Appendix 37

Whale Tail 2024 Fish Habitat Offsets Monitoring Report

AGNICO EAGLE

MEADOWBANK COMPLEX

2024 FISH HABITAT OFFSETS MONITORING REPORT

In Accordance with

DFO Fisheries Act Authorization 16-HCAA-00370

and

DFO Fisheries Act Authorization 20-HCAA-00275

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Complex

March, 2025

EXECUTIVE SUMMARY

In accordance with Fisheries Act Authorizations 16-HCAA-00370 and 20-HCAA-00275, Agnico Eagle maintains a Fish Habitat Offsets Monitoring Plan (FHOMP; Version 2, July, 2021) for the Whale Tail Mine. This Plan was developed to determine whether fish habitat offsetting described in the *Whale Tail Pit - Fish Habitat Offsetting Plan* (C. Portt and Associates, 2018a) and the *Whale Tail Pit Expansion Project Fish Habitat Offsetting Plan* (ERM, 2020) is ultimately constructed and functioning as intended.

Permanently raised water levels are the primary fish habitat offset under both the 2018 and 2020 offsetting plans for the Whale Tail Mine. Assessment of the existing flood zone prior to construction of permanent sills to maintain these water levels is required under conditions of the associated Fisheries Act Authorization 20-HCAA-00275. According to the FHOMP, monitoring was conducted under the pre-offsetting ecological monitoring program from 2021 through 2023. Along with data collected through other existing research and compliance monitoring studies, this program was intended to demonstrate whether areas of terrestrial flooding will provide suitable habitat for fish long-term. Results of those assessments were provided in the 2023 FHOMP Report (Agnico Eagle, 2024), with further analysis in the report *Impact Analysis of Fish Habitat from Flooding* (C. Portt & Associates, 2024), provided to DFO under separate cover in fulfillment of Condition 5.3.1 of FAA 20-HCAA-00275. Briefly, results of that analysis indicate a high degree of confidence that the predicted gains from habitat creation through flooding will be realized going forward.

In 2024, no field assessments were specifically required under the FHOMP, since pre-offsetting monitoring is complete and offsets are not yet constructed. Nevertheless, water level monitoring and water quality monitoring under the CREMP continued. Flood zone water levels remain similar to previous years and water quality within the flood zone remains suitable for aquatic life based on CREMP criteria.

In addition to flooding and other constructed habitat offsetting features, a portion of offsetting for Whale Tail Mine is provided through a suite of complementary measures (research projects). No physical monitoring is conducted in relation to research projects. However, progress monitoring is conducted to document annual activities, and results are summarized here to determine when criteria for success have been met.

Six research studies form the complementary measures for Whale Tail Mine offsetting. Some study periods have been extended compared to original timelines, as indicated in Table 1 below. In 2021, Study 4: *Arctic Grayling Occupancy Modelling* was completed and criteria for success were met with publication of a peer-reviewed manuscript, as described in the 2021 Fish Habitat Offsets Monitoring Report.

Table 1. Whale Tail Mine complementary measures (research projects). Estimated termination dates as of December 2024.

Study	Lead Researcher	Study Period
Study 1: Assessment of changes in aquatic productivity and fish populations due to flooding of Whale Tail South and downstream lakes during operations	H. Swanson	2018 – 2025
Study 2: Assessment of impacts of the Baker Lake wastewater outflow on aquatic systems including fish and fish habitat	H. Swanson, M. Hanson	2019 – 2026
Study 3: Literature review and field validation of northern lake fish habitat preferences	S. Doka	2018 – 2025
Study 4: Arctic Grayling occupancy modelling (COMPLETE)	H. Swanson	2018 – 2021
Study 5: End pit lake habitat use	TBD	TBD
Study 6: eDNA methods development	J. Stetefeld	2018 – 2025

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

SECTION 1 • INTRODUCTION

1.1 BACKGROUND

In accordance with Fisheries Act Authorizations (FAAs) 16-HCAA-00370 and 20-HCAA-00275, Agnico Eagle maintains a Fish Habitat Offsets Monitoring Plan (FHOMP; Version 2, July, 2021) for the Whale Tail Mine. This Plan was developed to determine whether fish habitat offsetting described in the *Whale Tail Pit - Fish Habitat Offsetting Plan* (C. Portt and Associates, 2018a) and the *Whale Tail Pit Expansion Project Fish Habitat Offsetting Plan* (ERM, 2020) is ultimately constructed and functioning as intended.

This monitoring program is organized to meet the requirements of the FAAs listed above. Specifically:

Fisheries Act Authorization 16-HCAA-00370 (July, 2018):

- Condition 4.3 – Offsetting criteria to assess the implementation and effectiveness of the offsetting measures: All fish habitat offsetting measures shall be completed and functioning according to the following criteria:
    - 4.3.1 – Offsetting measures shall be carried out in accordance with the measures set out in the Proponent's Whale Tail Pit Fish Habitat Offsetting Plan (including the updated Appendix C, dated May 2018), or the most recent version approved by DFO;
    - 4.3.2 – All offsetting features are to be constructed prior to re-flooding of the north basin of Whale Tail Lake in accordance to the schedule outlined in the Whale Tail Pit Fish Habitat Offsetting Plan dated March, 2018 (or most recent approved version);
    - 4.3.3 – The offsetting features (e.g. shoals) have established aquatic biota and are being utilized by fish for one or more of their life history functions.
- Condition 5.1 – the proponent shall conduct monitoring of the implementation of offsetting measures according to the approved timeline and criteria;
    - 5.1.1 – List of timeline(s) and monitoring and reporting criteria:
        - 5.1.1.4 – the Proponent shall provide an annual Whale Tail Pit Fish Habitat Offset Monitoring Report to DFO (and interested parties) following the construction of the offsetting habitat by March 31. The proponent is required to provide the report until DFO indicates this requirement has been met.

- 5.1.1.5 – As part of the annual report, the Proponent shall include, but not limited to:

    - A digital photographic record with GPS coordinates of pre-construction, during construction, and post-construction conditions shall be compiled using the same vantage points and direction to show that the approved works have been completed in accordance with the offsetting plan;

    - A summary of field observations for each respective year as well as the as-built survey;

    - A detailed analysis report summarizing the effectiveness of the offsetting measures.

