APPENDIX I

Morrison Off-Lake Channel Compensation Plan Photos

Photo 1 Proposed off-lake channel location on the southeast shoreline of Morrison Lake

Photo 2 Typical vegetation within the proposed off-lake channel area

Photo 3 Shoreline with emergent vegetation and LWD at the proposed off-lake channel location

Photo 4 Vegetation and topography in the proposed off-lake channel location

Photo 5 Riparian and shoreline vegetation at the proposed off-lake channel location

Photo 6 Riparian vegetation at the proposed off-lake channel location

Photo 7 Soil profile within the off-lake channel area

Photo 8 Proposed off-lake channel vegetation and topography

Photo 9 Vegetation at the proposed off-lake channel site

Photo 10 Morrison Lake Shoreline at the proposed off-lake channel site

Photo 11 Morrison Lake shoreline and vegetation at the proposed off-lake channel site

APPENDIX II

Olympic Creek Compensation Works Photos

Photo 1 Olympic Lake

Photo 2 Beaver Dams and flooded forest at the Olympic Lake outlet

Photo 3 Olympic Creek Outlet into Morrison Lake

Photo 4 Angular cobble and boulders in Olympic Creek

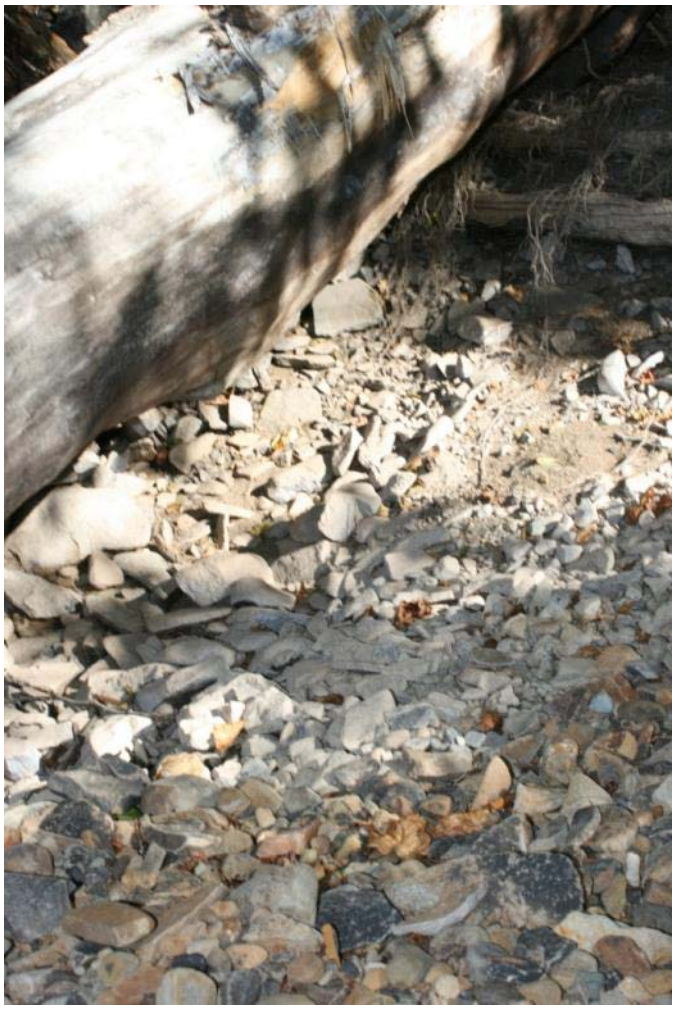

Photo 5 LWD and substrates in lower Olympic Creek

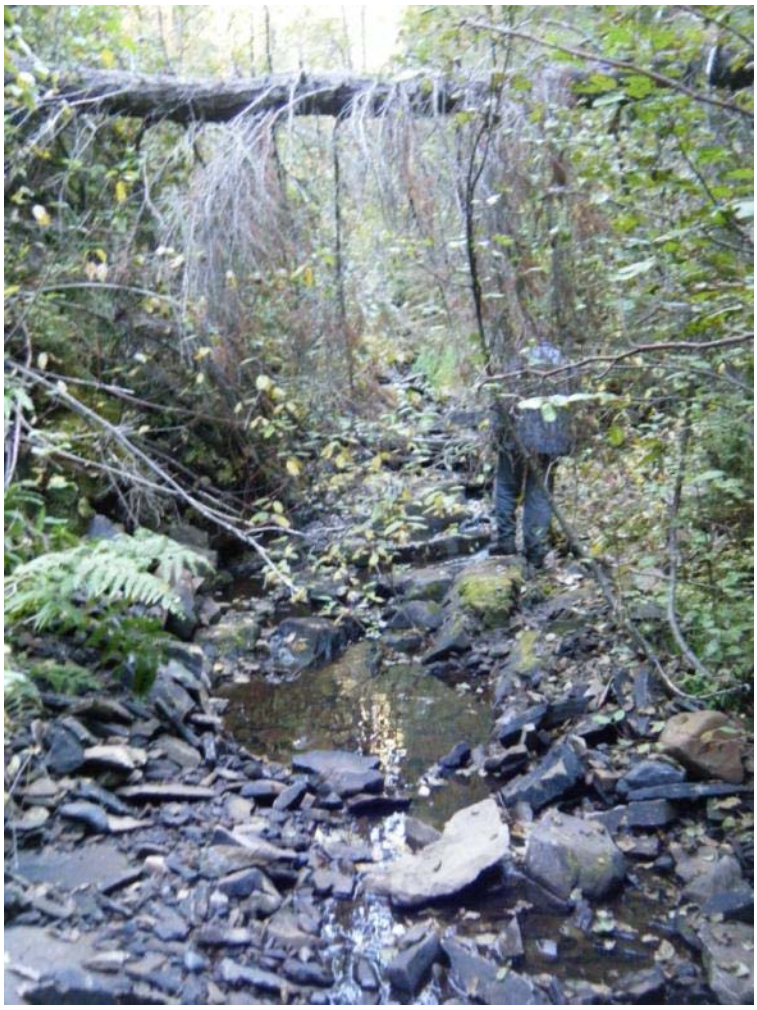

Photo 6 Isolated pools within Olympic Creek

Photo 7 One of several beaver dams blocking Olympic Lake outlet to Olympic Creek

Photo 8 Typical Olympic Creek boulders and riparian vegetation

Photo 9 Olympic Creek main channel near Morrison Lake

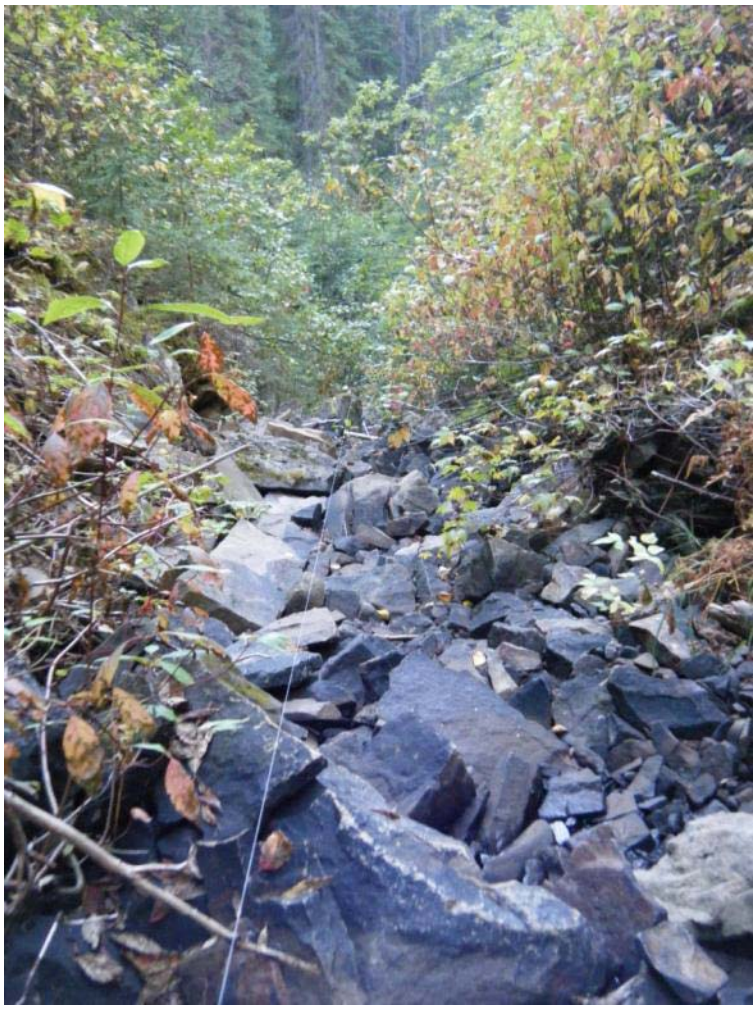

Photo 10 Angular boulders within the Olympic Creek

APPENDIX III

Fish Habitat Compensation Options (Report dated August 9, 2010)

Klohn Crippen Berger

December 7, 2010

Pacific Booker Minerals Inc.
#1702 - 1166 Alberni Street
Vancouver, British Columbia
V6E 3Z3

Mr. Erik Tornquist
Executive Director

Dear Mr. Tornquist:

Morrison Copper/Gold Project
Fish Habitat Compensation Options

Please find attached the above named report, which was prepared in August 2010. The objective of the report was to quantify the Fish Habitat Compensation Options for the Morrison Copper/Gold Project. The purpose of the report was to provide a framework for discussions with the Lake Babine First Nations (LBFN), DFO and other regulatory agencies with respect to optimizing the fish habitat compensation works to best meet the needs and objectives of reducing harmful effects and increasing/enhancing fish habitat in the area.

The report also includes additional information requested by the Department of Fisheries and Oceans (DFO) with respect to their responses to the Environmental Assessment Application – Addendum letters dated June 11, 2010.

Subsequent to this report, Pacific Booker Minerals (PBM) has carried out additional site work and aquatic and engineering studies to develop the Fish Habitat Compensation Plan (FHCP) for the Project.

This report, therefore, is superseded by the FHCP report, dated December 7, 2010. The main adjustments to the options presented in this report include feedback from DFO and the Lake Babine Nation (LBN), with respect to the preference of options. In general, LBN appear supportive of options that increase spawning capacity in Morrison Lake or Morrison Creek and increase the overall productive capacity with some utilization of beaver management. DFO have subsequently indicated that shoal options in Morrison Lake are not preferred.

PBM are committed to working with LBN and DFO to continue to optimize the FHCP to ensure that the loss of productive capacity of the aquatic habitat is mitigated, and to implement options which provide effective results.

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

Please contact the undersigned at your convenience if you have any questions or wish to discuss any aspect of this report.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Harvey McLeod, P.Eng., P.Geo.
Project Director

HM/JJ:tc

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1. INTRODUCTION

1.1 Background

Pacific Booker Minerals (PBM) is proposing to develop an open pit copper/gold mine on the east side of Morrison Lake, north of Babine Lake, in north-central British Columbia. PBM submitted an application for an Environmental Certificate from the Environmental Assessment Office (EAO) on September 28, 2009 (Rescan, 2009). The EAC Application was screened against the TOR by the Working Group, ministries and regulatory agencies including MOE and DFO, who provided comments as well as information requests to PBM.

Klohn Crippen Berger (KCB) was retained by PBM to address the deficiencies in the EAC Application leading to preparation of an Addendum to the EAC Application, which was submitted May 25, 2010. Additionally, on June 23, 2010, a letter on EAC Screening Clarifications (KCB) was issued that has since been included in the Addendum. The entire EAC Application inclusive of the Addendum was published on the EAO website on July 12, 2010 and is thus available publicly for the review Phase of the Environmental Assessment. It is understood that the Working Group including DFO will further review the EAC Application.

Since the submission of the Addendum, further comments and information requests were released to PBM on June 30, 2010 (DFO letter to EAO of June 11, 2010). Unfortunately this DFO letter was not available to PBM when the KCB letter of June 23, 2010 was issued. Therefore this current KCB letter has been prepared to address the outstanding deficiencies in the EAC Application, provide new information from field work completed in June 2010 and present updates to the fish habitat compensation plan. As noted herein, this letter updates and supersedes some of previously submitted information.

1.2 Requested Additional Information Requirements

The June 11, 2010, letter from DFO to the EAO (Appendix A) identified the primary remaining information requirements as follows:

- Physical fish habitat impacts resulting from the freshwater intake and effluent diffuser and the loss of riparian areas must be described and included in the fish habitat compensation balance tables;
- Fish habitat impacts associated with flow reductions to Stream 6070 must be provided;
- Confirmation of fish presence/absence must be provided for the streams/ wetlands within the area of the proposed TSF; and
- Fish Habitat Compensation Plans must be at an acceptable level to determine if impacts to fish habitat can be suitably mitigated in order to reach a determination on the significance of environmental effects and thus conclude the environmental assessment pursuant to CEAA.

The June 11 letter and attached table of comments also included recommendations and additional information requirements, including:

- A shoreline survey on both the east and west sides of Morrison Lake near the proposed mine site;
- Assessment of the effects of diversion ditches on stream flows and fish habitat;
- Rationale for no seepage pond below the west dam of the TSF;
- A map to show the locations of proposed fish habitat compensation sites;
- The fish habitat compensation plan should include more details on the treatments to enhance the productive capacity of fish habitat;

- Inclusion of all potential HADD's (harmful alteration disruption or destruction) of fish habitat in the HADD/ compensation tables;
- Further information on Nakinilerak Lake and Stream 10 (6070); and
- Further information on the fish habitat in Morrison Lake adjacent to the proposed site for the low grade ore stockpile (LGS).

The DFO letter of June 11 also noted that:

- Compensation options will not be considered as a means to address chemical pollution and contamination problems; and
- The creation of a TSF pond at the closure of the mine is not considered an acceptable form of compensation to offset the loss of aquatic habitat caused by the project.

The HADD area calculations and compensation options have been developed in more detail to account for the field work carried out in 2010 and more detailed water management optimization. These changes include modification/maintenance of flows to Stream 53400 (Stream 7) and field observations, as well as adjustments for specific structures and areas. The revised habitat balance also reflects the comments provided by DFO in the June 11, 2010, letter to the EAO.

1.3 Supplementary Fisheries Work

Since submitting the Addendum to the EAC Application in May 2010, and in light of the concerns raised by DFO in the letter of June 11, 2010, to the EAO, PBM commissioned KCB to conduct additional field surveys and further assess the potential effects, mitigation plans and compensation options for the Morrison Project.

In June, 2010, KCB personnel conducted further field inspections of streams, lakes, ponds and wetlands in the Project area, including both the potentially affected water-

bodies and those proposed as habitat compensation sites. Aerial, ground and/or snorkel surveys were completed in several small lakes (expanded beaver ponds) in the Morrison and Nakinilerak Lake drainages, including (see also Figure 1.1):

- Ponds in the TSF area;
- "Olympic Lake" and "Oval Pond" in Stream 77300 off Morrison Lake;
- Pond in Stream 09600 tributary to Tahlo Creek (99100);
- Large pond tributary to Nakinilerak Lake;
- Stream 6070 (MCS-10);
- Stream 53400 (MCS-7); and
- Morrison Lake shoreline.

The snorkel surveys were conducted by experienced fisheries biologists and included all, or most, of the shore-zone area and across each pond visited, on-ground and aerial photography and visual habitat assessment.

Stream flow and *in situ* water quality measurements were made in key locations on the Project site. Several other watercourses and wetlands were also surveyed by air and at accessible ground locations in June 2010. The observations in those surveys were applied to the assessment and are included here in the discussion of the identified fisheries concerns for the Project, including the final HADD area determinations and our recommendations for mitigation and fish habitat compensation.

