MEADOWBANK DIVISION

Habitat Compensation Monitoring Plan

In Accordance with Fisheries Act Authorizations NU-03-0190, NU-03-0191.3, NU-03-0191.4, NU-08-0013, and NU-14-1046

Prepared by:
Agnico-Eagle Mines Limited – Meadowbank Division

Version 4
February 2017

EXECUTIVE SUMMARY

General Information

This Habitat Compensation Monitoring Plan (HCMP) defines the sampling methods and criteria for success of the fish habitat compensation features described in Meadowbank's No Net Loss Plan (October, 2012) and subsequent addendum (Fish Habitat Offsetting Plan: Phaser Lake; November, 2016). In consultation with DFO, this HCMP is designed to meet monitoring and reporting requirements related to habitat compensation/offsetting as described in DFO Fisheries Act Authorizations: NU 03-0190 (All Weather Access Road, Condition 5), NU 03-0191.3 (Second and Third Portage Lakes, Condition 3 and 6),NU 03-0191.4 (Vault Lake, Condition 3 and 6), and NU-14-1046 (Phaser Lake, Condition 5). This plan will be updated to reflect conditions of future project authorizations and related offsetting plans.

Record of Changes

A record will document all significant changes that have been incorporated in the HCMP subsequent to the latest annual review. The record will include the names of the persons who made and approved the change, as well as the date of the approval.

Distribution List

Agnico Eagle Mines Limited will maintain a distribution list for the HCMP, providing information about all parties that receive the plan including mine personnel, departments, and outside agencies.

IMPLEMENTATION SCHEDULE

The implementation schedule for this plan is effective immediately subject to any modifications proposed by DFO as a result of the review and approval process.

DISTRIBUTION LIST

AEM - Environmental Superintendent

AEM – Environmental Coordinator

AEM – General Mine Manager

AEM – Site Services Superintendent

AEM – Field Services Supervisor

AEM – Engineering Superintendent

DFO Arctic Region Representative

DOCUMENT CONTROL

Document Control

Version	Date (YMD)	Section	Page	Revision
1	05/08			Initial document (Azimuth Consulting Group Inc.)
	26/03/09			Further detail by technical memorandum (Azimuth Consulting Group Inc.)
2	06/13	All	All	Document re-written to reflect updated NNLP (AEM, 2012b)
3	03/14	Added Section 4.3	15, 22-29	In consultation with DFO, AEM changed timing and frequency of monitoring back to the original DFO authorization timing.
4	02/17	All		Monitoring added for Phaser Lake in accordance with Fisheries Act Authorization NU-14-1046; Monitoring schedule amended for Portage and Vault Lakes

Version 4

Prepared By: Meadowbank Environment Department

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SECTION 1 • INTRODUCTION

1.1 BACKGROUND

Agnico Eagle Mines Limited (AEM) Meadowbank Division currently operates an open pit gold mine located on Inuit-owned land in the Kivalliq Region of Nunavut. The mine site is approximately 70 km north of the hamlet of Baker Lake. Mining rights for this site were obtained by AEM from Cumberland Resources Ltd. in 2007.

Since mining activities at this site were planned to result in the harmful alteration, disruption and destruction of fish habitat, a series of DFO Fisheries Act Authorizations have been required. In 2006, Cumberland Resources Ltd. developed a No Net Loss Plan (NNLP) in support of the initial application to DFO. This plan has since been updated and quantified losses to fish habitat that were expected to occur, and described the habitat gains that would be achieved through compensation measures or fisheries offsets.

The first DFO Fisheries Act Authorization (NU-03-0190) issued was for the All Weather Access Road, in 2007. This was followed with the issue of a Fisheries Act Authorization for the Portage lakes area (July 30, 2008; NU-03-0191).

As a result of discrepancies between the 2006 NNLP and the issued Portage Lakes Fisheries Act Authorization, as well as changes to construction feasibility and mine site designs, Meadowbank's NNLP was updated in October, 2012. An updated Fisheries Act Authorization for the Portage lakes area was provided in March, 2013 (NU-03-0191.3), and a new Authorization for Vault Lake was provided in May, 2013 (NU-03-0191.4). Following submission of an addendum to Meadowbank's NNLP (Draft Fish Habitat Offsetting Plan: Phaser Lake; February, 2016), Agnico Eagle received a Fisheries Act Authorization for Phaser Lake in July, 2016 (NU-14-1046).

In support of each application for a Fisheries Act Authorization, this Habitat Compensation Monitoring Plan has been developed and maintained for the Meadowbank site. The purpose of this plan is to describe the specific monitoring program that will be implemented to determine the effectiveness of fish habitat compensation or offsetting features. This plan will be updated to reflect associated offsetting plans and related project authorization conditions of future extensions of the Meadowbank mine. Habitat compensation monitoring techniques described in this plan are expected to be transferable to future offsetting measures. A summary of plan revisions is provided in the Document Control section.

Efforts have been made to update terminology used in this Plan to reflect the current Fisheries Act provisions (generally, habitat "offsetting" has replaced language regarding habitat "compensation"). However, to maintain continuity with previous versions and existing Fisheries Act Authorizations, it will continue to be referred to as the Habitat Compensation Monitoring Plan.

1.2 OBJECTIVES

In general, habitat gains at Meadowbank are planned to be achieved through re-flooding of de-watered lake basins and pit areas following construction of features such as dike faces and roads that act as reefs or shoals, access enhancements for isolated fish populations, and land-to-lake conversions. Based on the conditions in the Fisheries Act Authorizations described above, assessment of the structure and successful utilization of these features by fish are the primary goals of the monitoring program.

This work will be carried out as a targeted monitoring plan under the Meadowbank Aquatic Effects Monitoring Program (AEMP).

The objectives of this plan are:

1. To provide an overview of habitat offsetting features at Meadowbank
2. To summarize the habitat monitoring conducted to date
3. To describe the physical and ecological monitoring methods for each feature
4. To describe the quality assurance and control measures to be included in the monitoring program
5. To define the criteria for success
6. To present the monitoring frequency and reporting schedule

SECTION 2 • HABITAT OFFSETTING FEATURES

In the 2006 NNLP, habitat gains for the Meadowbank site were largely to be obtained from re-flooding of dewatered basins and excavated pits. The construction of boulder gardens, reef and shoal features within the dewatered basins were proposed to increase habitat value. In addition, large (19 ha) finger dikes and habitat mounts were planned for in-water construction in Second and Third Portage Lakes (outside the dikes) to provide supplementary habitat gains pre-closure.

Re-flooding of the dewatered areas remains the primary offsetting measure to be implemented at Meadowbank (AEM, 2012b; AEM, 2016a). However, based on the experience of AEM with in-water dike construction, the supplementary dike construction projects proposed previously were found to be technically challenging to construct without possible short-term impacts on the aquatic system. The updated 2012 NNLP therefore includes similar finger dike features, with modifications for improved constructability and reduced potential for impact to the receiving environment. A current schedule of completion for the habitat features is provided in Table 1.

2.1 RE-FLOODING OF DEWATERED BASINS AND PITS

As previously stated the major compensation measure proposed for the Meadowbank site is the re-flooding of dewatered basins and some associated pits following mining activities. In order to provide the greatest gain:loss ratio possible, considerations for improving fish habitat have been incorporated into the basin and pit designs (e.g. boulder gardens, backfilling of deep pits). During consultations prior to submission of the offsetting plan for Phaser Lake, it was determined that new pit areas that are not backfilled (BB Phaser Pit) would no longer be considered to have any habitat value when calculating offsets. However, re-flooding the former Phaser lake bed (non-pit area) and the backfilled Phaser Pit is considered to provide a habitat offset.