Fisheries Act Authorization 20-HCAA-00275 (July, 2020):

- Condition 4.3 – Offsetting criteria to assess the implementation and effectiveness of the offsetting measures: All fish habitat offsetting measures shall be completed and functioning according to the criteria below;

    - 4.3.1 - Offsetting measures shall be carried out in accordance with the measures set out in the Proponent's offsetting plan dated June 5, 2020 in the Whale Tail Pit Expansion Project - Information Requirements in Support of the Application for Authorization Under Paragraph 35(2)(b) of the Fisheries Act prepared by ERM Consultants Canada Ltd and Appendix H – Offsetting Design;

    - 4.3.2 - Where Proponent did not provide the detailed engineering plans, offsetting measures shall also be carried out in accordance with the measures as agreed upon after consultation with DFO and other interested parties as per section 4.8.1;

    - 4.3.3 - The Proponent shall provide DFO with sufficient information for DFO to determine if flooding of south portion of Whale Tail Lake area as a result of the Whale Tail Dike (PATH No.: 16-HCAA-00370) provides suitable habitat and enhances productivity of target species as identified through consultation with local communities prior to commencement of consultation on final design of offsetting sill. A report shall be presented to DFO as outlined in section 5.3.1 of this Authorization.

- Condition 5.1 - Schedule and criteria: The Proponent shall conduct monitoring of the implementation of offsetting measures according to the timeline and criteria below [or according to the timeline and criteria in the offsetting plan approved by DFO, referred to in section 4.2 and attached to this authorization and which are the following:

- 5.1.1 List of timeline(s) and monitoring and reporting criteria:
  - 5.1.1.1 The Proponent shall monitor the geotechnical aspect of the proposed offsetting sill to establish its efficacy to maintain water levels as predicted and examine erosion or slumping twice a year over a 10-year period following the construction of the offsetting sill in 2026.
  - 5.1.1.2 The Proponent shall monitor both biological (fish use, health and biological traits) and ecological (water quality, periphyton productivity) properties of the offsetting habitat expanding on required monitoring in the Fisheries Act Authorization for the Approved Project (PATH No.: 16-HCAA-00370). The proponent shall conduct the biological monitoring programs every year from the date of issuance of the Authorization to the construction of the offsetting sill to show compliance with criteria 4.3.3 and in years 1, 3, 5 and 10 following the construction of the offsetting habitat to establish efficacy of the offsetting measures to provide suitable habitat and enhance productivity of target species.

- Condition 5.2 - List of reports to be provided to DFO: The Proponent shall report to DFO on whether the offsetting measures were conducted according to the conditions of this authorization by providing the following:
  - 5.2.1 The Proponent shall provide a Whale Tail Expansion Fish Habitat Offset Monitoring Report to DFO including geotechnical and biological and ecological monitoring as per section 5.1.1. The Proponent is required to provide the Report by March 31 of 2027 and update annually for 10 years or until DFO indicates requirements of this Authorization have been met.
  - 5.2.2 As part of the annual report the Proponent shall include, but is not limited to:
    - 5.2.2.1 a digital photographic record with GPS coordinates of pre-construction, during construction and post construction conditions shall be compiled using the same vantage points and direction to show that the approved works have been completed in accordance with the offsetting plan, and as-built plans and engineering diagrams;
    - 5.2.2.2 a summary of field observations for each respective year; and,
    - 5.2.2.3 a detailed analysis report summarizing the effectiveness of the offsetting measures including the final engineering designs, and maps from flooding models.
  - 5.2.3 The Proponent shall provide a summary report of all Whale Tail Expansion Fish Habitat Offset Monitoring Reports described in section 5.2.1

before March 31, 2036 to DFO (and interested parties) which shall analyse results from the offsetting measures of the Whale Tail Expansion Project following the construction of the offsetting habitat. DFO reserves the right to request additional Summary Report if annual reporting were to continue until requirement has been met.

- Condition 5.3 Other monitoring and reporting conditions for offsetting:
    - 5.3.1 The Proponent shall provide a detailed *Impact Analysis of Fish Habitat from Flooding* by March 31, 2024. The content of this report shall be discussed and approved by DFO (and interested parties) and will be used to establish if the proposed offsetting measures are likely to provide suitable habitat and enhance productivity of target species.

Further, in accordance with monitoring recommendations in DFO guidance documents (e.g. Smokoroski et al., 2015), two types of monitoring are specified:

1. "Compliance" monitoring assesses the physical structure and stability of offsetting features to verify that they were constructed as designed.

2. "Effectiveness" monitoring of biological and ecological endpoints (water quality, periphyton growth, fish use) to assess whether offsetting features are functioning effectively as fish habitat.

1.2 OBJECTIVES

The majority of habitat gains for offsetting at the Whale Tail Mine are planned to be achieved through habitat creation and enhancement efforts. To ensure that offsets are functioning as effective fish habitat, assessment of the structure, stability, and successful utilization of these features by fish are the primary goals of the monitoring program for habitat enhancement/creation offsets.

The overall objectives of FHOMP reporting are:

- To describe the compliance and effectiveness monitoring methods for assessments conducted in the preceding year according to the FHOMP and describe any deviations from the FHOMP.
- To present the results of data analyses conducted according to the FHOMP.
- Using those results, to determine whether criteria for success have been met.

In addition to the constructed habitat offsetting features to be monitored through this plan, a portion of offsetting for Whale Tail Mine (FAA 16-HCAA-00370) will be provided through a suite of complementary measures (research projects). Full progress reporting is completed for these programs under separate cover and provided to DFO by May 30 annually, according to conditions of the FAA. Study plans and success criteria for the complementary measures

are described in the *Whale Tail Pit - Fish Habitat Offsetting Plan* – Appendix C (May 2018) and referred to minimally here. However, this report does include a summary of research study progress, along with annual activities of the oversight body (Meadowbank Fisheries Research Advisory Group; MFRAG) and indicates when criteria for success have been achieved.

