Appendix B

PERFORMANCE SPECIFICATIONS

1.0 Project Objectives

The Province's expectations from the Contract are summarized below. These expectations are provided to the Proponents as general guidance. There is no order of preference in the listing.

1. Buildings and landscaping are to provide an aesthetically pleasing site. The buildings should be designed and constructed to retain their appearance under local climatic conditions for 20 years minimum, including exposure to sea air.
2. Recognizing the proximity of the community of Britannia Beach, the likely expansion of residential areas on private land, and the proximity of the BC Mining Museum, all facilities are to be designed to mitigate visual and noise impacts.
3. Safety during construction and operation are important to both the Proponent and the Province. There is a preference for safety to be designed in to the facilities by such means as wide roadways, ease of access to process equipment, and "inherently safe" features. Potentially unsafe situations are to be mitigated during design. The Province intends to conduct a full safety review of the designs, and expects to be invited to participate in the "HAZOP" reviews conducted by the Proponent.
4. The treatment technology and Project design have the flexibility to efficiently treat a wide range of mine water, including water with lower metal concentrations than the projected "average" chemistry, as the metal concentrations are expected to decrease with time.
5. All facilities are expected to be in use after the term of the contract. Quality is to be designed into the facilities so that at the end of the Term, the facilities are fully operable, excluding deterioration due to normal wear and tear. Only new equipment and materials will be allowed in the construction of any facility, without the prior consent of the Province.
6. The facilities are to be designed, constructed and operated in a manner that is protective of the environment, and in accordance with all current environmental regulations and standards.
7. Protection of the environment is also achieved by a WTP that operates consistently, efficiently and reliably. Ease of operation of the process, and the provision of installed spares for critical process equipment, are considered to be desirable features. Consistent with the philosophy of protecting the environment, the Province wishes to incorporate features that will minimize the frequency of "By-pass Events".
8. Ease of monitoring and controlling the operations of the plant.
9. Efficient use of human and other resources through remote monitoring of the operation of the plant, ease of maintenance, and efficient use of chemicals and power.
10. Continuing improvement in performance during the operating phase.

2.0 Specific Planning Requirements

2.1 Sustainability and Life Cycle Issues

The Proponent will be required to develop the Project consistent with the concept of responsible and sustainable development. This includes improving the facility's economic performance both in life cycle and capital cost terms. It also means the facility will be more resource efficient particularly with respect to the use of labour, energy, reagents and materials used in its construction and operation. General considerations will include:

- The design shall attempt to facilitate the most efficient use of materials and the minimization of waste, e.g. standardized dimensioning;
- The design shall maximize the use of environmentally responsible production processes;
- The design shall increase the lifespan of the building by the use of durable materials;

The Project, including the mine water conveyance system to the plant and the outfall, should be designed and constructed on an energy efficient, low maintenance basis with a minimum life for:

- Structural elements of at least 50 years.
- Underground utilities – 50 years.
- Roofing – 25 years.
- Mechanical components of - 20 years.
- Electrical items of at least - 20 years.
- Instrumentation of at least - 10 years.

with no major overhauls or replacement anticipated during the first 75,000 hours of operation.

Should major maintenance be required during the Term, it will be the responsibility of the Proponent. Items that have a design life cycle of less than 20 years must be clearly identified by the Proponent.

2.2 Integrated Design Management Program and Partnering

The Proponent will be required to utilize an integrated design management program with respect to the design development of the Project. An integrated team approach to design recognizes that crucial decisions made at the start of the design have substantial impacts in the final construction and operation of a facility. It is therefore required that all the design trades (e.g. mechanical, electrical, etc.) work in conjunction with each other from the start, rather than being brought in sequentially on the Project to design their respective systems in isolation.

2.3 Scope of Design and Construction Work

2.3.1 Water Management and Treatment

- Provide paved access roads within the Site. This includes any new access roads required for access to the WTP for supply of chemicals and removal of Sludge. A permanent means of access for construction traffic is required through/around the Project for access to the area behind the mill (concentrator) building. The road from the Project to the BC Hydro substation does not need to be paved.
- Provide a paved parking area of sufficient size to permit parking of two tour buses as well as visitors and the Proponent's personnel.
- Provide site grading and drainage to effectively manage uncontaminated runoff from upstream of the plant site and from the plant site itself. This includes the flows in seasonal creeks in the plant site area. The installed drainage system must be independent of the drainage systems through the property of the BC Mining Museum, and not add to the surface water runoff or groundwater flux through the Fan Area. Uncontaminated runoff is to be discharged through the outfall system
- Provide security systems to minimize the potential for the public to access the Facility area, including the 4100 Level adit and the Province's property behind the BC Mining Museum, and to minimize the potential for injury to the public.
- Provide utility connections from the BC Hydro sub-station to the WTP, the groundwater and storm water pumping systems and other installations requiring electric power supply.
- Provide site power distribution as required for the operation of the Facility.
- Provide telephone, fax and hi-speed internet communication capabilities.
- Provide process water and potable water supply.
- Provide sanitary sewage disposal.
- Provide a fire alarm system to meet the guidelines in Appendix B, Section 3.11.
- Provide a site communications system to meet the guidelines in Appendix B, section 3.11.
- Provide for pumping of groundwater from the groundwater pumps on the Fan Area to the WTP, together with intermediate surge tanks, electrical and instrumentation connections, as required. The pumping system is to be capable of handling a range of 25 m3/hour to 150 m3/hour. The Proponent will be compensated for this work through a Cash Allowance. Impoundment of groundwater behind the 4100 Level Plug will not be allowed.
- Provide for pumping storm water from the existing storm sewer line that collects storm water from the Museum property to the outfall system. The flow of storm water being pumped to the outfall is to be measured and recorded on a continuous basis. The design requirements are still in development. The Proponent will be compensated for this work through a Cash Allowance.
- Design and construct a WTP with a Design Capacity of 1,050 m^3/hour. The hydraulic capacity of the WTP, which is the flow rate that can be handled without spillage is to be 1,400 m^3/hour. The Proponent should consult the mine reservoir

model prepared by SRK Consultants Ltd. to develop a design basis for the minimum flow rates of mine water. The WTP must be capable of treating groundwater on a continuous basis. The groundwater is to be assumed to be saline, and the volume may range from 25 m^3/hour to 150 m3/hour. . A separate treatment circuit for groundwater is acceptable. The WTP must be capable of treating a range of water qualities as specified in this RFP and RFP Documents, and be capable of meeting the Discharge Permit Criteria.

- **NOTE RE GROUNDWATER TREATMENT: The Province recognizes that treatment of saline groundwater to meet the water quality criteria in the discharge permit may not be possible due to the higher solubility of metal chlorides. A program is underway in June 2004 to address this issue. In the event that the test program demonstrates that the discharge permit criteria cannot be met due to the presence of chlorides, the Province may remove groundwater treatment from the RFP. In this case, the Province will work with the Selected Proponent after award of the contract to mutually determine the best method of handling groundwater.**
- Provide a new valve and pipe installation at the 4100 Level plug. In the event that the Proponent accepts the existing temporary installation, the Proponent will be responsible for all future modifications to this installation.
- Provide a Contaminated Water conveyance system from the 4100 Level plug to the WTP. The Proponent may elect to accept the existing temporary installation within the 4100 Level Adit as either as temporary or permanent facility, but in doing so, must accept all onward risks and costs associated with this installation. The Proponent will be responsible for all future modifications to this installation.
- Provide a system for the monitoring of water levels in the mine workings and for remote control of the flow rates. The Proponent may elect to accept the existing installation as either a temporary or permanent facility.
- Provide a system for the introduction of groundwater into the WTP.
- Provide a system for the automatic and continuous recording of the flow in m^3/hour, and the parameters specified in Appendix B-2. The flow rates of mine water and groundwater are to be measured and recorded separately.
- Provide process control instruments to continuously measure and record the volume (in m^3/hour), and pH, of untreated water that is by-passing the Project and being fed into the outfall system.
- Provide reagent storage systems with the capability to store sufficient reagents and chemicals to meet the projected usage if the Project was to operate continuously at the Design Capacity.
- Provide a centralized, air-conditioned control room, housing process automation, control and data recording equipment, to which all process control signals are fed, including those from the control systems in the 4100 Level adit, and both the flow measurement from the groundwater pumping system and the storm water pumping system.
- Provide a building to house: (a) the process equipment that by its nature or function must be protected from the weather, (b) the control room, and (c) storage areas for repair supplies and bagged chemicals or reagents.

- Provide a system to enable excess water volumes to by-pass the WTP when the volume of water entering the mine workings exceeds both the capacity of the plant and the available storage capacity of the mine. Provide a means for neutralization of this water so that the combined flow of treated and "by-pass" water is within the pH range specified in the discharge permit. The by-pass water must be combined with the treated effluent before it enters Howe Sound

2.3.2 Outfall System

- Provide a piping system capable of conveying a combined flow of 3,600 m^3/hour of treated water, and water that has by-passed the WTP to a marine outfall system in Howe Sound, which will discharge the effluent through a diffuser at a depth of 50 meters below sea level.
- Provide for the addition of treated groundwater into the outfall system.
- Provide for storm water that is collected from the existing storm sewer line that discharges into the existing outfall at Britannia Creek to be piped into the outfall system.
- Provide sampling points to allow water samples to be obtained after the groundwater and surface water has entered the outfall. As a minimum a sampling point is to be provided where the outfall pipe enters Howe Sound.
- Provide all chambers to have locked, removable covers.

The following are provisional scope items that will be discussed with the Preferred Proponent. The off-shore components of the outfall are not to be included in the cost estimate, and will be addressed through a Cash Allowance. They are provided here for reference and to ensure that the onshore component is compatible.

- Locate the first port of the diffuser within one metre of 53.2 m below MSL (50.0 m below LLW).
- Conduct a survey of bottom current velocities along the marine section of the outfall, and incorporate this information into the design of the marine section of the outfall
- Design of the diffuser to minimize the dynamic loading on the seabed floor.
- Design the outfall with three diffuser ports. Although modelling has shown that a one-port diffuser is capable of meeting the dilution requirements for treated water, the 3-port diffuser is a requirement to provide a margin of safety when other water sources, such as by-pass event and/or storm water are being discharged.
- Design the marine section of the outfall in a manner that a slope failure will not cause a failure of the entire submerged pipe.
- Design the marine section of the outfall so that a failed section of the outfall pipe can be replaced in an expedient manner to minimize environmental effects of the pipe failure. Since the delivery of pipe is anticipated to be the constraining factor on rapid replacement of the line, the Proponent's are requested to include the cost of a section of spare pipe (as a separate line item cost) in their Price Proposal.

2.4 Scope of Services during Operations

The Proponent will be responsible for the overall operation, repair and maintenance of the Project constructed in a manner that is in compliance with the requirements this RFP and RFP Documents, and that maintains the utility of the assets over the Term. The services during the operating phase are described in Appendix B2 along with monitoring requirements for such services. The Proponent shall generally provide any services reasonably required, but not listed, to operate, repair and maintain the Project and sustain a fully functioning facility.

The Proponent is not responsible for the repair and maintenance of other facilities such as the mine water diversions and the Workings.

2.5 Design Requirements

2.5.1 General Requirements

Proposals should demonstrate the Proponent's clear and coherent understanding of the challenges to be faced in implementing the Project. Topics that Proponents may wish to address in the Proposal may include, but are not to be limited to:

- achieving highest and best use of the opportunity;
- allocating risk in an appropriate manner;
- partnering with other Proponent members to ensure the Project is delivered as planned;
- ensuring a well designed and cost effective Project Plant that meets the Province's functional requirements;
- ease of modification of the plant to incorporate future technological advances in control technology, .
- dealing with public concerns in an appropriate manner; and
- quality of asset created for the Province.

2.5.2 Code Requirements

All aspects of the design are to be certified by a Professional Engineer registered to practice in the Province of British Columbia experienced in the design of process facilities of comparable complexity, size and function.

The Project design is to be prepared in accordance with the current edition of the BC Building Code, the National Building Code, and any other applicable Regulations, Ministry of Water, Land and Air Protection approvals and other authorities having jurisdiction. The Plant will be of a standard that meets those for equivalent facilities in North America.

The Proponent shall include submission, approval and payment for all necessary permits, fees and licenses from authorities having jurisdiction. The Project will not be exempt from the normal requirements related to permits and building inspections.

The facility life span is expected to be fifty (50) years without major structural repairs (excluding wear surfaces) and planned accommodation of settlements.