2.1.1 Portage Lakes Area

Following completion of mining in the Portage and Goose Island pits, the impounded former lake area will be gradually re-flooded. Post-closure (after water quality criteria are met), the Bay-Goose dike will be breached to allow fish entry and re-gain the temporarily lost habitat. The portion of Second Portage Lake between the East Dike and the Central Dike will become part of Third Portage Lake, due to the land-to-lake conversion resulting from the Portage Pit construction. The East Dike will not be breached in order to maintain the current 1 m difference in elevation between Second Portage and Third Portage Lakes.

Prior to re-flooding, a number of habitat improvement measures will be implemented to increase the productive capacity of this area (Figure 1). Construction of a boulder garden feature along the west side of the soft-sediment Bay-Goose Basin will increase habitat suitability in this area. This feature will consist of at least 2.97 ha of heterogeneous, coarse substrate habitat in the <4 m depth zone, just west of the Goose Island Pit. Further, construction of mine-related features (pit caps, roads and dikes) from coarse rock material throughout the basin will create shoals and reefs after re-flooding. In addition, approximately 30% of the area of Portage Pit will be backfilled to a depth of 4-10 m during the construction phase, reducing the amount of ultra-deep water areas, and increasing habitat suitability in this area.

2.1.2 Vault Lake and Phaser Lake Area

After mining, Phaser Lake will be connected to Vault Lake via the Phaser and Vault Pits, and eventually the Vault Dike will be breached to allow a connection to Wally Lake. Post-closure alterations to Vault and Phaser Lakes will result from construction of pits, pit caps, roads and dikes. Both lakes will be expanded as a result of land-to-lake conversion in the Vault Pit and Phaser Pit (as shown in Figure 2). Partial backfilling of Phaser Pit will reduce the amount of ultra-deep areas. Vault Pit will not be backfilled, but is assumed under the NNLP (AEM, 2012) to provide overwintering habitat, which is limited in these relatively shallow lakes. BB Phaser Pit will not be backfilled, and in accordance with recent DFO consultation, it is not assumed to provide any habitat value. However, future monitoring of the pit areas to determine habitat suitability will be conducted as described herein. Further habitat improvements in Vault and Phaser Lakes will be made through development of shoals due to permanent roadway construction, areas of mixed substrate from temporary haul roads, and the improvement of the connecting channels between Vault and Wally Lakes, and Vault and Phaser Lakes, to allow fish movement. In particular, the connection to Vault Lake will provide access for Arctic char, which were not naturally present in Phaser Lake. Improvement of the connection to Wally Lake will involve deepening the channel inside the Vault Dike to a depth of at least 3 m, while the lake is dewatered, to allow fish passage year-round after removal of the dike.

As per the Fisheries Productivity Investment Policy: A proponent's guide to Offsetting (DFO Nov. 2013), AEM will also work with DFO prior to and during the transfer or stocking of all fish species from adjacent lakes into reflooded areas. This includes transferring Arctic char from Wally Lake into the re-flooded Vault Lake, Vault Pit, Phaser Lake and Phaser Pits. As discussed in the NNLP (2012), it was suspected that the lack of char in Wally and Phaser Lakes is due to historical isolation and the lack of deep-water habitat, which is preferred by this species. Pit development in the Vault Lake area will provide a significant quantity (approximately 45 ha) of this deep-water habitat, which is limited in the Vault Lake Area, but is prevalent in all nearby char-bearing lakes.

Legend

Post-Closure Features

- Capped roadways
- Dike to remain
- Finger dike
- Breach in dike
- Free dump boulder garden
- Mixed substrate basin
- Pit
- Pit capping

Bay Goose Basin Conceptual Drawings

POST-CLOSURE FEATURES

DOUGAN & ASSOCIATES
ECOLOGICAL CONSULTING & DESIGN
77 Wyndham Street South • Guelph ON N1E 5R3
T 519.822.1609 • F 519.822.5389 • www.dougan.ca

PROJECT: DA11-062-02

CLIENT: Agnico-Eagle Mines Ltd., Meadowbank Div.

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UTM Zone 14 NAD83

DATE: OCTOBER 2012

SCALE: NTS

DRAWN BY: MAY

CHECKED BY: RV

FIGURE:

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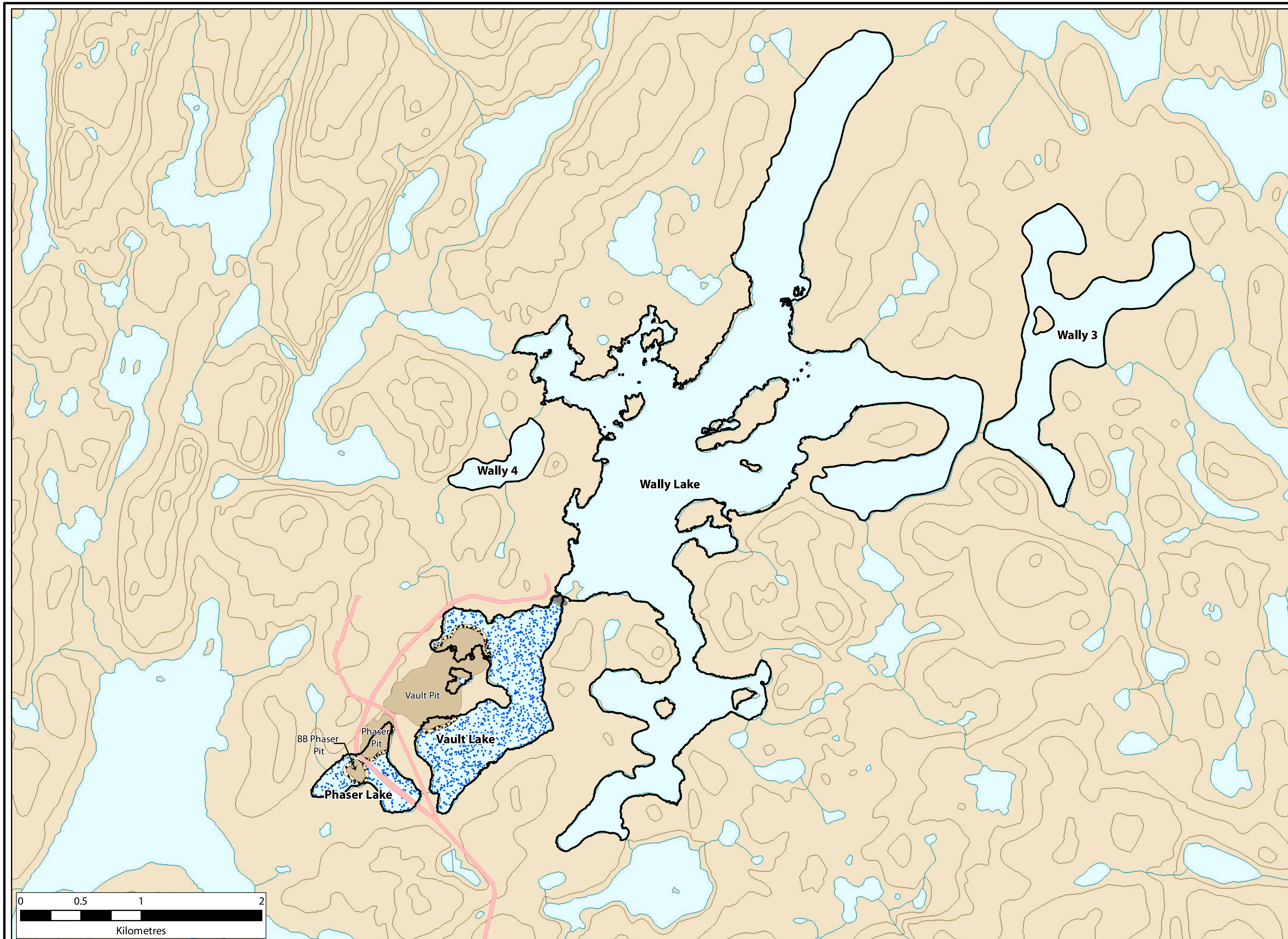

Features
Vault Lake Area

DOUGAN & ASSOCIATES
ECOLOGICAL CONSULTING & DESIGN
77 Wyndham Street South • Guelph ON N1E 5R3
T 519.822.1609 • F 519.822.5389 • www.dougan.ca

PROJECT: DA11-062-06

CLIENT: Agnico-Eagle Mines Ltd., Meadowbank Div.