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665,000 670,000 675,000

6,130,000 6,125,000 6,120,000

N

Tahlo Tributary Lake

Stream 09600

Nakinilerak Lake

Oval Lake

Olympic Lake

Nakinilerak Tributary Lake

Stream 77300

Morrison Lake

Stream 6070 (MCS-10)

TSF Pond

Proposed Tailings Facility Footprint

Off-Channel Area

Stream 53400 (MCS-7)

Stream 44800 (MCS6)

Proposed Mine Site Footprint

Booker Lake

Stream 2900 (MCS-5)

Rock Reef

Off-Lake Area

Stream 25500 (MCS-4)

665,000 670,000 675,000

Legend

- Proposed Treatment Plant Discharge Line and Diffuser
- Proposed Freshwater Intake Line
- Major Contours
- Minor Contours
- Rivers and Streams
- Lakes and Ponds

Notes:
1. UTM Zone 9N, NAD83
2. Contour interval is 20m.
3. Map data is BC TRIM (1:20,000)

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN-CRIPPEN REPORT DATED _____

0 2,000 m

CLIENT pbm

Klohn Crippen Berger

PROJECT MORRISON COPPER/GOLD PROJECT
LAKE EFFECTS ASSESSMENT

TITLE FISH HABITAT COMPENSATION PLAN MAP

PROJECT No. M09382A03

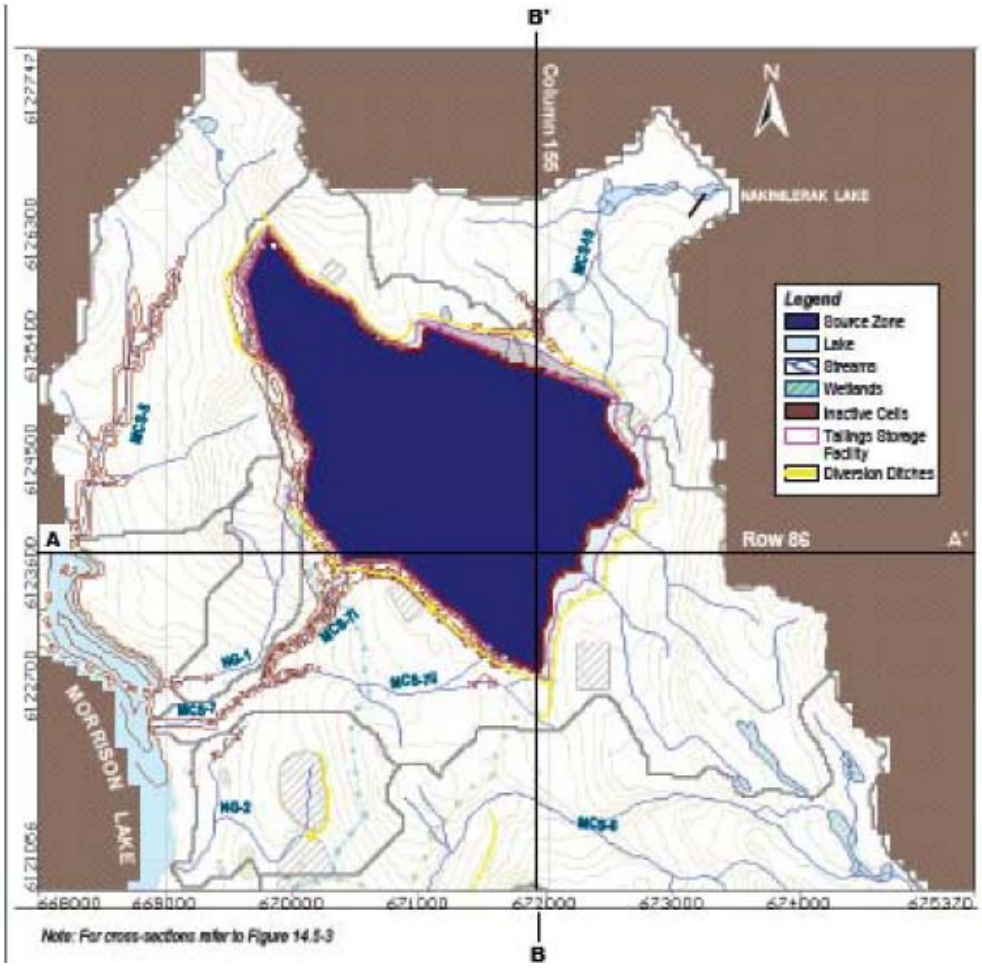
FIG No. 1.1

1.4 Drainage Re-Design

As a result of the recent site investigation and considering the proposal in the initial EAC Application, it is recognized that changing the water management plan for Stream 53400 (Stream 7) will allow for the retention of all of the fish-bearing length of the creek, as well as the riparian area along that part of the creek. This proposed design change is believed to minimize any project impacts to fish or riparian habitat within Stream 7.

1.4.1 Previous Design Reducing Stream 53400 Flows

It was originally planned to divert water along the south-west side of the TSF into tributary MCS-7ii in Figure 3.2 of the Addendum Appendix AB and thence to Stream 53400 (Stream 7 aka MCS-7).



This proposed design would have almost entirely dewatered the upper 977 m of fish-bearing habitat above where MCS-7ii merges with MCS-7i to become Stream 53400, while retaining most of the flow in the lower 1,032 m to Morrison Lake. This was the basis for the HADD projections used in the EAC Application (Rescan, 2009) and in the subsequent Addendum Appendix AB (KCB, 2010).

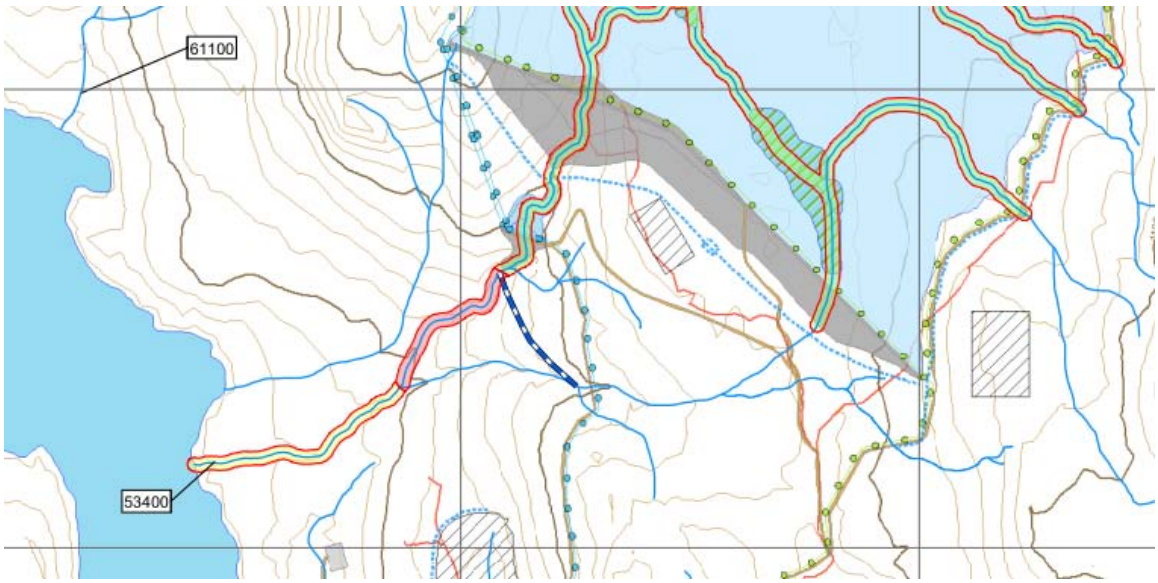
1.4.2 Option for Maintaining Stream 7 (53400) Flows Discussed in EAC Application

The benefit of avoiding the dewatering of the upper 977m of fish bearing habitat in MCS-7i was recognized but deemed to be "unlikely" in the EAC Application,

Volume III, Section 13.6.5.3 'Unlikely Mitigation and Compensation Locations', page 13.39 states:

> Previously, water diversion channels have been designed to replicate natural stream habitat to provide habitat compensation for mining projects (Rescan 2003, 2007). Therefore, the possibility exists to design the proposed TSF water diversion into stream 53400 as a natural watercourse capable of providing additional rearing habitat for rainbow trout. However, the current watershed upstream of this reach is non-fish-bearing because of a high gradient (37%) cascade barrier (see Section 7.10) and the diversion channel will travel across this same gradient, albeit at an oblique angle (Figure 13.6-1). Constructing a diversion channel that matches the 4% gradient of the fish-bearing upper reach would require a final approach approximately 230 m long into the 20 m high canyon that contains the upper reach of stream 53400. Therefore, a diversion designed to provide fish habitat is unlikely for this location because of these engineering constraints.

EAC Application, Volume III, Figure 13.6.1



1.4.3 New Design Option for Maintaining Stream 7 Flows

PBM now proposes to avoid the dewatering of the upper 977 m of fish bearing habitat in MCS-7i. However, rather than implement the "unlikely" option described in the EAC Application, PBM proposes to alter the water management plan to direct water from the diversion ditches along the south and east side of the TSF then into MCS-7i just below the seepage dam. During construction, operations and initial closure this design will maintain majority of the flow[1] to the 977 m section of MCS-7i between the seepage dam and the intersection with MCS-7ii. Ultimately, after closure, when the water quality in the TSF is suitable for direct discharge to streams, sufficient water will be directed to MSC-7i to restore the full flow in MCS-7i.

This alteration to the water management plan will achieve the retention of approximately 0.3 ha of fish-occupied habitat and 5.9 ha of riparian habitat that was previously included as lost fish-bearing habitat and this is reflected in the revised habitat budget tables.

[1] If sufficient flow is not achieved by designing the diversion to sustain the flow then a separate small (4"-6"diameter) dedicated pipeline will be installed to provide freshwater, drawn from the intake in Morrison Lake, to Stream 7 just below the seepage control dam on any occasion that more water is needed for fish. Supplemental flows of several litres per second could be readily applied as needed during mine operations and in post-closure until the TSF pond water is suitable for direct decant to Stream 7.

2. PROJECT EFFECTS

2.1 HADD's of Fish Bearing Habitat

As the key fisheries concerns relate to HADD and compensation areas, the areas of fish habitat impacted by the proposed project are shown below, followed by discussion of each area. Residual impacts to fish bearing habitat will be offset by the construction of compensatory habitat as described in Section 4.0 of this report.

2.1.1 Initial EAC Application HADDs of Fish Bearing Habitat

The EAC Application (EAC Application, Volume III, Table 13.6-1) describes the impacts of the Morrison Project on fish habitat to include permanent displacement of 2.23 ha of streams and 19.46 ha of wetted pond habitat (Table 2.1). The determination of stream HADD areas assumed an average stream width of 1.5 m, except for stream 53400 for which the mean wetted width was conservatively taken as 3.4 m, the width at the creek mouth on Morrison Lake (EAC Application, Volume III, Section 13.6.2, page 13-32). The estimated stream and pond areas lost to Project infrastructure were summarized in Table 13.6-1 in the EAC Application, and are shown below in Table 2.1.

Table 2.1 Fish Habitat Losses to Project Infrastructure per EAC Application

Watershed Basin	Infrastructure Type	Stream Area Lost (ha)	Lake/Pond Area Lost (ha)
Morrison Lake	TSF	1.64	8.95
	WRD	0.37	0.81
	Seepage Ponds	0.05	n/a
	Open Pit	0.17	9.70
Totals		**2.23**	**19.46**

The areas to be lost were shown by stream name, fish species and habitat type in Table 13.6-2 in the EAC Application (Rescan, 2009) as follows (Table 2.2).

Table 2.2 Areas Lost by Stream and Habitat Type as Shown in the EAC Application

Stream	Length Lost (m)	Width Lost (m)	Stream Area Lost (ha)	Riparian Area Lost (ha)	Fish Species	Habitat Type	Habitat Quality
Complete loss of fish habitat							
2900 (MCS-5, Mine area)	150	1.5	0.023	1.35	RB, CO	Rearing	Fair
53400 (MCS-7)	977	3.4	0.332	19.93	RB	Rearing	Good
Total			0.355	21.28			
Partial loss of fish habitat							
25500 (mine area)	164	0.10	0.002	n/a	RB, CO	Rearing	Good
44800 (MCS-6)	3,041	0.03	0.009	n/a	RB, CO	Rearing, spawning	Good
53400 (MCS-7)	1,032	0.38	0.040	n/a	RB	Rearing, spawning	Good, fair
Total			0.050				
Total Lost Habitat			**0.405**	**21.28**			

2.1.2 Revised HADD Areas

To clarify the amounts of fish habitat, both barren and fish-occupied, to be displaced by the Morrison Project, each remaining area of concern is discussed more fully below.

2.1.2.1 Stream 7 (53400): Downstream of TSF

For this detailed HADD assessment, KCB has reviewed the water management plan to achieve maintenance of flows in MCS-7i in Stream 53400, downstream of Main Dam of the Tailings Storage Facility (TSF). As described in Section 1.4.3, the design of the TSF diversion ditches will be changed to ensure that the flow in MCS-7i is maintained, thus achieving retention of approximately 0.3 ha of fish-occupied habitat and 5.9 ha of riparian habitat that was previously included as lost fish-bearing habitat.

The diversion channel for creek flow around the TSF area will connect to MCS-7i immediately below the seepage control dam and provide flow in the creek over the full length to Morrison Lake. However, as the full original flow in MCS-7i will not be maintained, the aquatic area lost during mine life will be approximately 0.38 m wetted width of an average 3.40 m wetted width. After mine closure, 100% of the upstream catchment flow will be returned to the creek, such that it will continue to support fish to the same linear extent as at present.

The upper area of Stream 53400 (MCS-7) which is fed from MCS-7i will also be subject to partial flow loss causing an average 0.38 m decrease in wetted width on a mean wetted width of 3.4 m (as in the EAC Application and Addendum) over a length of 1032 m. Thus the total fish habitat area in the main Stream 53400 lost to partial dewatering is taken as 0.38 m less wetted width over the 2,009 m (977 m + 1,032 m) of fish-occupied creek from Morrison Lake to the rock chute fish migration barrier where the seepage control dam will be located. The fish habitat loss will total approximately 0.08 ha over that length of Stream 53400 (MCS-7) with no expected riparian habitat losses.

Therefore, PBM will commit to providing adequate fish-flow to MSC-7i below the TSF area in all phases of the Project and after mine closure, 100% of the original flow will be returned to the creek.

Hence the previously predicted loss of fish habitat in the 977 m of the fish-occupied area in MCS-7i will not occur and the changes in flow rates will not be permanent as was previously allowed for; rather the relatively modest changes in stream flow will be partial and temporal in nature.

Nutrient Supply from TSF Area to Stream 53400

Rescan (2010) studied drift invertebrates in Stream 53400 in July 2009 and found that most drift items came from terrestrial origins (e.g. adult craneflies, blackflies, mosquitoes, midges and caterpillars), along with stream-origin (autochthonous) taxa such as mayfly and stonefly nymphs. There was little difference in the numbers or proportions of species in the drift samples from upper to lower sections of Stream 53400. The drift samplers were set in groups of three in the upper, middle and lower sections of the creek for about 3 to 3.5 hours and the nine (9) nets filtered from 20.2 to 110.6 m^3 of water during the sampling time.

Average drift density (# organisms/m^3) was greater at the upper and middle sites than at the lower site. Densities ranged from 2.3 to 7.2 organisms/m^3 and the biomass ranged from 0.00025 to 0.0016 mg/m^3. For present assessment purposes, and in keeping with the results of the July 2009 field work by Rescan (2010), the higher figures will be used (i.e. 7.2 organisms/m^3 and 0.002 mg/m^3) to represent the numbers and biomass of nutrient materials entering the upper end of the fish-bearing reaches of Stream 53400.

Drift invertebrate species richness ranged from 14 taxa at the lower site to 17 taxa at the mid and upper stations. In almost all samples, adult craneflies (Tipulidae) of terrestrial origin dominated the catch, followed by other dipteran chironomids (e.g. midges, mosquitoes, blackflies) and mayflies (Ephemeroptera). The terrestrial portion of the drift samples comprised 68 to 78% of the taxa caught in the nets, particularly adult craneflies and caterpillars. There was a gradual increase in the numbers of stoneflies, dipterans and mayflies from the upper to lower sections of the creek (Rescan, 2010).

Fish stomach content (diet) analysis by Rescan (2010) showed few adult craneflies. Diptera (2-winged flies) and Lepidoptera (caterpillars/butterflies) and were the most abundant prey items of rainbow trout in Stream 53400. By weight, 65% of the stomach

contents of rainbow trout (N=8) consisted of lepidopterans, while ephemeropterans showed 16% and unidentified insect parts 10%. Comparison of the stomach and drift samples showed some overlap in represented invertebrate groups, including ephemeroptera, lepidoptera, coleoptera (beetles) and dipterans; however, the large numbers of craneflies found in the drift samples were not reflected in the fish stomach samples.

The uppermost traps caught material that may have originated in the TSF area, which includes approximately 10.6 ha of stream and pond habitat, such that the drift production was about 0.22 to 0.68 organisms per hectare. The densities of plankton and drift organisms in the largest pond in the TSF area were much greater than that (e.g. >100/m^3). If fish could access the pond, they would find a relatively dense food supply; this also applies to the barren ponds found during the field work as potential habitat compensation areas. By allowing direct fish access to the food sources, considerably more food would be available and fish production would increase.

2.1.2.2 Stream 10 Downstream of TSF

In addition to the areas shown in the above table and as noted in the DFO letter of June 11, 2010, fish habitat losses in Stream 6070 (MCS-10) should be added to the HADD areas. Stream 6070 is a tributary to Nakinilerak Lake and drains a small part of the proposed tailings storage facility (TSF). This stream was surveyed in June 2010 on the ground and by air, and water quality samples taken.

As indicated in the EAC Application, Stream 10 (6070) drains the geographic area from the proposed TSF to Nakinilerak Lake. Construction of the TSF North Dam and proposed seepage control dam immediately downstream of the North Dam will reduce the size of the Stream 6070 watershed. The current total watershed area of Stream 6070 is

approximately 399 ha (Figure 8.5-2 EACA Section 8.5.4.2). The TSF dam and related works, including the seepage dam, requires drainage losses of approximately 87 ha (21.8%) of the uppermost portion of the watershed. However, as described below, it is likely that the loss of stream flow is in fact less than the 87 ha determined in the EAC Application. Furthermore, the actual watershed loss will be temporal in nature, and will not result in a permanent reduction of drainage area.

Stream 10 (6070) originates near the natural divide between the watersheds draining into Morrison and Nakinilerak Lakes; it is roughly on this natural divide that the TSF North Dam will be constructed. Stream 6070 flows north eastward through dense mature mixed forest, alder and devil's club to the lake near its southern end (Figure 1.1). One moderately large beaver pond and several smaller dams occur in the middle reach (Figure 1.1, Photo 1). Channel widths are 0.5-2 m wide in the upper reach on the forested slope, and 3-4 m wide at the mouth at Nakinilerak Lake. Stream 6070 exhibits a riffle-glide habitat over patchy cobble/pebble substrates, with black soil banks, woody debris and dense riparian cover.