2.5.3 Design Review Requirements and Documentation

All drawings and calculations shall be in Metric (S.I.) Units.

The Province will carry out compliance reviews during the Project design development. These reviews will include all design disciplines and will confirm the Proponent's design complies with the standards, specifications and criteria comprising schedules to the Project Agreement. The Proponent may request a review of the civil, structural and architectural design separately from the review of the mechanical and electrical designs to facilitate the construction schedule. The Proponent will present drawings at the 50% and again when the design is 90% complete. The design development will be based on the design review and consultation process. Each submission will include five paper copies and one electronic copy (AutoCAD 2000 or later) of the design drawings and specifications.

Before proceeding with the final design, the Proponent will present 50% complete design drawings to the Province for review. The Proponent will provide a detailed architectural design report in full compliance with this RFP and RFP Documents.

The Project design report will provide the following information:

The following drawings are required:

- key plan;
- plans of all aspects of the facility;
- process and instrumentation drawings;
- process mechanical drawings and equipment lists;
- structural drawings;
- process design criteria;
- process flow diagram and mass balances;
- control panel layouts and I/O listing;
- typical sections;
- electrical single line diagram;
- technical data sheets for major equipment;
- hydraulic profiles for the influent and effluent piping systems; and
- plan and cross-section drawings of piping installations.

The drawings will clearly show and describe the materials to be used and the equipment details. The Province will be allowed ten (10) business days to review these plans before the Proponent may proceed with the final design. The Proponent will be required to meet with representatives of the Province, and fully discuss the basis for the design. The Proponent will be responsible for obtaining all approvals from utilities and other government agencies, other than those identified as the responsibility of the Province in Appendix H.

The next review by the Province will be at the 90% design stage. The Province will review the completed drawings before the Proponent proceeds with construction. This review will assure that the design drawings have been completed in accordance with the approved preliminary design and scope of works. The Province will review these plans

within ten (10) business days and obtain sign off before the Proponent may finalize the design and proceed to construction.

2.5.4 Design Folders

Design folders will be prepared for the 90% design submission and will have indexes and sectional dividers. They will contain pertinent correspondence and will be arranged in chronological order by subject matter. The folders will include design calculations, material specifications, and should reference and confirm any pre-design study information utilizing the construction design for the work. The Project record submission identified in 2.6 will also contain these folders.

2.5.5 Design Modification

In the event that the Proponent wishes to modify the Project drawings during construction, it will prepare and submit revised drawings to the Province for review according to the above procedure for compliance review.

2.6 Project Record Submission

The following records will be supplied by the Proponent and the Province may inspect these upon providing reasonable notice:

- as constructed plans, survey plans and cross section plans;
- design folders;
- WCB notice of project;
- minutes of all meetings, including pre-construction;
- construction inspectors daily reports;
- surveys during construction;
- settlement surveys;
- supplemental drawings;
- underground utility plans;
- road and pavement structure design;
- landscape plans;
- copies of all approvals and permits required for the completion of the Project;
- all ancillary works including but not limited to storm drainage, sanitary sewer, lighting, parking areas and road works;
- quality control test data and all inspection reports; and
- signed quality control reports from engineer.

2.7 COMMISSIONING, START-UP AND TESTING REQUIREMENTS

The Proponent will be required to demonstrate full compliance with the performance specifications through a thorough commissioning and start-up process.

2.7.1 Commissioning

The Proponent shall conduct a thorough shakedown and commissioning of the facilities to ensure that all mechanical and electrical/instrumentation systems are capable of functioning as designed. The commissioning period is the Proponent's opportunity to test the various systems and correct any deficiencies found, prior to the commencement of start-up of the facilities. The Proponent may use Contaminated Water during the commissioning period, and will be paid for water treatment, provided the discharged effluent meets the Discharge Permit Criteria.

2.7.2 Performance of the Acceptance Testing

The Proponent shall be responsible for operation of the facility during this period. The Proponent shall permit monitoring of its efforts during this period by the Province in order to gain a greater working knowledge of the systems.

The Proponent shall pay for any extraordinary costs incurred due to shakedown, including, but not limited to, equipment or facility damage. The Proponent shall be responsible for all maintenance and repairs of the upgrades to the facility during this period, including spill cleanups.

2.7.3 Start-up Testing

Proponent shall indicate in writing to the Province that the shakedown and commissioning is complete and that the facility is ready for start-up and treatment of Contaminated Water. All permanent system components must be in place before requesting the start-up testing.

The objective of the start-up testing program is to demonstrate:

i. that the process technology is capable of meeting the operating guidelines for the treatment of Contaminated Water, and generation of Sludge in accordance with the specifications of the RFP and RFP Documents.

ii. That all system components, including the mine water level control and the outfall, are operable.

iii. That the process control systems are capable of controlling the water treatment process.

iv. That the usage of chemicals is generally in accordance with the usage stated in the Proponent's proposal

The Province, or its representatives, will be allowed to witness all or part of the start-up testing program.

The Proponent will be paid for the water treated to the standards in the Performance Requirements during the start-up period in accordance with the Project Agreement, as if the provision of the service had started, for the purposes of payment.

2.8 Operational Acceptance Testing

Upon the satisfactory completion of the start-up testing, the Project will be considered to be in commercial operation, subject to satisfactory confirmation that the Project is capable of treating a minimum of 1,050 m^3/hour of Contaminated Water for a consecutive thirty (30) day period, while meeting the Discharge Permit Criteria. The operational acceptance testing may be deferred to the spring freshet period of the year

following commissioning, but, in any event, must be completed within 12 months of the completion of commissioning. Payments will be made to the Proponent during operational acceptance testing in accordance with the Project Agreement.

The Proponent shall assemble its commissioning team and shall conduct the acceptance testing of the facility, which the Province shall witness, to determine whether it meets the specifications contained herein. The Province reserves the right to determine the specific dates and time of the test in order to ensure sufficient Contaminated Water, equipment and personnel are available. If such a determination results in a delay of the acceptance test, an extension of the time limits included under the payment section of the Project Agreement shall be granted, provided that the Proponent gave adequate notice of at least 10 days.

Generally, the test parameters for acceptance are compliance with the technical specifications.

The Province shall conduct a visual inspection of the various systems prior to, and at the conclusion of the testing with the Proponent, noting any obvious leaks and other indications of poor workmanship, equipment failures/damage or abnormal wear and tear, as determined at the sole and absolute discretion of the Province. The Proponent shall repair such leaks, damage or wear. If the Province concludes that such leaks, equipment failure/damage or wear are of a reoccurring nature, the Province, in its sole and absolute discretion, may declare that the Project has failed the acceptance test.

If, in the Province's sole opinion and absolute discretion, the Proponent does not pass the operational acceptance testing, the Province reserves the right to allow the Proponent to undertake remedies as agreed with the Province and to retake the acceptance testing at a later date, or to waive any minor irregularity that occurs during the testing. The Province will not unreasonably deny the Proponent's request for a second acceptance test.

In addition to the specific actions contained above, the Province may require the Proponent to demonstrate the facility's ability to comply with any of the parameters contained in this RFP and RFP Documents.

3.0 Design Criteria and Performance Specifications

3.1 Quality Management

The Proponent will submit a detailed Quality Control Plan to the Province Contact Person within thirty (30) calendar days of receipt of the Notice of Award. The quality management manual will be developed from the Quality Management Plan submitted after the Proponent had been notified it was the Preferred Proponent.

No Work will be done on Site until the Quality Control Plan has been submitted and reviewed by the Province as complying with the Project Agreement requirements as laid out in this RFP and RFP Documents, or as subsequently may be negotiated.

3.2 Geotechnical Design Criteria

3.2.1 Geotechnical Assessment

Soil Investigation Reports pertaining to the plant site area at the 4100/4150 Level benches have been prepared by Golder Associates, AMEC (geotechnical) and URS (environmental). These reports are available in the RFP Data Room. The Proponent

may undertake additional site investigations as may be deemed necessary by the Proponent, at no cost to the Province, to undertake adequate foundation design.

The Proponent shall demonstrate that the estimated total and long-term differential settlement will not affect the structural integrity, functionality, and operation and maintenance of the facility.

The maximum permissible total and differential settlements for the various structures are to be specified by the structural engineer responsible for the design of the structures. The Proponent will install settlement markers and monitor at 2 month intervals throughout the construction and the Warranty Period specified in the Project Agreement, to confirm the maximum permitted settlement is not exceeded.

The Proponent is solely responsible for adequately designing the foundation system and for the adequate performance of the foundations in accordance with the Project Agreement.

3.2.2 Seismic Design

Seismic Zoning for the Project area will be as defined in the National Building Code of Canada (NBCC) and British Columbia Building Code (BCBC).

Liquefaction potential of the subsurface soils shall be evaluated by a geotechnical engineer retained by the Proponent. The design shall incorporate ground improvements and other methods of addressing potential liquefaction to meet the NBCC and BCBC.

3.2.3 Foundation Design/Retaining Wall Design Criteria

The Design Engineer will specify:

- The minimum factor of safety against bearing capacity failure under static conditions ;
- The minimum factor of safety against sliding under static loading; and
- The minimum factor of safety against overturning under static loading.

3.2.4 Settlement Analysis

Settlement analysis of structures will be performed. Foundations will be designed such that differential settlement between adjacent footings is limited to the amount tolerable as specified by the structural engineer and as specified by the appropriate codes.

The Proponent shall demonstrate that the estimated total and long-term differential settlement will not affect the structural integrity, functionality, and operation and maintenance of the facility.

3.3 Site Controls

- Horizontal Control is based on the UTM ground coordinate system as shown by the drawings
- Vertical Control is based on the elevations in metres referenced to the ground UTM grid
- Mean sea level as the 0 m datum.

- Topographical data for the Plant site area (4100/4150 Level benches and access road) will be provided by the Province in electronic format (AutoCAD 2000 or later).

3.4 Design and Construction Parameters

3.4.1 Project Flows of Contaminated Water from the Reservoir

The projections of flows of Contaminated Water from the mine reservoir (discharging via the 4100 Level Plug) have been based upon a compilation of historic flow records (adjusted to incorporate the recorded or estimated flow of water historically discharging via the 2200 Level adit which was closed in 2001 by installation of a concrete plug), computer modeling, and incorporation of data generated during a "Plug Test" (mine filling test) in 2002. This information is the best information available, but is inherently uncertain due to the database used in the modeling and the limited time record of 24 years (1977 to 2001).

As a result of this modeling, and the discharge permit application to MWLAP, the Project is to be designed for a Design Capacity of 1,050 m^3/hour. The Project must be able to meet the requirements of the discharge permit for dissolved metals, pH, total suspended solids (TSS), and acute toxicity, on a sustained basis when operating at the Design Capacity.

Providing that the Project is operating at the Design Capacity, and the reservoir is full to the maximum operating level [approximately 240 metre level above the plug], any excess water will be permitted to by-pass the WTP, providing that this water is mixed with the treated effluent prior to discharge to the marine environment, and that the pH of the discharge, before the addition of any storm water, meets the pH criteria of the Discharge Permit. The maximum projected flow rate from the mine is 3,600 m^3/hour is based upon a 50-year return period event. The total water management system, including conveyance system from the 4100 Level Plug to the WTP, the WTP by-pass system and outfall system must be capable of handling 3,600 m^3/hour. The Province accepts the risk that the flow rate may exceed this figure on rare occasions, and that this could result in the reservoir overflowing through the 3250 Level adit. The Province will construct a means for handling such an extraordinary overflow event, and will not hold the Proponent responsible for any environmental consequences of this overflow, providing that the Proponent has met his other obligations with respect to the operation of the Project.

The hydrological model of the mine reservoir, as developed by SRK Consultants, is available in the password-protected section of the RFP electronic data room.

3.4.2 Flow of Groundwater

The groundwater in the Fan Area is contaminated due to the flux of water through the Museum area, and the former concentrate storage area, both of which are underlain by soils containing mine tailings and waste rock. Drilling investigations and computer modeling have provided a basis for the assessment of the means of mitigating the flux of groundwater from entering the environment at the foreshore. The Province has committed to the mitigation of this source of contamination by installing a groundwater collection system. [This collection system will be installed by others prior to the commencement of operation of the treatment plant] Prior to the startup of the Project, the collected water will be discharged through the existing outfall pipe at Britannia Creek.