DATE: JUNE 2015

SCALE: 1:29,531

DRAWN BY: LC

CHECKED BY:

FIGURE:

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The information displayed on this map has been compiled from various sources. While every effort has been made to accurately depict the information, this map should not be relied on as being a precise indicator of locations, features, or roads, nor as a guide to navigation. MNR data provided by Queen's Printer of Ontario. Use of the data in any derivative product does not constitute an endorsement by the MNR or the Ontario Government of such products.

2.1.3 Dogleg System

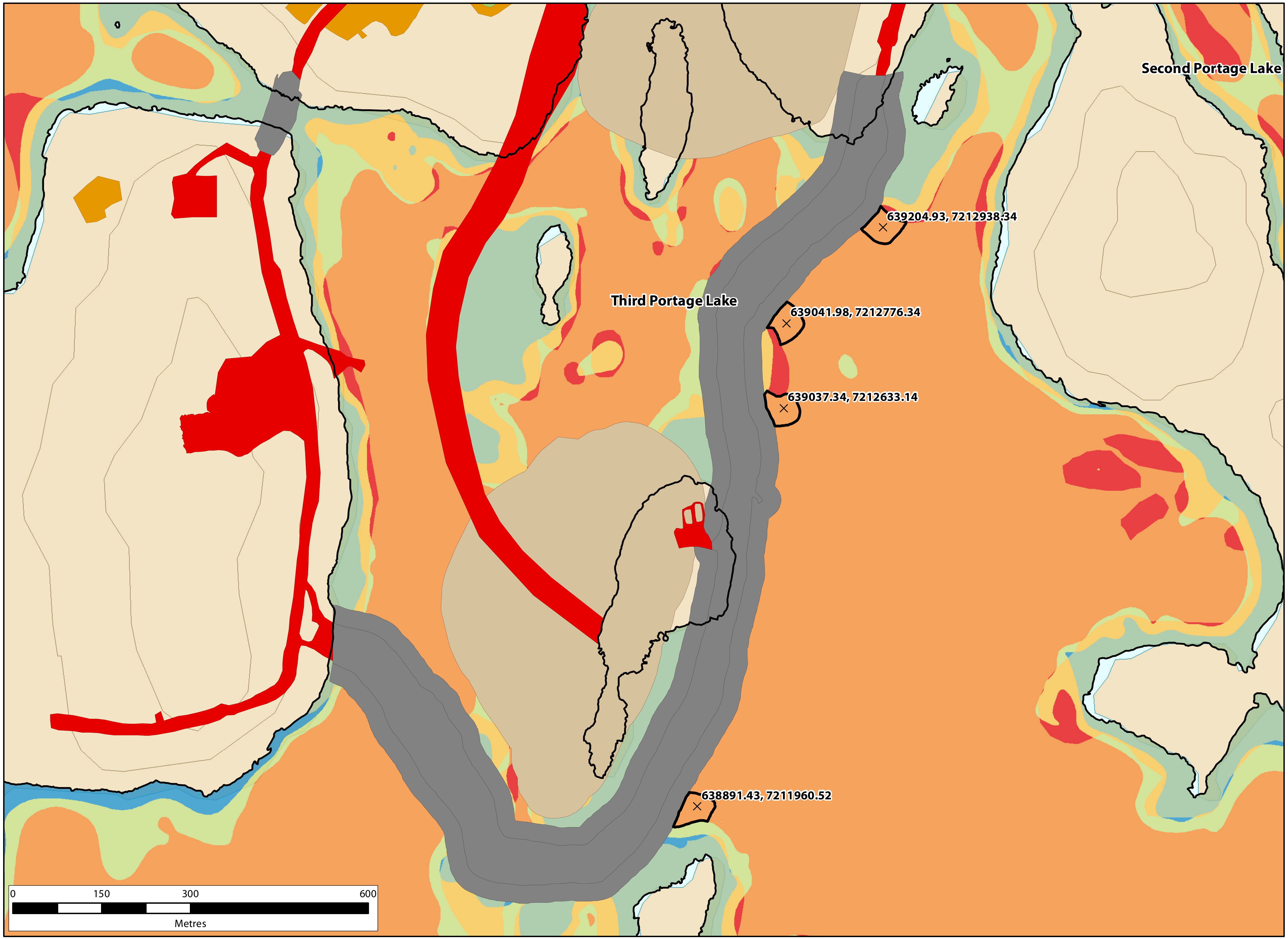
Dogleg Pond and the “North Portage” ponds, Dogleg North Pond (NP-1) and NP-2, are isolated ponds located near the waste rock area, just north of Second Portage Lake. They are shallow ponds, with a maximum depth of 11 m in Dogleg Pond. Dogleg North Pond reaches about 3.8 m in depth, and NP-2 has a small area of about 5 m depth. The project described below was not specifically developed as compensation, but has integrated habitat compensation with water management to result in a small net gain of fish habitat.

NP-2 formerly drained into the TSF area of Second Portage Lake, while Dogleg and Dogleg North drain towards the main body of Second Portage Lake. Since drainage of NP-2 became blocked by the waste rock pile on the northern edge of the TSF, a connecting channel was excavated to direct flow from NP-2 to Dogleg North, effectively increasing the drainage area of Dogleg and Dogleg North Pond. The accompanying increase in wetted area is estimated at 5% for Dogleg Pond, 15% for Dogleg North Pond, and 5% for NP-2.

Through construction of the diversion channel, connectivity between the ponds has been improved, and previously inaccessible habitat in Dogleg North Pond will be available for use by lake trout and round whitefish currently inhabiting Dogleg Pond and NP-2. Eventually these ponds may be seasonally accessible from Second Portage Lake. This connection would theoretically provide access for Arctic char to the Dogleg system, but because it is deemed unlikely due to the shallow, ephemeral nature of the connections, access for char is conservatively excluded from habitat gain calculations.

2.2 FINGER DIKES

In keeping with the original NNLP, a number of finger dikes are proposed to be built, extending from the Bay-Goose Dike into Third Portage Lake. While the original NNLP (2006) proposed 19 ha of finger dikes, AEM has found that the method described for construction to pose safety concerns, as well as potential concerns with elevated TSS during settling of material. Therefore, as described in the 2012 NNLP, the new finger dikes will be 1 ha in total at their base. Potential locations for each finger dike are shown in Figure 3. Specific locations will be chosen prior to construction. These changes will not alter the monitoring techniques described in Section 4 and 5.



Legend

- Study Lakes
- Potential Finger Dike

2011 As Built Mine Plan

- Quarry
- AWPAR Quarry
- Dewatered Lake
- Portage Attenuation Facility
- Tailings Storage Facility
- Roads
- AWPAR
- Dikes
- Stockpiles
- Mine Pit Updated Area
- Facility
- Airstrip
- Waste Dump

Habitat Type

1, 2, 3, 4, 5, 6, 7, 8, 9

Minesite Features
Potential Finger Dike

DOUGAN & ASSOCIATES
ECOLOGICAL CONSULTING & DESIGN

77 Wyndham Street South • Guelph ON N1E 5R3
T 519.822.1609 • F 519.822.5389 • www.dougan.ca

PROJECT: DA11-062-02

CLIENT: Agnico-Eagle Mines Ltd., Meadowbank Div.