In the present assessment, as well as in the previous reports by KCB on this Project (Addendum to EAC Application, May 2010), Stream 6070 is considered fish-bearing for most of its length to the base of the slope of Hearn Hill ridge. It is known to support rainbow trout and red-side shiners in its mid-lower reaches (Bustard, 2005).

The proposed TSF will only displace the uppermost portion (approximately 200 m (0.02 ha)) of Stream 6070 and potentially reduce flows within the upper reach. Diversion ditches will be installed on both sides of Stream 6070 immediately below the TSF dam in that area to capture overland and shallow groundwater flow for realignment into the system. Assuming proportionality between the watershed area displaced and the wetted width and stream flow, the average wetted width of the creek will be reduced by

approximately 22%, or about 22 cm in a 1-m wide section within the upper reach well above the downstream beaver ponds. The percentage loss of wetted area was determined in the water balance modelling in the Addendum to the EAC Application (KCB 2010).

Lost flows to Stream 6070 will be partially mitigated by an additional flow of 2-3 litres/sec of tailings water seepage into the Stream, based on the most recent water balance modeling for the TSF as shown in the Addendum to the EAC Application. Most of the catchment area near the TSF will discharge to Stream 6070 in its upper reach, either via the diversion/collection ditches and dam, or at lower elevations from groundwater flow. The quality of this water is expected to meet all water quality guidelines (CCME and BCWQG) except for cadmium[2], which is also known to be elevated in the background groundwater system, and will be greatly diluted within a few meters (perhaps a few centimetres) of emerging into the surface drainage. No adverse effects of cadmium are anticipated for fish stocks in the creek and lake downstream.

During mine operations, the seepage dam will collect some of the drainage, from approximately 40 ha of watershed, for return pumping to the TSF. Drainage ditches will intercept upland drainage from approximately 47 ha of watershed, on both sides of Stream 6070 and divert that clean water to the system downstream of the seepage pond and thence to Nakinilerak Lake. The amounts of water and tailings seepage removed from the creek at the seepage control dam may cause partial dewatering of the creek below the seepage dam to at least the 1 m beaver pond downstream. The potential reduction in wetted area in the creek between the seepage dam and the 1 m downstream beaver pond is expected to be minimal, estimated on the order of 22%, or 0.36 m less

[2] The seepage water quality meets BCWQGs for aquatic life for all parameters, except cadmium, which is slightly elevated. However, baseline cadmium concentrations in groundwater significantly exceed guidelines and the predicted concentrations are not expected to be measureable, and, therefore, have a very low risk of a significant adverse environmental effect.

wetted width, which will apply over the affected stream length in that reach (850 m) for a total mean reduction in wetted area of approximately 300 m^2, or 0.03 ha.

Upon closure, the quality of the TSF seepages is predicted to meet all applicable water quality criteria (e.g. CCREM and BCWQO's for aquatic life). At that time, all drainage (i.e. TSF seepage, near-surface groundwater and overland runoff) will remain in the stream and move downstream as under natural conditions. The natural watershed area will be reinstated to its original size of 399 ha.

Our assessment concludes that about 22% loss of wetted width and a proportionate wetted area may occur on a temporary basis in the upper reach of Stream 6070 due to the placement of the proposed TSF for the Morrison Project. The dewatered area will become less relative to the wetted area farther downstream, as drainage from the rest of the watershed (including an unaffected tributary) and groundwater adds to the flow, and should be minimal at the creek mouth on Nakinilerak Lake. The ponded areas behind beaver dams will also remain approximately as they are (assuming no other influences), as the water levels are controlled more by the dams than the flow rates. The large pond in Stream 6070, which provides a substantial part of the fish-bearing habitat in the creek, will remain as is, except for any natural changes over time.

Stream 6070 will continue to support fish at approximately the same numbers and distribution as in the past, as most of the habitat loss will occur in the uppermost reach on the relatively steep (20%+) hill slope. Nevertheless, for conservative planning purposes, the 22% loss figure for wetted width was applied to this creek to calculate the potential HADD area, which was previously reported (KCB letter of June 23, 2010) as approximately 0.02 ha. The revised figure of 0.03 ha was added to the habitat compensation budget table in the revised compensation plan in this document.

2.1.2.3 Mine Area

Full or partial dewatering of the lowermost sections of Stream 2900 (MCS-5), Stream 25500 and possibly Stream 44800 (MCS-6) will result in a loss of approximately 0.15 ha of stream wetted area. These figures remain the same as in the EAC Application and the Addendum. Impacts associated with the dewatering of these watercourses will be offset by the construction of compensatory habitat as described in Section 4.0 of this report.

2.1.2.4 Freshwater and Effluent Pipelines

The freshwater and treated effluent pipelines will impact an estimated 0.07 ha of shoal and lake bottom habitat along the pipeline alignments (0.60 m wide displaced area over 160 m length and 0.30 m wide over 2,000 m, respectively). The area of shoal and lake bottom habitat was calculated based on the area of habitat below the high water mark which will be overlain by the freshwater and treated effluent pipelines. The impacts associated with the freshwater and effluent pipeline infrastructure will be offset by the construction of compensatory habitat as described in Section 4.0 of this report.

The bottom habitat along the pipelines would not be completely disrupted or destroyed and KCB recommend that 50% of the plan area of the pipelines be used for HADD calculations.

2.1.2.5 Summary of HADD/s

Table 2.3 shows the revised HADD compensation areas for the Morrison Copper/Gold Project.

Table 2.3 Areas of Fish-Occupied Habitat Lost by Stream Number and Habitat Type – Revised July 2010

Stream	Length Affected (m)	Width Lost (m)	Stream Area Lost (ha)	Riparian Area Lost (ha)	Fish Species	Habitat Type	Habitat Quality
Complete loss of fish-occupied habitat							
2900 (Mine area: MCS-5)	150	1.5	0.023	1.35	RB, CO	Rearing	Fair
Partial loss of fish-occupied habitat							
25500 (mine area)	164	0.10	0.002	n/a	RB, CO	Rearing	Good
44800 (Mine area: MCS-6)	3,041	0.03	0.009	n/a	RB, CO	Rearing, spawning	Good
53400 (TSF: MCS-7)	977	0.38	0.037	n/a	RB	Rearing	Good
53400 (TSF: MCS-7)	1,032	0.38	0.039	n/a	RB	Rearing, spawning	Good, fair
6070 (TSF: MCS-10)	1,200	0.33	0.04	n/a	RB, RSS	Rearing	Good
Diffuser pipeline	2000	0.3	0.03*	n/a	SO, CO, RB, OS	Lake bottom	Fair
Water supply pipeline	160	0.6	0.005*	n/a	SO, CO, RB, OS	Lake bottom	Fair
Total							
Total Lost Habitat			**0.18**	**1.35**			

* habitat losses for the pipelines are taken as 50% of the footprint areas

In the revised HADD figures (Table 2.3) the total fish-occupied aquatic habitat area lost to the Morrison Project is approximately 0.18 ha, or 1,800 m^2.

2.2 Barren Fish Habitat

Displacement of habitat will also occur for the barren (fishless) creeks and ponds within the Project area, including the ponds and creeks in the TSF area, Booker Lake and Ore Pond. These impacts will result in an overall loss of 27.5 ha of habitat that although barren, still support or produce aquatic organisms on which Morrison Lake fish depend (i.e. productive capacity). The overall productive capacity of the 27.5 ha of aquatic habitat impacts could be calculated using Rescan (2009) benthic invertebrate data to

measure these habitats current yield of biological material such as fish food organisms and organic matter. The average productive capacity for these fishless habitats can then be calculated (grams/m^3) and used to quantify the compensation required. Opportunities for compensation for productive capacity are described in Section 4.2 of this report. Preliminary estimates from the Rescan information are in the order of 0.002 mg of food production per cubic meter of stream flow from the barren fish habitat.

2.3 Riparian Areas and Wetlands

Approximately 1.35 ha of riparian area along fish-bearing stream habitat will be lost to the Project, mainly along Stream 2900, while about 16 ha will be lost adjacent to barren/fishless habitat, mainly in the TSF.

A total of 57 ha of wetland habitat (also fishless) will also be lost to the Project, mainly in the TSF area. Wetland habitat is considered semi-aquatic, with some nutrient value for fish downstream and feeding/ resting area mainly for birds and amphibians.

2.4 Summary of Project Effects

The impacted areas for both the fish-bearing and non fish-bearing water-bodies in the Project area are summarized in Table 2.4.

Table 2.4 Summary of HADD Areas and Compensation Options

Category	Area Affected (ha)
Fish Bearing – HADD's	0.18
Non-fish bearing ponds and stream sections	27.5
Riparian – fish bearing	1.35

3. SUPPLEMENTARY FISHERIES ASSESSMENT

Each of the items identified in the DFO letter of June 11, 2010, is discussed in more detail in the following sections.

3.1 Freshwater Intake and Treated Effluent Diffuser Pipelines

3.1.1 Freshwater Intake

The freshwater intake is used to supply potable water for the plant site and to offset the water balance during dry years or in the event of reduced pit dewatering inflow. The freshwater intake pipe will be 600 mm in diameter and extend 160 m into Morrison Lake. The pipeline will be buried in the ground on land and lie on the lake bottom to 20 m depth at the intake, with anchor blocks. The intake structure will be screened according to the screening guidelines for intakes (MOE 2006; i.e. with 0.1 inch perforations) to avoid entrainment of fish.

The average pumping rate from the water balance is 3 m^3/hr (0.83 lps); however the design pumping rate is 88 m^3/hr with a maximum capacity of 190 m^3/hr (55 lps). The pumping rate will depend on the actual water balance during operations.

The physical area that the pipeline will occupy on the lake bottom is approximately 100 m^2 or 0.01 ha. The final alignment of the pipeline will be determined in the detailed design and will be located to avoid potential spawning areas. Nonetheless, the potential effects to aquatic habitat will be limited to the pipeline alignment and within the shallow water depth (<2 m) where the pipeline will be buried below lake level.

The water intake will be used during construction, operations and early closure. It may however, also be retained for use in providing a small volume of fresh water for the water

treatment plant, and possibly to Stream 7 (53400) until TSF decants are suitable for direct release to the stream.

Operations Year -1 to ~Year 22

As noted in Addendum Appendix AC Water Management Design Section 4.9 Freshwater Intake:

The fresh water supply will be from Morrison Lake as shown on Drawing D-3105. The fresh/process water make-up system consists of a pump house and wet well located on shore, and a discharge pipeline to the plant site. Two Peerless 5 stage M12LD vertical turbine pumps will draw water from the well, connected to the lake by a 600 mm nominal diameter HDPE or steel intake pipeline. The intake line will be placed horizontally in a trench leading to the shoreline, approximately 2 m below average lake level. The pipeline will extend to a greater depth in the lake along the lake bottom, with a screened intake to prevent fish ingress. The discharge pipeline will be a 250 mm nominal diameter HDPE, SDR 11 pipe from the pump house to the plant site freshwater tank.

Closure Year 45+

The fresh water intake facility may continue to be used during the closure period for operation of the water treatment plant, summarized as follows:

As noted in Addendum Appendix AD Water Treatment Plant Design Section 4.1.1 Fresh Water System:

Fresh water will have to be supplied to the Water Treatment Plant. The design and cost of this system lies outside the scope of this study. Fresh water will be supplied to:

- Flocculent Preparation System;
- Gland Water System; and
- Emergency Shower.

The water will have to be non-corrosive in nature and with a minimum of suspended solids, and supplied at a minimum rate of 1.8 m^3/hr for the design feed.

3.1.2 Treated Effluent Pipeline and Diffuser

The water treatment plant will be commissioned in approximately Project Year 45 and will be used as long as required to treat surplus acidic water from the mine. The effluent diffuser discharge pipeline is 300 mm in diameter and extends 2000 m into Morrison Lake. The physical area on the lake bottom that the pipeline and the anchor blocks will occupy is approximately 600 m^2 or 0.06 ha. The final alignment of the pipeline will be determined in the detail design and will be located to avoid potential spawning areas. The potential effects to aquatic habitat will largely be limited to the pipeline alignment and within the shallow water depth (<2 m) where the pipeline will be buried below lake level.

The diffuser plume will be directed vertically upward and influence an area of up to 5.5 m radius and 40 m high, before meeting water quality guidelines for aquatic life beyond that initial mixing zone, as described more fully in the Addendum to the EAC Application.

Per Addendum Appendix AC Water Management Design, Section 6.6.3 Treatment *Plant Discharge:*

Discharge of treated water will be pumped to a submerged diffuser in Morrison Lake. The pump system will be housed within the treatment plant, and consist of two centrifugal pumps. Each pump is designed to pump the base flow, with one pump operating at all times and one pump on standby. During surge periods, both pumps will be operated for discharge at up to 1.5 times the base flow.

Water will be conveyed to the diffuser through a 300 mm diameter HDPE pipeline routed across the pipeline crossing and along the former ammonium nitrate and emulsion silos access road to the shore of Morrison Lake. The remaining 2000 m of pipeline will sit on the lake bottom weighted by concrete ballasts secured at 100 m intervals. The diffuser

discharge pipeline route is shown in Drawing D-3304. The average Morrison Lake water elevation is 732 masl, representing a total vertical head of -93 m. The total pipeline length is approximately 4300 m.

3.1.3 Morrison Lake Bottom

The proposed treated effluent pipeline from the treatment plant to the diffuser on the bottom in the deepest part of the north basin of Morrison Lake will traverse the lake bottom from the shallows in the littoral zone along the east side of the lake to the deeper areas well below the euphotic zone and thermocline. These areas are described below based on the work of Bustard (2005), Rescan (2009, 2010) and KCB field work in June 2010. In general, Morrison Lake is typical of many lakes in northern British Columbia – long and narrow with fine-grain sediments overlying glacial till gravels.

Bustard (2005) conducted a shoreline and littoral zone survey in Morrison Lake in July 2004, in which he characterized the lake bottom material as dominated by fines, with gravels underneath. Aquatic macrophytes are present in scattered patches in the euphotic littoral zone to approximately 4 m depth, beyond which there is insufficient light for productive photosynthesis. Rescan (2009) took sediment and benthic invertebrate samples from Morrison Lake in 2006 and 2007 that were also dominated by fine sediments. Most sites sampled by Rescan (2009) in 2006 (n=10) showed 26-68% clays, 32-575 silt and <1-33% sand, with <1% gravel. In 2007 (n=5), the sediments showed 12-37% clay, 6-56% silt, 12-73% sand and <1-33% gravel.

The total organic carbon (TOC) concentrations in the Morrison Lake sediments were relatively low at 6-9%. Metals showed a range of concentrations in the sediments, with some locations exceeding the BC and/or CCME guidelines for sediment quality. Iron, for example, exceeded the SEL (severe effects level) at all lake sites. Lead levels were below the LEL (lowest effects level) at all sites, while mercury exceeded the BC LEL

(0.2 mg/Kg) and the CCME ISQG (interim sediment quality guideline – 0.17 mg/Kg) at all lake sites in both years. Total zinc concentrations exceeded the BC LEL (120 mg/kg) in 2006 at 4 of the 5 lake sites, and the CCME ISQG guideline (123 mg/kg) was exceeded at 3 lake sites. No sites exceeded the CCME PEL (probable effects level – 315 mg/kg) or the BC SEL (820 mg/kg) in either year. Cadmium concentrations exceeded the BC LEL and CCME ISQG (0.6 mg/kg) in 3 of 5 locations; no sites exceeded the BC SEL (10 mg/kg) or the CCME PEL (3.5 mg/kg). All lake sites exceeded the BC LEL (16 mg/kg) and the CCME ISQG (37.3 mg/kg) criteria for copper concentrations; none exceeded the BC SEL (110 mg/kg) or CCME PEL (90 mg/kg).

As noted by Rescan (2009), the average density of benthic invertebrates in the five (5) lake sites sampled in 2007 ranged from 385 to 1,892 organisms/m^2. In 2006, the densities ranged from 237 to 557 invertebrates/m^2. These results indicated "significant variation in benthic density of Morrison Lake". Genus richness (diversity) ranged from 5 to 8 genera, except lake site A which showed 15 distinct taxa. Dipterans (2-winged flies) were dominant, followed by copepods, which were dominant at two of the five lake sites. The other taxa found in/on the lake sediments included: oligochaete worms, molluscs (snails and clams), nematodes, arachnids (spiders), cladoceran copepods, ostracods and megalopterans.

While the sediment and benthic invertebrate samples taken by Rescan (2008, 2009) were not in the deepest part of Morrison Lake, they likely represent a similar composition and perhaps greater density of organisms as occur in the deepest areas. As water temperatures, light penetration and biological activity are less in the deeper zones than in shallower water, fewer invertebrate numbers and taxa are likely to occur in the deep areas.

The lake bottom habitat could be characterized as cold and dark, with limited numbers and genera of benthic organisms living in and on fine grain sediments. The grain size and metals content of the sediments, as well as the life forms inhabiting those areas no doubt show a patchy distribution, as they do in the shallower parts of the lake.

Fish species, such as burbot and sucker, that typically live in close contact with lake sediments are also likely to occur in the deepest parts of the lake (approximately 60 m deep) and pelagic species, such as trout, salmon and char, would likely occur at depth in winter and in mid-summer (i.e. under ice and under warm water conditions, respectively). The species that occupy Morrison Lake include: sockeye, coho and chinook salmon, rainbow trout, dolly varden char, kokanee, cutthroat trout, lake whitefish, mountain whitefish, longnose sucker, largescale sucker, northern pikeminnow, redside shiner, peamouth chub, prickly sculpin and burbot. Only the burbot and possibly prickly sculpin are likely to remain at depth in the deepest areas for extended periods, while the other species likely occupy the lake shallows at most other times.

