pacific booker minerals inc.

#1103 - 1166 Alberni Street Vancouver, BC V6E 3Z3

Telephone: (604) 681-8556 *Toll Free*: 1-800-747-9911 *Fax:* (604) 687-5995

mail: info@pacificbooker.com *Symbols:* bkm-tsx venture / pbm-NYSE Amex *Website*: pacificbooker.com

December 23, 2015

Morrison Copper/Gold Project
Section 17 Order
Supplemental Application Information Request

TABLE OF CONTENTS

List of Tables

List of Appendices

1 INTRODUCTION

On July 7, 2015, the Ministry of Energy and Mines (MEM) and the Ministry of Environment (MOE) issued a Section 17 Order to Pacific Booker Minerals (PBM) outlining the requirements for "Scope, Procedures and Methods for a Further Assessment of the Morrison Copper/Gold Project (Proposed Project)". The scope of work requests the collection of additional baseline data, performing additional analysis/studies, and conducting additional consultation with First Nations. Klohn Crippen Berger (KCB) have been supporting PBM in the Environmental Assessment and in the preparations of this document.

PBM met with the Environmental Assessment Office (EAO) on July 21, 2015 and had subsequent meetings with Ministers and Deputy Ministers of the MEM and MOE. The purposes of the meetings were to have preliminary discussions on the potential path forward and to understand the potential expectations of the Regulatory agencies.

A key consideration in development of the Supplemental Application Information Request (SAIR) is clarifying the requirements for baseline data and analyses which are part of an Environmental Assessment (EA), whose main objective is to be able to conclude that there are "no risks of significant adverse effects". Collection of baseline data is a continuum over the life of a mining project, starting in exploration and carrying on with a comprehensive focus during the Environmental Assessment stage and into Permitting, and throughout operations and closure. An important objective during the EA stage is to identify data gaps that could, if not confirmed, lead to a fatal flaw in the project design and the conclusions of the EA.

The EAO Assessment Report (2012) identified 32 conditions as part of the Environmental Assessment Certificate, and some of these are relevant to the main areas of baseline data request in the Section 17 Order. The proponent supported these conditions in recognition that ongoing data collection and analysis is part of good environmental design practice and that such analyses would facilitate support of the permitting process.

The Section 17 Order outlines the scope of further assessment, which identifies areas which have been determined to require further information collection and analysis. The proponent proposes that a series of technical sessions be held with EAO, MOE, MEM and First Nations to assist the proponent in determining the "Scope" for further assessment. These proposed technical sessions will be described in Section 2, of this report, for each of the Section 17 Order areas of interest.

2 ADDITIONAL BASELINE INFORMATION REQUIREMENTS

2.1 Background

Baseline data collection for the Project has been carried out over the period of 2001 to 2011 and summaries are included in Appendix I and II. The EAO Assessment Report (2012) identified 32 conditions and some of these are relevant to the main areas of baseline data request in the Section 17 Order. Table 2.1 summarizes the areas of interest, baseline data available, context and the commitments that PBM have made moving into the Permitting and Operation stages. Table 2.2 summarizes key baseline information for Morrison Lake and hydrogeology.

Table 2.1 Summary of Baseline Data Status and Relevant EA (Permitting) Conditions

Section 17 Order Area of Interest	Baseline Data Available	Context	Permitting Stage Conditions[1]
Lake Modelling:	Fall and spring lake profiles (temperature, pH, electrical conductivity, dissolved oxygen); bathymetry, volumes, flows, limnology.	Lake modeling by Drs. Lawrence and Laval utilized conservative modelling parameters and indicated that predicted water quality will be below BCWQGs.	14. A plan for EAO to collect biological, physical and chemical information from Morrison Lake – and data collected to be utilized to support MOE permitting.
Salmon Fisheries	Spawning surveys, lake surveys, fisheries, etc.: DFO, Shortreed, Skeena Fisheries, Bustard, Rescan, KCB, Lake Babine Nation.	Extensive work and knowledge of the salmon is available starting with the hatchery (1907). There are no water quality effects of salmon. Limited spawning habitat in Morrison Lake. Appendix IV of the EAO Decision Response summarizes the Morrison Lake baseline data status.	17. Spawning surveys in Morrison Lake and Morrison River. 18. With LBN, measure sockeye escapement and enumerate juvenile sockeye in Morrison Lake. 22. With LBN, monitor fish tissue in resident and anadromous fish in Morrison Lake.
Hydrogeology	74 water level holes.	Comprehensive 3-D Model independently reviewed. Uncertainties in TSF seepage addressed by the liner. Uncertainties in the open pit addressed with the use of conservative upper bound parameters and monitoring.	9. TSF seepage mitigation with liner and monitoring. 10. Open pit seepage mitigation; install groundwater wells between pit and lake.
Instream Flow Incremental Methodology (IFIM) effects on Morrison Lake and Morrison River	Baseline flow data on Morrison River.	Effects on Morrison Lake predicted to be negligible. Potential effects on Morrison River addressed with a 6 inch diameter pipeline from Babine Lake for low flow augmentation in late winter. Low flow conditions do not apply during the spawning season.	15. A plan for DFO to collect data from Morrison River and an IFIM assessment and mitigation plan for operations.

[1] EAO Assessment Report – Appendix B Table of Conditions

The additional baseline data and technical analyses that will be carried out for permitting and operations will enhance and optimize the environmental design and management plans for the project. The data requirements are not considered necessary to fill in “fatal flaw” gaps in knowledge.

Table 2.2 Morrison Lake and Hydrogeology - Key Baseline Data Summary

Baseline Type	Parameter	Summary	References
Physical Parameters	Limnology (Depth, DO, temp, pH, Cond, Secchi)	▪ 2004: 2 locations (LS1 and LS2) sampled at surface to 30m. Sampled in July. ▪ 2006: 2 locations (Lake A-E) sampled at surface to 15m depth. Sampled in September. ▪ 2008: 5 locations (Lake A-E) sampled at surface to 29m depth. Sampled in July. ▪ 2010: 5 locations (Lake A-E) sampled at surface to 25m depth. Sampled in October. ▪ 2011: 5 locations (Lake A-E) sampled at surface to 30m depth. Sampled in January and June.	▪ Bustard, 2005 ▪ Rescan, 2009 ▪ Rescan, 2008 ▪ KCB, 2011
	Bathymetry	▪ 1945: Bathymetric survey map. ▪ 2008: Bathymetric surveys of Morrison Lake and Booker Lake conducted in August.	▪ Bustard, 2005 ▪ Rescan, 2008
	Water Quality	▪ 2004: 2 locations (LS1 and LS2) sampled at surface to 30m. Sampled in July. ▪ 2006: 2 locations (Lake A-E) sampled at surface to 15m depth. Sampled in September. ▪ 2008: 5 locations (Lake A-E) sampled at surface to 29m depth. Sampled in July. ▪ 2010: 5 locations (Lake A-E) sampled at surface to 25m depth. Sampled in October. Also sampled at 'Morrison Lake' site in March and September. ▪ 2011: 5 locations (Lake A-E) sampled at surface to 30m depth. Sampled in January and June.	▪ Bustard, 2005 ▪ Rescan, 2009 ▪ Rescan, 2008 ▪ KCB, 2011
	Lake Inflow / Outflow	▪ 1965 to 1970: Water Survey of Canada (WSC) hydrometric monitoring station on Morrison River, at the outflow of Morrison Lake. ▪ 2001 to 2011: 8 hydrometric stations sampled from 2001 to 2011 across January to November.	▪ Rescan, 2009 ▪ KCB, 2011
Sockeye Salmon	Fish Surveys	▪ Numerous studies within Morrison Lake and the inlets/outlets conducted from 1907 (Department of Fisheries and Oceans) to 2012 (DNA Assessment of the Morrison Watershed Sockeye Population 2012).	▪ Bustard, 2005
Hydrogeology	Groundwater Levels / Water Quality	▪ Locations: 22 monitoring locations. 12 wells between proposed pit and Morrison Lake (MW08-03 a/b, MW07-08 a/b, MW07-07 a/b, MW08-01 a/b, MW07-05 a/b, MW07-06 a/b), and 10 wells (between proposed TSF and the Lake MW-077-02 a/b, MW07-01 a/b, DH 06-12, MW07-03 a/b, MW07-04 a/b). ▪ Vibrating wire piezometers installed in 13 boreholes. ▪ Sampling conducted from 2006 to 2011. ▪ Water levels measured in 74 locations used for calibration of the model.	▪ Rescan, 2009 ▪ KCB, 2011
	Hydraulic Conductivity Testing	▪ Packer tests conducted on wells with falling head tests done to compare with Packer test results. ▪ Various geotechnical laboratory testing on geological units.	▪ Rescan, 2009

2.2 Morrison Lake

"Those features of Morrison Lake which are relevant to its capacity to assimilate mine effluent without long-term negative effect on water quality, including information on currents and flow regimes, current water quality and chemistry, temperature, limnology and lake behaviour (e.g. lake turnover). A minimum of one year of new baseline data must be collected."

Relevant baseline data has been collected from 2004 to 2011 and a summary of these data is included in Table 2.2, and in Appendix I – Table I-1.

In order to address the requested additional information and understand the ecological dynamics of Morrison Lake, it is proposed that a detailed and in depth technical session amongst specialists and working group members be undertaken in the immediate term. Specifically, this Technical Session is proposed to include:

- Technical Session
  - A detailed discussion that involves Dr. Greg Lawrence of the University of BC who is working on behalf of the Proponent, and the Working Group's technical team and the EAO along with their technical expert(s).
  - The objective of the technical session will be to jointly communicate concerns and risks with respect to the physical properties of the lake, the conservativeness or limitations of modeling, and the ability of the lake to assimilate mine effluent.
  - The process will be focused on identifying potential data gaps that are required to be filled to support and address concerns on the ability of the lake to assimilate mine effluent without long-term negative effects on water quality.
  - The proponent seeks clarity from EAO in the definition of "long-term negative effects"; e.g., is meeting the BC Water Quality Guidelines (BCWQGs) the requirement?

2.3 Sockeye Salmon Use

"Sockeye salmon use of Morrison Lake, Upper and Lower Tahlo Creeks and Morrison River, including those areas used for spawning and rearing"

Baseline data on sockeye salmon use has been collected since 1907 and a summary of data is included in Appendix I – Table I-2.

- Technical Session
  - As with discussions around Morrison Lake, it is proposed that a Technical Session be organized in the near term to assess and address data gaps and objectives of the additional salmon survey.

2.4 Hydrogeology

"Hydrogeology and groundwater data, specifically relating to areas below and between the Tailings Storage Facility and Morrison Lake, and the open pit and Morrison Lake."

Relevant baseline data that has been collected from 2008 to 2011 is summarized in Table 2.2, and in Appendix I – Table I-3.