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UTM Zone 14 NAD83

DATE: MARCH 2011

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FIGURE:

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2.3 WALLY LAKE ACCESS

Wally Lake is a 532 ha lake connected to Vault Lake (see Figure 2) via a seasonally passable channel. Fish movement between these lakes was found to be almost nil and this channel was diked prior to de-watering of Vault Lake. Information in baseline studies (2005) indicated that the only large bodied fish in Wally, Vault and Phaser Lakes were lake trout and round whitefish. In 2012, follow-up studies were completed which confirmed these results. Based on these studies, the 2012 NNLP proposed to provide access for Arctic char to enter Wally, Vault and Phaser Lakes from the isolated Wally 3 Lake (W3), which was found to have a population of char. However, the fish-out of Vault Lake in 2013 found that 5% of the fish population of this lake was in fact comprised of Arctic char, and a number of these were transferred to Wally Lake. As a result, AEM issued a technical memorandum to DFO to recalculate habitat units associated with Vault Lake (AEM, 2016b). Since Arctic char were found to inhabit Vault Lake, and the connection between Vault and Wally Lakes is already planned to be improved, AEM and DFO have discussed the benefits of constructing the channel between W3 and Wally Lake, and determined this project is no longer required (see DFO letter dated June 7, 2016: 2016 DRAFT – Habitat Compensation Monitoring Plan Review by DFO, Comment #2).

2.4 AWAR FISHERIES COMPENSATION

As part of the habitat compensation plan for construction of the roadway between Baker Lake and the mine site, a spawning pad was constructed in 2009 near bridge crossing R02 (Figure 4). This habitat compensation project was constructed according to design specifications that met biological criteria aimed at enhancing Arctic grayling productivity in this stream system. The construction focused on creating high value spawning and nursing habitat to compensate for the loss of the low and medium value habitat affected by bridge abutment construction at the four crossings. An overview of the Meadowbank area post-closure, incorporating all compensation features, is shown in aerial photo below.

Figure 4- Aerial Photo of R02 Habitat Compensation Feature- Taken in September 2009

SECTION 3 • HISTORICAL MONITORING

Until now, monitoring has proceeded according to the 2008 HCMP Version 1 (Azimuth, 2008a) and 2014 HCMP Version 3 (AEM, 2014). Based on construction to date, this includes monitoring of the R02 spawning pads along the AWAR, the East and Bay-Goose Dikes, and Dogleg Pond system. To date, four rounds of monitoring have been conducted.

3.1 AWAR MONITORING

In 2013 and 2015, monitoring of the spawning pads constructed at AWAR crossing R02 was conducted under the HCMP. As described in the schedule of monitoring events, the AWAR study includes a visual assessment of stability, as well biological monitoring to confirm use by Arctic grayling. The major component of the program consists of length and weight measurements and maturity identifications of adult fish captured in hoopnets. Nets are set to capture both upstream and downstream movements as soon as ice conditions allow. Additionally, reproductive success in this reach is assessed using larval drift traps.

To date, the constructed spawning pads have been visually confirmed to be stable as designed. Rates of shifting of material have not exceeded expectations at construction. Generally, condition factors of adult fish, population size distributions and timing of migration have consistent year-over-year, and confirm continued use of this area by Arctic grayling. Larval drift rates of collection continue to exceed those observed prior to construction of the spawning pad, suggesting a positive impact on Arctic grayling reproduction, either through direct use or reduced pressure on upstream spawning areas.

Overall, the constructed spawning pads have not only increased the quantity of high-value habitat, but appear to be effectively increasing production rates in the local population.

3.2 PORTAGE AREA MONITORING

Monitoring in the Portage area under the HCMP has been ongoing since 2009. In 2009, this included analysis of the East Dike face. Monitoring of the both the East Dike and Bay-Goose Dike faces was conducted in 2011, and 2015. Monitoring in 2015 also included an analysis of fish use in the Dogleg Ponds.

3.2.1 Interstitial Water Quality

Water samples are collected from between the rocks of the dike face using a tube sampler and electronic pump, and are analyzed for conventional parameters (hardness, conductivity, pH, and total dissolved and suspended solids), anions (alkalinity, chloride and sulfate), nutrients (ammonia, nitrate, nitrite, total Kjeldahl nitrogen, orthophosphate and total phosphate), organic parameters (chlorophyll-a, dissolved and total organic carbon) and total and dissolved metals at an accredited facility. While TSS was elevated in 2009 and at one station in 2015, this was likely due to sediment re-entrainment during sampling. The dissolved aluminum guideline was exceeded in one sample in 2009 due to marginally low pH, but this trend did not recur with additional sampling. Total phosphorus concentrations exceeded CCME guidelines in 2009 and 2011, but since orthophosphate was at or below detection, no potential ecological concerns were identified and this did not recur in 2015.

3.2.2 Periphyton Community

Density, biomass and composition of the periphyton community are measured in the shallow zone by collecting a sample from the rock face with a specialized scrubber. Underwater video imagery is used to qualitatively examine periphyton growth in the deep zone. Periphyton was found to colonize rocks in shallow areas in the first year after construction of both dikes, and increasing likeness to reference stations (in both density and composition) has been evident year over year.

3.2.3 Fish Use

In 2009, a variety of methods were tested to monitor fish use of the dike face, including hydroacoustic surveys, minnow traps, gill nets and visual observation. Only gill nets were found to be effective, and this method alone was used in 2011. In 2014 the HCMP was amended and in 2015 methods for monitoring fish use focused on the lower-impact techniques of angling and underwater video. Fish use of the dike faces was documented at rates no lower than reference stations in all years.

In 2015, two Arctic char were caught by angling in Dogleg Pond, and two Arctic char and two lake trout were caught in Dogleg North Pond (NP-1). NP-1 was previously determined to be fishless and access to this habitat for lake trout and round whitefish was identified as part of the onsite habitat compensation through construction of a diversion channel from NP-2 Pond, which occurred in 2013 (see Section 2.1.3). These results therefore indicate that the planned compensation has been successful at providing access to habitat in Dogleg North Pond for lake trout, and that Arctic char may be accessing Dogleg Pond from Second Portage Lake.

SECTION 4 • MONITORING COMPONENTS AND METHODS

Habitat gains at Meadowbank are planned to be derived through both physical improvements to existing habitat (e.g. creation of reefs), and the facilitation of access to new habitat (e.g. previously fishless or underutilized areas). As per the original Fisheries Act Authorization, regardless of the type of compensation, both physical and ecological components are included in the monitoring plan, to record whether each feature is constructed and is functioning as intended.

The assessment of habitat features incorporates monitoring methods with specific quantitative criteria for success (physical structure and interstitial water quality), as well as complementary “qualitative” tools (periphyton growth and fish use). All lines of evidence are then integrated in a weight-of-evidence approach to make the final determination regarding habitat feature functionality.

This updated monitoring program maintains the major elements of the original 2008 version (structure, water quality, periphyton and fish use), while modifying timelines and methods based on field experience, as well as to incorporate new offsetting features (AEM, 2012b; AEM, 2016a) and current life-of-mine designs, and to meet the conditions of new Fisheries Act Authorizations. The proposed type and schedule of monitoring is described for each feature in Tables 3 – 8, and details for each monitoring component are provided in Sections 4.1 and 4.2, below.

4.1 PHYSICAL COMPONENTS

Since the habitat evaluation procedure focuses on quantifying losses and gains to habitat, based on physical characteristics (area, depth and type of substrate), physical structure is arguably the most important component to monitor in cases where habitat offsets are derived from constructed features (such as reefs or boulder gardens).