3.1.4 Pipeline Installation

In the shorezone areas of Morrison Lake where the freshwater and treated effluent pipelines would be installed, the lines will be buried in the shallow sediments and covered with clean rip-rap rock for protection against ice scour, wave action and boat traffic. To install the lines, the near-shore work areas from the high water mark to about 1.5 m deep in the lake will be isolated from the lake using rubber coffer dams, sand bags, geotextile lining and silt fencing to separate the work areas from the lake water. Sump pumps will be used to dewater the work areas for excavation and spoil removal in the dry. Environmental protection measures will follow those outlined in standard guidelines for work in and near fish habitat, as shown in Appendix IV.

The trenches will be excavated on the near-shore upland and into the shallow littoral zone of the lake to contain the pipelines underground. The shorezone area temporarily disturbed (1-2 days at each of the two locations) will be returned to their original configuration, except where rip-rap material is used for pipeline protection. Beyond about 1.5 m deep in the lake, the pipelines will rest on the lake bottom to their distal ends at the freshwater intake and treated effluent diffuser locations.

The aquatic area disturbed by the near-shore pipeline installations in underwater trenches will include the 50 cm wide pipeline alignment as well as a small area of rip-rap material that will replace the existing silt/sand/pebble/cobble substrates common to the lake shore (as observed by Bustard 2004 and by boat and air in the June 2010 field work by KCB). The trenched area within the lake at each installation will be <10 m long from the high water mark to the 1.5 m depth contour, and the width of the rip-rap cover will be approximately 2 m, for a total of 20 m^2 at each site, or 0.004 ha in total. That area would be changed from the existing conditions to small rock reefs that may be productive for aquatic life in the future.

3.1.5 Assessment of HADD Areas for the Pipelines

The HADD areas for the pipelines have now (July 2010) been added to the areas lost to the Project for habitat balance calculations. The HADD areas for both pipelines are taken as approximately 50% of the footprint areas. The effects of and mitigation measures for pipeline installation are also discussed.

Also, and in response to a point raised by DFO, no HADD area on the lake bottom will be associated with the treated effluent plume. The effluent plume is described and assessed in the Addendum (Appendix AB) to the EAC Application. No significant

biological effects of the treated effluent plume are anticipated in the water column or bottom substrates of Morrison Lake.

The proposed freshwater supply pipeline and the treated effluent pipeline in Morrison Lake will, according to DFO, cause a HADD on the lake bottom habitat. While our professional opinion is that the pipelines will not cause a *harmful* alteration, disruption or destruction of fish habitat, but rather will provide hard surface area for attaching algae and cover for benthic invertebrates living beside and under the pipes, 50% of the footprints of the pipelines are treated here as HADD's to reflect DFO's assessment on those structures.

The widths of the pipeline alignments are 60 cm for the water supply line and 30 cm for the treated effluent line, such that the footprint area for the water supply and effluent pipelines would be about 96 m^2 and 600 m^2, respectively, or 0.07 ha in total. Fifty percent of that area has been added to the HADD tables to reflect some habitat displacement effect for the pipelines. Installation of the pipelines on the lake bottom will be completed using a barge from which the lines will be lowered to the lake bottom. Some incidental disturbance of the sediments near the final alignment may occur as the lines are manoeuvred into place; however, this brief and temporary disturbance is not considered fatally harmful to aquatic life and should cause no significant mortalities of fish or invertebrates. For calculation purposes, a 50 cm alignment width is used, rather than the 30 cm pipe diameter, to account for the concrete weights and temporary disturbances.

The effects of pipeline installation in the littoral zone of Morrison Lake are also considered here and mitigation measures recommended to protect the aquatic environment during the construction phase.

3.2 Stream 10 (Creek 6070) and Nakinilerak Lake

Baseline information for Stream 10a and Nakinilerak Lake is available in various third party reports as well as in data collected by PBM and their environmental consultants and is provided in the following documents:

- A Reconnaissance Survey of Nakinilerak lake (BCLKS-6072), Ministry of Sustainable Resource Management, Technical Report, (Burns and Tredger 1975) – Appendix III.
- Bathymetry Map – Appendix II.
- Fish and Fish Habitat & Aquatic Resources (2009 Rescan) - EAC Application Addendum Appendix AE.

Other key references to baseline information and effects assessment from the EAC Addendum Appendix AB Lake Effects are summarized in the attached Appendix I and Appendix II.

Nakinilerak Lake is located north of the tailings facility and approximately 150 m higher in elevation than Morrison Lake (Figure 1.1). The Lake is approximately 7.5 km long, with a surface area of approximately 7.3 km^2, a maximum depth of 29 m and a lake volume of approximately 80 Mm^3. A bathymetry Map of Nakinilerak Lake is included in Appendix II and a summary of the information contained in the EAC Application Addendum on the lake is contained in Appendix III.

The small change in flow and water quality in Stream 10 will not significantly affect fish populations in the creek, and have no effect on water levels, water quality or fish populations in Nakinilerak Lake. Further to the baseline information, also indicated in the EAC Addendum (Appendix AB), seepage from the Project will not have any significant

effect on Stream 6070 and, as such, the project will not have any significant effect on Nakinilerak Lake.

3.3 Confirmation of Fish Absence from TSF Ponds

In response to DFO's concern regarding the slight but remaining possibility that fish may occupy the TSF area, KCB biologists completed a dive survey in the largest pond, which is downstream of the other two smaller ponds; all are beaver dam-controlled. Two experienced divers swam the entire circumference of the pond in tandem, with excellent visibility (5-6 m). No fish were observed anywhere in the pond, while other life forms – tadpoles, leeches, mites, craneflies, mayflies, zooplankters – were abundant. The dive survey required approximately 40 minutes to complete the circumnavigation of the pond. Dives on fish-bearing lakes in the general area found fish (rainbow trout) within seconds of the divers entering the water. If fish were present in the TSF pond, either adults or juveniles would be readily visible in different areas of the pond. Previous sampling by Bustard (2004) using gillnets found no fish in either the largest or second largest ponds in the proposed TSF area.

The second largest pond in the proposed TSF area is only 1-2 m deep throughout its wetted area. It would not support fish in winter and is upstream of the larger pond. It was judged, upon close aerial inspection with excellent sunlight penetration and visibility, to be devoid of fish, and unsuited to winter or summer low water fish survival. A gillnet set by Bustard (2005) caught no fish. The third and smallest of the beaver ponds in the TSF area is also very shallow, isolated and located amongst dead trees. It is highly unlikely that fish would occupy this pond and not the larger ones in the same area. No fish were caught by Triton (2002) in the Steam 7 below the ponds, within the TSF area, or above the proposed seepage dam site using electro-fishing methods.

We concur with the previous findings (Rescan 2009) on fish presence/absence in the TSF area that no fish occupy the water-bodies in that area. This conclusion is based on three (3) sampling/ observation methods. A Section 2 listing under the Metal Mining Effluent Regulations (MMER) will not be needed for the proposed TSF area at the Morrison Lake Project. The ponds and creek sections in the TSF area are barren of fish; however, the physical displacement of these areas is a harmful alteration, disruption or destruction (HADD) of fish habitat, and the areas involved are included in the fish habitat budget tables.

4. FISH HABITAT COMPENSATION PLAN (FHCP) OPTIONS

4.1 Compensation for Fish Bearing Streams (HADD's)

4.1.1 General

The total HADD area for fish-bearing habitat is projected as approximately 0.18 ha (1,800 m^2), mainly due to partial dewatering of several creeks in the Project area. The proposed compensation objective is 2 for 1 replacement habitat for habitat loss, or approximately 0.4 ha (4,000 m^2), mainly in off-channel ponds and off-lake channels, as described below.

4.1.2 Off-Channel Ponds Downstream of TSF on Stream 7

During the June 2010 field work, the forested area north of Stream 7 (Figure 1.1) was inspected and flagged for possible fish habitat creation in the form of off-channel ponds and secondary channels. The area surveyed is relatively flat and low-lying (Photo 2), and would be suitable for off-channel habitat creation, mainly for juvenile rainbow trout rearing before they move to Morrison Lake. This would allow the trout fry to grow to parr size in a relatively protected area away from predators in the lake (e.g. lake trout, bull trout, pike minnows). The flow from Stream 8 (actually a tributary to Stream 7) would be diverted into the upper end of the new habitat area to fill and maintain the pond(s), which would then drain to Stream 7 near the data logger approximately 30 m upstream of the creek mouth on Morrison Lake. Shallow groundwater would also contribute to maintaining water volumes in the new channels and ponds. Large woody debris (logs, root wads) and large boulders would be anchored into the ponds to provide cover and habitat complexity for the rearing fish. The new habitat area so created would be approximately 1 ha in size and include extensive new riparian areas with existing forest vegetation, as well as planted trees and shrubs, along the side channels and around the pond(s).

4.1.3 Off-Lake Channels near Morrison Lake

Another area considered for off-channel habitat creation is the lowland adjacent to the lowermost sections of Stream 4 and Stream 5 (Figure 1.1; Photo 3), where channels would be excavated parallel to the lake shore, lined with rock (spawning gravels and cover materials) and permanently flooded with lake water. The creeks would provide some flow-through while the water depth in the channels would be controlled by the lake levels. This area would provide spawning and early rearing habitat for salmonids, including potentially sockeye salmon, which are known to spawn in the lake shallows. The new channels would provide better spawning habitat than is available in most of the lake shallows. The riparian zone along the channels would also replace some of that lost to the Project, particularly in the TSF area. These channels would provide approximately 1 ha of new fish habitat and 1-2 ha of riparian area, depending on final design.

The off-channel works are close to the proposed minesite, such that access for heavy equipment will be good and the work could be physically completed successfully in the course of Project construction. The cost will be greater than some of the other options due to the need for heavy equipment, but not unreasonably so, and PBM will commit to ensuring the off-channel ponds and channels will be properly constructed. A qualified and experienced fisheries biologist will monitor the work and provide direction as to specifications and materials. The channels would be excavated and landscaped with rock and large woody structures before they are flooded with lake water. Maintenance of the inlet/ outlet channels, in particular, will be routinely done during mine life and as needed thereafter. It is expected that such channels will remain open and flooded without further human effort.

Off-lake channels could also be constructed within the footprint of the Overburden Storage Facility if an alternative site for the overburden storage were to be used. This area is ideally suited to construction of a meandering channel.

4.2 Aquatic Habitat Compensation for Non-Fish Bearing Habit

4.2.1 General

The compensation options for non-fish bearing streams and lakes can be based upon increasing the fish food productive capacity in the general area. Two main categories of compensation for fishless areas are presented in the following sections, mainly providing fish access to presently barren areas, and providing rock reefs as cover for juvenile fish in Morrison Lake. Both measures are aimed at increasing juvenile salmonid rearing area and fish survival.

4.2.2 Providing Fish Access to Barren Lakes

Several small lakes/large beaver ponds (Figure 1.1) were visited during the June 2010 field work, including:

- "Olympic Lake" (Creek 77300, tributary to Morrison Lake on the upper east side – Photo 4);
- "Oval Lake" (00253 BABL) – a large beaver dam-controlled pond in a tributary of Olympic Lake (Photo 5);
- A large pond in a tributary to Tahlo Creek just above Morrison Lake (Photo 6);
- A small lake/large pond tributary to Nakinilerak Lake (Photo 7); and
- The lakes and ponds in upper Stream 6 – fish bearing.

"Olympic Lake" (working name only)

Olympic Lake (in Stream 77300) draining to upper Morrison Lake is largely beaver dam-controlled and was found during the present study to contain rainbow trout. For the purposes of the baseline inventory, this confirms fish presence in that small lake for the first time.

While fish were observed in this pond, the lake also supports a relatively dense plankton community, numerous tadpoles and many swimming invertebrates, such that the lake is (in our view) under-utilized by fish (i.e. the fish population is relatively small and has not yet occupied the whole drainage to the level (biomass) that the system could likely support. Fish habitat productive capacity is good; however, fish access to/from the pond is restricted by the large and well-constructed beaver dam at the outlet. A rock chute below the beaver dam identified by Bustard (2005) was judged in this study as navigable by fish. The beaver dam is the main obstacle for fish access and limits the fish production capability of the system.

Although the lake already supports a few trout, it could be enhanced with improved fish access to support a far greater number, especially juvenile fish of Morrison Lake stock that could rear in the relatively protected pond before entering the larger lake. To improve fish access while also maintaining the pond level, a concrete, or wooden, weir could be installed, with a 2-3 step fish-way on the downstream side, as at "Creek M" near the Huckleberry Mine (Jemmett, 1997). The lake level would remain high to provide for full lake (habitat) volume and the weir would maintain a relatively constant and permanent pond environment.

Enhancing fish access to Olympic Lake would also benefit another compensation option in the same Creek 77300 watershed – another large, oval-shaped pond farther up the system. This pond/small lake ("Oval Lake", Photo 5) was found during the dive surveys

in this study to be fishless. It supports an abundant and diverse plant and animal community, similar in observed plankton densities to other barren lakes and ponds. The plankton and swimming invertebrate populations in fish-bearing water-bodies are typically much less dense due to predation/ feeding by fish. This pond too would be maintained at approximately its current full-pool water level using a permanent concrete weir in place of the beaver dam and several steps on the downstream side for fish access.

If both Olympic Lake and Oval Lake were enhanced for fish access, including the creek section between the two lakes, approximately 22.3 ha of fish habitat would be rendered more productive for fish. We estimate that many hundreds to a few thousand fish could occupy that system additional to present fish population levels in the general area, and considerably more than in the barren and fish-occupied habitat to be displaced by the mining Project. The newly accessible habitat also has an extensive riparian zone that would provide shade and nutrients (e.g. insect drop) directly to fish (i.e. around/along fish-bearing waters).

The technical and economic feasibility of successfully completing the dam replacement and installation of a small fish-way is, in our opinion, very good, as the work can be done by a small crew using hand tools. No overland access for heavy equipment would be necessary, such that no HADD from the compensation work will occur. A beaver dam removal and long-term beaver control plan would be necessary for the lake outlets and sections of the creek system to maintain access for fish.

Tahlo Creek Tributary Pond

A relatively large and fish-barren pond/small lake occurs in the upper reaches of a tributary to Tahlo Creek (Stream 05700, Figure 1.1, Photo 6), which flows into the north end of Morrison Lake. Its status as fishless is based on a snorkel survey during the present study by two experienced fisheries biologists, who covered more than half the

circumference of the lake over approximately 40 minutes of diving. No fish were observed in any part of the lake, while there are many swimming invertebrates, plankters and tadpoles.

This small lake is also beaver dam-controlled at its outlet and is the deepest of the ponds and lakes surveyed at an estimated 6-8 m. As described for the other barren lakes, a permanent weir and small fish-way would be constructed in place of the beaver dam to maintain the lake level and volume, while allowing for fish access to and from the lake. This would provide approximately 8.9 ha of newly available lake habitat and 0.59 ha of creek habitat, and considerably increase fish production in that system (i.e. many hundreds to a few thousand more fish). No fish were previously caught by SKR (2001) using electro-fishing and trapping methods in this system.

The feasibility of installing a small dam and fish-way at the lake outlet is good, as the work could be completed by a small crew using hand tools, as was successfully done at Creek M near the Huckleberry Mine (Jemmett, 1997). For conservative planning purposes, increased fish production in this system is also rated as equivalent to adding 5 ha of new fish habitat to the Morrison Lake system.

Tributary Lake to Nakinilerak Lake

A relatively large pond/small lake on the west side of Nakinilerak Lake (Figure 1.1; Photo 7) was also dive-surveyed for fish presence/absence in late June 2010. After nearly an hour of in-the-water survey by two experienced fisheries biologists, no fish of any species or life stage was observed, such that the lake is apparently barren of fish, or contains very few. However, this water-body is also beaver dam-controlled, <1 km from Nakinilerak Lake and has no other impediments to fish migration (i.e. no gradient-controlled obstacles, such as chutes and cascades). It is likely that fish can access this lake under some flow and dam conditions; however, it is under-utilized by

fish, based on the abundance of other life forms and apparent absence (no sightings) of fish in the dive survey. Bustard (2004) found northern pike minnows (aka northern squawfish) in a tributary to this lake and near the mouth of the creek on Nakinilerak Lake, but none were observed in the lake in 2010.

A permanent lake maintenance weir to replace the main beaver dam controlling the lake level would maintain the lake level/ volume while allowing fish access via a built-in fish-way of several steps. This method was successfully used for the Huckleberry Mines' fish habitat compensation plan, in which a large pond was preserved at a near-full water level and volume for fish occupancy and production. The area of permanently available and relatively stable aquatic habitat that would be made more accessible for fish in the small lake near Nakinilerak Lake would be approximately 11.6 ha of lake and more than 0.1 ha of creek. A permanently stable, accessible and productive lake would considerably increase fish production in the Nakinilerak drainage and more than offset any losses in Creek 6070 due to Project infrastructure. It would also contribute to the total increase in fish production provided by the proposed fish habitat compensation plan for the Morrison Project. Nevertheless, we have conservatively used an effective area of increased fish production of 5 ha.