The Province expects that it will be required to treat this water in the Project, and therefore, wishes to incorporate a provision for treatment into the scope of work. The projected flows under various conditions may range from 25 to 150 m^3/hour.

The groundwater to be collected is expected to be a mixture of contaminated fresh (non-saline) and saline water. The salinity of the groundwater is unknown, is subject to seasonal variations, and may only be estimated from available analytical data. The chemical characterization data for the groundwater sampled during 2003 and early 2004 have been used to develop a design basis which is presented in Appendix D, Section 2 – Groundwater Chemistry.

Testing is in progress in early June, 2004 to determine if the salinity of the groundwater is likely to influence the concentrations of dissolved metals in the treated effluent. A decision will be made regarding the requirements to treat groundwater once this information is available to the Province.

3.4.3 Flows of Storm Water

Storm water from runoff on the Museum site is currently collected and directed through a storm sewer to the existing outfall at Britannia Creek. This facility, which was installed in 2003, consists of a series of collection drains and a gravity main connecting to the existing outfall. As-built drawings of the installation are available in the electronic data room.

The Proponent is required to design, install and operate a storm water pumping system with the capability to pump 50 m^3/hour of storm water from the existing storm sewer to the new outfall system once it is in operation. Since the design basis has not been established, the Proponent is not required to address the design and construction of the storm water pumping system in the Proposal. The Proponent will be compensated through a Cash Allowance.

3.4.4 Contaminated Water Characteristics

The Contaminated Water from the mine reservoir is acidic and contains varying concentrations of dissolved metals, including copper, zinc, cadmium, iron, manganese, and aluminium. Various geochemical models and the Plug Test have been used to develop a projected range of concentrations of the contaminants of concern. It is to be noted that the concentrations are not independent variables, but depend upon complex geochemical interactions. The projected “average” concentrations used in the feasibility study are not to be interpreted as being indicative of average long-term conditions. Proponents are encouraged to independently review all the data used to develop the mine water characteristics, and the reports prepared by the Province’s consultants. Proponents are advised that there is some evidence that the metal concentrations may vary (reduce or increase) due to either the effects of time or operation of the reservoir.

The Proponent is responsible for the treatment of all Contaminated Water that is within the ranges for the 10^{th} to 90^{th} percentile as presented in Appendix D Section 1.0 Mine Water Chemistry, Table 2, and is to design the Project to treat this range of influent water chemistry. The Province will not consider payment of any additional compensation to the Proponent unless the Contaminated Water is outside the 10^{th} to 90^{th} percentile range shown in Table 2 of Appendix D for a period in excess of 30 days of operation, and it can be demonstrated that the condition adversely affected the effluent quality or the Proponent’s costs.

3.4.5 The Provincial Guidelines for Effluent Discharge

The following Provincial Guidelines are to be used as target levels for designing the Project. The feasibility assessment identified the target levels as appropriate design levels that the WTP could achieve on an average annual basis. The Province supports the use of these target levels as a basis for design. Proponents should state the actual design levels in their proposals. The stated target levels will be one of the considerations in the evaluation of whether the Proponent's proposal will consistently meet the Discharge Permit Criteria.

Parameter	**Limit**
dissolved copper	≤ 0.02 mg/L,
dissolved iron	≤ 0.01 mg/L,
dissolved zinc	≤ 0.03 mg/L,
dissolved aluminium	≤ 0.5 mg/L,
dissolved manganese	≤ 0.2 mg/L,
dissolved cadmium	≤ 0.001 mg/L,
total suspended solids	≤ 10 mg/L,
pH range	6.5 to 9.5
and, on a grab sample;	
96HRLC50 fish bioassay	≥100% survival (non-acutely toxic)

Additional parameters specific to the treatment process may be added.

The point of measurement for both the Discharge Permit and the Provincial Guidelines will be at the discharge from the Project into the pipe leading to the Outfall in Howe Sound, before the introduction of Contaminated Water from controlled bypass events or storm water.

3.4.6 Treatment Process Technology

The Province has not specified a water treatment technology. Proponents who have been selected to respond to this RFP have already supplied technical information related to a preferred technology, and this technology has been accepted by the Province as a demonstrated technology. In the event that the Proponent wishes to present a different technology at the proposal stage, the Proponent must provide comprehensive supporting information to justify the change, the effects, if any, on the ability to meet the Discharge Permit Criteria. This new technology will be evaluated under the "pass/fail" criterion described in the Request for Expressions of Interest, and may also be subject to other criteria at the sole and absolute discretion of the Province. The Province is not obligated to accept any Proposal that is not based upon the technology that has already been judged to be a demonstrated technology.

3.4.7 Handling and Disposal of Process Sludge or By-products

The Province considers the proposed means for the handling and disposal of Sludge or by-products from the Project to be a significant aspect of water treatment at the Britannia Mine. The Proponent must provide evidence that the solid or liquid wastes from the proposed treatment process will **not** be considered or classified as a Special Waste.

Proponents will be permitted to use a portion of the area near the plant site for temporary or seasonal storage of Sludge prior to transport. An area under the BC Hydro

right-of-way at the northern end of the 4100 Level bench has been identified as a potential site. BC Hydro has stipulated a minimum standoff from pylons and minimum static and dynamic (operating) clearance beneath overhead cables as described in the Design Specifications.

While beneficial reuse of the Sludge is the preferred disposal method, Proponents will be allowed to propose off-site disposal or the utilization of other areas within the Province's property at Britannia, including Mount Sheer and Jane Basin for the long-term impoundment of Sludge, providing that the Proponent is able to obtain the necessary permits for a solid waste disposal facility. A tipping fee will apply to any impoundment on the province's property where the Province is expected to assume any risk or liability. A fundamental requirement for any on site disposal is that the Sludge is not classified as a Special Waste. In the event that the Sludge produced during Operations is classified as a Special Waste, the Proponent will be responsible for all additional costs associated with additional treatment or disposal of the Sludge.

The Province owns land to the east of the Site, including an area referred to as Jane Basin. Jane Basin includes a man-made depression referred to on various maps as the East Bluff Glory Hole that resulted from former mining operations undermining the surface and causing the collapse of the surface into the mine workings (the Workings). Previous studies, which are available in the RFP data room, have indicated some geotechnical concerns with a rock bluff (Jane Bluff) that overhangs part of Jane Basin, and that is expected to fail at some time in the future. Failure of Jane Bluff could result in a movement of rock that may affect any planned location of a Sludge impoundment facility in Jane Basin. If the Proponent proposes to construct a Sludge impoundment facility, it must locate this facility outside of the projected debris flow path or assume all risks associated with a failure of Jane Bluff. The Proponent is to assume all liability associated with this facility. The Province will provide assurances that other materials will not be placed in the facility.

The Province will consider a proposal to place the Sludge in the East Bluff Glory Hole above the former mine workings, and will accept the long-term risks and liabilities of this option providing that the Proponent:

- Develops a management plan to demonstrate that the Sludge can be stored on the Site during the winter months, and can be transported to Jane Basin when the Jane Basin road is accessible.
- Commits to the long-term repair and maintenance of the temporary storage facility at the Site, and the Jane Basin road.
- Commits to dewatering the Sludge sufficiently for transport to Jane Basin.
- Commits to placement of the Sludge in a manner that is consistent with the requirements of the regulatory authorities.
- Commits to paying the Province a tipping fee.

The Mines Act requires that all mining wastes, which would include WTP Sludge, must be managed in a safe and environmentally responsible manner. Recent discussions with MEM have indicated that MEM will consider an application for the placement of WTP Sludge in the East Bluff Glory Hole that connects into the Workings. However, they may place conditions on this method of disposal, and the conditions may be dependent upon the physical and chemical characteristics of the Sludge. A Refuse Discharge Permit from WLAP will also be required. The Province has applied for a

Refuse Discharge Permit for the disposal of certain existing mine wastes on the premise that the placement of these materials above the Workings will not have a material environmental consequence.

Proponents who intend to dispose of the Sludge outside of the Province's property at Britannia must clearly state the intended destination for the materials and provide the Province with assurances that the materials will be managed in accordance with the *Waste Management Act* and other applicable legislation and disposed of in an environmentally-acceptable manner.

3.4.8 Effluent Disposal and Outfall

The Proponent is required to discharge the effluent from the Project, together with Contaminated Water that by-passes the WTP, and surface water runoff from the Fan Area into a marine outfall into Howe Sound. Previous studies, which are available in the RFP data room, have identified that a location about 1.5 km south of Britannia Beach is a feasible location for this outfall. The Proponent is expected to retain risks associated with the on shore portion of the outfall.

The Province accepts that this location has a potential for slope failure and the risk associated with the slope failure of the off-shore portion of the outfall will remain with the Province. The Proponent is expected to bear all risk associated with the design, construction, placement, operations, and maintenance of the off shore portion of the outfall.

The Province will not accept an outfall located offshore of Britannia Creek in the area identified as the "North" site in the reports prepared by Komex, due to the high probability of a slope failure in this area. The Province does not wish to accept the potential environmental consequences of a relatively frequent interruption in service.

The Province has commissioned scoping studies to identify an overland routing from the Site to the south outfall location. The routing is entirely on land owned by the Province, BC Rail or the BC Museum of Mining. The Province has held preliminary discussions with the landowners, and understands that there are no objections to this routing, subject to the satisfaction of certain conditions related to construction along the BC Rail right-of-way. Notwithstanding the above, the Proponent is responsible for the route selection for the overland component, and for the location of the sub- marine portion of the outfall system. In the event that the Proponent selects another routing, the Proponent will be responsible for acquisition of all rights-of-way.

The provision of the sub-marine portion of the outfall is covered by a Cash Allowance and the Province will negotiate the final details of the proposed outfall with the Preferred Proponent. The onshore or overland portion of the outfall system is part of the requirements of this Proposal and is to be included in the Proponent's bid price.

3.4.9 The Automated Process Control System

Collection system monitoring and alarm systems together with data logging and reporting functions must be designed to encompass not only the WTP, but also the instruments at the 4100 level plug, the groundwater pumping and collection system and the outfall. The system must be user friendly and flexible to ensure that as new technology becomes available it can be readily incorporated into the system.

There are numerous control options available and it will be up to the Proponent to select and configure a system which provides complete control and monitoring of the system.

Instrumentation and Control System Design guidelines are presented in section 4 of Appendix B.

3.4.10 Noise Design Considerations

The development of the Britannia Beach area site will include residential housing, some of which will be relatively close to the Site. The level of noise (night time) at the nearest residential units to the plant fence line could have an impact on the long term commercial success of the residential development, and the Province wishes to avoid such impacts.

The layout and location of the residential development is currently in the planning stages, and could change once the developer finalizes his design and approvals. For this reason any residential locations presently identified can only be considered provisional. The current development plans will be posted on the protected portion of the web site for the Project.

The limit of 40 dBA at the fence identified elsewhere in the RFP is a guideline, intended to demonstrate the importance of noise within the project. The initial project goal is to achieve 30 dBA at the nearest residences (night time, summer, residence windows open).

The level of 40 dBA at the fence can be adjusted if the Proponent demonstrates that their proposed equipment locations, primary acoustic attenuation and any agreed secondary mitigation measures outside the fence (at the Proponents cost) will achieve the required levels in the residential area/s. These calculations will have to be sealed by an appropriately qualified professional engineer.

It is anticipated that some items of equipment in the Proponent's proposal may produce near field sound pressure levels of 95+ dBA. Successful sound attenuation by the Proponent will have to include specific attention to the issues of inlet and exhaust ventilation on the attenuated structures as well as all other building openings (doors, windows etc.).

Any items of plant that may produce high levels of noise that would not normally run overnight (silo filter shakers or reverse jet cleaners, etc.) should be inhibited from running overnight. This will ensure there is no possibility of a control failure causing night time noise problems.

3.5 Materials

3.5.1 General Requirements

All materials incorporated into the work shall conform to the latest edition of the appropriate CSA and ASTM specifications or to other standards expressly specified in the RFP and RFP Documents. All provisions in the CSA and ASTM and other standard specifications specified regarding materials, workmanship, finish, inspection and rejection are hereby made part of the specifications as far as they are applicable and not inconsistent with the specifications.