1.3 SUMMARY OF OFFSETTING FEATURES

The following constructed features will create or enhance fish habitat to offset losses occurring from the Whale Tail Mine. Complementary measures (research projects) are also summarized. Further details are provided in the *Whale Tail Pit - Fish Habitat Offsetting Plan* (C. Portt and Associates, 2018a) and the *Whale Tail Pit Expansion Project Fish Habitat Offsetting Plan* (ERM, 2020).

1.3.1 Constructed Offsets

1.3.1.1 Rock Shoals and Road Scarification

In the dewatered area of Whale Tail Lake (Figure 1), roads and jetties will be scarified or converted to coarse substrate as necessary to create shoal-like features. In addition, an 8.7 ha network of shoals (referred to as grid shoals based on their conceptual design pattern) will convert a portion of the North Basin to higher-value habitat. Works will be conducted prior to the start of reflooding of the Whale Tail Pit and be accessible to fish post-reflooding. Prior to 2024, reflooding was scheduled to begin in 2026, with opening of the Whale Tail Dike for fish re-entry scheduled for 2042. With an approved extension to the life-of-mine, the water management strategy was revised in 2024, and re-flooding of the Whale Tail Pit is now scheduled to begin in 2028, with dike breach and fish re-entry estimated for 2046.

1.3.1.2 Water Retention Sills and Flooding

During the operations period for the Whale Tail Mine, flooding around the perimeter of Whale Tail Lake (South Basin) and additional lakes to the southwest is required for water management purposes (Figure 1). Flooding was initiated in 2019 and stabilized through construction of the South Whale Tail Channel (SWTC) in 2020, which is a temporary hydraulic connection to Kangislulik Lake for the purposes of passive water management. The majority of fish habitat offsets for the Whale Tail Mine will be obtained by constructing two permanent water control structures (sills) to maintain elevated water levels in some of these flooded areas long-term. Sills are designed to create approximately 46.6 ha of new aquatic habitat by expanding Whale Tail Lake, and 31.35 ha of new aquatic habitat by expanding Lake A18. Lake A18 sill construction is currently scheduled for 2029. Mammoth Sill construction will occur prior to completion of Whale Tail Pit re-flooding (est. 2046).

Legend

- Roads
- Measured peak flood level (155.84 masl; Oct 2019)
- Regional Watershed Boundaries
- Amaruq Watershed Boundaries
- Dotted line = water elevations prior to flooding (NRCan 1:50K)

AZIMUTH

Client	Agnico Eagle Mines Limited - Meadowbank Division
Figure 1	Post-Flood Water Levels in the Impoundment
Project	Whale Tail Mine

Date: March 16, 2023
Datum: NAD 83 UTM Zone 14N
Scale: 1:40,000
Software: QGIS version 3.22.11-Białowieża

REFERENCES:
1. Mine Plan from Agnico Eagle (2021)
2. Satellite image from ESRI taken on July 6, 2022
3. Regional watershed boundaries from NRCan
4. Amaruq watershed boundaries from Agnico Eagle

1.3.2 Complementary Measures

A suite of complementary measures (research projects) is included as offsetting for the Whale Tail Mine. These studies continue to inform Agnico Eagle's offset planning in Nunavut as well as fish and fish habitat monitoring techniques. The complete scope of these complementary measures including methods, timelines, deliverables, and budgets is provided in Appendix C (May, 2018) of the *Whale Tail Pit - Fish Habitat Offsetting Plan* (C. Portt and Associates, 2018a). Studies include:

1. Assessment of changes in aquatic productivity and fish populations due to flooding of Whale Tail South and downstream lakes during operations

2. Assessment of impacts of the Baker Lake wastewater outflow on aquatic systems including fish and fish habitat

3. Literature review and field validation of northern lake fish habitat preferences

4. Arctic Grayling occupancy modeling (complete)

5. Assessment of pit lake habitat and use by fish (concept phase)

6. Development of methods for the collection and analysis of aquatic eDNA for fish community assessment

These programs have been developed in collaboration with research partners at academic institutions, and generally consist of 2-5 year study plans initiated in 2018 or 2019. One study (Study 5 - pit lake habitat use assessment) is in the concept phase.

1.4 SCHEDULE FOR MONITORING

The complete schedule for monitoring of offsets is described in the FHOMP. Generally, a pre-offsetting monitoring program occurred from 2021 – 2023, prior to construction of any permanent sills, to determine effectiveness of flooded terrestrial zones as fish habitat (Table 2). Results for that program were provided in the 2023 version of this report (Agnico Eagle, 2024), with additional analysis provided to DFO in 2024 under separate cover (*Impact Analysis of Fish Habitat from Flooding – C. Portt and Associates, 2024*), in fulfillment of Condition 5.3.1 of FAA 20-HCAA-00275.

No field assessment was required in 2024, but monitoring for water levels and water quality continued under other compliance programs and results are summarized here.

Final monitoring for constructed offsets is planned to begin after construction of the permanent sills and other offsetting features..

Progress updates for complementary measures are provided annually.

Table 2. Schedule of assessments conducted under the pre-offsetting ecological monitoring program for the Whale Tail Mine.

Component	2021	2022	2023	2024**
Water levels	✓	✓	✓	✓
Water quality	✓	✓	✓	✓
Periphyton (visual and/or artificial substrate study)	✓*	✓	✓	-
Small-bodied fish – shoreline habitat	✓	✓	✓ **	-
Large-bodied fish - foraging and spawning habitat	-	-	✓	-
Report	Data report	Data report	Data report and Final analysis report	Data report

**Pilot study*
***Not required under FHOMP, but collected opportunistically or through other ongoing programs.*

SECTION 2 • MONITORING METHODS

2.1 CONSTRUCTED OFFSETS

Physical structure monitoring is intended to confirm and report compliance with requirements of the associated *Fisheries Act* Authorizations to construct specific habitat offsets.

Ecological monitoring will be conducted to assess the effectiveness of these features in supporting fish.

A complete description of scheduled monitoring to assess physical structure and ecological function of the offsetting features is provided in the FHOMP, and methods for assessments completed in 2024 are described below.