As for the other potential compensation sites described above, the technical and economic feasibility of successfully installing a small dam and fish-way at the outlet of this lake is considered good. The work can be completed by a small field crew using helicopter support and hand tools. Ongoing beaver management would be necessary to optimize the habitat value for fish production; however, this small creek/lake system has a relatively short (1 km) creek to Nakinilerak Lake, with its numerous fish species, such that beaver control and stream enhancement would be relatively limited for the potential gain in fish habitat productivity (for fish of several species).

Lakes and Ponds in Stream 6

This creek is perhaps the most fish-productive of any in the Project area, as fish can access the full length of the stream and the headwater lakes (Figure 1.1). This system would be maintained in as pristine condition as possible throughout the life of the proposed Morrison Mine, such that fish will continue to utilize the available habitat. Fish habitat protective measures will be applied to avoid any habitat disruption or destruction in this creek/ lake system. Its lower reach supports coho salmon and rainbow trout, while the upper reaches and lakes also support rainbow trout. A school of about 15 sub-adult and adult rainbow trout were observed milling around near a (breached) beaver dam in the uppermost lakes in late June 2010.

For baseline fisheries information purposes, the presently described dive surveys confirmed, for the first time, the presence of fish in the uppermost lakes in Stream 6. While the small lakes are at relatively high elevation, the stream gradient remains passable for fish from Morrison Lake to the headwater lakes (only water depths in the creek would limit salmon, as in most of the other small creeks around the lake).

PBM commits to maintaining and perhaps enhancing the fish habitat and fish productive capacity of Stream 6 using all acceptable impact avoidance, mitigation and enhancement methods. No specific compensation works are proposed for this creek (i.e. in this creek); the small HADD area (0.009 ha) from partial dewatering (0.03 m less wetted width) will be offset in other nearby locations. Enhancement in Stream 6 may be undertaken during mine construction and operations, depending on more detailed assessment of the system.

4.2.3 Rock Reef in Morrison Lake

As previously proposed in the EAC Application Addendum (KCB 2010), a large rock reef could be created in the lake shallows to provide cover in the interstitial spaces for

juvenile salmon, trout and char to avoid predation by larger fish (Appendix VI; Photo 8). The reef(s) would be constructed with large rock from the open pit and provide at least 1 ha of new/ improved fish habitat that could increase fish production in the lake by increasing survival of salmonid juveniles in the fry-parr-smolt stages. The reef(s) would be placed below the shoreline gravels that occur around most of the lake shallows, such that the reef(s) do not interfere with lakeshore spawning, or with boat navigation on the lake.

One or several reefs totalling 1 ha to 2 ha in area will be constructed in the lake shallows (e.g. in the lower littoral zone along the deepest parts of the near-shore euphotic zone just at and below Secchi disk readings (approximately 4 m deep) and/or the thermocline depth (4 m to 7 m in July). In that location, the reef will project into the productive sunlit zone in epilimnetic water and in deeper areas provide cover in the colder water of the upper hypolimnion. A reef will straddle the area between the upper and lower water masses to provide cover and attachment habitat for a variety of plant and animal species. The reef(s) will also be sufficiently deep to allow for unobstructed fish, human swimmer or boat passage over the rock structures. Authorizations under the Fisheries Act and Navigable Waters Protection Act will be obtained in advance of any such work.

Mine rock will be barged to the designated areas and carefully released over an area of 1 ha to 2 ha along the lake bottom. The lake bottom in the south basin of Morrison Lake was sampled for sediments and benthic invertebrates by Rescan (2009) and Bustard (2005) completed a shoreline survey and habitat classification in Morrison Lake in July 2004. The substrate type and sediment quality, as well as information on the benthic invertebrate community in the lake sediments are described above for the effluent pipeline installation, and also apply to the rock reef concept.

It is understood that a rock reef will cover and perhaps largely smother much of the sedentary life in the designated areas for reef development; however, the reefs will provide considerable habitat diversity, cover, attachment sites, living quarters and possibly reproductive habitat for a range of fin-fish and invertebrate forms. It is our professional opinion that such a reef will provide considerably more productive habitat for fish life than the existing fine-grain sedimentary substrates. The cover value alone for sockeye salmon, rainbow trout and other salmonid juveniles in Morrison Lake will likely be significant and allow for greater fry-parr-smolt survival in an important salmon-bearing system.

The reefs will be irregularly shaped in both horizontal and (to a limited extent) vertical planes to provide considerably more substrate surface area than currently exists in those areas of the lake with soft, fine-grain sediments (i.e. most of the lake bottom). In terms of useable area for algae, fungi, and both micro and macro-organisms, a rock reef with many surfaces on three-dimensional structures will very likely provide several times the surface area as relatively level and uniform silt-sand substrates. The habitat loss to place the rocks will fairly quickly change to gains in the presence and growth of larger invertebrate and vertebrate forms. Salmonid juveniles and other fish species will quickly use the area for cover, and large invertebrates such as snails and insect nymphs will also move into the reefs.

The timing of reef construction will be planned to avoid the fall spawning period for the anadromous salmon, as well as the resident kokanee, lake trout, dolly varden char, and both lake and mountain whitefish. The work will also be timed to avoid the spring spawning runs for resident rainbow trout and most of the coarse and forage species. The proposed work windows will include both mid-summer and possibly mid-winter periods, the latter depending primarily on safety. If winter work on reef construction is undertaken on the lake ice, much smaller and more frequent loads would be taken out to the

designated areas. Alternatively, a bubbler system might be used to keep the area ice-free for barge/ boat work, as on the Babine Lake barge route.

The combination of new spawning area provided by the off-lake spawning channels described above should substantially increase fish production in the area through increased egg-fry and fry-parr-smolt survival. The proposed channel(s) and reef(s) could significantly increase fish production in the Morrison Lake system and more than offset the habitat losses due to the Morrison Project.

Construction of the rock reef(s) will be technically and economically feasible, especially as the proposed reef site is close to the open pit and general works yards for the Morrison Mine. Rock material will come from the open pit during the early mining process and will be hauled by truck to a barge on the lake shore, and then taken out to the reef site <500 m away. PBM is prepared to ensure that the reefs are constructed as planned and with no significant adverse environmental effects. The value of the reefs as fish production habitat (including for plants, invertebrates and fish) will greatly exceed the fish production capacity of the existing sedimentary substrate.

4.3 Riparian Areas

New riparian areas will be retained, or developed, along the off-channel and off-lake ponds and spawning channels proposed for Stream 7 area and adjacent to Morrison Lake where Stream 7 and the next unnamed creek to the north are located (Figure 1.1; Appendix VI). At least 1,000 linear meters of new off-channel habitat could be created with approximately 30 m of riparian area on each side, or 60,000 m^2 (6 ha) of riparian habitat in total.

At the off-lake compensation site on the east side of the south basin of Morrison Lake, two spawning channels could be created, each about 2,500 m long and 2-3 m wide, with up to 50 m wide riparian habitat on each side of each channel. In this way, 50 ha of new riparian zone will be created along and between the new channels and the lake. To the extent possible, the existing tree-shrub-grassland vegetation will be retained and new plants planted to create the riparian area.

As noted above in the discussion of the proposed new off-channel and off-lake habitat, both areas will be readily accessible by heavy machinery to excavate the channels and ponds. A temporary clear-span bridge will be used to cross Stream 7 to construct the off-channel works in that area.

The TSF pond will also develop riparian vegetation over the years after mine closure. While DFO has indicated that any wetland in the TSF area must be discounted as compensation fish habitat, as it will take many years to develop, that area will eventually develop a wetland community, including riparian area, that may contribute to aquatic production. The tailings area at the Bell Mine on Babine Lake shows fairly well developed wetland and riparian vegetation 18 years after mine closure (1992), as shown in Photo 9. Similar wetland and riparian vegetation will very likely occur in the TSF at the Morrison Project within 15-20 years of mine decommissioning. In terms of the typical ecologic life of aquatic biomes, such as ponds and wetlands, that time scale is relatively insignificant, after which the pond/wetland will function for many decades to centuries before gradually transitioning to a more terrestrial ecosystem.

5. OTHER FISHERIES INFORMATION REQUIREMENTS

5.1 Morrison Lake Shoreline Survey

The June field work included a reconnaissance by boat of the east side of Morrison Lake from the south basin near Stream 25500 to Stream 77300 (Olympic Lake system), with observations of shoreline conditions. Bustard (2005) completed a relatively detailed shoreline survey by boat for the entire lake. KCB has provided a work plan for a survey during sockeye spawning time in August-September 2010 in conjunction with LBN field studies. That work will include boat and dive surveys, both for salmon spawning grounds and lake bottom conditions, and including the pipeline locations in the lake shallows, the area near the low grade ore (LGO) stockpile and the proposed rock reef site.

Details on the lake shore areas will be provided as soon as the surveys are completed.

5.2 Effects of Diversion Ditches

The clean water diversion ditches around Project facilities will direct water to both barren and fish-bearing water-courses. In almost all cases, the diversion channels will cross few elevation contours, as they run across the slopes with relatively low gradient. An exception is the west-side diversion channel below the TSF at Stream 7, which is relatively steep; however, it will empty into the seepage control pond, which will attenuate its flow energy and extract sediments. Any suspended material will be returned (during mine operations) to the TSF.

The clean water diversions will be lined with geotextile cloth and/or clean rock to prevent within-channel erosion and sediment transport, and cross-channel berms of clean river gravel, straw bails or silt-fencing will be used to filter out suspended sediments as needed. Where flow velocities are a concern, the diversion and connecting creek channels will be lined with rock at points of increased turbulence and potential erosion. The

channels will be fully constructed, lined and prepared for service before land plugs are removed to allow water flow into and through the diversion channels. This work will be supervised by qualified fisheries and engineering personnel.

5.3 Map of Proposed Compensation Sites

A map showing the locations of the proposed fish habitat compensation sites is included here as Figure 1.1 and Appendix VI. Large-scale maps and drawings will be provided for those compensation options selected for further work.

5.4 HCP Techniques

The methods used to enhance fish habitat will follow those in several published guidelines on fish habitat improvement techniques (e.g. Adams and Whyte 1990; Newbury and Gaboury 1994; Slaney and Zaldokas 1997; Chilibeck et al., 1992). The enhancements proposed are relatively non-technical and well within the prescriptions outlined in the available guidelines. PBM will have all the necessary equipment and personnel on site to successfully complete the habitat work in the selected locations. The work would be supervised by experienced fisheries, engineering and landscaping personnel.

The methods, technical and cost feasibility, and expected fish production benefits for the proposed FHCP options are described for each option in earlier sections of this document.

5.5 Morrison Lake at LGO Stockpile

As noted above, a shoreline survey of Morrison Lake will be completed during the planned late summer-early fall field trip in which a range of tasks will be completed, including a boat survey and possible dive survey of the lake shore area near the LGO

Stockpile site. Bustard (2005) identified that area as rearing habitat, which could apply to most of the lake shallows; it was not identified as a salmon spawning area.

The terrain below the proposed LGO pile to Morrison Lake is relatively steep, such that the lake bottom drops away fairly quickly with distance from shore and is >3 m deep within 5 m of the high water mark. Further detail will be provided following the late summer work.

6. SUMMARY OF HADD/COMPENSATION BUDGET

Table 6.1 summarizes the predicted HADD and compensation areas of fish-bearing habitat for the Morrison Copper/Gold Project.

Table 6.1 Summary HADD and Compensation Budget

STREAM & LAKE POND	PROJECT AREA	DESCRIPTION	BASELINE		HADDs (Areas Lost)		
			Length	Width	% Watershed Reduction	Equivalent width lost (m)	Wetted area lost (ha)
Stream 7	TSF	Creek 53400; partial dewatering	2,009	3.4		0.38	0.076
Stream 6	Mine	Creek 44800; partial dewatering	3,041	1.5		0.03	0.009
Stream 5	Mine	Creek 2900; complete dewatering	150	1.5	100	1.5	0.023
Stream 4	Mine	Creek 25500; partial dewatering	164	1.5		0.1	0.002
Stream 10	TSF	Stream 6070 to Nakinilerak Lake; partial dewatering	1,200	1.5	22	0.33	0.040
		Sub-total					0.150
Pipelines (50% loss area)	*Morrison Lak*	*Freshwater intake pipeline (600 mm dia.)*	160	0.6		0.3	0.005
		Effluent discharge pipeline (300 mm dia.)	2,000	0.3		0.15	0.030
		Sub-total					0.035
		Total					**0.184**

COMPENSATION 0PTIONS

Objective for fish bearing habitat is based on 2 x's area lost		
COMPENSATION ITEM	AREA (ha)	COMMENTS
Stream 7 off-channel ponds	0.15	1,500 m^2 of ponds (e.g. 3 ponds each 10m x 15m in diameter)
Stream 7 off-channel ponds	0.018	180 m2 of pond (e.g. 1 pond 16 m in diameter)
Off-Lake Channel	0.046	460 m^2 of off-lake channel
Off-Lake Channel	0.004	40 m^2 of off-lake channel
Off-Channel Ponds	0.08	800 m^2 of pond (e.g. 1 pond 32 m wide)
Off-Lake Channel	0.01	100 m^2 of channel (e.g. 2m x 50 m)
Off-Lake Channel	0.06	600 m^2 of channel (e.g. 2m x 300 m)
Total	**0.37**	

The proposed compensation options will more than offset the expected fish habitat losses due to the Project. The compensation options are moderate in size and complexity, such that each can be fairly readily constructed at reasonable cost.

For the non fish-bearing aquatic habitat (e.g. in the TSF area, Booker Lake and Ore Pond) compensation will consist of providing increased food productivity in the project area by increasing fish access to fishless lakes and constructing rock reef habitat in Morrison Lake.

For wetlands, which include both aquatic and terrestrial habitat values (e.g. for birds), the total loss is projected as approximately 57 ha, which will be offset by wetland creation in the TSF area and, if needed, wetland construction adjacent to Morrison Lake.

Riparian habitat losses will total about 17.4 ha, which will be replaced at a ratio of 1:1 with new riparian area adjacent to the above-proposed off-channel ponds and off-lake channels, as well as the riparian area around the TSF and other wetlands.

In summary, both the fish-bearing and non fish-bearing aquatic habitat losses due to the Morrison Copper/Gold Project will be fully compensated such that the productive capacity of the local fish habitat will be maintained, or enhanced, while the wetland and riparian areas will also be fully compensated.

We trust the above will provide stakeholders with sufficient information to decide on which compensation options are preferred and most feasible for detailed design as the Project moves forward in the assessment process.

KLOHN CRIPPEN BERGER LTD.

John Jemmett, R.P.Bio.
Senior Fisheries Biologist

Mathew MacKinnon, M.Sc.
Fisheries Biologist

Harvey McLeod, P.Eng., P.Geo.
Project Director

REFERENCES

Burns, and Tredger. 1975. Lake Survey Data – Nakinilerak Lake. Data report for BC Ministry of Environment, Sept. 10, 1975. 17 pp.

Bustard. 2005. 2004 Fisheries Studies Morrison Watershed. Prepared by David Bustard and Associates Ltd. For Pacific Booker Minerals Inc., July 2005. 52 p. + Appends.

Hatlevik, S.P. 1981. A Fisheries Inventory of Some Streams within the Morrison Lake-Hatchery Arm Portion of Babine Lake. Skeena Fisheries Report No. 80-5.

Jemmett, J. 1997. Fish Habitat Compensation Plan for the Huckleberry Copper Mine. Prepared for Imperial Metals Corporation.

Jones, R.F. and D. Tredger. 1975. Lake Survey Data – Nakinilerak Lake. Data summary and bathymetric map prepared for the Fish & Wildlife Branch of the BC Ministry of Environment, September 10, 1975. 17 p.

KCB. 2010. Morrison Copper/Gold Project: Environmental Assessment Application Support – Lake Effects Assessment. (Addendum to the EAC Application) by Klohn Crippen Berger Ltd., May 2010. 142 p. + Appends.

Rescan. 2010. Morrison Copper/Gold Project: 2009 Fish and Fish Habitat and Aquatic Resources Report. Prepared by Rescan Environmental Services Ltd. For Pacific Booker Minerals Ltd., April 2010. Approx. 150 p.+

Rescan. 2009. Morrison Copper/Gold Project: Environmental Assessment Application. Prepared for Pacific Booker Minerals Inc. by Rescan Environmental Services Ltd., September 2009. 2,000+ pp.

Smith, J. 2010. Morrison Copper/Gold Project – Addendum Screening Level Review. Letter from DFO to the EAO, June 11, 2010. 12 pp.

Triton. 2003. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory in the Tochcha Lake Watershed and Select Tributaries to Babine Lake. Prepared by Triton Environmental Consultants for Canadian Forest Products Ltd.

Triton. 1999. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory in the Babine Lake Watershed. Prepared for Northwood Pulp and Timber Ltd.

APPENDIX I

Letter of June 11, 2010, from DFO (Jack Smith) to the EAO (Tracy James)

Fisheries and Oceans
Pêches et Océans

Pacific Region
Suite 200 - 401 Burrard Street
Vancouver, B.C.
V6C 3S4

Région du Pacifique
Pièce 200 - 401 rue Burrard
Vancouver (C.-B.)
V6C 3S4

Your file *Votre référence*

Our file *Notre référence*

File: 5300-10-084
06-HPAC-PA1-00004

Tracy James, Project Assessment Officer
British Columbia Environmental Assessment Office
1st Floor 836 Yates St
PO Box 9426 Stn Prov Govt
Victoria BC V8W 9V1

June 11, 2010

Dear Tracy

Re: **Morrison Copper/Gold Project - Addendum Screening Level Review**

Fisheries and Oceans Canada (DFO) has completed a screening level review of the supplemental information submitted by Pacific Booker Minerals (PBM) for the Environmental Assessment Certificate (EAC) application for the Morrison Copper/Gold Project. The screening level review consisted of determining the presence or absence of information that was identified as deficient by DFO from the original EAC Application submitted in September of 2009.