All structures will be assessed post-construction to determine whether they meet the assumptions of their associated no-net-loss or offsetting plan. These include area, depth and substrate characteristics. For each feature, a comparison will be made to the specifications described for these characteristics, to determine whether expected physical habitat gains are achieved in the as-built state (i.e. to confirm features were constructed as planned). This analysis is separate to as-built reports, which are required under NU-03-0191.4, Condition 6.3, but may make use of information provided in those reports. Habitat compensation monitoring reports will, however, include the photographic evidence (pre-, during and post-construction) of compensation features, as described under NU-03-0191.3, Condition 6.4, NU-03-0191.4, Condition 6.2. Photographic evidence for the AWAR compensation feature has previously been included in annual AWAR monitoring reports (e.g. AEM, 2010).

In addition to the analysis of depth, area and substrate in the dry basins, structural integrity will be qualitatively assessed after re-flooding for features in the de-watered basins, to record any movement occurring during this process.

Methods of evaluation will depend on the specific compensation feature, as detailed in Tables 3 - 8. In general, methods will include:

On-the-ground photos – photos will be taken of the compensation feature pre-, during and post-construction and included in HCMP reports.

Aerial photos or PhotoSat Imagery – will be taken of dry basins just prior to re-flooding, to compare areal extents of compensation features with NNLP predictions. Differences will be estimated visually or by GIS.

Visual observation – conducted to ground-truth substrate types for confirmation in air photos.

Field survey – conducted in the dry to determine depth-below-surface of compensation features.

Bathymetric survey – conducted to determine the final depth contours of compensation features that are constructed in-water (i.e. finger dikes).

Underwater video – conducted post-flooding to qualitatively examine structural integrity of constructed features.

Results will be recorded for each feature and compared to the associated NNL or offsetting plan estimate in an HCMP report, making use of the example provided in Table 2.

Analysis of the physical components will occur in the dry for features constructed in de-watered basins, in order to facilitate ground-truthing of substrate and total area. This analysis will occur just prior to re-flooding, such that features are in their final condition. As-built reports will first be consulted to determine if the required information is available. For features constructed in-water (finger dikes, access enhancements), analysis of the physical components will be conducted in the years after construction.

4.2 ECOLOGICAL COMPONENTS

Ecological monitoring elements include interstitial water quality, open basin water quality, periphyton community biomass and fish use.

No changes are proposed here to ecological monitoring methods for habitat features discussed in previous versions of the HCMP (monitoring for features associated with Fisheries Act Authorizations NU-03-0190, NU-03-0190.3, and NU-03-0190.4). The basic monitoring methods for these habitat features are maintained from the 2008 HCMP, with some modifications in 2014 based on field experience. Monitoring for these features focuses on identifying any ecological constraints to habitat function, and the weight-of-evidence evaluation of functionality is primarily based on capability to support fish, rather than on actual use (although fish use in comparison to reference sites is monitored). This approach was initially described in the 2008 HCMP, which formed the basis of monitoring for Fisheries Act Authorizations issued in 2007, 2008, and 2013. However, according to the requirements of DFO's "Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting" (November, 2013), monitoring for offsets developed after that time (Phaser Lake) will further aim to determine whether the system has reached full ecological functionality (i.e. supports fish reproduction, growth, and survival).

Further details of methods for each monitoring component are described below, and in Tables 3 – 8.

4.2.1 Interstitial Water Quality

Modeling during the EIA process indicated that metals leaching from quarried rock would not significantly impact the aquatic environment. Nevertheless, interstitial water quality of constructed habitat compensation features will be assessed through the HCMP to verify these predictions.

In order to collect a representative sample from the bioactive zone between the rocks, an electric diaphragm pump with food-grade silicon tubing is used. Samples will be taken at depths between 1 and 4 m, and analyzed in an accredited laboratory for total suspended solids, and total and dissolved metals. Results will be compared to background concentrations and CCME guidelines where available. Locations and schedules for interstitial water quality sampling are described in Table 3.

4.2.2 Open Basin Water Quality

Modeling during the EIA process indicated that water quality in re-flooded pits and basins would support healthy fish populations. Because the re-flooded areas form part of Meadowbank's habitat compensation, water quality will be monitored as part of the HCMP, in conjunction with Type A Water License requirements, and eventually, the Core Receiving Environmental Monitoring Program (CREMP), in order to determine when breaching of the dike to allow fish access is appropriate. Sampling will be based on procedures and parameters analyzed in the CREMP (Azimuth, 2015) and as identified in Type A Water License 2AM-MEA1525. During operations and closure, analyses will generally be conducted monthly during open water or bi-annually in each pit basin (Goose Island, Portage, Vault, Phaser, and BB Phaser pits), with specific locations determined by experienced field technicians and in accordance with NWB Water License requirements. Analyses will include vertical depth profiles of temperature, DO and conductivity to a representative depth. Secchi depth and surface pH will also be determined at each sampling location. Water samples will be collected from approximately 3 m depth by pumping lake water using weighted flexible (food-grade silicone) tubing, and a diaphragm pump connected to a 12 volt battery. A depth of 3 m is chosen for consistency across all basins and seasons (i.e., sampling at 3 m is still possible in the winter under ice). The lakes are never thermally stratified and are well mixed; given the uncertainty in the end pit water quality, varying depths of samples will be taken. An inline filter is connected to the end of the outflow tube when filling bottles for dissolved metals and dissolved organic carbon analyses.

Water samples will be analyzed by an accredited facility for conventional parameters (hardness, conductivity, pH, turbidity, and total dissolved and suspended solids), anions (alkalinity, bromide, chloride, fluoride, silicate and sulfate), nutrients (ammonia, nitrate, nitrite, total Kjeldahl nitrogen, orthophosphate and total phosphate), organic parameters (chlorophyll-α, dissolved and total organic carbon) and total and dissolved metals. Results will be compared to background concentrations, CREMP trigger or threshold levels and CCME guidelines where available. Locations and schedules for open basin water quality sampling are described in Tables 4 - 6.

4.2.3 Periphyton Community

The periphyton community consists of a collection of microorganisms, including algae, that grow attached to or in very close proximity to submerged substrate. Colonization of the community occurs over time, with rates depending on nutrient and light availability. Periphyton is an important food source for benthic invertebrates, so colonization will be monitored to ensure that quarried rock substrate provides habitat that is as suitable at this level of the food chain as natural substrate.

Periphyton sampling for habitat assessments will be carried out in the same manner as described in the CREMP (Azimuth, 2015). Briefly, a specialized scrubber will be used to collect periphyton samples from a prescribed area of rock face, in order to calculate cell density, biomass (μg/cm^2), and species composition. Underwater video may also be used in deeper areas to make qualitative assessments of periphyton growth. Results will be compared to reference sites, baseline data, and/or historical monitoring programs. Locations and schedules for periphyton sampling are described in Table 3.

4.2.4 Fish Use

4.2.4.1 Portage Lakes, Dogleg Ponds, Vault Lake

The ultimate goal of NNL planning according to AEM's 2012 NNLP is to provide suitable habitat for fish populations. As described previously, fish data for the Portage Lakes, Dogleg Ponds, and Vault Lake will be used as a complementary qualitative tool to support the assessment of habitat feature functionality.

Since the use of gill nets has historically been found to result in elevated incidences of mortality, angling and underwater motion camera techniques were proposed in 2014, implemented in 2015 and will continue to be used to establish fish presence around the constructed habitat features and in open basins. Catch per unit effort and physical characteristics (species, length, weight, maturity, sex) will be recorded and compared to reference areas and/or historical results, as the dataset allows. If these techniques are not successful, a DFO representative will be contacted and the use of gill nets may need to be included. Hoopnets or trap nets may be used at dike breaches to assess fish movement into the re-flooded basins. Locations and schedules for monitoring of fish use are provided in Tables 3 – 8.