In 2011, the EAO commissioned an Independent 3rd Party Review[2] of the hydrogeology and groundwater data. The review identified the risk of potential effects on Morrison Lake water quality due to groundwater flows. The concerns were addressed by the Proponent with: (1) placement of a geomembrane liner under the tailings storage facility to effectively limit seepage; and, (2) use of upper bound permeability values for modeling of the interaction between the open pit and Morrison Lake and for the water balance.

- Technical Session
  - Proposed with Working Group members and specialists retained by EAO to review the hydrogeology and identify any potential data gaps that could lead to a significant adverse effects; and to review and modify proposed mitigation measures.
  - Review the hydrogeology and identify any potential data gaps that could lead to a significant adverse effects.
  - Review mitigation measures.

2.5 Morrison River Instream Flow Requirement

"2.1.1(d) An Instream Flow Requirement for Morrison River following the Instream Flow Incremental Methodology including technically feasible options to mitigate any potential water quantity effects to spawning in Morrison River and Morrison Lake."

Baseline data on Morrison River has been collected since 1907 and general Morrison Lake data is summarized in Appendix I.

The potential for flow reduction (on the order of 15 L/s) in Morrison River during the winter low flow, using the upper bound water balance conditions, was identified by the Proponent[3]. PBM also notes that this is part of the Part of Fisheries Authorization. The potential for a low flow effect occurs later in the mine life during upper bound modeling conditions. Mitigation measures are available and include:

1. Pump from Babine Lake; and, does this require an EA along the pipeline route? If so should this be noted?

[2] Robertson Geoconsultants Ltd., December 2, 2011.
[3] Review Response Report-Rev.2, June 30, 2011

2. Store water in a reservoir located near the mine that would discharge into Morrison Lake during the low flow period.

- Technical Session
  - Review water balances for different scenarios and identify any data gaps in quantifying the quantity of water.
  - Review mitigation alternatives of pumping and/or water storage.

3 ADDITIONAL TECHNICAL ANALYSIS

3.1 General

Section 2 of Schedule A of Section 17 Order identifies areas that additional information and analysis is sought. PBM has reviewed these requests and, for record purposes, note that additional technical analysis have been provided in the Environmental Assessment Application and in responses provided by PBM after rejection of the EA; the main elements are summarized in Table 3.1.

Table 3.1 Summary of Section 17 Requests and PBM Status of Technical Analysis Request

SECTION 17 Order No.	INFORMATION REQUEST	PBM STATUS (COMMENTS AND REFERENCE DOCUMENTS)
2.1.1a	Consideration of waste rock disposal options and ARD/ML Policy	KCB is of the opinion that placement of PAG rock into the TSF is a higher environmental risk than the proposed backfilling of the open pit. ▪ RRR-Rev. 2[4]: pg 5, 6 ▪ 3rd Party Review Report[5]: pg.113-115 ▪ EAC Rejection Response[6] – pg. 3-6 ▪ EAO Decision Response[7] – pg. 3-9, 21 ▪ Response to Working Group[8] – pg. 26, 27
2.1.1b	Technical options for not using Morrison Lake for dilution	The alternative of using Babine Lake was discussed with EAO and was not deemed appropriate or necessary to assess.
2.1.1c	Water treatment technologies to treat to BCWQGs	An independent technical expert has advised PBM on water treatment technologies. Technology does not currently exist to treat to BCWQGs ▪ RRR-Rev. 2: pg. 121,122 ▪ 3rd Party Review Report: pg. 25,26; Appendix III ▪ 3rd Party Review Response Addendum I : pg. 10,11 ▪ EAC Rejection Response – pg. 3-12 ▪ EAO Decision Response – pg. 13,14 ▪ Response to Working Group – pg. 6,7
2.1.1d	Analysis of diffuser and lake mixing	Independent technical assessment and reviews have been carried out for PBM and EAO that has not identified a risk of a significant adverse effect. ▪ RRR-Rev. 2: pg. 145- 157 ▪ 3rd Party Review Report: pg. 90—95, Appendix V ▪ EAC Rejection Response – pg. 3-12 ▪ EAO Decision Response – pg. 13-20 & Appendix II ▪ Response to Working Group – pg. 4-17

[4] Review Response Report – Rev. 2, Klohn Crippen Berger, June 30, 2011
[5] Third Party Review Report
[6] EAC Rejection Response, Klohn Crippen Berger, October 30, 2012
[7] EAO Decision Response Report, Klohn Crippen Berger, March 10, 2014
[8] Response to Final Comments of the Working Group, Klohn Crippen Berger, May 23, 2014

SECTION 17 Order No.	INFORMATION REQUEST	PBM STATUS (COMMENTS AND REFERENCE DOCUMENTS)
2.1.3	Assessment of risk of adverse effects	The Effects Assessment follows EAO Guidance on Effects Assessment and concludes that the risk of a significant adverse effect has not been identified. ▪ RR-Rev. 2: Chapter 10 & Appendix IV – Effects Assessment ▪ 3rd Party Review Report: pg. ▪ EAC Rejection Response – pg. 3-12 ▪ EAO Decision Response – pg. ▪ Response to Working Group – pg.4-22 ▪ Response on Mt Polley Recommendations – pg. 7, 8 & Appendix I
2.1.4 to 2.1.7	Alternative means for tailings management	The risks associated with placement of dewatered tailings in wet, cold climates, and the associated costs do not support the application at the Morrison Project. Response on Mt Polley Recommendations ▪ Assessment of "dry stacked" tailings[9]

The proponent proposes that a series of technical sessions be held with EAO, MOE, MEM and FN to assist the proponent in determining the "Scope" for further assessment.

3.2 Analysis of Alternative Project Design Components

Alternative Waste Rock Disposal Options

> *"2.1.2 (a) Waste rock disposal options, in particular those which are consistent with provincial policy on management of potentially acid generating rock."*

The alternatives available for waste rock disposal include:

1. Placement on land up-slope of the open pit;
2. Placement into the open pit on closure; and
3. Placement in the Tailings Storage Facility (TSF).

The proponent's consultant, Klohn Crippen Berger (KCB), strongly believes that placement of the waste rock in the TSF is contrary to the intent of the Mount Polley's Panel Report which is to reduce the risk of the TSF. Placement of waste rock in the TSF would unnecessarily increase the TSF risk.

The concern with being "consistent with provincial policy on management of potentially acid-generating rock" have been addressed a number of times previously, as noted in Table 3.1.

- Technical session
  - Communication of concerns and identify potential risks.

[9] Environmental Assessment Application – Response on Mount Polley Panel Recommendations, Klohn Crippen Berger, March 19, 2015

- Consolidation of previous studies and documentation of supporting details.
- Alternatives will consider: the proposed in-pit disposal, TSF disposal and on-land disposal.

The alternatives assessment considered: physical, geochemical and environmental risk assessment, considering operations and closure, and a cost analysis. The failure modes effects assessment (FMEA) methodology will be used a risk assessment of the alternatives.

Alternative Effluent Disposal Options

> *"2.1.2 (b) Technical options for disposal of mine effluent, in particular those which would not rely on dilution with Morrison Lake as the primary means of mitigation."*

The primary means of mitigation is water treatment and dilution with Morrison Lake. The alternatives for effluent disposal include discharge into Babine Lake

- Technical session
  - identify potential technical options

Alternative Water Treatment Options

> *"2.1.2 (c) An analysis of long-term water treatment options with a focus on the ability to treat to meet British Columbia Water Quality Guidelines."*

Current technology is not able to treat economically to the BCWQGs. The selected high density sludge water treatment method was selected on the basis of reliability, cost and the ability to meet discharge requirements.

- Technical session
  - identify potential long-term water treatment options that could meet BCWQGs.
  - Assessment and quantification of alternatives considering reliability, effectiveness and cost.

Alternative Diffuser Design

> *"2.1.2 (d) Analysis of the performance of the diffuser, with a particular focus on using inputs and new information gained from 2.1.1."*

Design of the diffuser is integrated with the lake mixing model and is normally carried out at the permitting stage. Nonetheless, an assessment of diffuser alternatives and optimization of the diffuser design can be carried out.

- Lake modeling will be carried out using several potential diffuser designs.
- Sensitivity modelling runs will be carried out for varying effectiveness of the diffuser efficiency.

3.3 Assessment of Potential for Significant Adverse Effects

"2.1.3 Additional analysis of whether the proposed Project is likely to have significant effects on the environment using an assessment methodology which takes into account, specifically, the levels of risk, likelihood and uncertainty associated with the existing mine design mitigation measures."

The additional analysis will be based on the failure modes and effects assessment (FMEA) methodology and will comprise workshops and risk assessment.

- A risk assessment will be conducted, which will include:
  - Develop values for quantification of: likelihood (e.g. annual probability), uncertainty (e.g. upper bound); consequence (e.g. effects on water quality, aquatic habitat, fisheries, social, heritage and health);
  - workshop to identify potential events and pathways for effects;
  - assess likelihood, uncertainty and consequences; and
  - risk assessment and risk management plan.

3.4 Alternative Tailings Management Options

"*2.1.4 A description and an assessment of alternative means of undertaking the proposed project with respect options for tailings management that considers technology, siting and water balance."*

" 2.1.5 The assessment described in 2.1.4 must present and compare best practices and best available technologies for tailings management for the project, along with options for managing water balance to enhances safety and reduce the risk (likelihood and consequence) of a tailings dam failure during all phases of mine life (construction, operations, closure, post-closure). The assessment must present and compare technically and economically viable engineering solutions that are available to adequately address site conditions, with a particular focus on technical options for siting and designing tailings storage or management facilities which may have fewer potential effects on Morrison Lake."

" 2.1.6 The assessment provided in 2.1.4 must provide a clear and transparent evaluation of the factors that supported the selection of the most suitable options. Factors that will be taken into consideration in the evaluation include safety, technical and financial aspects, and implications for environmental, health, social, heritage and economic values. The assessment must consider these factors in relation to tailings management options in both the short term and long-term context. Life cycle cost assumptions (construction, operations, closure, post-closure) must be included in the analysis of the options."

" 2.1.7 The analysis described in sections 2.1.4 – 2.1.6 should demonstrate that the Proponent has considered other options that can address the potential for adverse effects on the factors noted in 2.1.6; for the project design option selected, considered the potential risks

and implications of that option, and have a technically and economically feasible plan to address the potential risks and implications; and has provided a clear and transparent rationale for the selected option(s).”

An assessment of alternative tailings management options was carried out by Klohn Crippen Berger[10] which concluded that dry stack tailings was not technically or economically feasible.

- Technical Session
  - Propose that a Technical Session be organized with representatives of the Proponent and experts from EAO and the Working Group.
  - Present and discuss alternatives for tailings management.
  - Identify gaps in existing assessment and define a comprehensive strategy for addressing those gaps.