3.5.2 Goods and Materials to be furnished by the Proponent

- Only new materials and product are to be supplied by the Proponent for use on this Project, unless recycled or reused products are specifically approved by the Province.
- Only products for which replacement parts and service are readily available are to be used. The use of 'end-of-line' or 'surplus' discounted items, where an extended support period cannot be identified are not suitable for incorporation into the design.
- The manufacturer's/suppliers instructions for material or product and installation methods are to be complied with in all cases.
- Metal fastenings and accessories in the same texture, colour and finish as the base metal are to be supplied. Prevent electrolytic action between dissimilar metals. When securing exterior work or work that may be located in a corrosive atmosphere, non-corrosive fasteners are to be used.

3.6 Environmental Criteria

All facilities must be designed and constructed giving consideration to the effects of the facility and operation upon the environment, and the surrounding land owners. The Britannia town site is intended to be developed for residential housing (250 + units). The sound level at the fence enclosing the Project will be a very important issue for residents and the Proponent will be obliged to design the plant and control noise levels during operation so residents are not disturbed. This will be a particularly sensitive issue at night (ambient levels ~30 dBA).

- Noise – less than 40 dBA (total peak for the plant) at the fence line. This requirement is due to the proximity of future residences. The Operator will be required to demonstrate, with calculations, the anticipated peak sound at the fence, and will be responsible for mitigating any exceedances during Operations.
- Dust – in addition to meeting all standards and permitting requirements established by the regulatory authorities, the facilities are to be designed and operated to minimize fugitive dust. Dust control must be designed in to the Project.
- Odour - in addition to meeting all standards and permitting requirements established by the regulatory authorities, the facilities are to be designed and operated to minimize the frequency and severity of odours. Odour control must be designed in to the Project.

Appendix B2 contains a list of Environmental Criteria Proponent must satisfy during Operations.

3.7 Civil Design Criteria

This Section includes the criteria and design basis for the earthworks, site roads, drainage facilities, sanitary sewage, potable water, fire water main and offsite process piping systems for the Project. The design shall comply with these design criteria. Items not covered herein shall confirm to the appropriate publications referenced throughout these performance specifications.

3.7.1 Site Preparation and Earthworks

3.7.1.1 Cuts and Fills

The earthworks design is required to provide cut and fill earthworks that will remain physically stable for the design life of the project, with respect to both mass stability and surface erosion.

The Site shall be stripped of all topsoil vegetation and other organic debris. Topsoil suitable for use in slope remediation should be stockpiled in a location provided by the Province. The Proponent shall present a plan for stockpiling and re-use of topsoil materials for approval by the Province.

The western part of the Site is underlain by a disused concrete-lined sludge pond ('sedimentation pond'). Depending on the plant layout proposed by the Proponent, part of this area may be encroached by the Site fill. Only topographical information is available for this part of the Site. Proponents must satisfy themselves of the ground conditions underlying and proximal to the sedimentation pond.

3.7.1.2 Compaction

Fill material will be conditioned, placed, spread and compacted to achieve a sufficient density commensurate with achieving approved design parameters of bearing capacity and settlement tolerance. If necessary, sub-excavate and replace unsuitable weak or compressible sub-grade soils in order to ensure that the required design parameters are achieved.

3.7.1.3 Typical Gradients

A cross slope of 2% will be maintained for site grading purposes.

3.7.1.4 Side Slopes

At the Site, required excavation to achieve design grades is expected to encounter both native in-situ soils, and mine waste rock materials. The geotechnical boring records provide an indication of the distribution and thickness of the mine waste rock fill material. All mine waste rock material is to be excavated and removed from the Site. Excess waste fill may be disposed on lands owned by the Province. Disposal of waste rock and spoil on land owned by the Province will require the Proponent to obtain the approval of the Ministry of Energy and Mines (MEM).

Maximum side slopes for both plant area and access road:

In Cut area	1.5(H):1(V) in soil
	0.33(H):1:(V) in rock, if encountered
In Fill area	2.0(H):1(V) at the plant site
	1.5(H):1(V) for road way fill

3.7.1.5 Special Surface Treatments

Shotcrete, geosynthetic or other surface erosion control measures may be used as required for the slope stability.

3.7.2 Drainage Structures

3.7.2.1 General

The drainage design will intercept and safely convey all storm runoff, seasonal streams and seepage waters impinging on the Site. The following design basis will apply to storm drainage structures:

Climatic design data specified in the BC Building Code, and other design criteria specified by governing agencies.

- 1:100 year 24 hour storm event or any other applicable event.
- Compliance with applicable environmental regulations for drainage structures, water flow and discharge.

3.7.2.2 Sizing of Drainage Works

Ditches will be designed to:

- provide ample capacity for the design storm flow, below freeboard level;
- ensure that flow velocities for the design event are at or below standard levels specified for the types of material exposed in the side slopes;
- be designed accordingly for mineral and forest debris prevalent on the slopes above the site when sizing ditches and culverts.

The following minimum criteria will apply:

Minimum positive slope 0.2%

Minimum ditch depth 300 mm

3.7.3 Site Roads

The roads will be used to provide access for construction and operations. During operations traffic on the road may comprise vehicles used by the Proponent and visitors to the Site.

3.7.3.1 Design Parameters

	Design Parameter
Minimum width of asphalt paved surface	5.5 m
Minimum shoulder width	1 m
Maximum gradient	8%
Maximum design speed	40 km/h
Design loading	MS200
Crown slope	2%

Minimum surface course of crushed, durable, well graded, granular material	150 mm

The design storm for ditching and culvert design will be as follows, subject to approval by governing agencies:

Culverts and ditches 10 yr. 24 hour

Headwater Requirements 50 yr. 24 hours

3.7.3.2 Pavement

Pavement structure will be designed according to the following requirements:

Pavement Thickness	The Proponent is required to design surface asphalt, base course, and sub-base to suit subgrade conditions and anticipated traffic loading. This is subject to amendment by the governing agency that may impose additional minimum standards.
Maximum grade	8% (less than 300 m)
Surface:	Central Crown with 2% cross slope
Runoff Control	Side road ditches and slope erosion protection measures commensurate with exposed materials

At this time, no guardrail or safety berm is specified along the outside edge of fill embankments, given the private controlled status of the road and the low frequency of traffic. This is subject to approval of the appropriate governing agency.

3.7.3.3 Buried Pipe

All culverts and other buried pipes shall be designed to ensure that sufficient protective cover is provided to avoid adverse impacts of loaded vehicles using site roads and parking and manoeuvring areas at the site.

3.7.3.4 Sanitary Sewer

The septic tank and/or sanitary sewer system will be designed in accordance with governing codes and requirements.

3.8 Structural and Architectural Design Criteria

This Section includes the criteria and design basis for the structural and architectural works for the Project. The design shall comply with these design criteria. Items not covered herein shall confirm to the appropriate publications referenced throughout these design criteria.

3.8.1 General

All in-ground structures shall be designed to resist uplift from hydrostatic head if sub-drainage systems fails and tanks are empty. All liquid containing structures shall conform to ACI-350 “Environmental Engineering Structures”.

3.8.2 Cast-in-Place Concrete

1) Reference Standards (latest edition as of execution of contract):
   - Concrete Materials and Methods of Concrete Construction: CSA-A23.1
   - Methods of Test for Concrete: CSA-A23.2
   - Portland Cement: CAN/CSA-A5/A8/A362
   - Supplementary Cementing Materials: CAN/CSA-A23.5-M
2) Concrete testing by an independent testing agency, shall be at the Proponent’s cost. Testing shall be in accordance with CSA-A23.1 except for the following:
   - The average of any three consecutive 28 day tests shall not be below the specified design strength.
   - No one test shall be below 90% of the specified design strength.
3) All reinforcement to be to CSA A23.1 Grade 400W.

3.8.3 Hydrostatic Testing

1) Hydraulic structures shall be subjected to hydrostatic testing upon completion.
2) The Proponent shall, prior to testing, finish the structures and shall repair and waterproof any areas which appear to be inadequate.
3) Testing shall be done after completion of repairs and finishing work, and after concrete has adequately cured, but before backfilling. Structures shall be filled slowly to maximum water level and left to stand for 3 days.
4) There shall be no persistently damp areas on exterior faces, nor any visible leakage at any point. Following this visual inspection test, the water level shall be brought to the original level.
5) The hydrostatic test will begin at this time and will last for five days. There shall be no leakage at any point.
6) In case of inadequacies, the structure shall be emptied, the deficiencies repaired and the hydrostatic test shall then be repeated.
7) The Proponent shall supply, install and remove a liquid level measuring device with a sharp pointed metal probe with a locking or clamping screw. The device shall have a scale graduated in millimetres.

3.8.4 Miscellaneous Metals

3.8.4.1 Materials

- All stairs, ladders, walkways and access hatches are to meet WCB requirements.
- All miscellaneous metals to be a minimum of hot dipped galvanized.

- Steel – conform to CAN/CSA-G40.21-M, Grade 300W.
- Steel pipe – conform to ASTM A53 – Grade B.
- Galvanizing – conform to CAN/CSA-G164-M.
- Stainless steel – ASTM A167-86 and A276-86a or Type 316.

3.8.4.2 Fastenings and Anchor Bolts

- Anchor bolts to ASTM A307-86a, unless specified otherwise.
- For fastenings in stainless steel and aluminium use stainless steel Type 316 ELC ASTM A167-86.
- For structural steel use high strength bolts to ASTM A325M-86.
- All fasteners submerged in water – Stainless Steel Type 316 ELC ASTM A167-86.

3.8.5 Architectural Finishes

1) External architectural finishes for all structures are to be appropriate to the location.
2) Roofing shall meet the requirements of the RCABC.
3) Sound levels at the property line shall not exceed 40 dbA. Sound levels within buildings are to conform to WCB regulations.
4) Reference standards (latest edition as of date of execution of Contract):
   - CSA Standards on Concrete Masonry Units CAN3-A165-M
   - Mortar and Grout for Unit Masonry CSA-A179-
   - Masonry Design for Buildings CAN3-S304-M
   - Connectors for Masonry CSA-A370-
   - Masonry Construction for Buildings CSA-A371-

3.8.6 Painting

Surface preparation paint application and paint products are to comply with the Canadian Painting Contractor's Architectural (CPCA) Painting Specification Manual, latest edition.

3.8.7 Structural Steel

Limit States Design for Steel Structures, CAN/CSA-S16

Cold Formed Steel Structural Members, CSA-S136

General Requirements for Rolled or Welded Structural Quality Steels, CAN/CSA-G40.20

Structural Quality Steels, CAN/CSA-G40.21

Welded Steel Construction (Metal Arc Welding), CSA-W59

3.8.8 Concrete and Reinforcement

Concrete Materials and Methods of Concrete Construction, CSA-A23.1

Design of Concrete Structures, CSA-A23.3

Welded Steel Wire Fabric for Concrete Reinforcement, CSA-G30.5

Welded Deformed Steel Wire Fabric for Concrete Reinforcement, CSA-G30.15

Billet-Steel Bars for Concrete Reinforcement, CAN/CSA-G30.18

3.8.9 Masonry

Masonry Design for Building, CSA-CAN3-S304.1 (limit states design)

Concrete Masonry Units, CSA-A165

Motor and Grout for Unit Masonry, CSA-A179

3.8.10 Timber

Engineering Design in Wood (Limit States Design), CSA-O86.1

National Lumber Grades Authority (NLGA)

3.8.11 Tanks

Welded Steel Tanks for Oil Storage, API 650

Standard for Welded Steel Tanks for Water Storage, AWWA D100

Steel bins, small water tanks (shop fabricated and transported as full units), and all non-water tanks shall be designed in accordance with the requirements of API 650. Large water tanks (field assembled) shall be designed in accordance with the requirements of AWWA D100.

3.9 MECHANICAL DESIGN GUIDELINES

This section presents guidelines to indicate the standard that will be acceptable to the Province. In the event that a Proponent wishes to establish design criteria that are different from the guidelines, the Proposal must clearly define the exceptions and present an explanation of the costs and benefits. Notwithstanding the above, variations from the Codes will not be permitted.

3.9.1 Preamble

The Province requires the Proponent to select equipment that will result in efficient life cycle costs and that the following issues will be reviewed as part of this process:

* Reliability
* Durability
* Ease of maintenance
* Demonstrated strong product support
* Energy consumption/efficiency

3.9.2 Reliability

Mechanical equipment shall have been supplied and used in similar duties for a minimum of five years. This shall be demonstrated by manufacturer's references supplied with the proposal.

It is considered important that the selected design capacity of any equipment be significantly within (25% below) the rated maximum capacity of the item (pump, blower, fan, gearbox etc.). This will allow some margin for adjustments to the process during the operating life of the plant. It is envisaged that this will also improve the individual reliability of equipment.