4.2.4.2 Phaser Lake Monitoring

In accordance with DFO's "Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting" (November, 2013), monitoring of fish use in Phaser Lake will aim to demonstrate that the system has reached full ecological functionality (i.e. supports fish reproduction, growth, and survival). This status will be assessed through year-over-year analysis of length-frequency distributions and abundance data, and potentially through the proposed research program described below. Planned methods to monitor fish populations in the re-flooded Phaser Lake will generally be the same as those described in Section 4.2.4.1, including angling and underwater camera use. It is estimated to be more likely that use of gill nets may be required to demonstrate that criteria for success have been met (see Section 5.3.5) in the case of Phaser Lake. However, DFO will be contacted regarding the need to utilize gill nets prior to their implementation.

In addition to angling, underwater camera monitoring, and potential gill netting, AEM is proposing to work with researchers as a complementary offsetting measure (described in the Phaser Lake Offsetting Plan; AEM, 2016a). This research may focus on a fish tagging program to assess movements, survivorship, and habitat use of fish introduced to the re-flooded Phaser Lake. While not specifically planned as a component of the HCMP, if successful, this program would complement the standard monitoring data.

4.2.4.3 AWR R02 Compensation Monitoring

Monitoring fish use of the compensation structure at R02 will continue as previously. This monitoring program consists of sampling adult fish populations using hoopnets, and assessing reproductive activity using larval drift traps.

As described above, hoopnets consisting of either a 4 ft (1.22 m) or 3 ft (0.9 m) diameter front hoop will be used to target Arctic grayling. The captured fish are gently removed by field technicians from the nets using dip nets, placed in large tubs filled on location with stream water for biological processing and then placed in a recovery tub. The fish are released up or downstream of the hoopnets (depending on the fish's migration direction) following handling. Biological processing includes measurement of fork length, weight and maturity.

Hoopnets are placed adjacent to the habitat compensation area, in a riffle/ side channel area upstream of the bridge and downstream of the compensation area, and immediately upstream of the culverts. Nets are set with the goal of capturing the maximum number of fish moving beyond the R02 bridge crossing, but also to assist in determining effectiveness of the R02 habitat compensation area. Larval drift traps were placed in representative, high to moderate flow sections of the stream, both upstream and downstream of the habitat compensation feature. These traps consist of a square sided cone with a ridged frame that funnels into a 0.5 mm nitex mesh bag. Attached at the back of the nitex bag was a Nalgene®-type container where the drift is collected. The frame is submerged at least halfway under water and secured by poles on each side. Drift traps will be checked at least every other day. Larval drift will be identified in the field and preserved in vials of diluted formalin.

4.3 FREQUENCY

The sampling schedule and general locations are described in Tables 3 - 8. Specific sampling locations will be determined in the field by a qualified environment technician or biologist.

SECTION 5 • QA/QC AND CRITERIA FOR SUCCESS

5.1 LABORATORY QA/QC

Water Quality – Data Quality Objectives (DQOs) are numerically definable measures of analytical precision and completeness. Analytical precision is a measurement of the variability associated with duplicate analyses of the same sample in the laboratory. Completeness for this study is defined as the percentage of valid analytical results. Duplicate results will be assessed using the relative percent difference (RPD) between measurements.

The laboratory DQOs for this project are:

Analytical Precision = 25% RPD or less for concentrations that exceed 10x the method detection limit (MDL).

Completeness = 95% valid data obtained.

Periphyton Community – Laboratory analyses for periphyton samples will be conducted by experienced scientists following a standardized procedure (i.e., quality assurance), internal quality control samples (e.g., duplicate counts) will be included to document analytical variability.

5.2 FIELD QA/QC

Water Sampling – Field QA/QC standards during water sampling will be maintained for every sample. The standard QA/QC procedures include thoroughly flushing the flexible tubing and pump to prevent cross-contamination between stations and thoroughly rinsing the sample containers with site water prior to sample collection. Trip blanks and field duplicates will be collected (approximately 1 per 10 samples). Field duplicates assess sample variability and sample homogeneity; a RPD of 50% or less for concentrations that exceed 10x the MDL is considered acceptable.

Periphyton Community – Standard procedures will be used to collect biota samples. All sampling gear will be thoroughly rinsed between sampling stations to ensure that there was no inadvertent introduction of biota from one station to another. A field duplicate will be collected for phytoplankton at one sampling station per sampling event to assess sampling variability and sample homogeneity. Due to large natural variability and the qualitative nature of this component, no specific RPD acceptability criterion is recommended for density and biomass.

Fish Use – These study components will be conducted in accordance to the general practices listed previously. All relevant spatial and depth information will be recorded. Fish biological data will be recorded as will reference spatial information. Field notebooks or field sheets will be used to compile notes and observations relevant to the studies. Fishing will be carried out by experienced technicians or biologists who are very familiar with this kind of work. Video/photo survey data will be conducted carefully to provide representative images of target communities. All relevant spatial and depth information will be recorded and identified by the time stamp (or photo number) and tape number (or memory card number).

5.3 CRITERIA FOR SUCCESS

As described in AEM's 2008 HCMP, a weight-of-evidence approach will continue to be used to determine whether habitat offsetting features are functioning as intended. Specific, quantitative criteria for success have been established for physical structure and water quality components of the monitoring program, whereas monitoring of periphyton growth and fish use are considered qualitative tools without specific success criteria. Results of these assessments will not be used on their own for decision-making, but will be considered along with results of structure and water chemistry monitoring to evaluate whether habitat features are functioning as intended.

The following specific success criteria will be used prior to integrating data in a weight-of-evidence evaluation of habitat compensation and offsetting projects:

5.3.1 Physical Structure

In order to provide the required habitat gains, constructed features should meet the specifications described for area, depth and substrate in the NNLP. Where specifications are not met, the total habitat units afforded by the feature in its as-built state should be calculated. If there is a deficiency in habitat units site-wide, DFO will be consulted.

5.3.2 Interstitial Water Quality

Water chemistry results will be compared to reference locations, and CCME water quality guidelines. Since analysis of large in-water features (dikes) to date has not indicated any significant adverse effects on water quality, success criteria are expected to be met in the future. However, if necessary, follow-up sampling will be conducted as soon as practical (next ice-free season). If water quality criteria do not meet background or CCME guidelines after two monitoring events, risk-based toxicity reference values will be compared, and additional testing, such as laboratory toxicity tests will be considered. Because onsite experience and HCMP dike face monitoring results to date indicate that adverse effects are unlikely, any additional testing would be determined in consultation with DFO in the unlikely situation that it is required.

5.3.3 Open Basin

Long-term water quality predictions made during the initial planning phase of the project (Cumberland, 2005) indicated that although some water quality parameters in the Vault and Portage Pit lakes may exceed CCME criteria in year 10 post-closure, they would be within the same order of magnitude, which was recognized as the sensitivity limit of the modelling exercise. In particular, CCME exceedances were predicted for cadmium, zinc and arsenic in the Bay-Goose/Portage area, and for aluminum, arsenic, cadmium, copper, fluoride, mercury, and unionized ammonia (NH_3) in the Vault area. In addition, a temporary chemocline was predicted to occur 100 m below water surface in the Portage pit. Since pit backfilling is now prescribed for that area, this may not be a factor.

Since the pits are to be flooded with water from adjacent lakes, chemistry is expected to be similar. During HCMP monitoring of the re-flooded basins, water chemistry results will be compared to reference locations, CREMP trigger/ threshold levels, and CCME guidelines where available. The dike will be breached to allow mixing with adjacent lakes and fish entry once water quality meets these criteria during three sequential sampling events.