[10] Environmental Assessment Application – Response on Mount Polley Panel Recommendations, Klohn Crippen Berger, March 19, 2015

4 EFFECTS ASSESSMENT REQUIREMENTS

"2.2 Should a new mine design or mitigations be proposed as a result of the further information gathering, analysis and assessment, an analysis of the potential effects to the environment, social, economic, heritage and health valued components is required, using current EAO assessment methodology."

- PBM will carry out the relevant effects assessment for any new design or mitigation components following the current EAO assessment methodology.

5 FIRST NATION ENGAGEMENT PLAN

"2.3 The potential adverse effects on Lake Babine Nation, Yekooche First Nation, Gitanyow Nation and Gixstan Nation and their potentially existing aboriginal rights, including title (Aboriginal Interests), and to the extent appropriate, ways to avoid, mitigate or otherwise accommodate such potential adverse effects, taking into account the applicable legal tests."

"8.2.1 For the purposes of developing the SAIR, the Proponent must engage with Lake Babine Nation with respect to their perspectives and opinions about the proposed Project and the potential effects of the proposed Project on their Aboriginal interests."

"8.2.2 Within timelines established by the Executive Director or delegate, the Proponent must prepare a Lake Babine Nation Engagement Plan that will guide engagement activities during the preparation of the SAIR and the review of the Supplemental Application. The Executive Director or delegate will assess the adequacy of the Engagement Plan activities. The Executive Director or delegate may order additional engagement activities within the prescribed time limits."

"8.2.3 The Proponent must include in its Application a summary of the engagement with Lake Babine Nation that the Proponent has carried out in relation to the proposed Project, since the issuance of this Order. The summary of engagement must identify issues and concerns raised by Lake Babine Nation with respect to the proposed Project's potential adverse effects including traditional uses and how these issues and concerns are to be addressed."

"12.1 Where requested by and within any time limits set by the Executive Director or delegate, the Proponent must respond to issues that are identified in comments submitted by First Nations identified in Section 8 of this Order, federal, provincial and local governments agencies and the public which are received during the review of the Supplemental Application, and that the Executive Director or delegate considers to be within the scope of the assessment."

A Lake Babine Engagement Plan has been prepared and submitted in draft to EAO for comment on December 22, 2015.

In reference to other Aboriginal Group's with interests in the proposed project, the Proponent believes that consultation with Aboriginal representatives should be conducted in the spirit of mutual respect, integrity, and transparency. The Proponent aspires to develop a mutually beneficial relationships with Aboriginal groups and communities for the life of the Project and beyond. The Proponent recognizes that honest and open consultation during the EA process is an important step in establishing that relationship.

Beyond the procedural aspects of consultation that have been delegated to the Proponent, it is the Proponent's intention to continue to proactively engage with Aboriginal Groups regarding any potential adverse effects and potential benefits of the proposed Project. The Proponent hopes that engagement on these topics will strengthen the Proponent's relationship with Aboriginal Groups and

help to better understand and address concerns about potential adverse effects resulting from the development of the Project.

In order to ensure that consultation is conducted in the spirit of mutual respect, integrity, and transparency, the Proponent commits to:

- providing accessible and understandable Project information and discussion opportunities in a timely manner and in a format that suits Aboriginal groups;
- allowing Aboriginal Group members and representatives sufficient time to review Project documents and information; and
- considering and, wherever practicable, incorporating feedback received from Aboriginal Groups, or providing a rationale of why such feedback was not incorporated.

6 SCOPE OF FURTHER ASSESSMENT

"2.4 For greater clarity, the scope of further assessment does not include the existing social, heritage, economic, health or environmental assessments completed by the Proponent and reviewed by EAO, other than those potential effects to those environmental valued components described in the above sections 2.1.1, 2.1.2, 2.13 and 2.1.4."

- The scope of the further assessment will follow the guidance outlined in the Section 17 Order.

APPENDIX I

Morrison Lake and Hydrogeology Baseline Data Summary

Table I-1 Morrison Lake Physical Parameter Baseline Summary

Table I-2 Sockeye Salmon Use Baseline Summary

Table I-3 Hydrogeology Baseline Summary

Table I-1 Morrison Lake Physical Parameters Baseline Summary

Date	Study			Comment
	Title	Author	Overview	
1945 to 1948	Various	Fisheries Research Board	Detailed limnology, fish population netting program, and fish diet studies were undertaken in Morrison Lake during the summer period.	
1948	A comparative limnological study of Lakelse and Morrison Lakes, B.C. with a view to assessing the suitability of Morrison Lake for the propagation of sockeye salmon. MS. Thesis. University of BC.	McMahon, Vernon Herbert	Limnological study, water quality, physical environment, sediment, zooplankton, benthic inverts, fish and fish habitat.	Physical, chemical and biological components of Morrison Lake.
1998	Trophic Status and Rearing Capacity of Smaller Nursery Lakes in the Skeena River System	Shortreed et al.	Lake trawl and hydroacoustic surveys.	Lake limnology information was collected at the time of the fish sampling to update previous sampling conducted on a monthly basis in Morrison Lake.
1998	Appendix N - Initial Environmental Studies 1998 prepared by JL Harper	Harper, JL	Provides water quality results from 1997 sampling and identifies future baseline requirements for water quality, fisheries, ARD/ML.	
2005	2004 Fisheries Studies Morrison Watershed	David Bustard and Associates Ltd.	Summarizes background fisheries information available for the Morrison Watershed. It focuses on Morrison Creek, Morrison Lake and its inlet tributaries, with the objective of providing an overview of the fisheries resources of the entire watershed. However, because of the large watershed size and significant amount of background fish information, the report presents more detailed information available for the proposed project area and its immediate vicinity (1:20,000 project map – back envelope).	Two limnology stations were established in the north and southern basins of Morrison Lake (Figure 2). Temperature /oxygen profiles were developed to 30 m depths at these sites. Secchi readings were taken at each site. Water samples were collected at the surface and 25 m depths, and pH and conductivity were measured in the field. Samples were retained for total and dissolved metal and nutrient analyses. The limnology sites were located in deeper sections of the south and north basins (LS1 and LS2 in Figure 2) of Morrison Lake in mid-July 2004. The thermocline occurred between 4 and 7 m depth (Figure 14). Surface temperatures approached 20ºC during the surveys. Dissolved oxygen levels were between 8 and 10 mg/l throughout the 30 m profile at both sites. Fisheries agencies indicated that the historical bathymetry data for Morrison Lake was adequate (Bustard, 2005).
2008	EA Application Appendix 27 - Aquatics Baseline Report 2008	Rescan	Presents the results of field studies conducted in 2008 on the water quality, sediment quality, as well as the primary and secondary producer communities in the Morrison Copper/Gold Project area. Objectives of the assessment were to determine the baseline conditions (adding to the data previously collected in 2006 and 2007) and characterize limnology and aquatic habitats in the proposed mine receiving environment and along the proposed transmission line route.	The study includes aquatic data for 11 streams and 5 Morrison Lake sites.
2009	Morrison Copper/Gold Project 2008 Hydrology Baseline Report	Rescan	Describe the baseline surface water hydrology of the Project area. Results from on-site monitoring in 2007 and 2008 and an analysis of long-term regional data are presented in this report.	The Water Survey of Canada (WSC) operated a hydrometric monitoring station on Morrison River, at the outflow of Morrison Lake, from 1965 to 1970.
2009	EA Application Appendix 21 - Bathymetry Baseline Report	Rescan	Provides the bathymetry survey results for Morrison and Booker Lakes.	Bathymetric surveys of Morrison and Booker Lakes were conducted between August 14 and 18, 2008.
2009	EA Application Appendix 26 - Aquatics Baseline Report 2006-2007	Rescan	This report presents the 2006/2007 aquatics baseline study for Pacific Booker Minerals Inc. (PBM).	The study includes aquatic data for 10 streams, 4 ponds, Morrison Creek and Morrison and Booker Lakes. Basic physical Limnological parameters were measured at two lake sites (Booker Lake and Ore Pond) and three pond sites (ponds X, Y, and Z), in 2006 and 2007.
2010	Morrison Copper/Gold Project: 2009 Fish and Fish Habitat and Aquatic Resources Report	Rescan	Water quality sampling at five sites on Morrison Lake, at multiple depths (surface, thermocline and bottom). A depth profile including in situ measurements of temperature profiles to confirm stratification, pH, dissolved oxygen, total dissolved solids, conductivity and oxidation reduction potential was conducted.	Aquatic resources data included sediment, benthos, benthic invertebrate and plankton, and periphyton.

Date	Study			Comment
	Title	Author	Overview	
2011	EAC Review Response Report - Rev. 2	KCB	Appendix I summarises Baseline Data for water quality (2004-2011), trip reports, and snow pack survey. Summarises the Morrison/Nakinilerak Lake Water Quality Baseline Sampling Report January 10 – 26, 2011.	Site sampled for water quality/depth/sediment/flow/habitat//benthics/fish/fish tissue from 2004-2011 : Stream 1 (MCS-1), Morrison River (Creek), Stream 4 (MSC 4), Unnamed Stream, (670947, 6117813;67782, 6118194;67838, 6118222;669856, 6119197), (Rescan 2009), Stream 5 (MCS-5), , Stream 6 (MSC-6), Stream 26 (discontinued), Stream 475000 (668583 6121074), Stream 50000-48010, Lower 7 (MSC-7), Stream 8 (MCS-8).
2010	Morrison Copper/Gold Project July 2010 Field Program	KCB	Provides overview of field program looking at potential fish habitat compensation areas, confirm fish presence in the tailings storage facility area and to check meteorological station. Water quality sample from Stream 10. Dive survey of pond in proposed TSF area to confirm absence of fish. Snorkel surveys in streams, ponds and lakes to identify compensation locations.	
2011	Morrison Copper/Gold Project June 2010 Field Trip Report	KCB	Provides overview of field investigations conducted by KCB to check for fish presence in Olympic Lake; conduct stream habitat assessments; collect water quality samples from the cubes and barrels; and, check the meteorological station. Water quality and flow measurements at MCS-5, 6, 7. Stream habitat observations made at MCS-4, 5, 6, 7, 10.	Quarterly water quality sampling program and in-situ water quality depth profile survey of Morrison Lake including average depth, Secchi Depth, Surface Temperature, Temperature at depth, pH, Specific Conductivity, Total Dissolved Solids, Salinity.
2011	Morrison Copper/Gold Project Spring 2011 Field Trip Reports	KCB	Overview of field program from May 31 to June 9, 2011. Purpose to capture spring freshet and lake turn-over in Morrison and Nakinilerak Lakes.	Morrison Lake was sampled for water quality and depth profiling on June 1, 2011 and June 2, 2011. Water quality samples were collected from five locations on the lake from the surface and deep (range 15 m to 30 m). A third set of samples were collected from mid-depth (proposed diffuser location). Vertical profile constructed at each site on Morrison Lake. Physical parameters collected included temperature, pH, specific conductance, dissolved oxygen (% and mg/l), total dissolved solids (TDS) and oxygen reducing potential (ORP).
2011	Metals concentrations in fish from Morrison and Babine Lakes.	Tamblyn, Greg (MOE EPD)	Baseline concentrations of metals in lake trout (Salvelinus namaycush) muscle and liver tissue in Morrison Lake.	Results similar to Bustard 2005 and Rescan 2009.
2011	The Sockeye salmon *(Oncorhynchis nerka)* of Morrison and Tahlo Lakes British Columbia, and their Importance to the Salmon Fisheries of the Skeena Watershed	Allen Gottesfeld, Davide Latremouille (Skeena Fisheries Commission)	BC Ministry of Environment FISS database reviewed by Gottesfeld et al., 2011. Sockeye Morrison & Tahlo Lakes SFC 2011.	Morrison Lake is dimictic with waters that mix from top to bottom during two mixing periods each year.
2012	Morrison Copper/Gold Project: PBM Third Party Review Response Report.	KCB	Appendix VI presents the Baseline Water Quality for Morrison lake Morrison Lake Mine Area Groundwater.	Water quality samples taken between 2006 to 2010. Samples for water quality/lake physical parameters collected at 26 locations including lake surface and depth.