2.1.1 Physical Structure Monitoring

Once permanent offsetting features are constructed, physical monitoring will include an assessment of flood zone area (hectares flooded, using measured water levels), shoal area, and stability of the features. No physical structure monitoring is specified in the FHOMP prior to that time. However, a review of water levels in the flooded Whale Tail South area is provided here for reference and to support ongoing analysis of flood zone habitat suitability and area. Throughout the operations phase, water levels within the Whale Tail South flood zone are measured every 3 h by piezometers installed in the Whale Tail Dike.

2.1.2 Ecological Monitoring

No ecological monitoring was required in 2024, but water quality monitoring continued under the CREMP. As part of the CREMP, mid-water column samples in areas > 5 m deep are collected at two sites from each of two formerly separate lakes in the flood zone (Whale Tail South and A20), as well as reference lakes Inuggugayualik Lake and Pipedream Lake, up to 5x/year. Complete methods are described in the 2024 CREMP Report (Azimuth, 2025), an Appendix of the Meadowbank Complex 2024 Annual Report to the NIRB.

2.2 COMPLEMENTARY MEASURES

As required by *Fisheries Act* Authorization 16-HCAA-00370, complete annual progress reports on complementary measures are provided to DFO by May 30 of the following year, including methods and preliminary results.

An interim update is provided in this report for each project, along with a description of activities of the MFRAG in the preceding year. These interim updates will focus on general activities and identifying progress towards study completion, and do not include specific methods and results.

SECTION 3 • RESULTS & DISCUSSION

3.1 CONSTRUCTED OFFSETS

3.1.1 Physical Structure Monitoring

Throughout the operations phase, water levels in the Whale Tail flood zone have been recorded every three hours using piezometers installed in the Whale Tail Dike. Measured water levels through 2024 are shown in Figure 2.

To date, since construction of the South Whale Tail Channel (2020 - 2024), water levels measured at the Whale Tail Dike have ranged between approximately 154.55 and 155.75 masl over the course of a year. Despite a reduction in operational water levels compared to FEIS predictions throughout the flood zone, measured elevations are generally similar to or exceed those that will eventually be maintained permanently for offsetting purposes, following sill construction (mid-summer levels of 154 masl in Whale Tail Lake, and 155.3 masl upstream of the A18 sill).

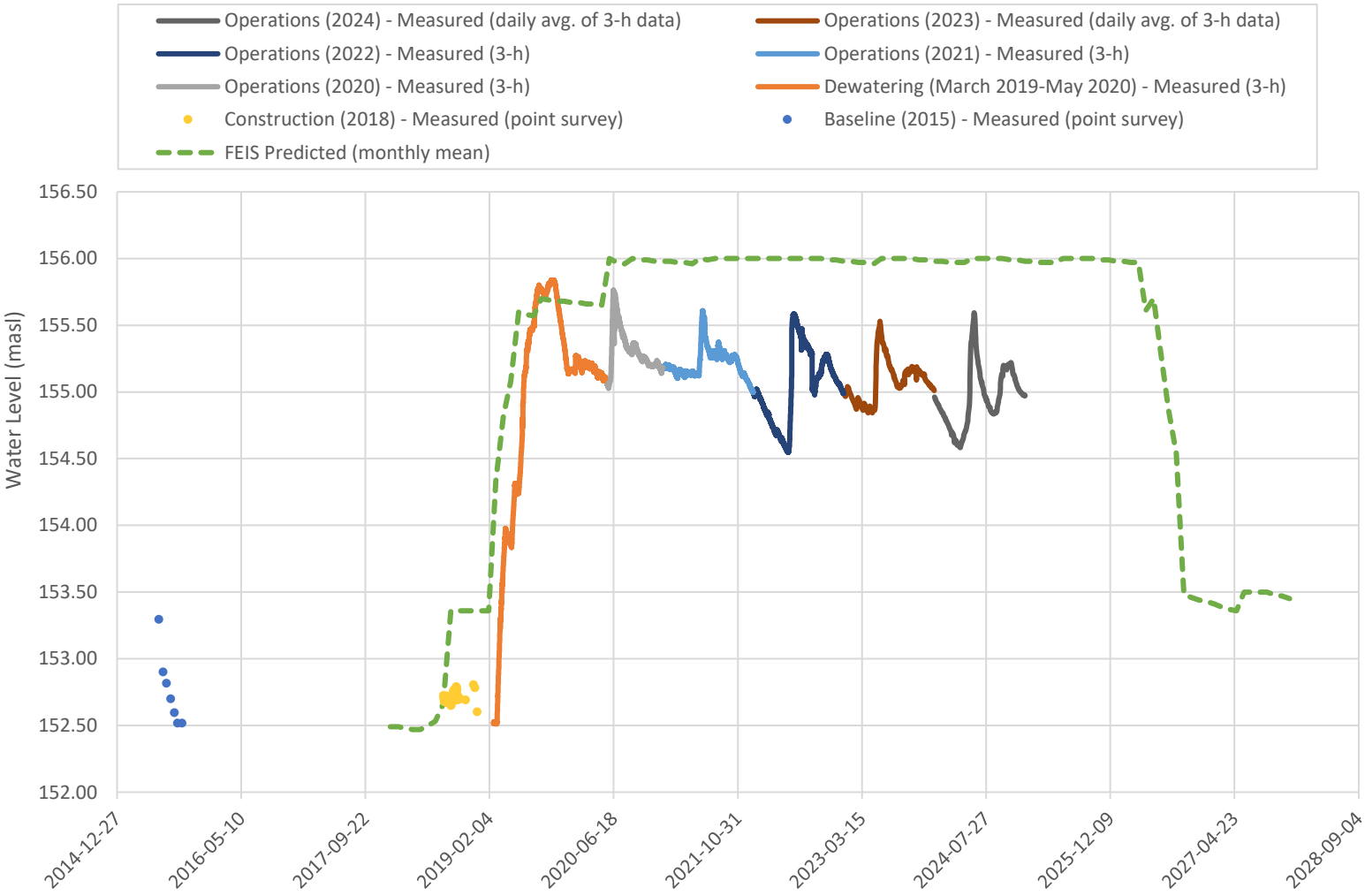

Figure 2. Measured and predicted water levels in the Whale Tail South flood zone.

