Alexander Creek upstream of the pond and include all waste rock contributing to the drainage and, as the waste rock dump essentially occupies the
Mine Rock Storage Design and Technical Feasibility	✓				Comment received from the KNC on July 15, 2020 as a follow-up to the June 29, 2020 Water Quality Working Group Meeting.	Given the complex layered construction of the rock dump and the distribution of waste rock and plant reject over time, how will preferential pathways along edge seepage be mitigated to limit untreated water reporting directly to the base of the rock dump? Does the 1-D numerical model accurately represent these expected conditions under the layering system fail scenario? Also, is it technically possible to maintain continuity of the plant reject layers in order to promote reducing conditions and not allow for creation of pathways with no treatment?	NWP recognized that preferential pathways at the edge of waste dumps will report directly to the toe seepage much faster than through the remainder of the dump. A portion of the infiltration into the dump is assumed to report to the waste dump toe through such preferential pathways, and is assumed to take on the water quality of oxidizing waste rock. The amount of water reporting through these sub-oxic pathways is based on the areas of the waste dump perimeters as well as an allowance for 5% of other infiltration amounts. NWP assumes that while best efforts will be made to maintain continuity of plant reject layers, the possibility remains that pathways could form. All modelling assumes the potential for some pathways to form. However, the construction sequencing and multiple layers should minimize the potential for full depth pathways to occur. Instrumentation and monitoring will provide information that allows dump designs and construction techniques to be modified should pathways be identified as a problem prior to the development of negative environmental impacts. Similarly, other efforts to manage and mitigate water from entering the dump can also be adjusted based on monitoring of the suboxic zone behaviors and how that relates to toe of dump water quality. Note that the intent is not treatment, rather the formation of conditions where treatment is not relevant.

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	Feedback	Received*:				
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Contaminants of Concern	✓			Comment received from ECCC on July 14, 2020 as a follow- up to the June 29, 2020 Water Quality Working Group Meeting.	ECCC understands that the Proponent has predicted water quality concentrations for all parameters (i.e., metals, major cations, and major anions) through water quality modelling and that contaminants of concern will be identified in the EIS. ECCC recommends that the Proponent clearly demonstrate in their EIS/Application: 1. How contaminants of concern are identified for the Project; and 2. How these contaminants of concern are released, attenuated, sequestered, or retained within the unsaturated layered waste rock pile and/or released in effluent.	The process for identifying contaminants of concern for the Project is summarized in Section 11.5.4.1.1Error! Reference source not found A discussion on the release, attenuation, or sequestration of contaminants is provided in Chapter 3, Appendix 11-C, 11-D, and 11-E.
Infiltration of the Waste Rock Pile	✓			Comment received from ECCC on July 14, 2020 as a follow- up to the June 29, 2020 Water Quality Working Group Meeting.	The cross-section and overview geometry of the unsaturated layered waste rock pile demonstrate that the unsaturated layered waste rock pile is designed to be a long linear structure with a fairly flat surface. The Proponent also presented an expected infiltration rate of 50% for uncovered waste rock and 15% for waste rock covered by plant rejects. While a long linear structure with a fairly flat surface may minimize oxygen diffusion into the pile, it may create favourable conditions for pooling and infiltration of precipitation and surface run on from adjacent areas. The design of the pile may not be conducive to precipitated water running off the pile minimizing contact with waste rock and coal rejects. ECCC recommends the Proponent clearly demonstrate in their EIS/Application: 1. How much precipitation and run-on will go into the unsaturated layered waste rock pile; 2. How precipitation and run-off are diverted around the unsaturated layered waste rock pile; 3. How precipitation and run-on to the unsaturated layered waste rock pile to maintain unsaturated conditions; 4. Where precipitation entering uncovered waste rock and covered waste rock will go if not infiltrated; 5. The rationale as to why an infiltration rate of 50% for uncovered waste rock is reasonable and realistic; 6. The rationale as to why an infiltration of 15% for waste rock covered with plant rejects is reasonable and realistic; and 7. How pooling of water and erosion of the covering plant rejects layer will be minimized during operations prior to reclamation of the pile surface.	The infiltration through the exposed surface of the waste rock will highly dependent on the surface condition; traffic surfaces will have a lower infiltration compared to areas where end-dumping is on-going. Additionally, the infiltration is also expected to vary spatially due to variable properties of the waste rock, thus very difficult to measure and model. The assumed net infiltration values of 25 and 50% of mean annual total precipitation (MATP of 717 mm) for exposed waste rock are based on literature and observations and would be expected to represent the conditions at the site. Runoff was considered negligible on uncovered waste rock and the losses would be attributed to evaporation/sublimation and wind transport. The infiltration through the covered waste rock was assumed at 15% (MATP) based on experience for similar covers, while being somewhat conservative with the assumed value. The 2.5 m thick cover configuration consists of 1.5 m of coal reject placed over a 1 m layer of "breaker reject". Additional simulations were performed with a surface boundary condition based on climatic data (precipitation and potential evapotranspiration) and with adjustments to emulate the frozen winter conditions with a freshet period. These simulations indicated net infiltration values of about 10% of MATP and runoff values in the range of 1 to 4% of MATP. These results show that the assumed 15% net infiltration is adequate for the purpose of the water balance. The waste rock piles should be configured to a final landform that will prevent ponding on the surface and erosion on the side-slopes.