Table I-2 Sockeye Salmon Use Baseline Summary

Date	Study			Comment
	Title	Author	Overview	
1907 to 1936	Various	Department of Fisheries and Oceans	Sockeye spawning hatchery data from 1907 to 1938. Eggs were obtained primarily from Morrison Creek and supplemented intermittently with eggs obtained from the Babine, Fulton and Morrison Rivers; Pierre, Pinkut, Tachek and Tahlo Creeks; as well as from the Stuart Lake hatchery.	In 1928 eggs and fry from Stuart Lake Hatchery transferred to Tahlo Creek and Morrison Lake.
1930 to present	Various	Department of Fisheries and Oceans	Estimates of annual salmon escapements into Morrison River and Tahlo Creeks based on a combination of aerial and ground surveys.	
1945 to 1948	Various	Fisheries Research Board	Detailed limnology, fish population netting program, and fish diet studies were undertaken in Morrison Lake during the summer period.	Kokanee represented 11% of the overall catch reported during the 1946-1947 netting program.
1948	A comparative limnological study of Lakelse and Morrison lakes, B.C. with a view to assessing the suitability of Morrison Lake for the propagation of sockeye salmon. MS. Thesis. University of BC.	McMahon, Vernon Herbert	Limnological study, water quality, physical environment, sediment, zooplankton, benthic inverts, fish and fish habitat.	Physical, chemical and biological components of Morrison Lake.
1952	Skeena River sockeye escapement and distribution	Brett, J.R	J. Fish. Res. Board Canada 8:453 - 468.	
1972	Migration of yearling sockeye salmon (Oncorhynchus nerka) as determined by time-lapse photography of sonar observations.	Groot, C	Research study on Morrison sockeye smolt migration associated with enhancement of sockeye salmon. J. Fish. Res. Board Can.29:1431-1444.	Morrison Lake provides high-quality rearing habitat for juvenile sockeye.
1981	Addendum Appendix Q - 1981 Fish Invent Streams Morrison Lake	Hatlevik, S.P. (BC Fish and Wildlife Branch)	Provides inventory of 11 streams within the Morrison Lake region; 8 streams provide good rearing habitat for coho and/or rainbow trout, 1 stream is utilized by spawning sockeye salmon, Morrison River and Tahlo Creek provide excellent spawning habitat for sockeye, coho, pink and rainbow.	
1998	Trophic Status and Rearing Capacity of Smaller Nursery Lakes in the Skeena River System	Shortreed et al.	Lake trawl and hydroacoustic surveys.	Sockeye fry dominated the trawl catches in Morrison Lake. Canadian Technical Report of Fisheries and Aquatic Sciences 2240. 78 pp.
2001	Factors Limiting Juvenile Sockeye Production and Enhancement Potential for Selected B.C. Nursery Lakes	Shortreed et al.	Factors limiting juvenile sockeye production.	Spawning ground capacity is limited in this system and is likely not sufficient for the predicted optimum escapement.
2003	Reconnaissance (1:20,000) Fish and Fish Habitat Inventory in the Tochcha Lake Watershed and Select Tributaries to Babine Lake	Triton Environmental Consultants	Identifies known fish species occurring in Babine and its tributaries in the Morice Timber Supply Area (TSA). The inventory provides information regarding the characteristics, the distribution and the relative abundance of fish species, as well as information on biophysical lake and stream data. This information can be used for the interpretation of habitat sensitivity and fish production capability.	Morrison Creek - average of 8,900 annual escapement during the 1990's. This stream is also used by coho (263 average during 1990's), and pink (<100 fish) during high escapement years. Babine rainbow trout do not appear to spawn in Morrison Creek itself, but do use unnamed tributaries to Morrison Creek for spawning, as do coho. Talho Creek – This system is the largest tributary to Morrison Lake. A significant population of non-enhanced sockeye spawn here (average run 4,400 during the 1990's). The Upper Tahlo stock has been identified as being at high risk of extinction (Morrell 2000). It also receives some use by coho (FOC 2001).
2004	Stock status and Lake based relationships for wild Skeena River sockeye salmon.	Cox-Rogers, S., J.M.B. Hume and K.S. Shortreed.	Canadian Science Advisory Secretariat Research Document 2004/10.	
2005	2004 Fisheries Studies Morrison Watershed	David Bustard and Associates Ltd.	Summarizes background fisheries information available for the Morrison Watershed. It focuses on Morrison Creek, Morrison Lake and its inlet tributaries, with the objective of providing an overview of the fisheries resources of the entire watershed. However, because of the large watershed size and significant amount of background fish information, the report presents more detailed information available for the proposed project area and its immediate vicinity (1:20,000 project map – back envelope).	Morrison Lake shoreline spawning surveys, limnology survey, fish community lake survey. Provides available fisheries background information - sockeye, coho, pink, chinook, kokanee salmon, rainbow trout, cutthroat trout, char species, burbot, and whitefish - presents distribution and abundance, spawning, migration for Morrison watershed. Also presents status of fish information specific to PBM project area - Creeks 07100, 20000, 23700, 25500, 29000, 44800, 53400, Morrison Lake, and Morrison creek and tributary 10000. Sockeye spawned along the Morrison Lake shoreline immediately south of Creek 44800 with a total Morrison River sockeye run in 2004 of 13,000 fish. Number of sockeye spawners observed in Morrison Lake 150.

Date	Study			Comment
	Title	Author	Overview	
2008	EA Application Appendix 27 - Aquatics Baseline Report 2008	Rescan	Presents the results of field studies conducted in 2008 on the water quality, sediment quality, as well as the primary and secondary producer communities in the Morrison Copper/Gold Project area. Objectives of the assessment were to determine the baseline conditions (adding to the data previously collected in 2006 and 2007) and characterize limnology and aquatic habitats in the proposed mine receiving environment and along the proposed transmission line route.	
2009	Morrison Copper/Gold Project Fisheries Baseline Report (2006-2008)	Rescan	Fish community survey in Morrison Lake species presence, length and weight measurements, condition factors, metals analysis, length-frequency distributions, and catch per unit effort. Shoreline habitat and spawning surveys. Detailed bathymetric surveys.	Sockeye spawn in the Morrison Lake outlet to Morrison River, immediately south of the mouth of stream #44800, and extensively throughout the Morrison River down to Lake Babine from August to mid-October. Productive high-quality lake trout spawning sites occur in the northern basin of Morrison Lake.
2010	Morrison Copper/Gold Project: 2009 Fish and Fish Habitat and Aquatic Resources Report	Rescan	Water quality sampling at five sites on Morrison Lake, at multiple depths (surface, thermocline and bottom). A depth profile including in situ measurements of temperature profiles to confirm stratification, pH, dissolved oxygen, total dissolved solids, conductivity and oxidation reduction potential was conducted.	Aquatic resources data included sediment, benthos, benthic invertebrate and plankton, and periphyton.
2010	Salmon Spawning Report 2010 Morrison Watershed	Alana Dickson (Lake Babine Nation)	Morrison Lake shoreline spawning surveys with a focus on sockeye salmon.	Sockeye spawn in the Morrison Lake outlet to Morrison River, and immediately south of the mouth of stream #44800. Number of sockeye spawners observed in Morrison Lake unknown.
2010	Morrison Copper/Gold Project July 2010 Field Program	KCB	Provides overview of field program looking at potential fish habitat compensation areas, confirm fish presence in the tailings storage facility area and to check meteorological station. Water quality sample from Stream 10. Dive survey of pond in proposed TSF area to confirm absence of fish. Snorkel surveys in streams, ponds and lakes to identify compensation locations.	
2011	Salmon Spawning Report 2010 Morrison Watershed	Alana Dickson (Lake Babine Nation)	Morrison Lake shoreline spawning surveys with a focus on sockeye salmon.	In 2011 the sockeye populations of the Morrison Watershed experienced a relatively abundant return, however, the total number of sockeye spawners observed in Morrison Lake totaled 224.
2011	The Sockeye salmon *(Oncorhynchis nerka)* of Morrison and Tahlo Lakes British Columbia, and their Importance to the Salmon Fisheries of the Skeena Watershed	Allen Gottesfeld, Davide Latremouille (Skeena Fisheries Commission)	Sockeye Morrison & Tahlo Lakes SFC 2011.	Morrison Lake is dimctic with waters that mix from top to bottom during two mixing periods each year.
2011	Fish Habitat Compensation Plan	KCB	Additional data collected is included in Appendix I – Baseline Data and in the (March 2011.	
2011	Morrison Copper/Gold Project Spring 2011 Field Trip Reports	KCB	Overview of field program from May 31 to June 9, 2011. Purpose to capture spring freshet and lake turn-over in Morrison and Nakinilerak lakes. Water quality samples from 5 locations. Eight streams were samples for water quality and flow. Ten groundwater wells were sampled. Shoreline habitat and spawning surveys, depth profiling and in situ measurements of temperature profiles to confirm stratification, pH, dissolved oxygen, total dissolved solids, conductivity and oxidation reduction potential was conducted.	Sockeye spawn in the Morrison Lake outlet to Morrison River, and immediately south of the mouth of stream #44800. Water sampling included sampling during freshet (Ice-Off) which confirmed that the Lake turns over.
2011	Metals concentrations in fish from Morrison and Babine lakes.	Tamblyn, Greg (MOE EPD)	Baseline concentrations of metals in lake trout (Salvelinus namaycush) muscle and liver tissue in Morrison Lake.	Results similar to Bustard 2005 and Rescan 2009.
2012	DNA Assessment of the Morrison Watershed Sockeye Population 2012	Alana Dickson	Samples from 132 sockeye from the Lower Tahlo Creek population, 132 sockeye from the Morrison Lake population and 125 sockeye from the Morrison Creek population were collected in the fall of 2012 from adults in their spawning grounds. No samples were obtained from the Upper Tahlo sockeye spawners. Samples were sent to the Molecular Genetics Laboratory at the Pacific Biological Station (Nanaimo, British Columbia) where allelic variation was analysed at 14 microsatellite loci.	