Note: Point measurement by GPS survey, 3-h interval by piezometer, or modeled monthly mean, as indicated. Predicted water levels are for Whale Tail Lake from FEIS Addendum for the Whale Tail Pit Expansion Project, Appendix 6-O, Table D-14 (Agnico Eagle, 2018).

3.1.2 Ecological Monitoring

3.1.2.1 Flood Zone Water Quality

Complete results of annual CREMP water quality monitoring are presented in the 2024 CREMP Report (an appendix of the 2024 Meadowbank Complex Annual Report). The summary here focuses on results within flood zone lakes (WTS and A20), as compared to baseline/reference (Inuggugayualik and Pipedream Lakes) within the CREMP analysis framework.

3.1.2.1.1 CREMP Summary

Briefly, since flooding of the Whale Tail South area has occurred, some exceedances of CREMP water quality triggers and statistically significant increases relative to baseline/reference conditions have been observed in flood zone lakes for:

- Conductivity, hardness, and related ionic compounds (TDS and constituent ions such as calcium, magnesium, potassium, and sodium),
- Nutrients (total Kjeldahl nitrogen, total phosphorus, total organic carbon and dissolved organic carbon),
- Titanium and/or lithium (WTS) – *no effects-based thresholds for aquatic life, and/or likely not mine-related*.

Similar to results seen over the years at the Meadowbank study lakes, these trends for conventional parameters, most nutrients, and major ions represent increases above baseline/reference conditions only. Except for total phosphorus (discussed below), none of the analytes exceeding CREMP triggers (generally set at the 95th centile of baseline data) have effects-based thresholds (e.g. CCME Water Quality Guidelines for the Protection of Aquatic Life). While mine-related changes in some of these conventional parameters and nutrients have occurred, the observed concentrations are not expected to result in adverse effects to aquatic life, as described in a review conducted and reported as an extension of the 2019 CREMP Report.

As predicted within the FEIS (Agnico Eagle, 2018), mean annual total phosphorus at WTS has increased since mining began, and has exceeded the CREMP trigger value (95th centile of baseline data) each year since 2019. For A20, the trigger has been exceeded each year beginning in 2021. FEIS-predicted and measured concentrations of nutrients to date are shown in Figure 6. While historically some individual measured concentrations of total phosphorus exceeded monthly FEIS predictions in WTS, measured concentrations have remained within predicted trophic levels to date. According to the FEIS, phosphorus and nitrate levels are predicted to increase in WTS until 2026, after which time concentrations are predicted to decline.

Under the CREMP, phytoplankton community sampling is also conducted at the same time as the water chemistry program. In the first few years after mining began, phytoplankton biomass appeared to trend upwards (Figure 4), and statistically significant increases compared to baseline/reference were observed in some flood zone lakes in some years. These trends were consistent with predictions made in the FEIS and generally correspond to observed changes in nutrients. Upward trends in phytoplankton biomass appear to have corrected and stabilized in 2024, with no statistically significant differences between flood zone lakes and baseline/reference conditions. In general, any observed changes in phytoplankton taxa richness have not been statistically significant and/or have not been attributed to mine activities.