Please accept the following comments organized by the respective Approved Terms of Reference (ATOR) section:

3.0 Project Description:

DFO requires the EAC Application include a complete description of all project components that could result in a harmful alteration, disruption or destruction (HADD) of fish habitat. Water management structures, including the effluent diffuser and freshwater intake, were identified as project components that were inadequately described in the original September 2009 submission. These items are briefly described in the information contained within the addendum package, however, the level of detail to determine the physical areas of potential impacts to fish habitat is not present for these components. These items are also excluded from the fish habitat compensation balance calculations.

5.6 Hydrology and Surface Water Quality and Quantity

In order to understand existing conditions of Aquatic Resources that could be affected by the project, an understanding of baseline conditions is required. In the screening of the September 2009 Application, baseline characterization of

Nakinilerak Lake, Stream 10 (6070) and the area of Morrison Lake adjacent to the proposed low-grade stockpile (LGS) was identified as deficient. The addendum contains baseline data for Stream 10 (6070) which flows into Nakinilerak Lake, but limited baseline data for Nakinilerak Lake is provided beyond inferred assumptions from Stream 10 data and some limited sport-fishing data. Sampling along the LGS is limited to a single sediment sampling site (site A) located to the South of the LGS as described in the September 2009 application.

5.8 Aquatic Biology and Fisheries

In the Morrison Lake Effects Assessment Report (May 2010) by Klohn Crippen Berger (Appendix AB), additional field studies are recommended to supplement the existing baseline information. These field studies include a shoreline survey along the east side of the lake to confirm sockeye spawning and confirmation of fish absence from the ponds within the proposed location of the TSF. For the shoreline sockeye spawning survey, DFO recommends that the shoreline across from the mine site is also included in the survey. In regards to the confirmation of Fish Absence in the ponds of the proposed TSF area, please be aware that the presence of fish in these ponds may have significant implications to the regulatory requirements for this project.

6.8 Aquatic Biology and Fisheries

To maintain a "no net loss" of fish habitat, the potential effects on fish habitat resulting from the project must be adequately described in the Application. Effects on fish habitat from certain mine components and from stream flow reductions are not fully included in the addendum materials or application.

The physical effects on fish habitat of the freshwater intake and effluent diffuser is not described in the September 2009 Application or in the addendum. Although originally described as an "infiltration gallery", the freshwater intake is now described as a constructed pipeline into Morrison Lake. The effluent diffuser is described as a 2000 metre pipeline along the bottom of Morrison Lake. The physical impacts on fish habitat from both of these structures must be considered.

Although the potential chemical effects of tailings water discharge is considered for stream 6070, the potential impacts of flow reduction to this stream does not appear adequately described.

9.2 Habitat Mitigation and Compensation Plan

In the final determination of whether the project will result in significant adverse environmental effects pursuant to the Canadian Environmental Assessment Act (CEAA), potential project-related impacts to the environment must be identified and mitigation must be proposed where potential impacts cannot be avoided. Fish habitat compensation is a form of mitigation for project-related impacts to fish habitat. In order for DFO to conclude that the proposed project will not result in a likelihood of significant adverse environmental effects, habitat compensation

plans must be developed to a level that that ensures the proposed mitigation will address the identified project-related impacts.

The September 2009 Application did not provide a Fish Habitat Compensation Plan (FHCP) of sufficient detail to ensure that project related environmental effects on fish habitat will be adequately mitigated. The acceptability of the proposed habitat compensation plan was not evaluated in this preliminary screening of the addendum materials, only whether the compensation plan accounted for all likely HADDs to fish habitat. The FHCP included in the Addendum did not include the effluent diffuser or the freshwater intake. The HADD table calculations also appear to have removed the areas of riparian area requiring compensation which were originally included in the September 2009 EAC Application

In consideration of the material presented in the addendum and the information available in the original September 2009 EAC application, DFO will require the following information in order to consider the EAC Application at a sufficient level to complete a detailed review pursuant to CEAA:

1. Physical fish habitat impacts resulting from the freshwater intake and effluent diffuser and the loss of riparian areas must be described and included in the fish habitat compensation balance tables.
2. Fish Habitat impacts associated with flow reductions to Stream 6070 must be provided.
3. Confirmation of fish presence/absence must be provided for the streams/wetlands within the area of the proposed TSF.
4. Fish Habitat Compensation Plans must be at an acceptable level to determine if impacts to fish habitat can be suitably mitigated in order to reach a determination on the significance of environmental effects and thus conclude the environmental assessment pursuant to CEAA.

The purpose of this screening was to determine whether information was present or absent. A detailed review of the information presented was not completed. Nonetheless, DFO is forwarding some preliminary review comments to assist with the development of the FHCP:

1. Compensation options will not be considered as a means of addressing chemical pollution and contamination problems, reliable control techniques must be installed and operated to mitigate such problems at the outset. Please also note that deposits of deleterious substances (pollution) are not authorized by DFO under subsection 35(2) of the Fisheries Act.
2. The creation of a TSF pond at the closure of the mine is not considered an acceptable form of compensation to off-set the loss of aquatic habitat caused by the project. TSF facilities are considered constructed project components in which any predicted future fish habitat values are uncertain and would only occur at a point in the future that would not offset current project impacts.

For your benefit, I am also attaching a table of detailed comments which outline some of the preliminary review comments and deficiencies identified in the Addendum.

Thank-you for the opportunity to comment and I am available to discuss these comments further.

Regards,

Jack Smith
Environmental Assessment Analyst
Environmental Assessment and Major Projects Unit
Oceans, Habitat and Enhancement

Cc Patty Menning, DFO
Robyn McLean, CEAAgency

TOR	Initial DFO EAC Application Comments	Addendum Comments
5.8 (b) Aquatic Biology of Fisheries	There is no mention of potential effects to fish from the effluent diffuser installation and discharge into Morrison Lake (as briefly mentioned in section 4.12.4.13 Tailings Dam Construction, page 4-121) and the release of excess water to Morrison lake from the pit (as described in Table 13.3-1, page 13.9). A description of the fish habitat at these locations must be included. If there will be flow reductions to Nakinilerak Lake and stream 6070 from the north seepage pond and dam, these potential impacts and residual effects should be addressed in the body of this application and the assessment data (fish productivity) should be included in the Baseline Appendices.	Appendix AB Lake Effects Assessment Note: App. AB recommends additional field studies to supplement the baseline information: • Shoreline survey along the east side of the lake near the proposed mine to confirm sockeye spawning (DFO also recommends that the shoreline across from the mine site is also assessed for beach spawning) • DFO is extremely concerned that there are still outstanding plans to "definitely confirm the absence of fish in the TSF ponds"(App.AB, S13.5,P148). If fish are in the ponds, MMER TIA listing process will be required. The application is incomplete without this confirmation.
6.8 Aquatic Biology and Fisheries	Section 8.9 states that because there are no fish in the 'affected aquatic environments' no compensation is required. Please note that the Federal Fisheries Act defines Fish Habitat as, "...spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly .....".If draining these waterbodies alters the potential to provide these life processes to downstream fish values, than these areas are defined as, "fish habitat" and impacts will require a Fisheries Act Authorization and compensation. Section 8.10.4.3 states that "juvenile fish and egg mortality is possible from reduced water flow ...resulting in dewatering and pool isolation during summer flows and overwinter freezing to the bottom during winter low flows." The application does not adequately detail the amount of habitat that may be lost or may be rendered harmful from the diversions. Fisheries Act Authorization does not permit the	App. AB, S5 (Lake Effects Assessment) and AC have conceptual design of diffuser and water freshwater intake, however, no discussion of installation methods, mitigation and compensation for the physical footprints of the structures is provided.

	destruction of fish. If fish will be killed by other means than fishing, a Sec. 32 Authorization to kill fish will be required. As per CEAA, all phases of the project must be considered. It is predicted that the pit will reach the optimal water level at year 24. After this time, excess water in the pit will need to be released. DFO will need details on how this water will be released including any additional diffuser installations into Morrison Lake. • The effluent diffuser installation and discharge into Morrison Lake (as briefly mentioned in section 4.12.4.13 Tailings Dam Construction, page 4-121) and the release of excess water to Morrison lake from the pit (as described in Table 13.3-1, page 13.9) may require a Fisheries Act Authorization.	
d) flow changes from water management and diversions; and	More information is required on the seepage dams (North and South), polishing ponds and outlet diffuser into the bottom of Morrison Lake. (page 4-121). The diffuser installation will most likely require a Fisheries Act Authorization and compensation Section 8.10 DFO would like to see more details on the proposed stream diversions including where the flow re-enters the stream, the design of the structures, details of potential downstream impacts from reduced flow on features such as rearing pools, etc	The discharges of the diversions ditches into natural streams are not described. (e.g.: Example the west diversion around the proposed waste rock dump) The rationale for excluding a seepage collection dam for the west dam of the TSF is not provided. Appendix AC states, "a seepage collection pond will be constructed downstream of each dam". The descriptions of any potential impacts of the construction of diversion structures (i.e. bank stabilization or disturbance) where clean water will divert to streams are not provided. The construction phase drawing D-3101 shows that initially diversion around the east of the proposed TSF will be directed into stream 53400 (fish bearing). How will this flow then be redirected to over this stream to the main seepage dam during operation?

(e) impacts from compensation activities.	Incomplete: Section 13.6.8 deals with Monitoring, not with the potential impacts which may result from compensation activities. Please clarify.	Same comment as initial comment.
(h) all creeks and rivers that may experience changes to fisheries resources including, but not limited to the Morrison valley, and streams associated with the road access, any linear corridors for pipelines or conveyors, transmission line	There will be a dam/diversion on Stream 6070 which drains into Nakinilerak Lake. This system was described as good quality habitat with beaver dams and a log jam. There is no data to suggest that these barriers are not temporary with a potential for future fish migration/use. Potential impacts to this system from altered flow and potential for spills/accidents should also be considered.	Appendix AB (Lake Effects) address only the potential for tailings discharge water quality, not flow changes. Flow reduction for Stream 6070 was also not included in Appendix AB Sec 9 - Residual Impacts

(i) habitat loss or alteration, including aquatic vegetation and sensitive areas such as spawning grounds (including shoreline spawning assessment of Morrison Lake), nursery areas, winter refuges and migration corridors, and riparian (streamside) vegetation	Section 8.10.4.3 states that "juvenile fish and egg mortality is possible from reduced water flow ...resulting in dewatering and pool isolation during summer flows and overwinter freezing to the bottom during winter low flows." The application does not adequately detail the amount of habitat that may be lost or may be rendered harmful from the diversions. Fisheries Act Authorization does not permit the destruction of fish. If fish will be killed, by other means than fishing, a Sec. 32 Authorization to kill fish will be required.	
	DFO requests more details on the calculations of "partial loss of fish habitat" Table 13.6-2) as a result of altered flow. It was not explained how the predicted loss of flow was equated to a loss of stream width nor was it explained what impacts to rearing areas, migration areas and overwintering pools will occur as a result of the altered flow. An instream flow analysis to assess the potential impacts of flow reduction, Rescan 2009, was mentioned on page 13-43. The results of the study should be available for the review of the application. This information is required to determine the potential for a HADD resulting from reduced flow. This will also assist in the determination if the compensation plan is feasible to offset the HADD.	Addendum Appendix AB, Section 9 Residual effects is a re-statement of Table 13.6-2. There is no further explanation for the calculation of lost stream width (and no reference to the Rescan flow analysis). In addition the new version of the table omits the riparian removal calculation in the Fish Habitat Losses. The two documents are contradictory and DFO cannot conclude on the extend of the HADDs and if the compensation is feasible to offset the HADDs (thus concluding on the significance of effects)
	More information is required on the seepage dams (North and South), polishing ponds and outlet diffuser into the bottom of Morrison Lake. (page 4-121). The diffuser installation will most likely require a Fisheries Act Authorization.	App. AB, S5 (Lake Effects Assessment) and AC have conceptual design of the effluent diffuser, however, no discussion of installation methods, mitigation and compensation for the physical footprint of the structure.

	There is no mention of potential effects to fish from the effluent diffuser installation and discharge into Morrison Lake (as briefly mentioned in section 4.12.4.13 Tailings Dam Construction, page 4-121) and the release of excess water to Morrison lake from the pit (as described in Table 13.3-1, page 13.9). The installation of diffuser may require a Fisheries Act Authorization. It is unclear if the streams crossed by the tailings pipeline (buried) and/or water pipeline (above ground) will impact fish or fish habitat (including riparian habitat). The potential for habitat alteration or loss has been described when upgrading stream crossings (culverts bridge pilings). However the section then continues that DFO operational statements will be used to minimize these impacts. Please note that if the DFO OS are used properly there can be neither installation of culverts in fish streams nor any encroachment into the natural channel. It is unclear if a Fisheries Act Authorization will be required for any of the stream crossings. It is unclear what structure will be required when the diversion channel around the TSF converges with the mainstem of 53400. Will this convergence adversely impact rainbow trout habitat? DFO has asked the proponent to conduct detailed field assessments to confirm that the stream reaches within the proposed Tailings Management Area are non- fish bearing. Neither Fig 7.10-1 indicates that any recent assessments have occurred. No further assessment results are included in the Appendices nor mentioned in the body of the application. It is imperative that this	DFO cannot issue Sec 35.2 Authorizations for the HADD of fish habitat from the deposit of a deleterious substance. Note: page 132 of Appendix AB states, "seepage and effluent discharge may also be considered as HADD of fish habitat and therefore compensation would be required. The Fisheries Act does not Authorize the HADD of fish habitat resulting from the deposit of a deleterious substance. The deposit of a deleterious substance into waters frequented by fish constitutes a violation of Sec 36 of the Fisheries Act. DFO is extremely concerned that there are still outstanding plans to "definitely confirm the absence of fish in the TSF ponds"(App. .AB, S13.5,P148). If fish are in the ponds, MMER TIA listing process will be required. The application is incomplete without this confirmation.

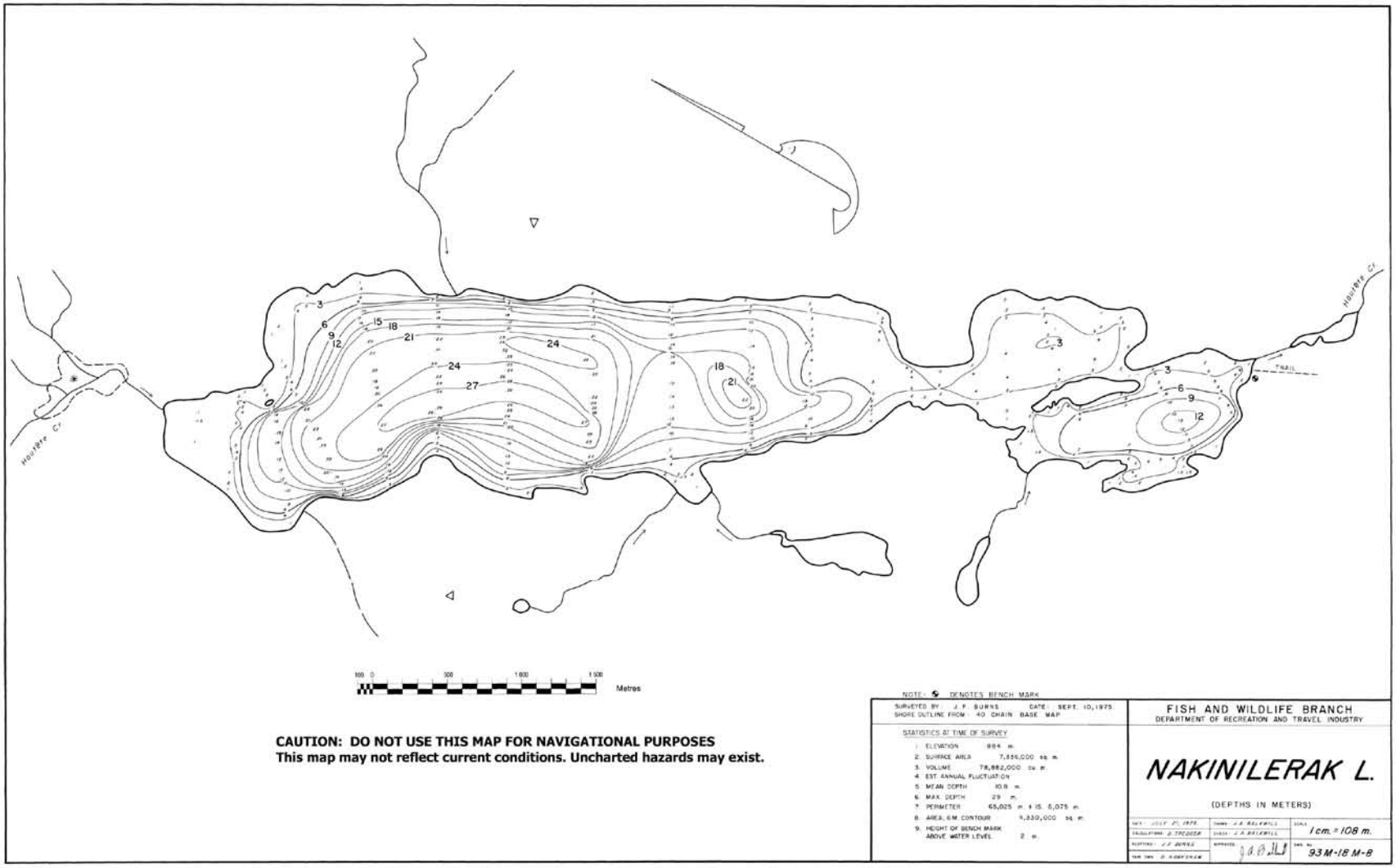
	work is conducted to ensure that the TIA is not located in fish-bearing waters. If the TIA is within fish-bearing waters, this would require a listing of the watercourse on Schedule 2 of the MMER. The HADDs list on page 13-36 should also include: flow reductions to Stream 44800 and 6070, effluent discharge installations, water pipeline stream crossings, road stream crossings. (Refer to DFO comments on the concordance table for further information requests on these activities.) OR the application should provide more information as to why these activities will not result in a HADD.	The Addendum Appendix AB includes a new table: 9.2 page 129 with Fish Habitat Loses. Reference to riparian vegetation removal (which was included in the initial application, volume3, 13-35, Table 13.6.2) has been removed. Impacts from riparian removal must also be included in the final calculation of predicted HADDs and requirements for compensation.
In the event that there is an unavoidable harmful alteration, disruption or destruction (HADD) of fish habitat, the Application will describe the "HADD" with regard to magnitude and significance,	Section 13.6.5.1 (page 13-38) proposes a plan to divert flow to just below the south seepage dam rather than the originally planned south trib of stream 53400. The report talks of the benefit of maintaining this section of fish habitat (977 m) but with significantly alterations to baseline flow. The report continues that no compensation would therefore be required.	Addendum AB, Section 10.3.3 lists potential compensation options but maps to show the proposed locations are not provided. Proposed areas for compensation are listed but the treatments to enhance the productive capacity are not provided. For example, what are Pacific Booker's plans for Olympic Lake? What are the plans to enhance the productive capacity to gain 22.5 ha