Table I-3 Hydrogeology Baseline Summary

Date	Study			Comment
	Title	Author	Overview	
2006	2006 Open Pit Geotechnical Investigations	Knight Piesold Consulting	Geotechnical investigation program consisted of oriented drill holes, piezometer installation and laboratory testing. All fieldwork was completed between January to February 2006.	Seven oriented core drill holes were completed during this time period. In addition to detailed geotechnical logging, core sample collection and packer permeability tests were completed on these drill holes. Laboratory test work on selected rock samples included point load tests (PLT), unconfined compressive strength (UCS) testing and direct shear tests. Piezometers were installed in selected geotechnical drill holes for groundwater level and field permeability measurements.
2007	2010 Open Pit Site Investigation - Rev. 0	KCB	Summary of the data collected during the field drilling, carried out between January 12 and February 4, 2010 and from April 5 to April 19, 2010.	Single packer hydraulic conductivity testing was undertaken in drill holes DH-10-2, DH-10-4, DH-10-6, DH-10-8, DH-10-9, DH-10-10 and DH-10-12. Falling head tests were done in two completed open holes to compare with Packer test results.
2009	Morrison Copper/Gold Project Groundwater Baseline 2008	Rescan	Hydrogeology site investigation from 2007 and 2008 field seasons. Includes 22 monitoring wells. Packer testing of subsurface materials (1-3 tests per hole). Water level seasonal variation. Sampled for water quality seasonal variation.	**Packer testing:** Low conductivity till overlying higher conductivity fractured bedrock. Fracturing in bedrock becomes less dense with depth and conductivity tends to decrease. Overburden hydraulic conductivity ranges from 4.70×10^{-11} to 1.40×10^{-5} m/s. Bedrock hydraulic conductivity ranges from 8.10×10^{-11} to 1.23×10^{-5} m/s. **Water levels:** Groundwater flow from east of site towards Morrison Lake. Artesian conditions noted at lower elevations. **Water quality:** Testing – general, total metals, dissolved metals, nutrients, total organic carbon. Parameters that exceed BCWQG for drinking water: hardness, colour, conductivity, pH, TDS, turbidity, fluoride, sulfate, TOC, dissolved Al, total Sb, total As, total Ba, total Cd, total Cr, total Cu, total Fe, total Pb, total Mn, total Hg, total Na, total U. Parameters that exceed BCWQG for FAL: fluoride, sulfate, nitrite, diss Al, tot Sb, tot As, tot Cd, tot Cr, tot Cu, tot Fe, diss Fe, tot Mn, tot Hg, tot Ni, tot Se, tot Ag, tot Th, tot Ti, tot Zn.
2009	Morrison Copper/Gold Project Hydrogeology Baseline	Rescan	Characterizes groundwater quantity and quality by installing shallow and deep groundwater monitoring wells across the Morrison property.	The study primarily involved drilling 22 boreholes with either overburden drilling equipment or diamond drilling equipment; installation of 22 monitoring wells; hydraulic conductivity testing of the subsurface materials; monitoring seasonal variation of water levels; and monitoring seasonal variation in groundwater quality. This report presents data from the 2007 and 2008 field seasons, and also serves to characterize the baseline hydrogeological conditions on the Morrison property.
2010	Morrison Lake Surface/Groundwater Baseline Monitoring Report	KCB	Overview of Morrison Lake Surface/Groundwater Baseline Monitoring conducted from October 19 – 25, 2010.	Groundwater samples were collected from 21 of the 25 wells (see sampling results Appendix II) using Watera, bailer, or electric pump sample collection methodologies. All groundwater well sites were visited by NB and the LBN team. Most sites were accessed by hiking and/or a 4-wheeler.
2011	Morrison Copper/Gold Project Spring 2011 Field Trip Reports	KCB	Overview of field program from May 31 to June 9, 2011. Purpose to capture spring freshet and lake turn-over in Morrison and Nakinilerak Lakes.	Twelve groundwater wells were selected to be sampled, all but two wells (MW07-07A and MW07-05B) were sampled for water quality and water level. Appendix II of report contains lab reports but results were not compared to WQGs.
2011	EAC Review Response Report – Rev. 2	KCB	Appendix I summarises Baseline Data for water quality (2004-2011) and trip reports.	

APPENDIX II

Morrison Lake Baseline Review and Temporal Data Plots

Morrison Lake Summary[11] (KCB-2012)
Morrison Lake Temporal Data Summary[12]

[11] EAC Application, EAO Decision Response, Appendix IV, Klohn Crippen Berger, March 2014
[12] Review Response Report, Rev-2, Appendix I, Klohn Crippen Berger, June 2011

Morrison Lake Summary (KCB-2012)

Klohn Crippen Berger

December 10, 2012

Pacific Booker Minerals
1702 – 1166 Alberni Street
Vancouver, British Columbia
V6E 3Z3

Erik Tornquist
Executive VP and COO

Dear Mr. Erik Tornquist:

Morrison Project
Morrison Lake Summary

1 INTRODUCTION AND SUMMARY

This letter summarizes the studies and data that have been carried out on Morrison Lake since the early 1900's, and includes the studies that have been carried out by Pacific Booker Minerals over the period of 2003 to 2012. The summary is focused on the lake and does not include the associated studies on the aquatic and environmental aspects of the tributary streams and Nakinilerak Lake, that have also been carried out in support of the Environmental Assessment.

Morrison Lake has a surface area of 13 km^2, has a mean depth of 21 m and a maximum depth of 60 m. Morrison Lake drains via the Morrison River into the Morrison Arm of Babine Lake. Fish species composition in Morrison Lake include rainbow trout, cutthroat trout, kokanee, sockeye salmon, coho salmon, chinook salmon, lake trout, lake whitefish, mountain whitefish, longnose sucker, largescale sucker, northern pikeminnow, burbot, peamouth chub, redside shiner, and prickly sculpin.

Lake trout and lake whitefish are the predominant fish species within Morrison Lake and high-value lake trout spawning areas are prevalent within the north basin. Morrison sockeye salmon spawn in both the inlet and outlet of Morrison Lake (Tahlo Creek and the Morrison River). Sockeye spawning within Morrison Lake has only been observed in one short location around the approximately 48 km shoreline of the lake. While Morrison Lake provides good physical habitat for juvenile sockeye the lake is nutrient limited (oligotrophic) with negligible shoreline spawning habitat. The results of at least five shoreline spawning surveys indicate that in the order of less than 300 sockeye salmon spawn in Morrison Lake each year.

Rainbow trout from Morrison Lake utilize tributary streams up to impassable barriers for spawning and juvenile rearing. In addition, small populations of lake resident cutthroat trout are present within Morrison Lake and utilize lower Tahlo Creek for spawning. Burbot comprise less than 2% of the fish community while small-bodied in Morrison Lake are dominated by northern pike minnow, prickly sculpin, and redside shiner.

Klohn Crippen Berger Ltd. • 500 – 2955 Virtual Way • Vancouver BC V5M 4X6 • CANADA
604.669.3800 t • 604.669.3835 f • www.klohn.com

2 HISTORICAL FISH AND FISH HABITAT INFORMATION AVAILABLE

The following historical fisheries information is available for Morrison Lake and a summary of key information is included in Table 2.1:

- Sockeye spawning hatchery data from 1907 to 1938. Eggs were collected from Morrison Creek sockeye, incubated in a hatchery at the Morrison Lake outlet. Fry were released into Morrison Lake.
- The Department of Fisheries and Oceans annual salmon escapements into Morrison and Tahlo Creeks since approximately 1930. These estimates represent a combination of aerial and ground surveys.
- Detailed limnology and fish diet studies were undertaken in Morrison Lake during the summer period from 1945 to 1948.
- sockeye smolt migration information for Morrison Lake is described by Groot (1972) from early studies conducted in association with enhancement of sockeye salmon.
- Fisheries information on experimental outplantings of coho fry into Morrison Lake were undertaken between 2001 and 2003 in response to the collapse of upper Skeena coho stocks during the mid-1990's.

Table 2.1 Summary of Fish and Fish Habitat and Lake Studies for Morrison Lake

Date	Fisheries Study		Comment
	Author	Description	
1907 to 1938	Department of Fisheries and Oceans	Sockeye spawning hatchery data from 1907 to 1938. Eggs were collected from Morrison Creek sockeye, incubated in a hatchery at the Morrison Lake outlet. Fry were released into Morrison Lake.	
1930	Department of Fisheries and Oceans	Estimates of annual salmon escapements into Morrison and Tahlo Creeks based on a combination of aerial and ground surveys	
19445 to 1948	Fisheries Research Board	Detailed limnology, fish population netting program, and fish diet studies were undertaken in Morrison Lake during the summer period.	Kokanee represented 11% of the overall catch reported during the 1946-1947 netting program.
1972	Groot	Research study on Morrison sockeye smolt migration associated with enhancement of sockeye salmon	Morrison Lake provides high-quality rearing habitat for juvenile sockeye.
1998	Shortreed et. al	Lake trawl and hydroacoustic surveys.	Sockeye fry dominated the trawl catches in Morrison Lake
1995	Shortreed et. al	Limnology survey and nutrient capacity study.	Morrison Lake provides high-quality habitat for sockeye salmon fry although fry densities are low due to limited spawning areas.
2008	Rescan	Bathymetry Surveys of Morrison Lake.	
2004	Bustard	Morrison Lake shoreline spawning surveys, limnology survey, fish community lake survey.	Followed RISC standards for lake survey; Lake trout and mountain whitefish together comprised approximately 50% of the survey catch; Sockeye spawned along the Morrison Lake shoreline immediately south of Creek 44800 with a total Morrison River sockeye run in 2004 of 13,000 fish.
2006 to 2008	Rescan	Fish community survey in Morrison Lake species presence, length and weight measurements, condition factors, length-frequency distributions, and catch per unit effort. Shoreline habitat and spawning surveys. Detailed bathymetric surveys.	Sockeye spawn in the Morrison Lake outlet to Morrison River, immediately south of the mouth of stream #44800, and extensively throughout the Morrison River down to Lake Babine from August to mid-October. Productive high-quality lake trout spawning sites occur in the northern basin of Morrison Lake.
2010	Lake Babine Nation	Morrison Lake shoreline spawning surveys with a focus on sockeye salmon	Sockeye spawn in the Morrison Lake outlet to Morrison River, and immediately south of the mouth of stream #44800.
2011	Lake Babine Nation	Morrison Lake shoreline spawning surveys with a focus on sockeye salmon	In 2011 the sockeye populations of the Morrison Watershed experienced a relatively abundant return, however, the total number of Sockeye spawners observed in Morrison Lake totaled 224
2010 to 2011	KCB	Shoreline habitat and spawning surveys, depth profiling and in *situ* measurements of temperature profiles to confirm stratification, pH, dissolved oxygen, total dissolved solids, conductivity and oxidation reduction potential was conducted. Water sampling included sampling during freshet (Ice-Off) which confirmed that the Lake turns over	Sockeye spawn in the Morrison Lake outlet to Morrison River, and immediately south of the mouth of stream #44800.