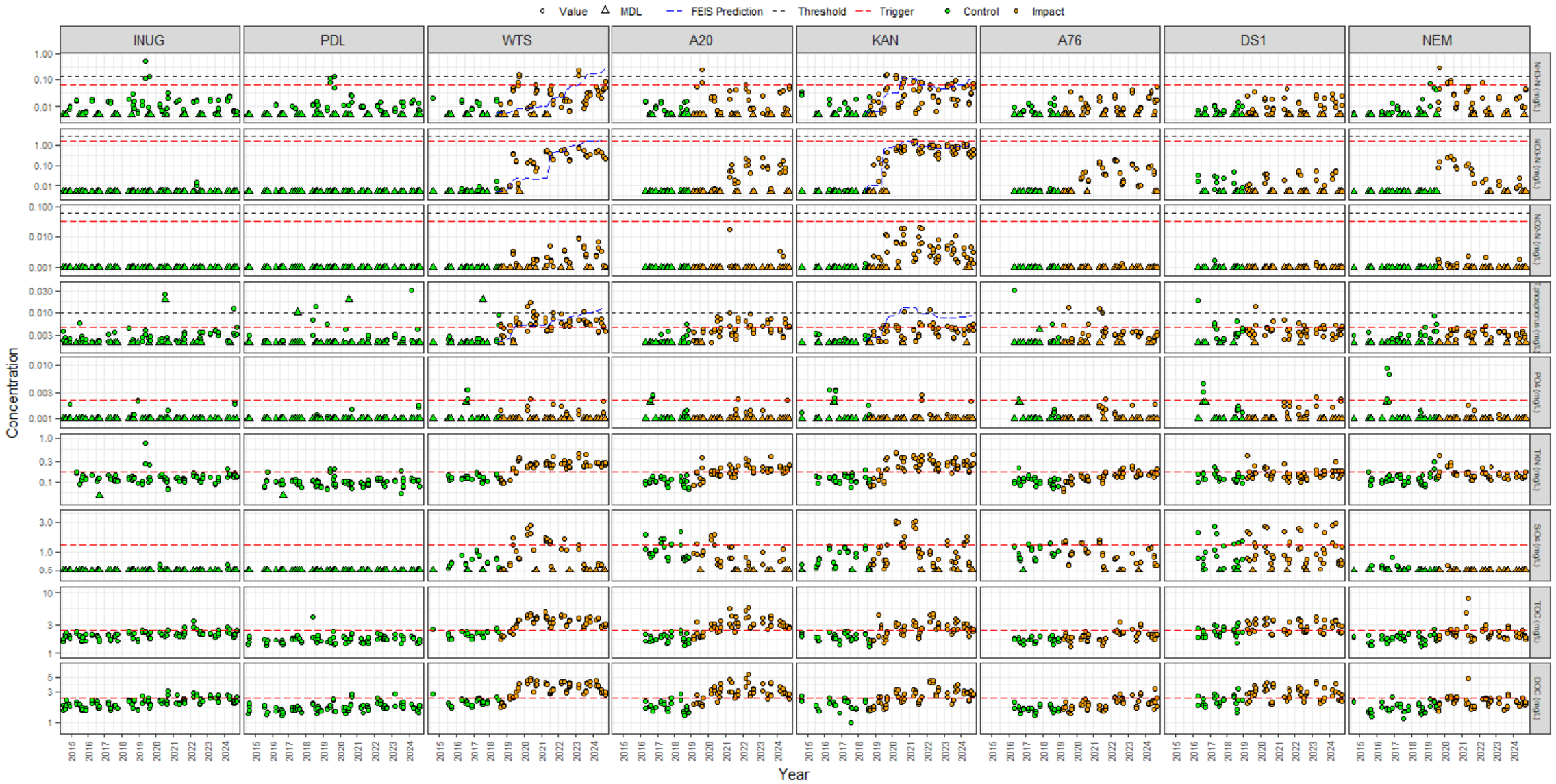

Figure 3. Nutrient parameters measured in Whale Tail Mine area lakes since 2014. Figure from Azimuth (2025). Flood zone lakes are WTS and A20.

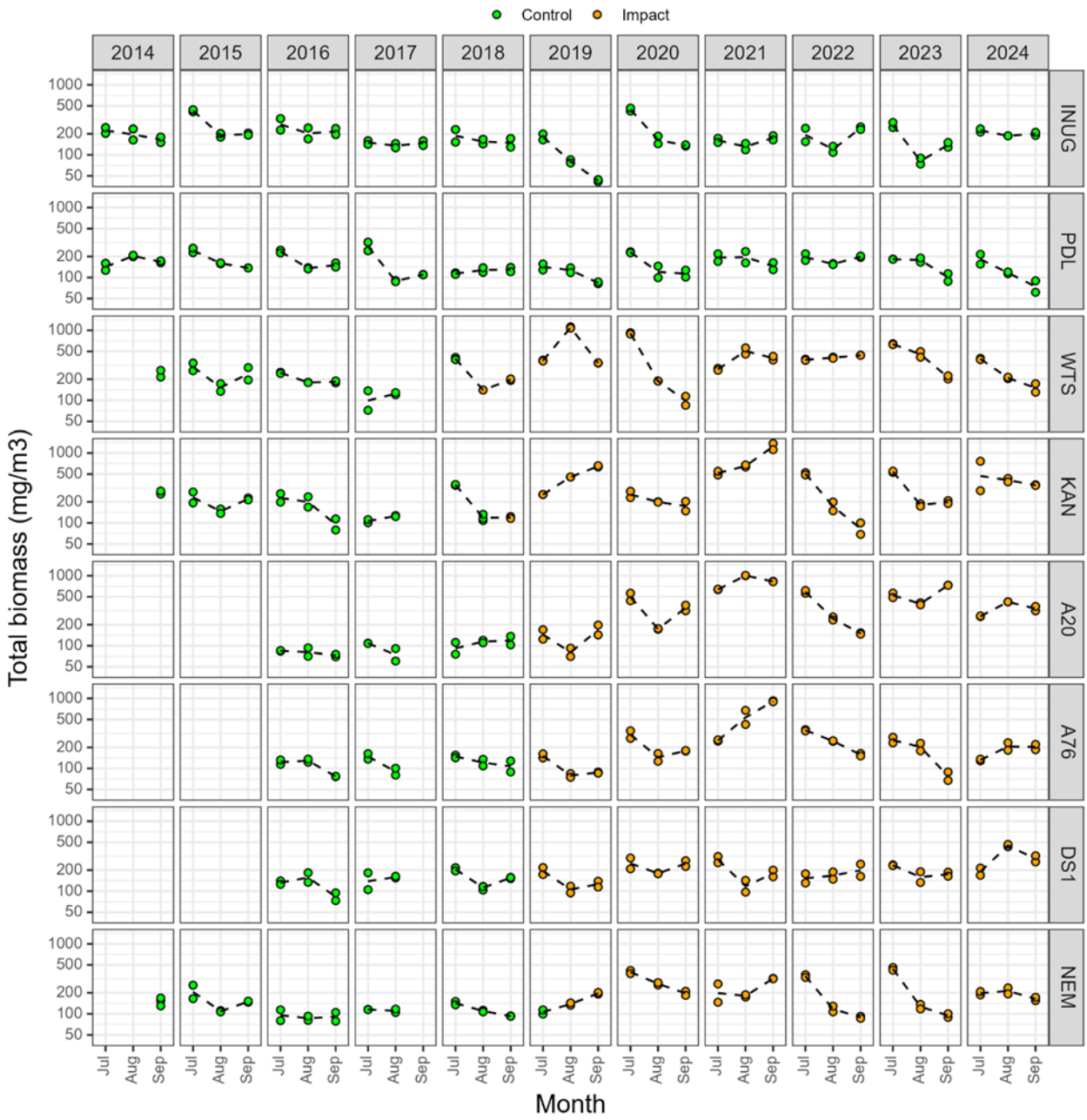

Figure 4. Total phytoplankton biomass (mg/m^3) from the Whale Tail Mine study lakes since 2014. Figure from Azimuth (2025). Flood zone lakes are WTS and A20.

3.2 COMPLEMENTARY MEASURES

An update is provided here on activities of the MFRAG along with a summary of progress for each research study in 2024. Full research methods are documented in annual progress reports provided to DFO by May 30 annually.

3.2.1 Activities of the MFRAG

As part of the Fish Habitat Offsetting Plan for Whale Tail Mine (C. Portt and Associates, 2018a), the MFRAG was conceptualized to provide a forum for input from key stakeholders. The MFRAG meets annually to review project progress reports, propose and approve or reject new projects or project components, and assess whether criteria for success have been met.