5.3.4 Periphyton Community

Since lakes in the Meadowbank region are ultra-oligotrophic and ice-covered for the majority of the year, periphyton development is expected to be slow and no specific criteria are provided for this monitoring component. Further, periphyton growth in the project lakes area has been shown to be highly variable in the past (Azimuth, 2008b). However, based on experience to date, the periphyton community on constructed habitat features is slowly developing and has been visible on new substrate within the first year of construction.

5.3.5 Fish Use

5.3.5.1 Portage area, Dogleg Ponds and Vault Lake

When Meadowbank's Fisheries Act Authorizations for the Portage Lakes and Vault Lake (NU-03-0191.3; NU-03-0191.4) were provided in March and May, 2013, the premise of NNL planning was that habitat compensation will increase the productive capacity of water bodies. Since it was recognized that factors other than habitat quantity or quality may limit fish population growth, no specific criteria for success were prescribed for this metric. Fish monitoring results will continue to be used as a complementary tool in the weight-of-evidence approach to verify the intended functionality of the habitat features. Observations of the East and Bay-Goose Dikes have indicated fish presence around these features is no lower than in reference areas, so this trend is expected to continue. This approach will apply moving forward for the Portage area, Dogleg Ponds and Vault Lake.

5.3.5.2 Phaser Lake Monitoring

According to DFO's "Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting" (November, 2013), monitoring of offsetting measures must be designed to confirm that serious harm to fish has been effectively counterbalanced. As a result, criteria for success for Phaser Lake are aimed at demonstrating presence, survivorship and full ecological functionality of the system (i.e. reproduction, growth, survival). For Phaser Lake, this status will be determined through year-over-year analysis of length-frequency distributions and abundance data.

5.3.5.3 AWR R02 Compensation Monitoring

No specific criteria are established for determining success of the spawning pads constructed at R02 based on fish use metrics (hoopnet catch, larval drift). Based on results to date, however, the number of successful spawning events has increased in this reach relative to pre-construction.

SECTION 6 • REPORTING AND PLAN REVIEW

Annual reports describing activities conducted under this Habitat Compensation Monitoring Plan will be submitted with AEM's Annual Report to the NIRB by March 31 of the following year.

The HCMP will be reviewed as required by the Meadowbank Environment Superintendent, and updated as necessary based on changes to mine site designs. All changes will be provided to DFO for approval.

SECTION 7 • REFERENCES

Azimuth, 2008a. Habitat Compensation Monitoring Plan, Meadowbank Gold Project. Prepared by Azimuth Consulting Group Inc. for Agnico-Eagle Mines Ltd. May, 2008.

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AEM, 2016b. Technical Memorandum – Re: Review of Offsetting Calculations Pursuant to Fisheries Act Authorization 03-HCAA-CA7-00191 (NU-03-0191.4) Vault Lake. To Julie Dahl, Fisheries Protection Program, Fisheries and Oceans Canada. From Ryan Vanengen (AEM), Stephane Robert (AEM) and Leilan Baxter (Consultant to AEM). February 22, 2016.

Cumberland, 2005. Meadowbank Gold Project - Water Quality Predictions. October, 2005.

TABLES

Table 1. Estimated timeline for the construction of fish habitat structures.

Lake	Feature Name	Date of Completion
Second and Third Portage Lakes	In-basin habitat improvements	Ongoing until re-flooding
	Re-flooded basins and pits	2029
	Finger dikes	2017
Vault Lake	In-basin habitat improvements	2014 until re-flooding
	Re-flooded basins and pit	2029
Phaser Lake	In-basin habitat improvements	2016 until re-flooding
	Re-flooded basin and pits	2027
	Access to Vault Lake	2027
Dogleg System	NP-2 channel	2013 (completed)
	NP-2 (increase in area)	2013- closure
	Dogleg North Pond (increase in area and access)	2013- closure
	Dogleg Pond (increase in area)	2015- closure
Wally Lake	Improved access from Vault Lake to Wally Lake	2029

Table 2. Example comparison of NNLP designs and as-built physical properties of habitat compensation features.

Feature	Assessment Metric*	Method	Design	As-Built
Boulder garden	Area	Air photo	2.97 ha	3.5 ha
	Substrate	Visual observation	Coarse	Coarse (indicate actual grain size)
	Depth	Field survey	> 4 m	> 4 m
	Stability	Underwater video	-	Minor movement

*Area, depth, substrate type or stability

Table 3. Summary of monitoring methods, analytical parameters, sampling frequency and number of samples for dike faces and finger dikes (under MMER Schedule II TSF and DFO NU-03-0191.3). *Dike as-built designs were incorporated into the 2012 NNLP. Active flooding (F) is estimated to be completed in 2024), and the dike breached in 2029 (B).

Feature	Component	Reason	Method	Parameters	Completed Sampling	Number of Samples	Sampling Schedule
East Dike	Interstitial water	Possible metals leaching	Tube sampler	TSS Total and dissolved metals	2009 2011 2015	2 locations (exterior) and 2 locations (interior, post-flooding)	Exterior: Odd-numbered years until 2021 Interior: Every two years between F and B, B+1, B+3, B+5.
	Periphyton	Base of food chain	Periphyton sampler	Biomass	2009 2011	2 locations (exterior) and	Exterior: Odd-numbered years until 2021

Feature	Component	Reason	Method	Parameters	Completed Sampling	Number of Samples	Sampling Schedule
					2015	2 locations (interior, post-flooding) Plus reference station	Interior: B+1, B+3, B+5.
	Fish use	Confirm use by fish	Angling Underwater motion camera	CPUE, physical characteristics	2009 2011 2015	2 locations (exterior) and 2 locations (interior, post dike breach) Plus reference station	Exterior: Odd-numbered years until 2021 Interior: B+1, B+3, B+5
	Structure	Design intent met	As-built designs	Area, substrate, depth zone	2012*	-	Complete
		Stability	Underwater camera	Qualitative observations	2009 2011	Vertical transects at 5 locations	Complete
Bay Goose Dike	Interstitial water	Possible metals leaching	Tube sampler	TSS Total and dissolved metals	2011 2015	3 locations (exterior) and 3 locations (interior, post flooding)	Exterior: Odd-numbered years until 2021 Interior: Every two years between F and B, B+1, B+3, B+5
	Periphyton	Base of food	Periphyton	Biomass	2011	3 locations	Exterior: Odd-

Feature	Component	Reason	Method	Parameters	Completed Sampling	Number of Samples	Sampling Schedule
		chain	sampler		2015	(exterior) and 3 locations (interior, post flooding) Plus reference station	numbered years until 2021 Interior: B+1, B+3, B+5
	Fish use	Confirm use by fish	Angling Underwater motion camera	CPUE Physical characteristics	2011 2015	3 locations (exterior) and 3 locations (interior, post flooding) Plus reference station	Exterior: Odd-numbered years until 2021 Interior: B+1, B+3, B+5
	Structure	Design intent met	As-built designs	Area, substrate, depth zone	2012*	-	Complete
		Stability	Underwater camera	Qualitative observations	2011	Vertical transects at 10 locations	Complete
Finger Dikes	Interstitial water	Possible metals leaching	Tube sampler	TSS Total and dissolved metals	-	2 locations	Odd-numbered years after construction (est. 2017) until 2021 One time between 2024 – 2026 (to coincide with

Feature	Component	Reason	Method	Parameters	Completed Sampling	Number of Samples	Sampling Schedule
							dewatering dike monitoring if feasible)
	Structure	Design intent met	Photos Field survey	Area, substrate, depth zone	-	-	Upon construction
		Stability	Underwater camera	Qualitative observations	-	One vertical transect of each dike	Upon construction
	Periphyton	Base of food chain	Periphyton sampler	Biomass	-	One location per finger dike (reference stations same as for Bay-Goose/East Dike)	Odd-numbered years after construction (est. 2017) until 2021 One time between 2024 – 2026 (to coincide with dewatering dike monitoring if feasible)
	Fish use	Confirm use by fish	Angling Underwater motion camera	CPUE Physical characteristics	-	One location per finger dike (reference stations same as for Bay-Goose/East Dike)	Odd-numbered years after construction (est. 2017) until 2021 One time between 2024 – 2026 (to coincide with dewatering dike monitoring if feasible)