3 1995 MORRISON LAKE FISHERIES INFORMATION SUMMARY

A baseline limnology, plankton, and fish community survey was conducted by Shortreed et al. (1998) to assess sockeye fry rearing in Morrison Lake.

3.1 Summary of Results

- Morrison Lake provided high-quality physical habitat for sockeye salmon fry.
- Nutrient concentrations and phytoplankton biomass place Morrison Lake in the upper range of oligotrophy.
- The zooplankton community was dominated by copepods, with the calanoid copepod (Epischura sp.) the most important food item for juvenile sockeye.
- Age 0 fall sockeye fry were relatively large, indicating an adequate food resource in Morrison Lake at present fish densities.
- Sockeye densities were low due to limited spawning ground capacity.
- To increase fry recruitment, the author suggests improvements to spawning grounds (i.e., removal of beaver dams) and/or supplementing native sockeye stocks with fry outplants.

4 2004 MORRISON LAKE FISHERIES INFORMATION SUMMARY

Fisheries background studies for Morrison Lake were conducted by Bustard in 2004. Work completed in Morrison Lake during the assessment included:

- Morrison lake shoreline spawning studies for kokanee and sockeye salmon at eight Morrison Lake locations, as well as within Tahlo Creek and Morrison River;
- Morrison Lake fish population survey including descriptive statistics (length, weight, sex, maturity for all captured species), and fish ageing analysis;
- baseline fish tissue metals analysis program;
- fish health assessment following fish health assessment procedures outlined in Environment Canada (2002); and
- shoreline survey, updated limnology study, and bathymetry analysis.

4.1 Summary of Fisheries Data Results

- Morrison Lake fish species included lake whitefish, northern pikeminnow, kokanee salmon, sockeye salmon, peamouth chub, lake trout, rainbow trout, mountain whitefish, longnose and largescale sucker, burbot, cutthroat trout, coho salmon, and redside shiner.
- Lake trout and mountain whitefish together comprised approximately 50% of the survey catch.

- Adult and juvenile rainbow trout occupied accessible portions of Morrison Lake tributary streams.
- Rainbow trout were a small component of the overall fish population in Morrison Lake.
- Juvenile coho occupied several Morrison Lake tributary streams below natural fish barriers (many temporary and permanent barriers to upstream fish migration exist in the form of beaver dams and waterfalls).
- Adult sockeye and coho spawned in lower Tahlo Creek, the Tahlo Creek beach mouth to Morrison Lake, and the Morrison Lake beach outlet. Also, depending on the year and stream flow, sockeye and coho spawned in one or more additional Morrison Lake tributary streams below natural fish barriers.
- Sockeye spawned along the Morrison Lake shoreline immediately south of Creek 44800 with a total Morrison River sockeye run in 2004 of 13,000 fish.
- Fish metal tissue analysis results showed elevated copper and zinc levels compared to uncontaminated lakes in BC.
- Mercury levels in lake trout samples from Morrison Lake showed elevated concentrations of mercury.

5 2006-2008 MORRISON LAKE FISHERIES INFORMATION SUMMARY

Work completed on Morrison Lake during the 2006-2008 Morrison Baseline Fisheries Assessment included:

- fish habitat and water quality assessments of Morrison Lake inlets/outlets, and tributary streams;
- fish community survey in Morrison Lake including species presence, length and weight measurements, condition factors, length-frequency distributions, and catch per unit effort;
- shoreline habitat and spawning surveys in Morrison Lake; and
- detailed bathymetry survey of Morrison Lake.

5.1 Summary of Fisheries Data Results

- At different times of year, fish species composition in Morrison Lake included rainbow trout, cutthroat trout, kokanee, sockeye salmon, coho salmon, Chinook salmon, lake trout, lake whitefish, mountain whitefish, longnose sucker, largescale sucker, northern pikeminnow, burbot, peamouth chub, redside shiner, and prickly sculpin.
- Lake trout and mountain whitefish together comprised approximately 87% of the catch during the Morrison Lake fish community survey.

- Lake trout were the most widely distributed and abundant large-bodied species in Morrison Lake with comparable lengths, weights, and condition factors at all sampling locations in Morrison Lake and within reference Tochcha Lake.
- Northern pikeminnow, prickly sculpin, and redside shiner were most abundant small-bodied fish within the Morrison Lake shoreline.
- Rainbow trout followed by coho salmon, had the widest species distribution in Morrison Lake tributary streams.
- Five Morrison Lake tributary streams were confirmed as fish bearing. No fish were present in streams #29000 and #50000-48010.
- Coho salmon and rainbow trout were captured in five Morrison Lake tributaries.
- Tahlo Creek and Morrison River contained coho salmon, rainbow trout, longnose sucker, northern pikeminnow, redside shiner, and prickly sculpin.
- The small-bodied fish community in Morrison Lake was dominated by northern pike minnow, prickly sculpin, and redside shiner.
- Morrison River and Tahlo Creek contained the highest fish abundance of all Morrison Lake tributaries.
- Coho salmon in stream #61100 were underweight compared to those in larger tributaries (i.e., Morrison River and Tahlo Creek).
- Productive high-quality lake trout spawning sites occur in the northern basin of Morrison Lake.
- Sockeye spawn in the Morrison Lake outlet to Morrison River, immediately south of the mouth of stream #44800, and extensively throughout the Morrison River down to Lake Babine from August to mid-October.
- Coho salmon spawn in smaller numbers immediately south of the mouth of stream #44800.

6 2010 MORRISON LAKE FISHERIES INFORMATION SUMMARY

Work completed in Morrison Lake during the 2010-2011 Morrison Baseline Fisheries Assessment included:

- shoreline spawning surveys within the south basin of Morrison Lake;
- stream habitat assessment for all Morrison Lake tributary streams; and
- quarterly water quality sampling program and in-situ water quality depth profile survey of Morrison Lake (Table 6.1).

6.1 Summary of Fisheries Data Results

- Productive high-quality lake trout spawning sites occur in the northern basin of Morrison Lake.

- Sockeye spawn in the Morrison Lake outlet to Morrison River, immediately south of the mouth of stream #44800, and extensively throughout the Morrison River down to Lake Babine from August to mid-October.
- Juvenile rainbow trout and coho are present within accessible portions of the lower reaches of several Morrison Lake tributary streams.

Table 6.1 Morrison Lake Physical Data Summary

Statistic	Morrison Lake
Surface Area (km^2)	13.3
Lake Volume (m^3)	286,000,000
Lake Turnover (m^3/year)	145,000,000
Average Depth (m)	21.6
Maximum Depth (m)	62.9
Average Width (m)	879
Maximum Length (m)	15,150
Mean Transparency (Secchi Depth (m))	1.78
Surface Temperature (**°C**)	10.5
Temperature at depth (**°C**)	4.32
pH	7.6
Specific Conductivity (**µs/cm**)	0.0615
Total Dissolved Solids (**g/L**)	0.0399
Salinity (ppm)	0.028

This letter is an instrument of service of Klohn Crippen Berger Ltd. The letter has been prepared for the exclusive use of Pacific Broker Minerals Inc. (Client) for the specific application to the Morrison Project. The report's contents may not be relied upon by any other party without the express written permission of Klohn Crippen Berger. In this report, Klohn Crippen Berger has endeavoured to comply with generally-accepted professional practice common to the local area. Klohn Crippen Berger makes no warranty, express or implied.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Harvey McLeod, P.Eng., P.Geo.
Principal

HM:cd

REFERENCES

Bustard, D 2004. Fisheries background studies Morrison Watershed 2004. Man. Report prepared for Pacific Booker Minerals Ltd.

KCB June 2010. 2010-2011 Spring Field Report. Report prepared for Pacific Booker Minerals Ltd.

Shortreed, K.S., K.F. Morton, K. Malange and J.M.B. Hume. 2001. Factors limiting sockeye production in selected B.C. Nursery Lakes. Canadian Stock Assessment Secretariat Research Document 2001/098.

Rescan. 2009. Morrison Copper/Gold Project Fisheries Baseline Report.Report prepared for Pacific Booker Minerals Inc. by Rescan Environmental Services Ltd. December 2008.

Rescan. 2009. Morrison Copper/Gold Project Bathymetry Report. Report prepared for Pacific Booker Minerals Inc. by Rescan Environmental Services Ltd. February 2009.

Morrison Lake Temporal Data Summary

	Water Quality												Depth											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
2010			X						X	X														
2011						X																		
Stream 9 (aka Olympic Creek)																								
2004																								
2005																								
2006																								
2007																								
2008					X	X	X	X																
2009																			X					
2010																								
2011						X																		
Stream 10 (6070) -1																								
2004																								
2005																								
2006								X																
2007					X					X														
2008						X	X																	
2009																								
2010			X						X	X					X									
2011						X																		
Stream 10 (6070) -2																								
2011						X																		
Hautete Creek - 1																								
2011						X																		
Hautete Creek - 2																								
2011	X					X																		
Tahlo Creek - 1																								
2004																								
2006																								
2010																								
Tahlo Creek - 2																								
2006																								
Stream 480-600800 (Babine)																								
2009																		X						
2010																								
2011																								
Proposed Transmission Line																								
Transmission Line (sampling at intervals)																								
2006																								
2007																								
2008							X																	
2009																								
2010																								
2011																								
Stream 11.9																								
2006																								
2007																								
2008							X																	
2009																								
2010																								
2011																								
Stream 17.1																								
2006																								
2007																								
2008							X																	
2009																								
2010																								
2011																								
TL Wetland																								
2006																								
2007																								
2008							X																	
2009																								
2010																								
2011																								
Power Station																								
2006																								
2007																								
2008							X																	
2009																								
2010																								
2011																								
Surface Water_ Morrison Lake- 2004-2011																								
	Water Quality												Depth Profile (Limnology / Physical Properties)											
Site A - Surface/Deep																								
2004																			X					
2005																								
2006								x													X			
2007																								
2008							x												X					
2009																								
2010			x						x	x												X		
2011	x					x							X					x						
Site B - Surface/Deep																								
2004																								
2005																								
2006								x																
2007																								
2008							x												X					
2009																								
2010										x												X		
2011	x					x												x						
2012																								
Site C - Surface/Deep																								
2004																								
2005																								
2006								x																
2007																								
2008							x												X					