In 2019, Agnico Eagle confirmed interest in MFRAG participation by DFO, the Kivalliq Inuit Association (KivIA), and the Baker Lake Hunters and Trappers Organization (BLHTO). As planned in the Fish Habitat Offsetting Plan for Whale Tail Mine, Appendix C (C. Portt and Associates, 2018a), Agnico Eagle also identified a third party external advisor (Dr. Kelly Munkittrick, University of Calgary) who will participate in all MFRAG activities. A draft Memorandum of Understanding and Terms of Reference (TOR) were developed by Agnico Eagle and reviewed by all parties. The initial meeting of the MFRAG was held on December 12, 2019 in Montreal, Quebec. Representatives from all member groups were in attendance. The group received presentations by lead researchers involved in each study, and had the opportunity for questions, comments, and open discussion. Each MFRAG member group was requested to provide written comments, if any, by February 28, 2020. Written comments were distributed to research study leads for consideration.

In 2020, the MFRAG TOR were finalized, and signed by all parties as of March, 2021. The second annual meeting of the MFRAG was held by video conference due to COVID restrictions on December 2, 2020, with all member groups participating (Agnico Eagle, DFO, KivIA, BLHTO). As in 2019, the group received presentations by lead researchers involved in each study, and had the opportunity for questions, comments, and open discussion. Each MFRAG member group was requested to provide written comments, if any, by January 13, 2021. Written comments were again distributed to all member groups and the research study leads for consideration. No major concerns with research study progress were raised during the meeting or in follow-up comments.

In 2021, the third annual meeting of the MFRAG was held by video conference due to COVID restrictions on December 14, 2021, with all member groups participating. As in previous years, the group received presentations by lead researchers involved in each study, and had the opportunity for questions, comments, and open discussion. Each MFRAG member group agreed to provide written comments, if any, by January 25, 2022. Written comments were again distributed to all member groups and the research study leads for consideration. No major concerns with research study progress were raised during the meeting or in follow-up comments.

In 2022, the fourth MFRAG meeting was held by video conference on November 18, 2022, with all member groups participating. The meeting format was the same as previous years. In advance of the meeting, all member groups received the previous year's Annual Progress Report, along with a non-technical summary in English and Inuktitut, and had the opportunity for questions, comments, and open discussion with the research teams. For Study 2 - Assessment of Impacts of the Baker Lake Wastewater Outflow on Fish Productivity and Fish Habitat (H. Swanson), a change in objectives was proposed to accommodate a delayed construction schedule for upgrades to the Baker Lake municipal wastewater treatment system. All MFRAG member groups were requested to provide written comments, if any, by December 16. Comments from DFO/KIA were received on December 23. Comments were also received from the external advisor, and were distributed to all parties and researchers for consideration.

In 2023, the fifth MFRAG meeting was held by video conference on December 12, with all member groups participating. As required every three years, the MFRAG Terms of Reference were reviewed, with no comment from any party. In advance of the meeting, all member groups received the previous year's Annual Progress Report, along with a non-technical summary in English and Inuktitut. Progress of each research study was presented by the lead researcher, and MFRAG parties had the opportunity for questions, comments, and open discussion with the research teams. Each MFRAG member group agreed to provide written comments, if any, by January 26, 2024. Written comments were only received from the external advisor, and were distributed to all member groups and the research study leads for consideration.

In 2024, the sixth MFRAG meeting was held by video conference on December 12, after groups were surveyed for meeting type preferences. All member groups participated, and the meeting proceeded in the same manner as 2023. Each MFRAG member group agreed to provide written comments, if any, by February 7, 2025. Written comments were received from DFO and the external advisor, and will be distributed to all member groups and the research study leads for consideration.

3.2.2 Study 1 - Assessment of Changes in Aquatic Productivity and Fish Populations Due to Flooding (H. Swanson)

3.2.2.1 Research Objectives

This research study aims to understand changes in small-bodied fish metrics indicative of population productivity during and after flooding in the Whale Tail Lake area. Changes in productivity will be related to water quality variables and qualitatively related to habitat characteristics.

3.2.2.2 Research Methods & Summary of Activities

In 2018, 2019, 2020, and 2021 the study focused on the collection of baseline data (2018) and flooding year 1, 2, and 3 data (2019, 2020, 2021) for small-bodied fish species (Slimy Sculpin, Ninespine Stickleback) within the Whale Tail South area. Shoreline electrofishing was completed for small-bodied fish in up to 8 waterbodies in the area of Whale Tail Lake: Whale Tail Lake, Kangislulik (Mammoth) Lake, A63, A20, A65, A44, B03, and Lake 8 (Figure 5). Monitoring endpoints that were selected for analysis (statistical or visual) include catch per unit effort, proportional catch, length, weight, condition, age, weight-at-age, and isotopes of carbon and nitrogen as indicators of carbon source and lipid content.