Feature	Component	Reason	Method	Parameters	Completed Sampling	Number of Samples	Sampling Schedule
Central Dike	Interstitial water	Possible metals leaching	Tube sampler	TSS Total and dissolved metals	-	2 locations	Every two years between F and B, B+1, B+3, B+5
	Periphyton	Base of food chain	Periphyton sampler	Biomass	-	2 locations (reference stations same as for Bay-Goose/East Dike)	B+1, B+3, B+5
	Fish use	Confirm use by fish	Angling Underwater motion camera	CPUE Physical characteristics	-	2 locations (reference stations same as for Bay-Goose/East Dike)	B+1, B+3, B+5
	Structure	Design intent met	As-built designs	Area, substrate, depth zone	-	-	Prior to flooding
		Stability	Underwater camera	Qualitative observations	-	Vertical transects at 5 locations	F+2

Table 4. Summary of monitoring methods, analytical parameters, sampling frequency and number of samples for compensation features constructed in the Portage basin (Under MMER Schedule II and DFO NU-03-0191.3). Active flooding (F) is estimated to be completed in 2024, and the dike breached in 2029 (B).

Feature	Component	Reason	Method	Parameters	Number of Samples	Sampling Schedule
Basin	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding
	Open basin water quality*	Possible metals leaching, anoxia	Tube sampler Grab samples Depth profiles	According to Type A Water License requirements	1 per pit area	According to Type A Water License requirements (monthly – bi-annually during operation/closure; annual throughout post-closure period)
	Fish use	To confirm the successful transfer or stocking and subsequent presence of fish; confirm survivorship. (re-flooded basin and at dike breach)	Angling Underwater motion camera Gill nets if necessary Hoopnets or trap nets or electrofishing (dike breach)	CPUE Physical characteristics Length-weight; meristics data on incidental mortalities	TBD by field staff	B+1, B+3, B+5
Roads	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding
		Stability	Underwater camera	Qualitative observations	Representative transects TBD by field staff	F+2

Feature	Component	Reason	Method	Parameters	Number of Samples	Sampling Schedule
Pits	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding
50 x 7 m rock shoal	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding
		Stability	Underwater camera	Qualitative observations	Representative transects TBD by field staff	F+2
	Interstitial water quality	Possible metals leaching	Tube sampler	TSS Total and dissolved metals	-	Every two years between F and B, B+1, B+3, B+5
	Periphyton	Base of food chain	Underwater camera	Qualitative observations	Representative transect TBD by field staff	B+1, B+3, B+5
	Fish use	To confirm use by fish	Angling++	CPUE Physical characteristics	One location TBD by field staff	B+1, B+3, B+5
Boulder garden	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding
		Stability	Underwater camera	Qualitative observations	Representative transects TBD by field staff	F+2

*Monitoring and sampling protocols will be developed and conducted in-line with CREMP sampling and will be conducted throughout the post-closure period; this duration will be determined in the final Reclamation and Closure Plan, to be submitted to NWB 1 year prior to closure.

Table 5. Summary of monitoring methods, analytical parameters, sampling frequency and number of samples for compensation features constructed in the Vault basins (under DFO NU-03-0191.4). Active flooding (F) is estimated to be completed in 2025, and the dike breached in 2029 (B)

Feature	Component	Reason	Method	Parameters	Number of Samples	Sampling Schedule
Basin	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding
	Open basin water quality*	Possible metals leaching, anoxia	Tube sampler Grab samples Depth profiles	According to Type A Water License requirements	1 per basin	According to Type A Water License requirements (monthly – bi-annually during operation/closure; annual throughout post-closure period)
	Fish use	To confirm the successful transfer or stocking and subsequent presence of fish; confirm survivorship. (re-flooded basin and at dike breach)	Angling Underwater motion camera Gill nets if necessary (DFO to be contacted prior) Hoopnets or trap nets or electrofishing (dike breach)	CPUE Physical characteristics Length-weight; meristics data on incidental mortalities	TBD by field staff	B+1, B+3, B+5
Roads	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding
		Stability	Underwater	Qualitative	Representative	F+2

Feature	Component	Reason	Method	Parameters	Number of Samples	Sampling Schedule
			camera	observations	transect TBD by field staff	
Pits	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding

*Monitoring and sampling protocols will be developed and conducted in-line with CREMP sampling and will be conducted throughout the post-closure period; this duration will be determined in the final Reclamation and Closure Plan, to be submitted to NWB 1 year prior to closure.

Table 6. Summary of monitoring methods, analytical parameters, sampling frequency and number of samples for offsetting features associated with Phaser Lake dewatering. Flooding (F) is estimated to be complete in 2027 and the dike breached in 2029 (B).

Feature	Component	Reason	Method	Parameters	Number of Samples	Sampling Schedule
Basin	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding
	Open basin water quality*	Possible metals leaching, anoxia	Tube sampler Grab samples Depth profiles	According to Type A Water License requirements	1 per basin	According to Type A Water License requirements (monthly – bi-annually during operation/closure; annual throughout post-closure period)
	Fish use	To confirm the successful transfer or stocking and subsequent presence of fish; confirm survivorship, growth, reproduction.	Angling Underwater motion camera Gill nets as necessary	CPUE Physical characteristics Length-weight; meristics data on incidental mortalities	TBD by field staff	B+1, B+3, B+5, or until presence, survivorship, growth, and reproduction are demonstrated
Roads	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding
		Stability	Underwater camera	Qualitative observations	Representative transect TBD by field staff	F+2

Feature	Component	Reason	Method	Parameters	Number of Samples	Sampling Schedule
	Periphyton	Base of food chain	Underwater camera	Qualitative observations	Representative transect TBD by field staff	B+1, B+3, B+5, or until fish presence, survivorship, growth, and reproduction are demonstrated
Pits	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding

*Monitoring and sampling protocols will be developed and conducted in-line with CREMP sampling and will be conducted throughout the post-closure period; this duration will be determined in the final Reclamation and Closure Plan, to be submitted to NWB 1 year prior to closure.

Table 7. Summary of monitoring methods, analytical parameters, sampling frequency and number of samples for access enhancement compensation features.

Feature	Component	Reason	Method	Parameters	Number of Samples	Sampling Schedule
Dogleg Ponds	Structure	Design intent met (monitor water levels, especially access to Dogleg North)	Bathymetric survey	Area of ponds, depth of access channels	All three ponds and connecting channels	2015, 2017, 2019, 2021 (Odd-numbered years); 2025
	Fish use	Confirm use by fish	Angling Underwater motion camera	CPUE Physical characteristics	TBD by field staff	Odd-numbered years until 2021; 2025

Table 8. Summary of monitoring methods, analytical parameters, sampling frequency and number of samples for All Weather Private Access Road R02 (bridge 1) habitat compensation features.

Feature	Component	Reason	Method	Parameters	Completed Sampling	Sampling Schedule
Spawning pads	Structure	Design intent met	As-built report	Area, substrate	2009	-
		Stability	Visual observation	Qualitative observations	2010 2011 2013 2015	Every-other year (Odd-numbered years) until 1 year after the road is decommissioned (last monitoring estimated in 2031)
	Fish use	Confirm use by Arctic grayling	Hoopnets set downstream and upstream Larvae traps	CPUE Physical characteristics	2009 2010 2011 2013 2015	As above