Note that electric motors should be selected for the actual duty.

In any case where the Proponent is not intending to install a spare, the Proponent should justify this decision with due regard to the impact that the failure of that piece of equipment will have on the process, until the repair is carried out. The location of spares and estimated total lead time, from failure to replacement, should be included.

3.9.3 Durability

Equipment shall be selected with proper attention to environmental conditions. Materials of construction and external surface finishes shall be selected for long life and to minimise corrosion. Internal finishes shall be selected to minimise both corrosion and erosion.

3.9.4 Ease of Maintenance

The installation of equipment shall be designed with due consideration for field maintenance and access.

Lifting beams and hoist anchor points shall be installed to allow equipment to be safely removed and replaced during the service life, with the ability to safely move the equipment to an adjacent lay down area using a hoist.

Couplings and bearings shall be designed to be easily removable, where feasible.

3.9.5 Product support

The ability of the manufacturer to support the equipment with timely spares delivery and technical on site assistance, either directly or through an agent is considered critical to the successful, long term operation of the plant. The Proponent should identify manufacturers support and the location of the nearest service centre, for each item of plant.

In cases where a manufacturer can provide a long term warranty and/or service support contract this should be described. If the Proponent is not proposing to install a spare, or carry a spare on site, the lead time for delivery of a complete unit should be included.

The Proponent should identify the envisaged operation staff level, normal working hours and anticipated level of maintenance support (if any) from Proponents.

The Proponent should identify the envisaged methods of technical & maintenance support for control, electrical, instrumentation and mechanical equipment. Both the anticipated normal response time (day time working) and out of hours responses should be stated. The information will include the estimated travel time to the site.

3.9.6 Energy Efficiency

Equipment will be selected to operate efficiently, where choices exist to optimise efficiency (i.e. bi lobe or tri lobe blowers). See Electrical section for selection of electric motors.

3.9.7 Codes

The mechanical systems must conform to all applicable codes, laws, bylaws and standards of practice for the intended use including:

* AFBMA Anti Friction Bearing Manufacturers Association

* AGMA American Gear Manufacturers Association

* AISC American Institute of Steel Construction

* ANSI American National Standards Institute

* API American Petroleum Institute

* ASME American Society of Mechanical Engineers

* AWS American Welding Society

* AWWA America Water Works Association

* BC building codes

* Canadian Gas Association

* Canadian Underwriters Laboratories

* CSA Standards including CSA W59 (welding)

* MSHA Mine Safety and Health Administration

* NFPA including 70-1991 National Fire Protection Code

* OSHA Occupational Safety and Health Administration

* SSPC Steel Structures Painting Council

* SMACNA Sheet Metal & Air Conditioning Contractors National Association including "Guidelines for Seismic Restraint of Mechanical Systems and Plumbing Piping Systems"
* UBC Uniform Building Code

* WCB Workers Compensation Board (BC)

* If there should be a conflict between the requirements of this specification and codes, laws and by-laws, then the most stringent or strict requirements shall apply.

3.9.8 Permits

The Proponent shall pay for and obtain all permits, authorizations and inspections required by the latest codes, laws and by-laws for mechanical systems. Changes and alterations required by an authorized inspector of any authority having jurisdiction shall be carried out immediately.

3.9.9 Elevations

The elevations of the Site are shown in the site plan. All equipment furnished shall be designed to meet stipulated conditions and to operate satisfactorily at these elevations.

3.9.10 Noise

It is envisaged that there will relatively few pieces of equipment with a substantial sound level (i.e. blowers, if required, and dust control, particularly the silo), and these items will require comprehensive sound attenuation in order for the noise issue to be thoroughly dealt with.

A nominal, initial standard of 45 dBA for each separate noise source has been set for near field sound pressure levels, with the goal of achieving less than 40 dBA (total peak for the plant) at the fence. This requirement is due to the proximity of some future residences to the site. The Proponent will be required to demonstrate, with calculations, the anticipated peak sound level at the fence.

3.9.11 Workmanship & Materials

The equipment manufacturer shall guarantee all equipment against faulty or inadequate design, improper assembly, defective workmanship or materials and leakage, breakage or other failure. Materials shall be suitable for service conditions.

All equipment shall be designed, fabricated and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thickness so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by specified tests.

Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. All structural members shall be designed for shock, vibratory and seismic loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall be at least 6 mm thick.

3.9.12 Lubrication

Equipment shall be adequately lubricated per manufacturer's instructions prior to shipment to the job site. Where equipment has to be drained of lubricant prior to shipment, for safety purposes, a warning shall be attached to the equipment adjacent to the lubricant fill point.

Grease fittings shall be provided for all grease lubricated bearings and sleeves and tubing shall be installed to permit greasing with unit in operation.

3.9.13 Bearings

- Unless otherwise specified, provide oil or grease lubricated, ball or roller type equipment bearings, designed to withstand the stresses of the service specified. Rate each bearing in accordance with AFBMA Methods of Evaluating Load Ratings of Ball and Roller Bearings.
- Provide equipment bearings that have a minimum L-10 rating life of 100,000 hours, as determined using the maximum equipment operating speed, unless otherwise specified.
- Fit grease lubricated bearings, except those provided factory sealed and lubricated, with easily accessible grease supply, flush, drain and relief fittings. Use extension tubes where necessary. Provide standard hydraulic alemite type grease supply fittings
- Equip oil lubricated bearings with either a pressure lubricating system or a separate oil reservoir type system.

- Each oil lubrication system to be of sufficient size to dissipate the heat energy generated in the bearing under a maximum ambient temperature of 40°C. Provide a filler pipe and an external level indicator gauge.

3.9.14 Drives

The opportunity to standardise drive couplings should be considered during initial selection of equipment. Spacer type couplings are preferred to simplify separation of direct drives. Manufacturer's warranties for equipment should include couplings.

Specific attention should be given to problems associated with field removal of couplings during the service life using standard hand tools (no flame), possibly after several years service.

V-belt drives shall have adjustable, overhead motor mounts and separate baseframe assemblies. V-belt drives shall be selected with a minimum service factor of 1.5.

3.9.15 Safety Guards

All belt drives, fan blades, couplings and other moving or rotating parts shall be covered on all sides by a safety guard in accordance with WCB regulations.

Safety guards shall be fabricated from durable material (1.6 mm or thicker galvanized or aluminium-clad sheet steel or from 13 mm mesh galvanized expanded metal).

Each guard shall be designed for easy installation and removal. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized.

3.9.16 Equipment Bases

Provide all supports, anchorage and mounting of all equipment in accordance with the manufacturer's recommendation, the BC Building Code and industry standard requirements. Each component of packaged equipment shall be provided with suitable bases or supports. Bases or supports shall be adequate for the equipment and service intended.

3.9.17 Special Tools & Accessories

Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

3.9.18 Surface Preparation and Finish

Steel and iron surfaces (equipment) shall be protected by suitable coating systems completely applied in the shop. Coating systems should be selected to provide high durability in the envisaged weather conditions. Consideration should be given to coating degradation due to direct sunlight ('chalking').

Surfaces that will be inaccessible after assembly shall be protected for the life of the equipment.

All surfaces shall be abrasive blasted to SSPC SP-6 Commercial Blast Cleaning (Including SSPC-SP-1 Solvent Degreasing) to obtain a 1- to 3-mil blast profile. Wheel

abrading or shot blasting (which leaves a slightly peened finish) is not acceptable. Soluble chlorides on the surface shall not exceed 2 ppm.

Surfaces to be finish coated after installation such as handrails shall be prepared for painting as recommended by the paint manufacturer for the intended service and then shop painted with one or more coats of the specified primer.

It is desirable if structural steel and walkways are finished hot dip galvanized or constructed from material that will not corrode. Galvanizing shall be to CAN/CSA G164-M.

3.9.19 Electric motors

The Electrical Guideline describes the general requirements of electric motors. Under steady operating conditions for duty described the power draw shall not exceed 85% of the available motor power (nameplate).

3.10 Major Equipment

This section presents guidelines to indicate the standard that will be acceptable to the Province. In the event that a Proponent wishes to establish mechanical equipment that is different from the guidelines, the Proposal must clearly define the exceptions and present an explanation of the costs and benefits. Notwithstanding the above, variations from the Codes will not be permitted.

This section addresses the major equipment for a lime-neutralization process. In the event that a Proponent intends to use another process, the Proposal must contain sufficient information on the major process equipment to achieve the intent of this section, which is to establish a quality standard for the major items of process equipment.

3.10.1 General

Equipment shall be fit for purpose, with specific reference to long and reliable operation. The Proponent is required to demonstrate this by showing that the required performance for each item is comfortably within the performance curve and providing documentation showing references for similar duties (over several years of operation) as well as any extended warranties that manufacturers are able to offer.

3.10.2 Agitators

3.10.2.1 Operational Requirements

The agitators will be installed in a dirty, wet and dusty environment.

The agitators covered by this specification will be installed outside and will be exposed to all weathers.

All agitators will be required to operate continuously, 24 hours per day, with scheduled shut down periods for routine maintenance and overhauls.

The agitators will be capable of start-up after tank contents have settled due to a power failure or other equipment shutdown reason.

The operating noise level must be a maximum of 45 dbA measured at the edge of tank (standing on the access walkway) containing the agitator.

The design life of the agitators shall be at least 20 years.

Agitator type (axial, hydrofoil, etc.) shall be designed and selected to efficiently achieve the duty at the maximum flow rates identified. In practice the system will, for the majority of the year, operate at lower flow rates.

3.10.2.2 Drive

The gearbox shall be a combination of helical and spiral bevel gearing in a housing of either high-quality close-grained cast iron or stress-relieved and reinforced fabricated steel. The gear reducer shall be constructed in accordance with AGMA 6010E. Reducer shall be suitable for AGMA Class II 24-hour continuous service under moderate shock conditions.

Gearbox shall be rated in accordance with AGMA standards, with a minimum service factor of 1.5 based on motor nameplate power rating and 24 hours operation and shock loading. Thermal rating shall be not less than the motor nameplate rating.

Gearbox shall have a minimum L-10 bearing life of 100,000 hours, based on the motor horsepower.

Gear reducer housing shall have an inspection door to allow inspection and checking of backlash and alignment of gears.

Bearings shall be ball or tapered roller type. Gears and bearings shall be enclosed in an oil bath housing with oil level gauge and necessary oil and containment seal, to prevent entering of dust and water or leakage of oil from the oil bath.

Gear reducer bearings shall be oil lubricated by immersion in an oil bath or by splash lubrication accomplished by means of gears or a slinger rotating on a horizontal shaft in an oil bath to ensure the positive displacement of oil to lubricate all critical bearings. Oil pumps will not be allowed.

A dry well seal shall be provided to prevent oil leakage down the output shaft. A dipstick shall be furnished to measure the oil level in the reducer housing. Sight glasses, or other visible means to measure oil levels, are to be allowed with discretion. Reliance on dirty or blocked visual oil level indicators may lead to equipment failure.

Reducer output shaft bearings (both solid and hollow shaft types) shall be grease lubricated or permanently lubricated. All oil fill and drain lines and grease fittings shall be located so as to be easily accessible.

3.10.2.3 Shaft and Impeller

The impeller assembly shall be designed to produce insofar as practical completely balanced loads on the vertical shaft. The agitator drive train shall be balanced to minimize vibration transmitted to the tank and agitator support bridge.

The agitator shaft shall be overhung and designed for operation without bottom or intermediate bearings. The agitator shaft design shall provide sufficient shaft rigidity to prevent undue shaft flexure and to prevent unbalanced forces on the gears and tank superstructures when agitator is operating during pump down of liquid level through the impeller.

Heavy duty tapered roller bearings or equivalent shall be furnished to absorb all thrust loads. Low speed gearing shall be placed close to the upper bearings so shaft flexure will cause only negligible gear movement.

The maximum operating speed shall be less than 65% of the first critical speed of the agitator.

The blade assemblies shall be rubber covered for abrasion resistance.

The agitator speed shall be chosen to provide the minimum impeller tip speed necessary to satisfy the agitation requirement specified.

All impellers shall be statically balanced.

The agitator design shall include provisions for ensuring the accuracy of alignment of the drive and agitator components during assembly.

Replacement of bearings, seals, driver, and gear units shall be possible without dismantling other major parts, and without emptying the vessel.

If necessary, shaft couplings shall be furnished on agitator impeller shaft.