and provide rationale to justify why the HADD is not avoidable and propose a fish compensation plan to offset the HADD such that no net loss of productive fish capacity is achieved. Adequate information will be described to demonstrate that the fish habitat compensation measures will be technically feasible and biologically effective.	Although DFO agrees that relocation and re-design to first minimize impacts is encouraged, DFO would require additional information and rationale as to why continued reductions to flow would not alter fish habitat, before we could agree that no HADD or compensation would be required. Question: Is the alternate diversion ditch to just below the south seepage dam now being proposed or is an option proposed by the consultant? Depending on the final plan, 977 m of habitat may or may not be dewatered. This information is integral to determine the significance of residual effects and if the amount of compensation being proposed is adequate. Section 13.6 should provide a table of projected HADD's (including any impacts from effluent diffusers, road and pipeline crossings and reduced flow) and projected habitat units gained by the proposed compensatory ponds. Can enough ponds be built in this reach of Stream 53400 to offset the productive capacity of all HADD's to the proposed 2:1 ratio? NOTE: DFO has not determined the appropriate ratio for compensation. Proponent should prepare plans for a range of expected ratios, incorporating risk of failure and sensitivity of species impacted. If detailed HADD/Compensation values are not available at this time, the section should at least provide a general range of expected HADD's and a specific max. area (or HUs) that can be constructed in this reach. Until this information is provided, DFO can not determine if the compensation option is feasible to offset the project HADD's	in habitat? DFO will require a more detailed conceptual fish habitat compensation plan to determine if the options are feasible and adequate to offset predicted HADDs. Also the HADD calculation must also include losses of riparian function (as included in the original application), impacts from the installation of the diffuser, rational for the HADD calculation for 'partial' loss in streams, loss of fish-bearing streams, removal of riparian vegetation associated with transmission lines and pipeline installation. Please note: The creation of a TSF pond at the closure of the mine to offset non-fish bearing ponds and stream sections will not be acceptable compensation Volume 3 stills outlines the plan for pool creation near stream 53400. This contradicts the compensation plan submitted in Appendix AB

9.2 Habitat Mitigation and Compensation Plan The Application will include habitat impact mitigation and compensation plans, including a fish habitat compensation plan (FHCP) to a level acceptable to Department of Fisheries and Oceans, if such are determined to be required. The Application will describe the implications of such plans on the environment and other species (e.g. a fisheries compensation plan altering migratory bird habitat). A wildlife and fisheries/aquatic assessment will be completed that identifies impacts and prescribes preliminary impact mitigation and compensation measures. For fish, a detailed FHCP with design drawings will be required if necessary to satisfy Section 35(2) of the Fisheries Act.	Section 13.6 should provide a table of projected HADD's (including any impacts from effluent diffusers and reduced flow) and projected habitat units gained by the proposed compensatory ponds. Can enough ponds be built in this reach of Stream 53400 to offset the productive capacity of all HADD's to the proposed 2:1 ratio? (NOTE: DFO has not endorsed this ratio as the desired target) If detailed HADD/Compensation values are not available at this time, the section should at least provide a general range of expected HADDs and a specific max. area (or HIS) that can be constructed in this reach. Until this information is provided, DFO can not determine if the compensation option is feasible to offset the project HADD's Guidelines have been provided to the proponent for a conceptual fish compensation plan. Please clarify why this has not been followed No detailed FHCP or design drawings were included.	Table 13.6.2 remains unchanged. Appendices AB has a different table than the original and has removed the reference to riparian removal impacts. Impacts from the installation of the diffuser and riparian removal from installation transmission lines, pipelines and diversions are not included in the addendum table. HADD associated with the Freshwater intake as described in Appendix AC is not included in FHCP Compensation locations were identified but the application is still devoid of any detail as to what habitat enhancement/creation is proposed. DFO cannot determine the extent of the predicted HADDs and will not be able to determine the significance of effects based on the compensation information provided. The application recommends that a preliminary fish habitat compensation plans is developed for discussion with DFO and EAO. This must be part of the application. No maps of the proposed compensation options, design drawings or description of the enhancement or creation of habit were provided

APPENDIX II

Bathymetric Map of Nakinilerak Lake (from Burns 1975)


HOUSTON CR.
TRAIL
3
6
9
12
15
18
21
24
27
Metres
CAUTION: DO NOT USE THIS MAP FOR NAVIGATIONAL PURPOSES
This map may not reflect current conditions. Uncharted hazards may exist.
NOTE: DENOTES BENCH MARK
SURVEYED BY: J. F. BURNS DATE: SEPT. 10, 1975
SHORE OUTLINE FROM: 40 CHAIN BASE MAP
STATISTICS AT TIME OF SURVEY
1. ELEVATION 884 m.
2. SURFACE AREA 7,856,000 sq. m.
3. VOLUME 78,882,000 cu. m.
4. EST. ANNUAL FLUCTUATION
5. MEAN DEPTH 10.8 m.
6. MAX. DEPTH 29 m.
7. PERIMETER 65,025 m. ± (S. 5,075 m.
8. AREA, 6 M. CONTOUR 9,330,000 sq. m.
9. HEIGHT OF BENCH MARK ABOVE WATER LEVEL 2 m.
FISH AND WILDLIFE BRANCH
DEPARTMENT OF RECREATION AND TRAVEL INDUSTRY
NAKINILERAK L.
(DEPTHS IN METERS)
1 cm. = 108 m.
93 M-18 M-8

APPENDIX III

Information on Nakinilerak Lake

Excerpts from the EAC Addendum, Appendix AC – Lake Effects (with edits to update to July 2010)

Executive Summary, Pg ii

The assessment concludes that the seepages and final effluent from the mine-site will not have a significant adverse effect on aquatic resources and fish stocks in Morrison Lake or Nakinilerak Lake.

3.2.3 TSF Seepage Flows, Pg 25

A small seepage flow of approximately 9.5 m^3/hr (2.6 lps) will move from the TSF towards a small stream MCS-10 at the north end of the impoundment, which then flows into Nakinilerak Lake;

3.2.6 TSF – Revised Water Quality Predictions for Downstream Creeks

MSC-7 flows will be substantially lower in spring-summer and higher in winter. MSC-8 may have permanently increased groundwater recharge from TSF seepages. MSC-10, which flows to Nakinilerak Lake, will also have permanently increased flows from seepage inputs. The low flows in all three streams will increase by 1.5 to 2 times present rates; the water quality will be close to guideline levels for most tailings constituents.

3.2.7 Summary of TSF Water Quality Effects, Pg 35

Nakinilerak Lake Influences

Stream MCS-10 is predicted to have slightly elevated Cd concentrations (1.25 x BCWQGs at low flow). Although, given the mitigating factors related to the prediction, it is a low risk that even those concentrations will be present. Additionally, the relatively low seepage flow of 9.5 m3/hr will require very little mixing with creek and/or near-shore lake water to meet BCWQGs and the potential effect on Nakinilerak Lake is, therefore, not significant.

8.1 Water Quality, Pg 122

Nakinilerak Lake

The very low quantities of TSF seepage that may enter the headwaters of the Nakinilerak drainage will be greatly diluted before reaching fish-bearing waters in the system, such that all tailings constituents will meet receiving water quality objectives. The fish stocks in the lake will not be affected by tailings seepages.

8.2.2 Benthos Pg 124

Nakinilerak Lake

The small amounts of TSF seepage that are expected to enter the headwaters of the Nakinilerak drainage will meet water quality objectives well before reaching the mid to lower reaches of the creek in that area and well before reaching Nakinilerak Lake, such that there will be no adverse effects on invertebrate production (benthic and planktonic) in the system.

The small gain, or loss, of fish habitat due to seepage inputs, or temporarily reduced catchment area, respectively, will also not significantly affect the fish productive capacity of Stream 6070, or Nakinilerak Lake.

8.2.3 Fish Populations Pg 125
Nakinilerak Lake
The very small quantities of tailings material that may exit the TSF in the direction of Nakinilerak Lake will have no adverse effects on fish populations in that system. The concentrations of tailings constituents will be well below guideline levels before they reach fish-bearing stream reaches, or the lake.

Conclusion
No fish population–level effects are anticipated from effluent discharges, or groundwater seepages, to Morrison Lake, or to Nakinilerak Lake.

8.2.4 Human Use of Aquatic Resources Pg 125
While sport fishing is known to occur on Morrison and Nakinilerak lakes, it is not expected that fish tissues will show elevated levels of contaminants as a result of any of the potential discharges from the mine. Nonetheless, a program of tissue testing will be carried out, along with other environmental monitoring, to confirm potential effects and ensure that no contaminants reach unacceptable levels in fish tissues.

9.3 Cumulative Impact Assessment, Pg 131
The low volumes of tailings seepages to Creek 10 (MCS-10) and Nakinilerak Lake will not adversely affect water quality, or fish production, in that system.

Section 12. SUMMARY AND CONCLUSIONS, Pg 149
Nakinilerak Lake Effects
Stream MCS-10, which drains north from the TSF into Nakinilerak Lake, is predicted to have slightly elevated Cd concentrations (1.25 x's BCWQGs at low flow). Although, given the mitigating factors related to the prediction it is a low risk that the concentrations would be present. Additionally, the relatively low seepage flow of 9.5 m3/hr would require very little mixing with creek, pond and/or near-shore lake water to meet BCWQGs and there is, therefore, a very low risk of a significant adverse environmental effect on Nakinilerak Lake.

The aquatic habitat area in Stream 6070 will increase slightly at times, especially during low natural flows, due to seepages (2.6 lps) from the tailings area. The stream flows may also be reduced below normal volumes at times due to the temporarily reduced catchment area in the headwaters from TSF dam placement. The difference, or net result, of the

seepage flows and reduced overland flows to the headwater section of Stream 6070 will likely show a slightly reduced flow overall. An area of aquatic habitat has been added to the HADD tables to account for a modest net reduction in flow volume and wetted area in Stream 6070.

APPENDIX IV

Mitigation Guidelines

There are numerous manuals and guidelines on the methods required to prevent harmful alteration, disruption, or destruction (HADD) of fish habitat. These include the recent *Fish-Stream Crossing Guidebook* (MoF, 2002), the *Land Development Guidelines for the Protection of Aquatic Habitat* (Chilibeck et al., 1992), and *Standards and Best Practices for Instream Works* (BC WLAP 2004). These and other guidelines detail the purpose and practice of setting leave strips (buffer zones), using erosion and sediment control measures, stormwater management, work in streams, fish passage concerns and culvert design, and recommended operating windows for fisheries sensitive zones.

Comprehensive guidelines to protect fishery resources include the following, which offer a range of effective measures that would, with proper supervision, ensure no net adverse impact to the local watercourses from land use practices. KCB would use these and other guidelines in the course of preparing mitigation plans and during construction monitoring for the Morrison Copper/Gold Project:

- Best Management Practices for Installation and Maintenance of Waterline Intakes (BC Environment 2006);

- Water Crossing Guidelines for the Pipeline Industry (TERA and Beak, 1993) - Comprehensive guide, with many illustrations, to all aspects of wet and dry stream crossing techniques, instream sediment control and environmental monitoring. Also known as “CAPP” guidelines (Canadian Association of Petroleum Producers);

- Environmental Objectives and Procedures for Water Crossings (Saremba and Mattison, 1984) by the BC Ministry of Environment. These guidelines focus on maintenance of natural stream conditions, provision of fish passage, prevention of pollution and sedimentation, and preservation of riparian vegetation;

- Guidelines for Environmental Protection from the Development of Electrical Transmission Lines (Saskatchewan Environment, 1980) – Comprehensive and specific to transmission lines;

- Guidelines for Land Development and Protection of the Aquatic Environment (DFO, 1978) - Precursor to the 1992 guidelines. Additional helpful material on detention and settling basins, collection ditches and swales;

- Guidelines to Protect, Maintain and Enhance Fish and Wildlife Habitat on and Adjacent to Proposed Golf Course Developments and Existing Course

Re-developments on Lowland Areas (Barnard, 1992) - Provides a useful list of riparian vegetation species;

- Riparian Assessment and Prescription Procedures - Field Guide (Oikos et al., 1996) - Includes assessment and prescription methods to rehabilitate disturbed riparian areas;

- Resource Road Rehabilitation Handbook: Planning and Implementation Guidelines (Interim Methods) (Moore, 1994) - Part of the Watershed Restoration Program (WRP) procedures manuals, which includes the BC Ministry of Forests Road Construction, Maintenance and Deactivation Handbook and other practical papers on erosion and sediment control;

- Culvert Guidelines: Recommendations for the Design & Installation of Culverts in British Columbia to Avoid Conflict with Anadromous Fish (Dane, 1978) - Includes a detailed appendix on methods to control erosion and sedimentation at construction sites, and to avoid perched culverts that block fish;

- Stream Stewardship - A Guide for Planners and Developers (DFO & BC Environment, 1993) - includes environmental protection measures for construction projects, and methods for longer term management of stream habitat;

- Environmental Code of Good Practice for Highways and Railways (Storgaard and Associates, 1979) - Detailed design, construction, operations and deactivation measures to protect fishery resources;

- Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Wright and Hopky, 1998) - Fisheries and Aquatic Sciences Technical Report;

- A Handbook for Fish Habitat Protection on Forest Lands in British Columbia (Toews and Brownlee, 1981) - Detailed methods to protect fish habitat during logging and clearing operations;

- Reclamation and Environmental Protection Handbook for Sand, Gravel and Quarry Operations in British Columbia (BC MoTH and Nat Res Can, 1995);

- Riparian Management Area Guidebook (BC MoF and MOE, 1995) - Guidelines for clearing within fisheries sensitive zones and for maintaining riparian areas;

- Standard and Best Practices for Instream Works (BC WLAP, 2004) - Comprehensive guide to fish protection measures during construction and maintenance of in-stream works, such as bridges and culverts;

- Fish Passage Culvert Inspection Procedures (WLAP WRP and MoF, 2000) - Fish migration barrier evaluation and corrective measures;

- Streamside Protection Regulation (BC MOE, 2004) - Riparian protection measures including setback requirements;

- Urban Runoff Quality Control Guidelines for British Columbia (BC Research, 1992) - Comprehensive guidelines on sediment control and contaminant removal in stormwater runoff;

- Bioengineering Techniques for Streambank Restoration (BC WLAP and MoF 1995) - Detailed review of central European practices;

- Fish-Stream Crossing Guidebook (BCEMPR, BCWLAP, BCF 2002) – Environmental protection guidelines for different stream crossing structures;

- Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO 1995) – Screen sizes and installation procedures for water intakes; and

- Environmental Best Practices for Highway Maintenance Activities (MoTI 2009) – Comprehensive manual of impact avoidance and mitigation techniques.