	Sediment												Flow											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
2010															X									
2011																		X						
Stream 9 (aka Olympic Creek)																								
2004																								
2005																								
2006																								
2007																								
2008							X																	
2009																								
2010																								
2011																		X						
Stream 10 (6070) -1																								
2004																								
2005																								
2006																								
2007					X	X	X	X		X							X	X	X	X	X	X		
2008							X								X	X	X	X	X	X	X	X		
2009																								
2010															X									
2011																		X						
Stream 10 (6070) -2																								
2011																								
Hautete Creek - 1																								
2011																								
Hautete Creek - 2																								
2011																								
Tahlo Creek - 1																								
2004																								
2006																								
2010																								
Tahlo Creek - 2																								
2006																								
Stream 480-600800 (Babine)																								
2009																								
2010																								
2011																								
Proposed Transmission Line																								
Transmission Line (sampling at intervals)																								
2006																								
2007																								
2008																								
2009																								
2010																								
2011																								
Stream 11.9																								
2006																								
2007																								
2008							X																	
2009																								
2010																								
2011																								
Stream 17.1																								
2006																								
2007																								
2008							X																	
2009																								
2010																								
2011																								
TL Wetland																								
2006																								
2007																								
2008																								
2009																								
2010																								
2011																								
Power Station																								
2006																								
2007																								
2008																								
2009																								
2010																								
2011																								
Surface Water_ Morrison Lake- 2004-2011																								
	Sediment												Flow											
Site A - Surface/Deep																								
2004																								
2005																								
2006								X																
2007																								
2008							X																	
2009																								
2010																								
2011																								
Site B - Surface/Deep																								
2004																								
2005																								
2006								X																
2007																								
2008							X																	
2009																								
2010																								
2011																								
2012																								
Site C - Surface/Deep																								
2004																								
2005																								
2006								X																
2007																								
2008							X																	

	Fish Habitat												Fish Survey											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
2010																								
2011																								
Stream 9 (aka Olympic Creek)																								
2004					X																			
2005																								
2006																								
2007																								
2008																								
2009							X												X					
2010																								
2011																								
Stream 10 (6070) -1																								
2004																								
2005																								
2006																								
2007																								
2008																								
2009						X												X						
2010																								
2011																								
Stream 10 (6070) -2																								
2011						X												X						
Hautete Creek - 1																								
2011																		X						
Hautete Creek - 2																								
2011						X												X						
Tahlo Creek - 1																								
2004					X																			
2006								X												X				
2010											X										X	X		
Tahlo Creek - 2																								
2006								X												X				
Stream 480-600800 (Babine)																								
2009						X												X						
2010																								
2011																								
Proposed Transmission Line																								
Transmission Line (sampling at intervals)																								
2006																								
2007																								
2008							X																	
2009																								
2010																								
2011																								
Stream 11.9																								
2006																								
2007																								
2008																								
2009																								
2010																								
2011																								
Stream 17.1																								
2006																								
2007																								
2008																								
2009																								
2010																								
2011																								
TL Wetland																								
2006																								
2007																								
2008																								
2009																								
2010																								
2011																								
Power Station																								
2006																								
2007																								
2008																								
2009																								
2010																								
2011																								
Surface Water_ Morrison Lake- 2004-2011																								
	Fish Habitat												Fish Population											
Site A - Surface/Deep																								
2004							X												X					
2005																								
2006																								
2007							X																	
2008							X											X						
2009																								
2010						Morrison Lake shoreline																		
2011																								
Site B - Surface/Deep																								
2004							X																	
2005																								
2006																								
2007							X																	
2008						X	X											X						
2009																								
2010																								
2011																								
2012																								
Site C - Surface/Deep																								
2004							X																	
2005																								
2006																								
2007							X																	
2008							X											X						

	Fish Tissue												Bray Curtis Percent Similarity Values of Benthos												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN
2010																									
2011																									
Stream 9 (aka Olympic Creek)																									
2004																									
2005																									
2006																									
2007																									
2008																			X						
2009							X	Rescan (2010)																	
2010																									
2011																									
Stream 10 (6070) -1																									
2004																									
2005																									
2006																									
2007																			X						
2008																									
2009																									
2010																									
2011																									
Stream 10 (6070) -2																									
2011																									
Hautete Creek - 1																									
2011																									
Hautete Creek - 2																									
2011																									
Tahlo Creek - 1																									
2004																									
2006																									
2010																									
Tahlo Creek - 2																									
2006																									
Stream 480-600800 (Babine)																									
2009																									
2010																									
2011																									
Proposed Transmission Line																									
Transmission Line (sampling at intervals)																									
2006																									
2007																									
2008																									
2009																									
2010																									
2011																									
Stream 11.9																									
2006																									
2007																									
2008																			X						
2009																									
2010																									
2011																									
Stream 17.1																									
2006																									
2007																									
2008																			X						
2009																									
2010																									
2011																									
TL Wetland																									
2006																									
2007																									
2008																									
2009																									
2010																									
2011																									
Power Station																									
2006																									
2007																									
2008																									
2009																									
2010																									
2011																									
Surface Water_ Morrison Lake- 2004-2011																									
	Fish Tissue												Bray Curtis Percent Similarity Values of Benthos												
Site A - Surface/Deep																									
2004																									
2005						X	Bustard (2004-2005)																		
2006																				X					
2007									X	X															
2008																									
2009																									
2010																									
2011																									
Site B - Surface/Deep																									
2004																									
2005																									
2006																				X					
2007									X	X															
2008																									
2009																									
2010																									
2011																									
2012																									
Site C - Surface/Deep																									
2004																									
2005																									
2006																				X					
2007									X	X															
2008																									

	Benthic Invertebrate \Benthos												Periphyton											
	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN
2010																								
2011																								
Stream 9 (aka Olympic Cr																								
2004																								
2005																								
2006																								
2007																								
2008						X												X						
2009																								
2010																								
2011																								
Stream 10 (6070) -1																								
2004																								
2005																								
2006																								
2007						X												X						
2008																		X						
2009																								
2010																								
2011																								
Stream 10 (6070) -2																								
2011																								
Hautete Creek - 1																								
2011																								
Hautete Creek - 2																								
2011																								
Tahlo Creek - 1																								
2004																								
2006																								
2010																								
Tahlo Creek - 2																								
2006																								
Stream 480-600800 (Babine)																								
2009																								
2010																								
2011																								
Proposed Transmiss																								
Transmission Line (sampling at intervals)																								
2006																								
2007																								
2008																								
2009																								
2010																								
2011																								
Stream 11.9																								
2006																								
2007																								
2008						X												X						
2009																								
2010																								
2011																								
Stream 17.1																								
2006																								
2007																								
2008						X												X						
2009																								
2010																								
2011																								
TL Wetland																								
2006																								
2007																								
2008																								
2009																								
2010																								
2011																								
Power Station																								
2006																								
2007																								
2008																								
2009																								
2010																								
2011																								

	Periphyton & PhytoPlankton Biomass												PhytoPlankton												ZooPlankton											
	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN
2010																																				
2011																																				
Stream 9 (aka Olympic Cr																																				
2004																																				
2005																																				
2006																																				
2007																																				
2008						X												X																		
2009																																				
2010																																				
2011																																				
Stream 10 (6070) -1																																				
2004																																				
2005																																				
2006																																				
2007						X												X																		
2008						X												X																		
2009																																				
2010																																				
2011																																				
Stream 10 (6070) -2																																				
2011																																				
Hautete Creek - 1																																				
2011																																				
Hautete Creek - 2																																				
2011																																				
Tahlo Creek - 1																																				
2004																																				
2006																																				
2010																																				
Tahlo Creek - 2																																				
2006																																				
Stream 480-600800 (Babine)																																				
2009																																				
2010																																				
2011																																				
Proposed Transmiss																																				
Transmission Line (sampling at intervals)																																				
2006																																				
2007																																				
2008																																				
2009																																				
2010																																				
2011																																				
Stream 11.9																																				
2006																																				
2007																																				
2008						X												X																		
2009																																				
2010																																				
2011																																				
Stream 17.1																																				
2006																																				
2007																																				
2008						X												X																		
2009																																				
2010																																				
2011																																				
TL Wetland																																				
2006																																				
2007																																				
2008																																				
2009																																				
2010																																				
2011																																				
Power Station																																				
2006																																				
2007																																				
2008																																				
2009																																				
2010																																				
2011																																				

Surface Water_ Morr	Benthic Invertebrate \Benthos												Periphyton											
Site A - Surface/Deep	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN
2004																								
2005																								
2006					X												X							
2007																								
2008					X													X						
2009																								
2010																								
2011																								
Site B - Surface/Deep																								
2004																								
2005																								
2006					X												X							
2007																								
2008					X													X						
2009																								
2010																								
2011																								
2012																								
Site C - Surface/Deep																								
2004																								
2005																								
2006					X												X							
2007																								
2008					X													X						

	Periphyton & PhytoPlankton Biomass												PhytoPlankton												ZooPlankton											
	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN
Site A - Surface/Deep																																				
2004																																				
2005																																				
2006																																				
2007																																				
2008						X												X																		
2009																																				
2010																																				
2011																																				
Site B - Surface/Deep																																				
2004																																				
2005																																				
2006																																				
2007																																				
2008						X												X																		
2009																																				
2010																																				
2011																																				
2012																																				
Site C - Surface/Deep																																				
2004																																				
2005																																				
2006																																				
2007																																				
2008						X												X																		

Water Quality	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
2009												
2010										x		
2011	x					x						
2012												
Site D - (Diffuser)Surface/Thermocline/Deep												
2004												
2005												
2006								x				
2007												
2008							X					
2009												
2010			X							x		
2011	x					x						
2012												
Site E - Surface/Deep												
2004												
2005												
2006								x				
2007												
2008							x					
2009												
2010										x		
2011	x					x						
Morrison Lake												
2010												
2011												
Surface Water _ Nakinilerak Lake												
Water Quality												
Nak 1 - Surface/Thermocline/Bottom												
2009												
2010										x		
2011	x					x						
2012												
Nak 2 - Surface/Thermocline/Bottom												
2010										x		
2011	x					x						
2012												
Nak 3 - Surface/Thermocline/Bottom												
2010										x		
2011	x					x						
2012												
Surface Water _ Other Lakes and Ponds												
Water Quality												
Booker Lake - Surface/Deep												
2004												
2005												
2006									x			
2007							x					
2008												
2009												
2010									x			
2011												
2012												
Natowite Lake												
2010												
2011												
Ore Pond												
2004												
2005												
2006									x			
2007							x					
2008												
2009												
2010												
2011												
2012												
Pond W												
2008												
2009												
2010												
2011												
2012												
Pond X												
2004												
2005												
2006									x			
2007							x					
2008												
2009												
2010												
2011												
2012												
Pond Y (00302-BABL												
2004												
2005												
2006									x			
2007							x					
2008												
2009												
2010												
2011												
2012												
Pond Z (00309-BABL)												
2004												
2005												
2006									x			
2007							x					
2008												
2009												
2010												
2011												
2012												
Olympic Lake												
2010									x			
2011												
2012												
Reference Lake (Tochcha 308436 6097986)												
2008												
2009												
2010												
2011												
2012												
Surface Water Quality Cubes and Barrels												