Carbon steel machined and flanged surfaces shall be coated with a heavy rust preventative.

The agitator shall have eyebolts suitable for lifting the entire drive assembly, motor, shaft and impeller assembly. To assure stability while lifting, attachment points will be arranged so that the complete unit can be lifted with the agitator shaft centre line vertical and the centre of mass directly below the crane hook.

Structural member connections shall be designed to withstand, within normal working stresses and deflections, all loads imposed on them by rotation of the assembly at maximum design speeds in water and in the dry and also loads which may be superimposed during or subsequent to erection while the tanks are empty. The Proponent will, during detailed design, provide sealed (P.Eng.) calculations to support the structural design of the support beams.

Shaft shall be adequately designed for the maximum power output of the drive unit. The impeller assembly shall be securely keyed to the shaft.

3.10.3 Clarifiers/Thickeners

3.10.3.1 Operational Requirements

The clarifier/thickener will be required to operate continuously, 24 hours per day, with scheduled shut down periods for routine maintenance.

The clarifier/thickener shall be capable of producing the required capacities as specified in the Process Design Criteria. In addition, the clarifier/thickener will be required to pass a maximum hydraulic flow which will be 1.33 times the overflow design flow, requiring that the feed launder and overflow launder are adequately sized for this condition (all other components will be sized based on the design flow). The maximum hydraulic flow is used purely to design the equipment such that this hydraulic load can be passed through the plant without overflowing tanks.

The clarifier/thickener shall be equipped with an energy dissipating feed well, suitable for the maximum and the minimum flow. The feedwell will allow proper blending of flocculent with feed slurries and to allow flocculated slurries to be introduced to the clarifier/thickener with minimum damaging shear at the low level.

The clarifier/thickener shall have a minimum 3 m sidewater depth.

The rake arms shall be a streamlined "low drag" type to minimize sludge bed disturbance.

The operating noise level must be a maximum of 45 dBA at the outer rim of the clarifier/thickener (standing on the walkway above the launder).

The design life of the clarifier/thickener will be at least 25 years.

3.10.3.2 Clarifier/thickener Mechanism Drive

Where a mechanical drive is selected for the rakes, the drive shall have a heavy duty balanced type drive head.

Where a hydraulic drive is selected for the rakes and rake lifting mechanism, the supplier shall provide a complete and self contained hydraulic package including electric drive motor(s) hydraulic pump(s), hydraulic motor(s), oil reservoir and all interconnecting piping, valves, filters and fittings. The entire package shall be assembled at the drive head and shall provide, as a minimum, alarm signals with voltage free contacts for low oil level, high pressure and high temperature conditions for remote monitoring.

The mechanism shall be supplied with a torque measuring system with local indication and provision for remote indication (using sensor mounted on the clarifier/thickener). The mechanism will be controlled to ensure alarm conditions ("high torque" & "extreme torque") are responded to in a timely manner without damaging the clarifier/thickener.

The clarifier/thickener mechanism shall be capable of starting under full load. Shaft, couplings and rakes shall be capable of transmitting the full stalled torque of the motor.

The clarifier/thickener mechanism shall include an automatic rake lift on high torque reading, with automatic/manual setting to lower the rake on resumption of low torque reading. The rake shall have a minimum lift of 600 mm (to be reviewed during final design). Limit switches (local and remote use) for high and low travel shall be provided.

Provide anti-friction type bearings; bearing average life rating must exceed 5 years of continuous operation.

Drive guards shall be provided to enclose all rotating parts. The guards shall be fabricated from expanded metal or heavy wire screen with a minimum opening of 12 mm and shall be designed for quick and easy access to the drive components. Check against general guard spec.

3.10.3.3 Support Bridge and Rake

The support bridge shall be designed to carry the mechanism, walkway, handrails, feedwell, feed launder, monorail, and all operating and seismic loads. The bridge will be supported on the tank rim. The Proponent will, during detailed design, provide sealed (P.Eng.) calculations to support the structural design of the support beams.

The feedwell will be supported from the bridge structure.

A feed launder shall be provided, suspended from the bridge, terminating 300 mm outside the outer tank wall. The battery limit connection shall be a standard pattern ANSI flange.

A walkway shall be included with the bridge to provide access to the drive head and drive components. The walkway shall be fitted with handrails and kickplates and extend across the entire tank. Both ends shall be accessed from platforms (Proponent supplies as part of total scope).

Cone scrapers shall be provided on the rake arms.

The concrete tank will include an overflow launder with a V-notched adjustable 316 stainless steel weir. The weir shall be attached to the concrete launder by cast-in or chemical set bolts.

The wetted rake components shall have a minimum corrosion allowance of 1.5 mm (1/16").

A lifting beam shall be provided to permit removal and installation of all the removable drive equipment and to assist in maintenance tasks on the mechanism drive. It is envisaged that equipment will be moved using a wheeled cart along the walkway and the walkway must be properly sized for this. At the outer end of the walkway a further lifting beam will be required to permit safe handling of equipment onto a truck or cart at grade level.

3.10.4 Lime Slaking System

The lime slaking system shall be capable of producing the required design capacity. The Proponent will state this capacity.

The lime slaking system will be installed in a dirty, wet and dusty environment.

The operating noise level must be a maximum of 45 dbA at one meter at any point outside the perimeter of the building containing the lime slaker. Specific attention to attenuation of the building ventilation system will be required.

The design life of the lime slaking system will be 25 years.

3.10.5 Lime Silo

The silo can be either fully welded or a bolted silo.

The silo shall be mild steel construction, consisting of a cylindrical section with cover. The discharge hopper shall have a cone angle of not less than 60 degrees to the horizontal.

The silo shall conform in design, workmanship, and material to AWWA D100 or API 650.

The silo will be supported on structural steel columns or steel skirt.

The cone discharge shall include an isolation valve to permit service of the discharge system. The isolation valve shall be manually operated knife gate valve. The valve shall be dust-tight and constructed of cast iron with 304 stainless steel knife gate. A limit switch shall be provided, operated by the silo knife gate to prevent operating of the vibrator if valve is closed. A flexible neoprene sleeve shall be provided with clamping plates and bolts suitable for connection to the lime feeder.

The lime silo shall include a dust collector. The unit shall be dust-tight, and weatherproof and shall be capable of discharging dust free air from the lime silo and guaranteed to meet applicable discharge limitations. All parts of the unit subject to service or maintenance shall be accessible by a person without the use of ladders or platforms.

The operating noise level of the dust collector must be less than 45 dbA at one meter from the unit, or from an enclosure around the unit. It is anticipated that the intermittent operation of this unit (particularly if reverse pulse jet) may be a potential source of noise related issues, if sound is not properly controlled.

The silo roof shall have a suitable combination manhole and vacuum pressure relief valve, and the roof shall be sloped for drainage. Steel railings and kickplates shall be provided around the perimeter of the lime silo roof.

The lime silo shall be provided with an external fixed galvanized steel ladder. The ladder shall be provided with a complete safety cage throughout its entire length. One platform shall be supplied at midpoint of silo.

The lime silo shall include a bin vibrator/s bolted to the discharge cone.

The interior of the storage compartment shall be smooth with no inward projecting elements (except for plates to protect the bin level sensors specified herein). All stiffeners and lateral bracing necessary for stability shall be provided as required and shall be installed on the outside of the storage silo, except that bracing and stiffeners for the roof shall be placed on the inside of the silo.

The storage silo shall be completely dust-tight and water-tight (weatherproof). All connections to the storage compartments shall be by flanged and gasketed connections. Gaskets shall be full face neoprene, or equal. All bolted connections shall utilize Type 316 stainless steel nuts, bolts, and washers.

The lime silo shall be designed to receive lime delivered by bulk tank truck equipped with self-contained pneumatic unloading systems.

The silo shall be provided with a lime supply fill line. Pipe shall be 4" inside diameter seamless steel pipe, Schedule 80 wall thickness, in accordance with ASTM A53. The elbows shall be long radius ductile iron castings with a Brinell hardness of not less than 550 or provided with highly reinforced replaceable integral wearback plate of this same Brinell hardness. The fill line shall be supplied with a 4" Kamlock truck hose adaptor complete with dust cap.

3.10.6 Lime Feeder

The lime feeder should be dust tight and constructed of lime resistant and abrasion resistant materials.

3.10.7 Lime Slaker

The slaker shall be either a paste or detention type, consisting of one slaking compartment containing rotating paddles for mixing, a dilution chamber with rakes or vibrating screens for agitation, a classifier for grit separation, a dust and vapour arrestor, and a conveyor for grit removal. The slaker is to be furnished with grit remover to assure positive discharge of grit.

A dust and vapour removal system should be provided.

3.10.8 Blowers

Air blowers will be required to operate continuously, 24 hours per day, with scheduled shut down periods for routine maintenance and overhauls.

Blowers that may be damaged due to discharge closure during operation shall be fitted with non-adjustable relief valves (internal or external) capable of full flow bypass if required. The relief system should be designed such that the blower will not be damaged due to prolonged operation while discharge is shut.

Blowers should be of a design that adds no oil mist to the air flow. Water mist addition to the air flow is acceptable in small quantities.

All air blower connections shall be ANSI Class 150.

The air blowers should be provided with some approved system for crane lifting, both of the assembly and the individual parts. Where eyebolts are used for this purpose these shall be securely fastened into a hole designed for the purpose of lifting (i.e. reinforced where necessary). The eyebolts shall be removable after installation of the air blowers.

The installation of the air blowers will require control of noise from the blower. This will include attenuation of both inlet and exhaust ventilation, as well as control of noise emitted from the blower to meet the requirements of 2.10.2.4. It is anticipated that the sound level at source for a blower may be ~100 dBA.

3.10.9 Tanks and Pump Boxes

Steel storage tanks shall be designed in accordance with the API 650 or AWWA D100 Code for Welded Steel Tanks.

Agitated tanks shall be provided with minimum 3.0 mm (1/8") wear allowance. Additional wear plates should be installed where erosion is anticipated to be significant (i.e. under the agitator in the area of flow into or out of the agitator).

All unlined tanks and pump boxes should have suitable corrosion/abrasion allowances added on the wetted surfaces, which shall be at a minimum 3.0 mm (1/8").

Pressure vessels shall be designed in accordance with CSA B51 latest edition and referenced specifications (e.g. ASME Code Section VIII), and registered with the appropriate BC provincial authority.

3.10.10 Piping

Piping materials shall be selected with due consideration of the fluid conveyed in terms of corrosion.

Acid feed water to the plant shall be piped in HDPE with appropriate wall thickness. For the fluid pressure, all HDPE pipe shall be continuously supported when installed above ground. PVC, ABS, or CPVC pipe shall not be used.

Power piping (instrument air) shall be designed to CSA B51.

3.11 Electrical Design Guidelines

This section presents guidelines to indicate the standard that will be acceptable to the Province. In the event that a Proponent wishes to establish design criteria that are different from the guidelines, the Proposal must clearly define the exceptions and present an explanation of the costs and benefits. Notwithstanding the above, variations from the Codes will not be permitted.

3.11.1 General

1) The electrical system is to be designed to comply the latest edition of all applicable Federal, Provincial and local Municipal codes including but not limited to:
   - National Building Code
   - I.E.S. (Illuminating Engineering Society)
   - CSA
   - CEC (Canadian Electrical Code Part 1)

- IEEE
- ULC
- BC Hydro, Fire Department, Building Department, Workers Compensation Board and all other local authorities having jurisdiction.

2) The Proponent is to obtain and pay for all necessary permits, licenses, inspections as required, and arrange for inspection of all work by the respective authorities having jurisdiction.

3) Include all necessary approval certificates for the Project. On completion of work present the final unconditional certificate of approval of the inspecting authorities.

4) Seismic restraints of electrical systems are to be designed to meet NBCC and Electrical Contractors Association of B.C. "Seismic Restraint Manual".

3.11.2 Standard of Products

1) All products and materials used shall be new and be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, the Proponent is to obtain special approval from the British Columbia Electrical Inspection Department. Where required, the products and materials shall have CSA/ULC labels.

2) All electrical equipment must be new and not be older than one year from purchase order date, of current manufacture, with assurance that spare parts are locally available for the foreseeable future. Electrical equipment shall be chosen on the basis of durability, serviceability and proven technology.

3) Complete installation to be carried out in accordance with CSA C22.1, B.C. Building Code, B.C. Electrical Safety Branch amendments. Provide underground systems in accordance with CSA C22.3 No. 7-M. Abbreviations for electrical terms to CSA Z85.