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Tonic	Feedback Received*	: Feedback Source	Consultation Feedback	Response or Actions Identified
Topic	IG G P/S	O	Consultation reeuback	Response of Actions Identified
Flow Paths, Seepage, and Travel Time		Comment received from ECCC on July 14, 2020 as a follow-up to the June 29, 2020 Water Quality Working Group Meeting.	It is not clear how water that infiltrates the saturated layered waste rock pile will flow through the pile, or how this is accounted for in the water balance and water quality models. In the presentation materials, the Proponent stated the "remainder of infiltration into the waste rock will be lagged and attenuated before it reports to the toe as seepage" and that the "velocity [is] based on unsaturated flow equations, using calculated average moisture content in the waste rock profile" and that the "travel time [is] based on average velocity and waste rock thickness." Within the unsaturated layered waste rock pile design, infiltrated water will likely move horizontally along contact surfaces between saturated plant rejects and unsaturated waste rock, rather than vertically through the pile, due to differing hydraulic conductivities between the plant rejects and the waste rock. Therefore, the flow is likely to move vertically through a reduced thickness (i.e., only a single waste rock layer) and move horizontally through the waste rock at the contact with the coal rejects. It is not clear if and how this was considered in the water balance and chemical load calculations. ECCC recommends the Proponent, in their EIS/Application, clearly demonstrate: 1. What the flow path through the unsaturated layered waste rock pile is and how the average velocity, attenuation, and lag time of infiltration through the pile is calculated/determined (e.g., whether it is treated as a large homogenous system or layered with different parameters for different layered units); and 2. How the following components were considered in the water balance model: a. Flow through (ie. hydraulic conductivity) the plant rejects and waste rock, b. Average velocity (average velocity for the entire pile or separate velocities for waste rock versus plant reject layers), c. Thickness of the waste rock, and d. Thickness of the plant rejects.	The waste rock piles will be unsaturated and are not expected to reach saturation with the exception of small discrete zones that may temporally approach saturation for short durations. The base of the waste rock piles may however reach saturation depending on the local drainage conditions. Lateral seepage will likely be present in the covered and uncovered waste rock piles but was not modelled. The presence of the internal finer coal reject layers will promote such lateral flow but is expected to occur at a localized scale and not to the overall scale of the waste rock piles. The occurrence of lateral seepage will likely be random given the variable properties of the waste rock. The travel time was estimated from the response of the bottom boundary to a change in the seepage rate after the top boundary was applied the infiltration. Two initial water content conditions were used to reflect the condition of the waste rock material. Travel times were based on thickness of the layers and estimated downwards velocity through the profile.
Contaminant Loadings	✓	Comment received from ECCC on July 14, 2020 as a follow- up to the June 29, 2020 Water Quality Working Group Meeting.	in the effluent from the sediment pond. This spike in	Spikes in selenium concentrations during the first 5 years are due to two parts. First, the process plant is consuming as much contact water as possible before using any fresh source so the pond is constantly being drained dry. The very small amounts of water remaining in the pool become very sensitive the addition of any mass into the pond. Secondly, as also seen in the modelling of the Main Sediment Pond, every year during the winter pond capacity is lost to ice formation. When ice forms, it rejects most of the