Depth	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
2009												
2010										X		
2011	X					x						
2012												
Site D - (Diffuser)Surface/Thermocline/Deep												
2004												
2005												
2006									X			
2007												
2008							X					
2009												
2010			X							X		
2011						x						
2012												
Site E - Surface/Deep												
2004												
2005												
2006									X			
2007												
2008							X					
2009												
2010										X		
2011	X					x						
Morrison Lake												
2010												
2011						x						
Surface Water _ Nakinilerak Lake												
Depth Profile (Limnology / Physical Properties)												
Nak 1 - Surface/Thermocline/Bottom												
2009						X						
2010												
2011	X					x						
2012												
Nak 2 - Surface/Thermocline/Bottom												
2010												
2011	X					x						
2012												
Nak 3 - Surface/Thermocline/Bottom												
2010												
2011	X					x						
2012												
Surface Water _ Other Lakes and Ponds												
Depth Profile (Limnology / Physical Properties)												
Booker Lake - Surface/Deep												
2004												
2005												
2006									X			
2007							X					
2008												
2009												
2010										X		
2011												
2012												
Natowite Lake												
2010												
2011												
Ore Pond												
2004												
2005												
2006									X			
2007							X					
2008												
2009												
2010												
2011												
2012												
Pond W												
2008												
2009												
2010												
2011												
2012												
Pond X												
2004												
2005												
2006									X			
2007							X					
2008												
2009												
2010												
2011												
2012												
Pond Y (00302-BABL												
2004												
2005												
2006									X			
2007							X					
2008												
2009												
2010												
2011												
2012												
Pond Z (00309-BABL)												
2004												
2005												
2006									X			
2007							X					
2008												
2009												
2010												
2011												
2012												
Olympic Lake												
2010												
2011												
2012												
Reference Lake (Tochcha 308436 6097986)												
2008												
2009												
2010												
2011												
2012												
Surface Water Quality Cubes and Barrels												

Sediment	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
2009												
2010												
2011												
2012												
Site D - (Diffuser)Surface/Thermocline/Deep												
2004												
2005												
2006								X				
2007												
2008							X					
2009												
2010												
2011												
2012												
Site E - Surface/Deep												
2004												
2005												
2006								X				
2007												
2008							X					
2009												
2010												
2011												
Morrison Lake												
2010												
2011												
Surface Water _ Nakinilerak Lake												
Sediment												
Nak 1 - Surface/Thermocline/Bottom												
2009												
2010												
2011												
2012												
Nak 2 - Surface/Thermocline/Bottom												
2010												
2011												
2012												
Nak 3 - Surface/Thermocline/Bottom												
2010												
2011												
2012												
Surface Water _ Other Lakes and Ponds												
Sediment												
Booker Lake - Surface/Deep												
2004												
2005												
2006									X			
2007							X					
2008												
2009												
2010			X									
2011												
2012												
Natowite Lake												
2010												
2011												
Ore Pond												
2004												
2005												
2006									X			
2007							X					
2008												
2009												
2010			X									
2011												
2012												
Pond W												
2008												
2009												
2010												
2011												
2012												
Pond X												
2004												
2005												
2006									X			
2007							X					
2008												
2009												
2010												
2011												
2012												
Pond Y (00302-BABL												
2004												
2005												
2006									X			
2007							X					
2008												
2009												
2010												
2011												
2012												
Pond Z (00309-BABL)												
2004												
2005												
2006									X			
2007							X					
2008												
2009												
2010												
2011												
2012												
Olympic Lake												
2010												
2011												
2012												
Reference Lake (Tochcha 308436 6097986)												
2008												
2009												
2010												
2011												
2012												
Surface Water Quality Cubes and Barrels												

Flow	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
2009												
2010												
2011												
2012												
Site D - (Diffuser)Surface/Thermocline/Deep												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012												
Site E - Surface/Deep												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
Morrison Lake												
2010												
2011												
Surface Water _ Nakinilerak Lake												
Flow												
Nak 1 - Surface/Thermocline/Bottom												
2009												
2010												
2011												
2012												
Nak 2 - Surface/Thermocline/Bottom												
2010												
2011												
2012												
Nak 3 - Surface/Thermocline/Bottom												
2010												
2011												
2012												
Surface Water _ Other Lakes and Ponds												
Flow												
Booker Lake - Surface/Deep												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012												
Natowite Lake												
2010												
2011												
Ore Pond												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012												
Pond W												
2008												
2009												
2010												
2011												
2012												
Pond X												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012												
Pond Y (00302-BABL												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012												
Pond Z (00309-BABL)												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012												
Olympic Lake												
2010												
2011												
2012												
Reference Lake (Tochcha 308436 6097986)												
2008												
2009												
2010												
2011												
2012												
Surface Water Quality Cubes and Barrels												

Fish Habitat	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
2009												
2010							Char Survey (FWS, Smithers, NO DATA)					
2011												
2012												
Site D - (Diffuser)Surface/Thermocline/Deep												
2004							X					
2005												
2006												
2007							X					
2008							X					
2009												
2010												
2011												
2012												
Site E - Surface/Deep												
2004							X					
2005												
2006												
2007												
2008												
2009												
2010												
2011												
Morrison Lake												
2010												
2011												
Surface Water _ Nakinilerak Lake												
Fish Habitat												
Nak 1 - Surface/Thermocline/Bottom												
2009						X						
2010												
2011												
2012												
Nak 2 - Surface/Thermocline/Bottom												
2010							Char Survey (FWS, Smithers, NO DATA)					
2011												
2012												
Nak 3 - Surface/Thermocline/Bottom												
2010												
2011												
2012												
Surface Water _ Other Lakes and Ponds												
Fish Habitat												
Booker Lake - Surface/Deep												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012												
Natowite Lake												
2010												
2011												
Ore Pond												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012												
Pond W												
2008												
2009												
2010												
2011												
2012												
Pond X												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012												
Pond Y (00302-BABL												
2004								X				
2005												
2006												
2007												
2008												
2009												
2010							X					
2011												
2012												
Pond Z (00309-BABL)												
2004								X				
2005												
2006												
2007												
2008												
2009												
2010							X					
2011												
2012												
Olympic Lake												
2010						X						
2011												
2012												
Reference Lake (Tochcha 308436 6097986)												
2008												
2009												
2010												
2011												
2012												
Surface Water Quality Cubes and Barrels												

Fish Survey	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
2009												
2010												
2011												
2012												
Site D - (Diffuser)Surface/Thermocline/Deep												
2004												
2005												
2006												
2007												
2008							X					
2009												
2010												
2011												
2012												
Site E - Surface/Deep												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
Morrison Lake												
2010								X				
2011												
Surface Water _ Nakinilerak Lake												
Fish Survey												
Nak 1 - Surface/Thermocline/Bottom												
2009						X						
2010												
2011												
2012												
Nak 2 - Surface/Thermocline/Bottom												
2010												
2011												
2012												
Nak 3 - Surface/Thermocline/Bottom												
2010												
2011												
2012												
Surface Water _ Other Lakes and Ponds												
Fish Survey												
Booker Lake - Surface/Deep												
2004												
2005												
2006								X				
2007												
2008												
2009												
2010												
2011												
2012												
Natowite Lake												
2010								X				
2011												
Ore Pond												
2004												
2005												
2006								X				
2007												
2008												
2009												
2010												
2011												
2012												
Pond W												
2008							X					
2009												
2010												
2011												
2012												
Pond X												
2004												
2005												
2006								X				
2007												
2008							X					
2009												
2010												
2011												
2012												
Pond Y (00302-BABL												
2004												
2005												
2006								X				
2007												
2008												
2009												
2010							X					
2011												
2012												
Pond Z (00309-BABL)												
2004												
2005												
2006								X				
2007												
2008												
2009												
2010							X					
2011												
2012												
Olympic Lake												
2010												
2011												
2012												
Reference Lake (Tochcha 308436 6097986)												
2008						X						
2009												
2010												
2011												
2012												
Surface Water Quality Cubes and Barrels												

Fish Tissue	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC
2009												
2010							*MOE tissues concerns with contamination					
2011												
2012												
Site D - (Diffuser)Surface/Thermocline/Deep												
2004												
2005												
2006												
2007									X	X		
2008												
2009												
2010												
2011												
2012												
Site E - Surface/Deep												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
Morrison Lake												
2010												
2011												
Surface Water _ Nakinilerak Lake												
Fish Tissue												
Nak 1 - Surface/Thermocline/Bottom												
2009												
2010										X		
2011												
2012												
Nak 2 - Surface/Thermocline/Bottom												
2010										X		
2011												
2012												
Nak 3 - Surface/Thermocline/Bottom												
2010												
2011												
2012												
Surface Water _ Other Lakes and Ponds												
Fish Tissue												
Booker Lake - Surface/Deep												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012												
Natowite Lake												
2010												
2011												
Ore Pond												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012												
Pond W												
2008												
2009												
2010												
2011												
2012												
Pond X												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012												
Pond Y (00302-BABL												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012												
Pond Z (00309-BABL)												
2004												
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012												
Olympic Lake												
2010												
2011												
2012												
Reference Lake (Tochcha 308436 6097986)												
2008												
2009												
2010												
2011												
2012												
Surface Water Quality Cubes and Barrels												

Bray Curtis Percent Similarity Values of Benthos	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN
2009													
2010													
2011													
2012													
Site D - (Diffuser)Surface/Thermocline/Deep													
2004													
2005													
2006								X					
2007													
2008													
2009													
2010													
2011													
2012													
Site E - Surface/Deep													
2004													
2005													
2006								X					
2007													
2008													
2009													
2010													
2011													
Morrison Lake													
2010													
2011													
Surface Water _ Nakinilerak Lake													
Bray Curtis Percent Similarity Values of Benthos													
Nak 1 - Surface/Thermocline/Bottom													
2009													
2010													
2011													
2012													
Nak 2 - Surface/Thermocline/Bottom													
2010													
2011													
2012													
Nak 3 - Surface/Thermocline/Bottom													
2010													
2011													
2012													
Surface Water _ Other Lakes and Ponds													
Bray Curtis Percent Similarity Values of Benthos													
Booker Lake - Surface/Deep													
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012													
Natowite Lake													
2010													
2011													
Ore Pond													
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012													
Pond W													
2008													
2009													
2010													
2011													
2012													
Pond X													
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012													
Pond Y (00302-BABL													
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012													
Pond Z (00309-BABL)													
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012													
Olympic Lake													
2010													
2011													
2012													
Reference Lake (Tochcha 308436 6097986)													
2008													
2009													
2010													
2011													
2012													
Surface Water Quality Cubes and Barrels													