3.11.3 Identification of Equipment

1) Products required having CSA, ULC, or other approval shall be properly identified or labelled indicating that the product has been approved.

2) Nameplates shall be provided for all electrical equipment such as power and distribution transformers, power and receptacle panel boards, Motor Control Centres, individual motor starters, fusible or non-fusible disconnect switches etc. Nameplates shall be engraved lamicoid identification plates with black letters on white background fastened by screws. Include the following information on nameplates:

   i) Disconnects: indicate equipment being controlled and voltage.

   ii) Terminal cabinets and pull boxes: indicate system and voltage.

   iii) Transformers: indicate capacity, primary and secondary voltages.

3) Panel boards shall be complete with a directory giving load description of each circuit controlled. Directories shall be clearly typed and shall be mounted in a metal frame with clear plastic cover on the inside of panel door.

4) Provide fully detailed operation and maintenance manuals for the electrical systems.

3.11.4 Power Supply

1) Power will be provided at 34.5 kV, 3 phase, 60 Hz from the existing BC Hydro 69 - 34.5 kV Britannia Substation. The available fault level is to be advised.
2) To accommodate this project and future needs, BC Hydro will eventually upgrade this substation and replace the 34.5 kV distribution in the area with a 25 kV system. Provision shall therefore be made at the WTP transformer for both primary voltages.

3.11.5 Site Voltage Distribution

1) Provide power to the site with a new power line from the existing Britannia Substation at 34.5 kV.
2) To accommodate the future 25kV supply, the WTP substation will have installed an autotransformer suitably sized for the installed capacity of the step down transformer to step down from the 34.5kV to 25kV. In the future, the autotransformer will be replaced with a direct connection from the 25kV supply to the transformer. (to be confirmed with BC Hydro) Alternatively, provide a step down transformer with both 34.5 and 25 kV primary windings.
3) The Project will use a step down transformer with a 600/347 volt wye secondary.
4) BC Hydro metering will be included at the existing 34.5 kV substation service point, although provision shall also be made at the Site substation, on the secondary (600V) side for future conversion.
5) The design of the electrical distribution system shall be based upon IEEE Standard No. 141 Recommended Practice for Electrical Power Distribution for Industrial Plants.
6) Power distribution will be accomplished with step-down transformers. The following distribution voltages will be used at site:
   - Medium Voltage Distribution 34.5 kV (future 25 kV)
   - Low Voltage Distribution 600 volts, 3 phase, 3 wire, 60 Hz
   - Small Power Distribution 120/208 volt, solidly grounded for lighting, convenience receptacles and small power applications
7) The Project shall be supplied with power through a main 600 V, 3 phase feeder originating at the Project substation.
8) The short circuit rating of the electrical equipment shall be specified based on the results of a short circuit study to be performed during the detailed design of the project.
9) Electrical coordination will be completed to minimize power interruption on operation of power system protective devices.

3.11.6 Emergency Power

1) Emergency battery power packs will supply back-up power to fire alarm system and emergency egress lighting fixtures.
2) Uninterruptible power supplies will be used to provide back-up power to critical control systems. The UPS equipment will be sized to permit operations to shut down

and back-up the computer and control systems to facilitate start-up on resumption of normal power.

3) The 600 volt distribution system will include provision for the connection of a portable generator unit to provide power in the event of a prolonged power outage. This will provide power for essential equipment only as permitted through the process control system. Provide a 200 KW 600 V 3 phase emergency generator with all ancillaries; 8 hour day tank and auto start system.

3.11.6.1 Project Utilization Voltages

Motors 3/4 HP to 250 HP	575 volts, 3 phase
Motors under 3/4 HP	120 or 208 volt, 1 phase or 208 volt, 3 phase
Heaters over 1.8 kW	575 volts, 3 phase
Heaters 1.8 kW and under	120 volt, 1 phase or 208 volt, 1 phase
Lighting	
- HID	208 volt, 1 phase
- Fluorescent	120 volt, 1 phase
Instrumentation and control	120 volt, 1 phase

Rating limits may vary in isolated cases to meet design limitations.

3.11.7 Electrical and Control Rooms

1) Electrical and Control Rooms will be built to meet a one-hour fire rating. All openings will be sealed and made water and dust tight using approved fire retardant materials.

2) All electrical rooms will have two means of egress at opposite ends of the room. The floors will be elevated from adjacent process concrete floors a minimum of 200 mm. No liquid or fluid piping shall be routed through electrical rooms.

3) Doors to the rooms shall be supplied with panic exit type hardware. Each electrical room shall have an equipment door sized to permit the largest piece of equipment to be installed/removed without removing doors from hinges.

4) Electrical rooms and control rooms shall be pressurized and air conditioned and designed in accordance with occupancy regulations.

3.12 Major Electrical Equipment

This section presents guidelines to indicate the standard that will be acceptable to the Province. In the event that a Proponent wishes to use electrical equipment that is different from the guidelines, the Proposal must clearly define the exceptions and present an explanation of the costs and benefits. Notwithstanding the above, variations from the Codes will not be permitted.

3.12.1 Substation Equipment

The HV power supply will have circuit-interrupting equipment (Gang-operated Fused load break switch) rated for the available fault level available from BC Hydro.

The BC Hydro service point will incorporate a new HV gang-operated fused load break switch rated for the service. Metering will comprise PTs, CTs and utility approved meters. Equipment will include two sets of meters, one for utility and one for the Province's use.

3.12.2 Power Transformer

The power transformer will be outdoor, oil filled with off-load manual tap changer. The transformer will be supplied with a 25 kV primary to meet BC Hydro's future standard voltage requirements. Initially the transformer will be fed from an autotransformer rated 34.5kV-25kV. The transformer will be sealed tank design with provision for future addition of one stage of fan cooling. The transformers will include HV and LV junction boxes. Alternatively, a power transformer with 34.5 and 25 kV primary windings may be used.

3.12.3 Motor Control Centres

The 600 volt MCC starters shall be combination type consisting of a motor circuit protector, magnetic contactor and ambient compensated solid state adjustable overload relay. Starters shall use "visible-break" protection. Motors up to and including 250 HP will be protected by solid state overload relays.

The magnetic trip settings and overload elements shall be selected to match the full load current of the motors. Magnetic starters shall be supplied with individual 120 volt control transformers with primary HRC fuses. Larger starters may employ a line voltage operating coil and auxiliary interposing relay.

Short Circuit bus bracing for 600 volt equipment will be 42,000 A RMS symmetrical.

3.12.4 Motors

All motors shall be high efficiency type. Motors will employ Class F or better insulation and shall have a horsepower rating based upon continuous operation at full load without exceeding 80°C temperature rise above 40°C ambient.

In general, motors will be totally enclosed fan cooled (TEFC) with cast iron frames and have a 1.15 service factor. Bearings shall be of the antifriction and regreasable type. Motor casing shall have porous plug breather drains at each end.

Motors will have NEMA design B characteristics with normal starting torque and low starting current for full voltage starting unless other characteristics are required by driven equipment. Starting methods will be full voltage except where reduced voltage starting is necessary.

Ratings of all motors 250 HP or less shall be to standard NEMA sizes, with 1200 or 1800 rpm synchronous speed, 'T' Frames unless the equipment load condition requires special motors.

Provide all 250 HP motors with two 100 ohm platinum RTDs per phase winding and one per bearing.

Terminal boxes shall be oversized and rotateable in 90° increments.

Stainless steel nameplates shall be provided.

Motors required for variable frequency drive applications shall be for inverter duty meeting of exceeding the requirements of NEMA MG-1, Part 31.

3.12.5 Enclosures

In general all switchgear, starters, control system equipment and small power distribution equipment will be installed indoors in pressurized and air conditioned electrical and control equipment rooms. Enclosures shall be NEMA 1A with gaskets for all equipment located in these rooms.

Electrical, control equipment and instruments located in process areas or outdoors shall be in NEMA 4X enclosures and supplied with anti-condensation heaters.

Any equipment located in hazardous areas shall use enclosures approved for use with the specified materials.

Cables will preferably enter equipment in process areas and outdoors from the bottom.

3.12.6 Termination Cabinets and Boxes

Connection boxes shall be provided with adequate interior space to allow termination of Teck type cables and shall contain mounted terminal blocks with identification to match the Schematic drawings. Terminal blocks shall be tubular screw type with pressure plate, minimum width 5 mm (1/4") and marked with the wire number. Provide a minimum of 20% spare terminals for future use.

3.12.7 Power and Control Distribution

Cable installation shall be with Teck type armoured cable on heavy-duty galvanized steel ladder type cable trays with 300 mm (12") rung spacing and 150 mm (6") depth. The cables shall meet the CSA Flame retardant 'FT4' and the Low Acid Gas Emitting 'AG14' standards.

Cable connectors shall be watertight and approved for the use with the cable used. Minimum cable size shall be copper #14 AWG for control and copper #12 AWG for power.

Wire numbering shall be tubular plastic or heat shrink type only.

Conduit system where required shall consist of RW90 conductors and ground wire run in rigid galvanized steel conduit or liquid-tight flexible conduit complete with suitable watertight connectors. In corrosive area, rigid PVC conduits shall be used. Minimum size shall be 3/4" (19 mm) trade size.

Electrical Metallic Tubing (EMT) is not approved as an alternate for this application.

3.12.8 Small Power Distribution

Small power will be supplied from dry type transformers fed from MCCs and rated 600-120/208 volt, 3 phase 4-wire. The transformers shall be sized to meet the load with a minimum of 25% spare capacity for future loads. The transformers shall be indoor air cooled with standard taps, suitable for wall or floor mounting.

Panel-boards will be 120/208 volt, three phase four wire, surface mounted copper bus with bolt-on circuit breakers. Units mounted in electrical rooms shall be in NEMA 1 enclosures. Units in process areas or outdoors shall be in NEMA 4X enclosures.

Loads shall be balanced to insure equal loading of primary phases.

3.12.9 Lighting

High Pressure Sodium lighting fixtures shall be used in all high bay, operating area and outdoor applications. Ballasts shall be high power factor energy saving type. Fixtures shall employ quick disconnect feature for installation/maintenance purposes.

Fluorescent lighting shall be used in all offices, electrical rooms and control rooms.

Minimum Lighting Levels shall meet the requirements of codes and regulations. The following is a guide for minimum acceptable levels:

- Process areas 350 lux
- Control rooms 550 lux
- Electrical rooms 350 lux
- Storage areas 200 lux
- Outdoor areas as required 15 lux
- Other areas not specified above Per IES Standards

Where outdoor areas require lighting, fixtures will be mounted on buildings. Building entrances and perimeters will be illuminated. Outdoor lights shall be photocell controlled. Concern shall be given to the surrounding area residents when designing the outdoor lighting system.

Emergency lights will be installed in stairways, exits and in process areas to provide sufficient light to allow safe egress of personnel from the building.

3.12.10 Fire detection

Supply a fire alarm system consisting of a microprocessor based advanced protection system. It shall use a network based, peer to peer design to communicate between various control and annunciator panels, distributed throughout the WTP connecting the panels together to act as a single system. The control panel, however, will be capable of stand-alone operation.

3.12.11 Communications

Supply a site communication system consisting of a multi-line telephone system as required and wireless mobile equipment for communicating between various areas of the plant and the WTP Control Room.

3.12.12 Grounding

All structures shall have a continuous grounding system installed.

All structures shall be connected to adjacent grounded systems with a minimum of two full capacity connections.

Major equipment shall be connected directly to the ground grid with a minimum of two ground connections. Transformers, switchgear and motors shall be equipped with ground connection to the enclosure or frame in addition to the Teck cable ground wires.

The electrical room shall have a ground bus installed with two connections to the structure ground grid.

Where conduit is used, a grounding conductor shall be installed.

4.0 Instrumentation and Control System Design Guidelines

This section presents guidelines to indicate the standard that will be acceptable to the Province. In the event that a Proponent wishes to establish design criteria that are different from the guidelines, the Proposal must clearly define the exceptions and present an explanation of the costs and benefits. Notwithstanding the above, variations from the Codes will not be permitted.

4.1 Process Control Approach

Process control for this plant will be by a stand-alone Programmable Logic Controller (PLC) system. The PLC system and communication network will be of current technology that has been field proven to be efficient and reliable. The system shall be designed to have 20% spare I/O and the capability to be expanded in future to control additional equipment required to meet future expansion of the facility.