APPENDIX V

Photographs

Photo V - 1 Beaver dams in Stream 6070 (MCS-10)

Photo V – 2 Site option for proposed off-creek pond construction

Photo V – 3 Site option for proposed off-lake channel construction

Photo V – 4 Olympic Lake

Photo V – 5 Oval Lake

Photo V – 6 Lake tributary to Tahlo Creek

Photo V – 7 Lake tributary to Nakinilerak Lake

Photo V – 8 Existing rock reef template within Morrison Lake

Photo V – 9 Wetlands in the tailings area at the Bell Mine

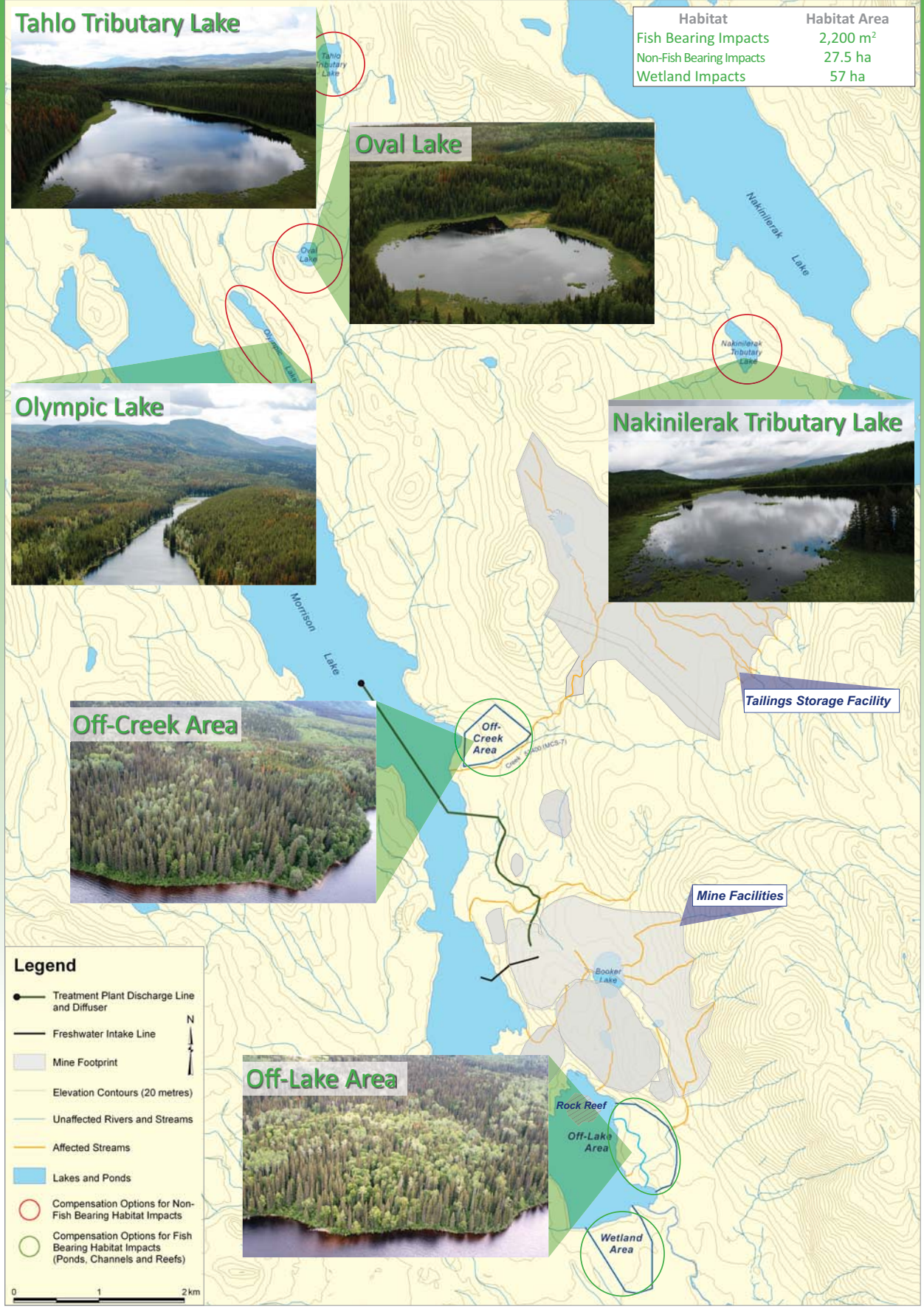
APPENDIX VI

Fish Habitat Compensation Options Poster

MORRISON COPPER-GOLD PROJECT

FISH HABITAT COMPENSATION OPTIONS

Habitat	Habitat Area
Fish Bearing Impacts	2,200 m^2
Non-Fish Bearing Impacts	27.5 ha
Wetland Impacts	57 ha

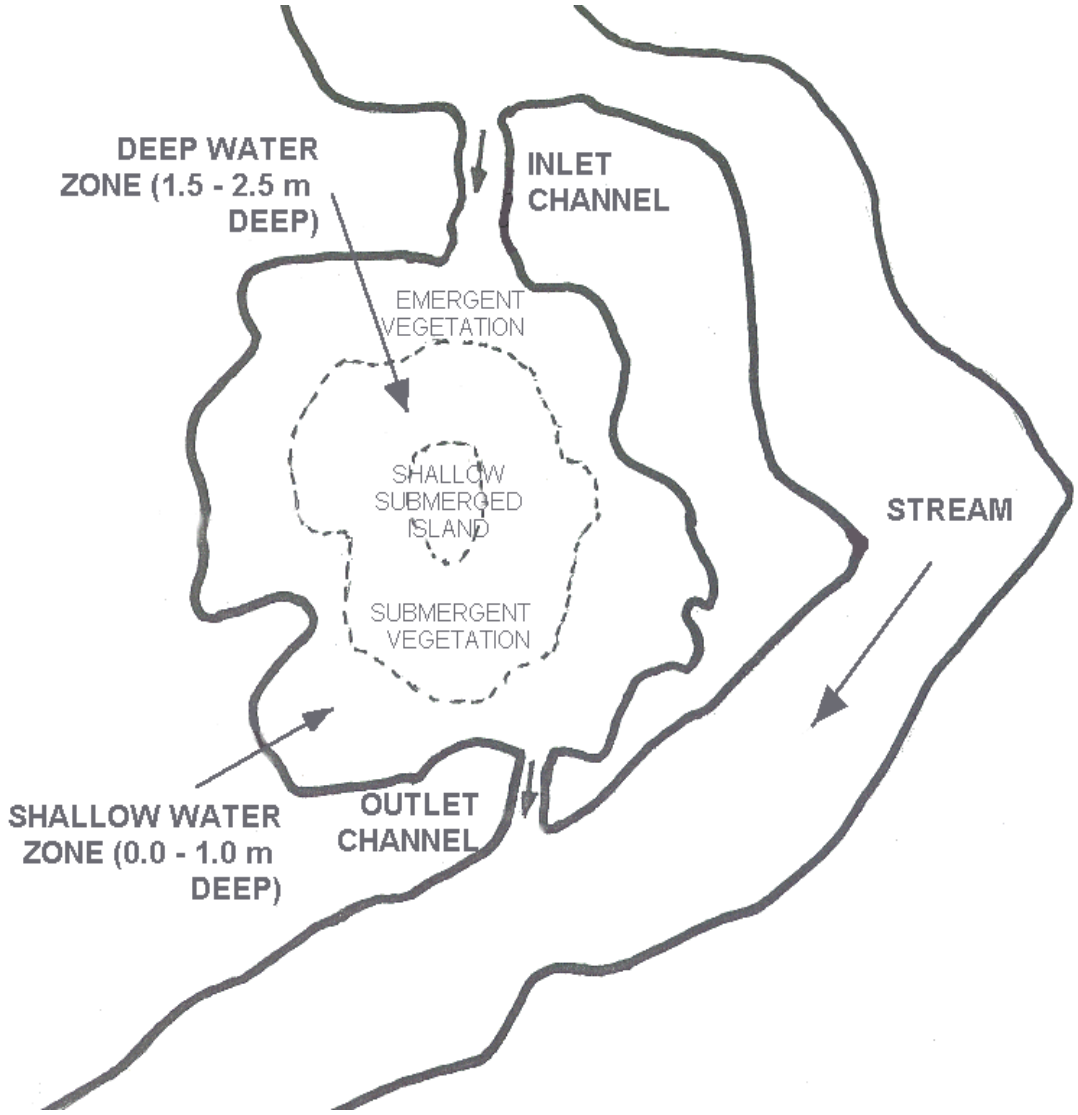


pbm

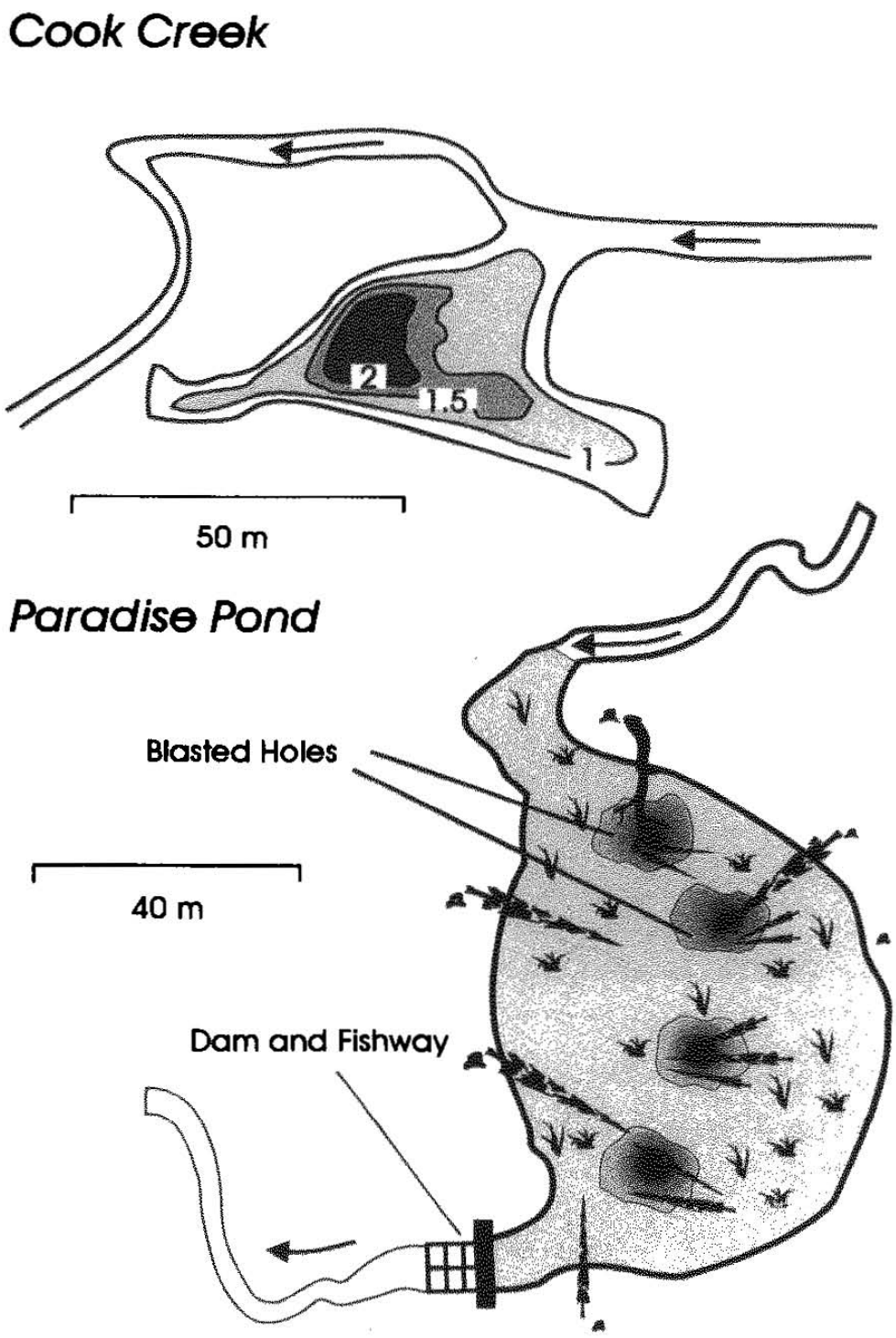
Klohn Crippen Berger

APPENDIX VII

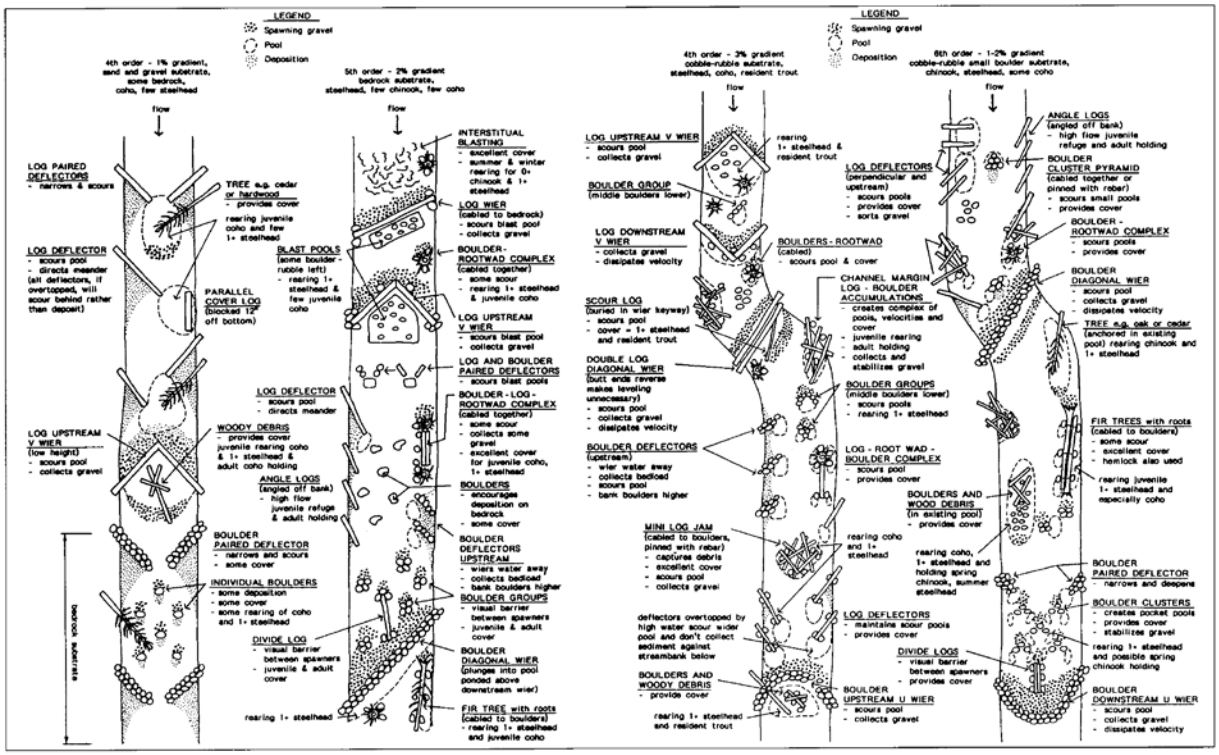
Examples of Fish Habitat Compensation and Enhancement Methods



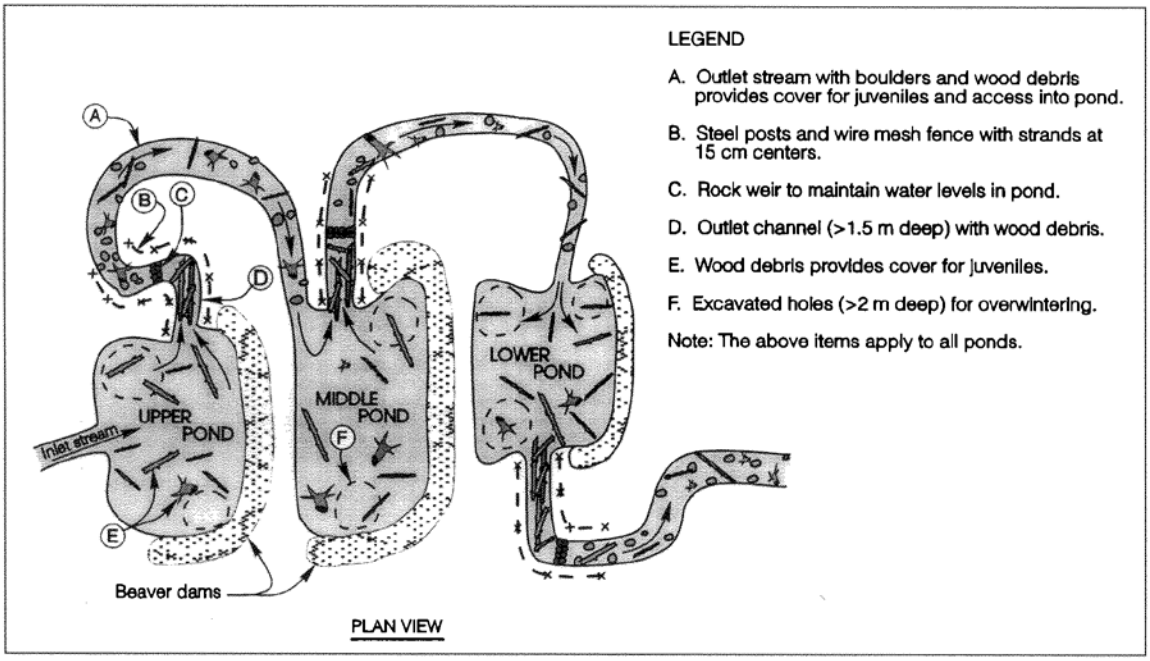
Typical off-channel pond with aquatic vegetation for juvenile fish rearing



Pond, dam and fishway to provide permanent fish access to ponds



Stream enhancement methods



Series of ponds with connecting channels

REFERENCES

Alberta Transportation. 2009. Fish Habitat Manual – Guidelines and Procedures for Watercourse Crossings in Alberta. Government of Alberta, Ministry of Transportation.

Slaney, P.A. and Zaldokas. 1997. Fish Habitat Rehabilitation Procedures. BC Ministry of Environment Lands and Parks, Watershed Restoration Technical Circular No. 9.