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			ECCC recommends that the Proponent, in their EIS/Application, present potential options to minimize contaminant loadings in the effluent of the unsaturated layered waste rock pile, and ultimately the sediment pond.	impurities in the water to the unfrozen water below the icepack causing an effect, known as cryoconcentration. This effect is conservatively simulated in the water balance model through temporary removal of the icepack from consideration in the water quality calculations.
				During the model simulations, when the spikes are seen in selenium concentration, there is generally very little to no water flow.
				NWP notes that since the plant is consuming essentially all of the contact water, high selenium concentrations in the in the interim settling pond does not mean discharge of high concentration water.
				NWP is committed to a 'defense-in-depth' strategy for selenium management. Instrumentation and monitoring of suboxic zone behaviour and toe water quality will guide adaptive management and adjustment of designs and operation prior to development of negative environmental impacts.
			The Proponent proposes to utilize source control for selenium, nitrate and other constituents through the construction of an unsaturated layered waste rock pile. ECCC is of the view that source control is an appropriate first line of protection in mitigating potential environmental effects. In addition to source control, it would be appropriate to also consider mitigation measures that can be	NWP is committed to a 'defense-in-depth' strategy for selenium management. Instrumentation and monitoring of suboxic zone behavior and toe water quality will guide adaptive management and adjustment of designs and operation prior to development of negative environmental impacts. Many steps can be taken prior to having to implementation of a proven technology such as an active water treatment facility.
Contingency Measures	✓	Comment received from ECCC on July 14, 2020 as a follow- up to the June 29, 2020 Water Quality Working Group Meeting.	implemented as a contingency plan, should the unsaturated layered waste rock pile not perform as expected. For the EIS, ECCC recommends that the Proponent consider the following in their project design: 1. Utilizing a proven treatment technology as a "back-up"	Very early on in the Project, NWP will have data on suboxic zone development and behavior based on the Test Dump constructed during site development. During early operations water will be recycled into the plant so that, even if water quality is not as predicted, it is not released to the environment.
			mitigation measure in case the (unproven) unsaturated layered approach is not able to achieve water quality that will not lead to effects in the receiving environment; and 2. How quickly a back-up operation can be designed, constructed, and commissioned.	This period of time will allow NWP to adjust the dump design and operation to determine if the goals can be met without implementing a back-up proven treatment technology. If adjustments are not successful, NWP would design, permit, construct, and commission a proven treatment technology as back-up prior to effects in the receiving environment.
Prediction Node Locations	✓	Comment received from ECCC on July 14, 2020 as a follow- up to the June 29, 2020 Water Quality Working Group Meeting.	For the EIS, ECCC recommends that the Proponent utilize a prediction node within West Alexander Creek, downstream of the final discharge point from the sediment pond and upstream of the confluence with Upper Alexander Creek, in order to demonstrate water quality in the receiving environment prior to dilution from non-mine impacted waters from Upper Alexander Creek.	A prediction node in West Alexander Creek downstream of the sediment pond and upstream of the confluence with Upper Alexander Creek was included (see Table 11.5-4).

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Water Source Terms		✓			Comment received from ECCC on July 14, 2020 as a follow-up to the June 29, 2020 Water Quality Working Group Meeting.	ECCC recommends that the Proponent clarify in the EIS submission how the source terms used in the water quality model for the unsaturated layered waste rock pile effluent is reduced significantly prior to release from the sediment pond.	 Within the water and load balance, flow contributions to the sediment pond can include: Direct precipitation on the pond; Runoff from undisturbed natural ground in West Alexander Creek; Runoff from uncovered waste rock; Runoff from waste rock covered with plant rejects; Runoff from reclaimed waste rock; Seepage from oxidized waste rock; Seepage from unoxidized waste rock; Seepage from unoxidized waste rock; and Groundwater contributions. These sources of water are of varied quality from essentially pure water to that of oxidized waste rock seepage. The blending of these different water sources in the Sediment Pond is simulated under an extremely dynamic system, where relative contributions of each water source varies on a daily basis depending on waste dump configuration, precipitation and snowmelt amounts, and volume of water in the Sediment Pond. The blending of these various water sources produces water qualities significantly lower than that of the waste rock seepage water quality predictions.
Comparison to Future Baseline Water Quality		✓			Comment received from ECCC on July 14, 2020 as a follow- up to the June 29, 2020 Water Quality Working Group Meeting.	It is unclear to ECCC how the predicted water quality for the project compares to the existing and predicted future baseline water quality. For the EIS submission, ECCC recommends that the Proponent clearly demonstrate what the predicted baseline water quality conditions are over the life of mine and compare these conditions to how project effluent changes the water quality in the receiving environment over time.	Predicted concentrations of contaminants of concern are compared to background water quality in the residual effects assessment (Section 11.5.4.2).

Note:

^{*} IG = Indigenous Group (group specified in feedback source); G = Government (provincial or federal agencies); P/S = Public/Stakeholder (Interest group, local government, tenure and license holders, members of the public); O = Other