At least one spare of each module type used in the control system, shall be kept on-site for maintenance purposes.

The control system will be designed to utilize device-level network technology for all motor control ("Smart-MCC's"). All digital controls, interlocks, switches, indicator lights, analogue process control loops, process indicators and analogue control devices shall be hardwired into the PLC control system.

The Human Machine Interfaces (HMI's) shall provide the monitoring, alarming, data logging and reporting aspects of the process control system. The HMI's shall also permit operations personnel to view graphical representations of the plant process and process data. This will enable them to change process control setpoints, start and stop motors etc. The HMI's shall have multiple levels of security depending on user qualifications.

The HMI computer network shall be setup to allow remote monitoring only of the plant. This link will allow the viewing only of the plant process and process data from off-site remote locations.

Control system processors shall be connected on an independent high speed network to allow peer-to-peer communication between processors in the plant and the HMI computers in the control room. If required, a separate remote I/O network shall be provided to allow for communications between control system processors and its remote I/O racks.

4.1.1 PLC's

The control system processor shall consist of a single high performance controller linked via an Ethernet network to the plant control room computers.

The PLC and hardware shall be supplied by recognized industry manufacturers of control equipment.

The process PLC shall be equipped with a local operator interface panel for monitoring and set point adjustment. The local operator interface shall be mounted on the door of the process PLC panel.

4.1.2 I/O Modules

The control system shall be capable of supporting digital and analog inputs and outputs. All I/O shall be individually isolated. All digital outputs shall be individually fused and digital inputs shall be fused based on logical functional groups.

Digital I/O modules shall be capable of supporting a minimum of 8 digital inputs or 8 digital outputs per module. Both inputs and outputs shall be 120Vac and the output channels shall have a minimum current rating of 3 Amps continuous with an inrush current of 5 Amps.

Analog I/O modules shall be capable of supporting a minimum of 8 analog inputs or 4 analog outputs at 4-20mA, 24Vdc.

4.1.3 Control System Remote I/O

The control system shall be capable of supporting remote I/O racks for distributing I/O in close proximity to the controls. Remote I/O racks shall be capable of supporting the operation of both discrete and analog I/O efficiently with a high speed communication link back to the main processor.

The remote I/O communications link will be capable of operating at speeds fast enough to support large volumes of I/O data from the remote racks. The remote I/O communication speed will not be below 1 Mbits/sec.

The update times of the remote I/O racks containing any amount of analog I/O will be less than 3 times the controllers scan rate.

4.1.4 Proponent Interface

The process plant control consoles (Human Machine Interface - HMI) shall be desktop PC-based units linked directly to the control system communication network (Ethernet). The control consoles shall be located in an air-conditioned control room.

A colour printer for printing reports and trends shall be supplied as part of the computer hardware in the control room.

The HMI console shall be setup to automatically backup historical data files.

At a minimum the HMI computer will consist of:

1) An Intel based PENTIUM(r) (2.8 GHz, 512 MB RAM, 2 x 120 GByte Hard Drive Raid 1 hot swappable, a Read/Write CD Rom Drive, 10/100 BaseT NIC) computer
2) An LCD Flat Screen Monitor (19" Minimum)
3) A graphics card and LCD screen combination capable of displaying 65536 colors at a resolution of 1024x768 pixels.
4) Uninterruptible Power Supply (to provide 30 minutes standby power in cases where a backup generator system is available. One hour standby power is required in cases where a backup generator system is not available.
5) Microsoft Windows 2000 Operating System
6) HMI Software.

4.1.5 Ethernet Communications

The process control system shall be capable of linking directly through an Ethernet switch to an Ethernet communication network. The HMI computers shall use this link to collect data about the process from the PLC.

4.1.6 Control System Equipment Installation

Controller equipment shall be mounted in metal cabinets, rated either NEMA 12 for electrical or control room installation or NEMA 4X designed to exclude oil, dust and sprayed water, for process areas and outdoor installations. Cabinet environment will be maintained within the operational conditions recommended by the equipment manufacturer.

All cabling shall meet flame retardant and gas emission standards, and be suitable for installation in cable trays (see Section 2.11).

I/O equipment shall be mounted in a cabinet with the following hardware:

- Field wiring terminals for all inputs.
- Fused field wiring terminals for all outputs.
- Power supplies for instruments and control loops.
- Cooling fans or air conditioning units (as required by location).
- Fluorescent light and 120Vac convenience outlets.
- Uninterruptible power supply (UPS) with 1/2 hour backup minimum.
- Multi-conductor cables for wiring from input/output terminals to control panels or junction boxes.
- Controller outputs connected to inductive 120Vac loads shall be protected by transient suppressors connected across the load and as close to the load as possible.

4.1.7 Control System Programming

The program shall be programmed in an IEC-1131 programming standard.

Each drive or process control loop shall be separated into its own control segment within the program for ease of retrieval and manipulation.

Emphasis shall be placed on simplicity and ease of maintenance rather than complicated programming strategies.

4.1.8 Programming Documentation

Proper identification and location of all pieces of hardware along with any required DIP switch settings and inter-wiring connections shall be provided in CAD format.

The control system shall be fully documented with address, logic description and module descriptions. The use of abbreviations will be avoided unless limited by space considerations.

All electronic copies of programs will be given a drawing number, program name and date. Full revision control shall be implemented with documented changes to the program for each revision.

4.2 Instruments

This section presents guidelines to indicate the standard that will be acceptable to the Province. In the event that a Proponent wishes to purchase instruments that are different from the guidelines, the Proposal must clearly define the exceptions and present an explanation of the costs and benefits. Notwithstanding the above, variations from the Codes will not be permitted.

4.2.1 General

Power supply to all two-wire devices shall be 120V, 60Hz.

All analog signals shall be 4-20mA DC. All input or output leads to any instrument must be sufficiently protected to be capable of being short-circuited or connected to ground without causing damage to any component in the system.

All discrete output signals shall be dry form 'C' contacts.

System internal wiring shall be rated 600V employing stranded PVC insulated machine tool wire rated 90ºC.

4.2.2 Field Instruments

4.2.2.1 General

All instruments used for measurement of parameters that affect payment or compliance with the Discharge Permit Criteria or permits must be reliable, easy to calibrate and capable of verification. It is the responsibility of the Proponent to provide instruments that meet this requirement.

All measurements devices/transmitters shall be supplied with internally mounted indicators whose scales shall be application specific. Analog indicators are to be scaled to indicate the process variable as a percentage of full scale.

All instruments, components, housing and enclosures shall be suitably protected from adverse conditions such as dust, rainfall, freezing temperatures, process sprays, protective heating, sealing, insulating or purging.

The material of construction for any instrument component that will come into contact with the process fluid shall conform to the specification for that equipment or pipeline in which it will be installed.

The degree of instrumentation will be the minimum required for safe operation of the plant and efficient control of the process using a minimum number of operators.

The control and instrumentation will be available for continuous operation twenty four hours per day, seven days per week. The system shall be designed to go into a fail-safe mode in the event of a failure (refer to the process specification).

All instrumentation furnished shall be standard catalogue items of suppliers. Component interchange ability to minimize spare parts and to simplify service and repairs will be attempted by using identical components, where possible.

All vendor-supplied packages will utilize control systems and instrumentation similar as those selected for plant control, where practical. Control systems for the equipment contained in vendor packages shall be capable of interfacing and communicating with the plant control system.

Field instruments will be suitably supported with due consideration given to accessibility and remoteness from heat, vibration etc.

Local indicators will be selected on the basis of readability, rugged construction and process connection.

4.2.2.2 Flow Instruments

Electromagnetic flow meters shall be used in slurry services where the fluid electro-conductivity is more than 10 micro-ohms per centimetre

Electromagnetic meters used in flow measurement applications (other than hydrocarbon applications) shall be supplied with lining material suitable for slurry applications and in all cases, provisions for appropriate grounding hardware (e.g. grounding rings, electrodes etc.) The associated converter/transmitter packages will allow for local indication of the measured process variable.

Ultrasonic flow meters, where used, shall be of the clamp-on transducer design with the signal processor / user interface package mounted near but independent of the pipe.

Rotameters may be used where low-flow linear characteristics and wide rangeability are desired.

4.2.2.3 Level Instruments - Liquids and Dry material

Ultrasonic measurement technique shall be used where continuous level measurement is required.

Capacitance type switches shall be used where distinct fixed level measurement is required.

4.2.3 Pressure Instruments

Pressure sensing elements used in slurry, dust or high corrosive scaling services that will limit the life or reliability of the sensing element, shall be isolated from the process medium by either a diaphragm seal or suitable purge seal complete with flushing connections.

Pressure instruments/transmitters shall be installed on all pump and compressor discharge lines, except for slurry pumps.

4.2.4 Temperature Instruments

Thermowells shall be installed at all process connections to permit the removal of the temperature sensing element.

Temperature (primary) elements shall be 100 Ohm platinum bulb RTD and shall be coupled to temperature transmitters.

4.2.5 Density Instruments

All density measurements of the product shall be made in the process pipeline directly.

The density shall be measured as mass in a given volume and not be inferred from another process variable.

The density instrument shall employ a fully automated sourceholder for remote shutter operation and failsafe shut-down of the radio-active source.

4.3 Video Surveillance

The Province will require a video surveillance of the Britannia mine facilities during the operations phase. The video surveillance system is to provide visual coverage of critical areas of the facility as determined by the Province. Surveillance cameras shall provide the following features:

1) Provide either 10/100 Base T Ethernet connectivity or dial up modem connectivity.
2) Shall contain a built in HTTP server, an FTP Client and an internet mail system.
3) Shall provide terminals to connect a motion detector or intrusion alarm contact.
4) Will be programmable under normal conditions to send a picture at a specified time interval to a specified location.
5) To activate the camera during certain times of the day to accept alarm an alarm condition. If an alarm condition occurs, the camera will take pictures at a specified timer interval different from normal conditions and send the picture to a specified location or email the pictures to a specified location.

If the camera is outside or located in adverse environments, it shall be protected by a suitable enclosure. The enclosure shall provide heat during the winter time so that the camera will operate within its design range. During summer time, ventilation shall be available so as not to overheat the camera.

The AXIS Communications Model 2100 Camera meets the requirements as specified above.

5.0 Operational Requirements

In addition to activities that the Proponent must perform to satisfy obligations under other sections of this RFP, the Proponent is required to provide the following sampling and analytical services. All analyses are to be performed in accordance with the protocols and procedures specified in the Discharge Criteria (Appendix C).

5.1 Measurement of Volumes

The measurement of the volumes of water treated, and basis for payment, will be at the point where the treated water exits the WTP, before the addition of Contaminated Water that is by-passing the WTP. In addition, the Proponent is required to measure the volumes of water at the following locations:

- Volume discharging from the 4100 Level Plug.
- Volume by-passing the WTP.
- Volume pumped to the WTP from the groundwater collection system, which may include surface runoff.
- Volume of storm water pumped directly to the outfall system.

All of the above measurements are to be continuous and recorded electronically.

5.2 Measurement of Physical and Chemical Parameters

NOTE: The following is a provisional listing of sampling and analytical requirements that will be finalized once the Proponent is selected. These requirements are the minimum

required by the Province. The Proponent may require more frequent sampling and analysis for process control.

Water is to be sampled and analyzed as follows:

- Mine water exiting the Workings.
  - Continuous – pH
  - Monthly – quantitative analysis for total and dissolved metals in accordance with the analytical protocol required in the discharge permit, and TSS.
- Groundwater pumped to the WTP
  - Continuous – pH and conductivity
  - Monthly –quantitative analysis for total and dissolved metals in accordance with the analytical protocol required in the discharge permit, and TSS.
- Storm water pumped to the outfall system
  - Quarterly – pH, quantitative analysis for total and dissolved metals in accordance with the analytical protocol required in the discharge permit and TSS.
- WTP effluent
  - Continuous – pH, turbidity.
  - 24 hour daily composite – semi-quantitative analysis for copper and zinc.
  - Weekly composite – quantitative analysis for total and dissolved metals in accordance with the analytical protocol required in the discharge permit.

Analysis for additional parameters specific to the process may be added.

The frequency of analysis will be reduced if the Proponent can demonstrate that the plant can operate reliably under varying conditions. If the semi-quantitative analysis indicates that the metal content exceeds the Provincial Guideline, as defined in Section 3.4.5 of this Appendix B, samples will be required to be sent for quantitative analysis until the cause is identified and resolved.