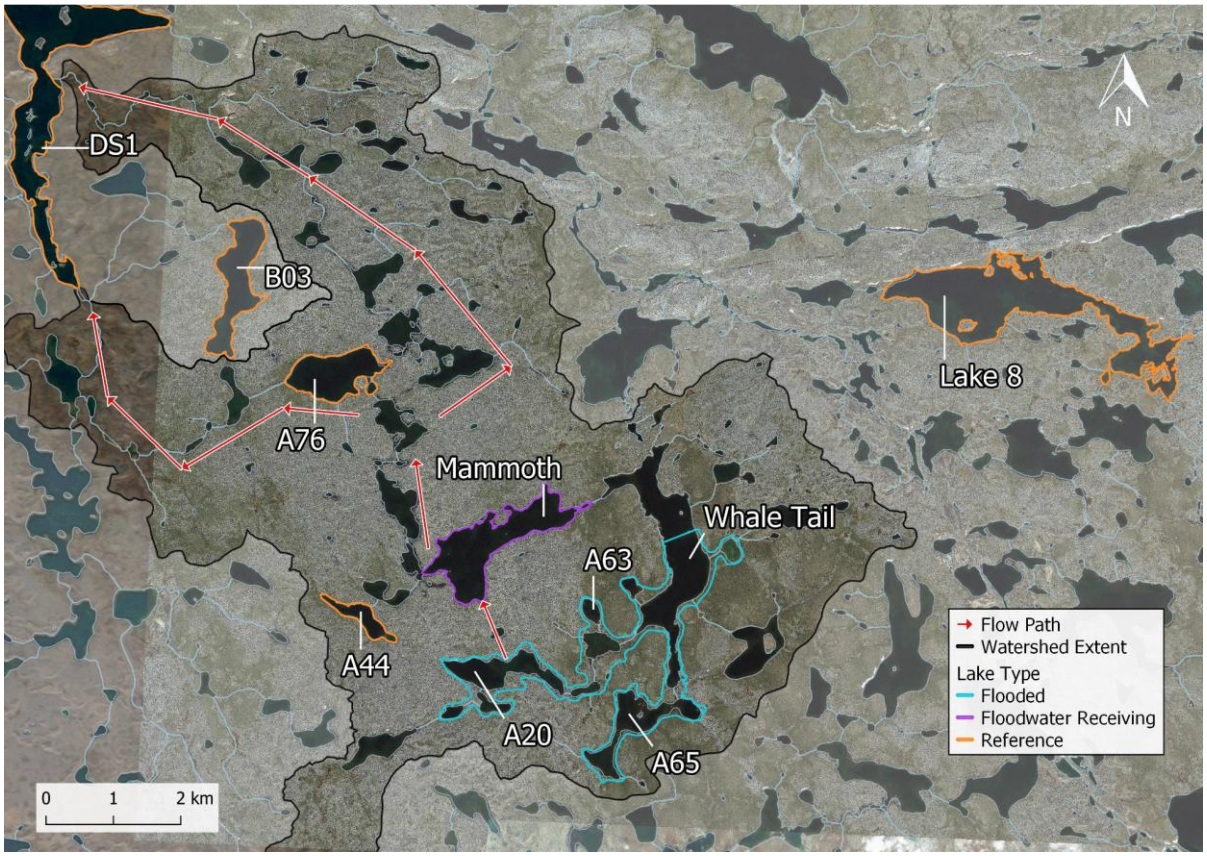

Figure 5. Whale Tail Productivity study area (Mammoth Lake is now referred to as Kangislulik Lake).

3.2.2.3 Study Completion

This study was scheduled for completion (final journal article submission) in 2022. However, due to various delays, an extension to 2025 is currently anticipated. Preliminary results were

presented at the 2024 MFRAG meeting. The final field season was completed on time as originally scheduled, in 2021.

3.2.3 Study 2 – Assessment of Impacts of the Baker Lake Wastewater Outflow on Fish Productivity and Fish Habitat (H. Swanson)

3.2.3.1 Research Objectives

A research program lead by Dr. Rob Jamieson (Dalhousie University) is underway to assess the current status of the wastewater treatment system in the hamlet of Baker Lake and develop designs for upgrades. This study was awarded an NSERC Collaborative Research and Development grant (NSERC-CRD) in 2019 to supplement funding from Agnico. As part of this holistic assessment, key questions related to understanding fish and benthic invertebrate populations are included as offsetting for the Whale Tail Mine. The fish and fish habitat portion of the study is being conducted by Dr. Heidi Swanson (Laurier University, formerly the University of Waterloo) and Dr. Mark Hanson (University of Manitoba).

The following current project goals are specific to fish and fish habitat:

1. Quantify the current fish habitat, fish health and fish productivity in the Arctic wastewater system (extended pre-construction assessment).

2. Develop and delivery training activities to support community-lead environmental monitoring programs for the post-construction period, tailored to the interests of community organizations.

3.2.3.2 Research Methods & Summary of Activities

General study methods follow Environmental Effects Monitoring (EEM) protocols to assess large-bodied fish population health within the wastewater outflow pathway as compared to reference systems (Figure 6).

Figure 6. Baker Lake wastewater study lakes and reference lakes.

Since 2018, the team has conducted the following activities:

2018:

- Reconnaissance year
- Collected water samples and sampled fish in Finger Lake and Airplane Lake
- Evaluated potential reference sites

2019:

- Selection of reference lakes
- Shoreline electrofishing, minnow trapping, gill netting in 5 waterbodies (Lagoon, Finger, Airplane Lake, R1 and R2)
- Fish presence/ absence
- Collected Ninespine Stickleback and Arctic Grayling for health indicators, otoliths, and tissue
- Working in collaboration with University of Manitoba and Dalhousie University, collected water quality samples and submitted for analysis

2020: Due to restrictions under the COVID-19 pandemic, the 2020 field season could not proceed. The study period has thus been extended by one year.

2021:

- Shoreline electrofishing, minnow trapping, gill netting in 5 waterbodies and the outlet of Airplane Lake (Lagoon, Finger, Airplane Lake, Airplane Lake creek, R1 and R2)
- Fish presence/ absence
- Collected Ninespine Stickleback and Arctic Grayling for health indicators, aging structures (i.e., otoliths), and tissue
- Collected sediment chemistry data
- Collected periphyton and zooplankton data
- Working in collaboration with University of Manitoba and Dalhousie University, collected water quality samples and submitted for analysis
- Completed otolith microchemistry analysis at University of Manitoba
- Data analysis, interpretation, thesis and manuscript writing

2022: Ongoing data analysis. No field data collection.

2023:

- Field data collection similar to 2021
- Field training (year 1) for community-lead monitoring, including photography for eventual development of visual sampling protocols for community use

2024:

- Benthic invertebrate sampling
- Year 2 training for community-lead monitoring and finalization of sampling protocols for community use
- Completion of an MSc thesis document for fish study component (*Metal Concentrations in an Arctic Wastewater Wetland: Insights and Innovations from Baker Lake, Nunavut, Canada;* McPhedran, 2024)

2025 plan:

- Benthic invertebrate sampling (final year) with training for community-lead monitoring

2026 plan:

- Completion of manuscript for benthic invertebrate study component

3.2.3.3 Study Completion

Final manuscript submissions for peer-reviewed publication are anticipated for 2025 (fish) and 2026 (benthic invertebrates).

3.2.4 Study 3 – Literature Review and Field Validation of Northern Lake Fish Habitat Preferences (S. Doka)

3.2.4.1 Research Objectives

Habitat preferences of northern fish species are not well understood, which causes significant uncertainty in habitat-based offset calculations. This study aims to:

1 - Identify literature data gaps in habitat associations of Meadowbank-area lake fishes such as Lake Trout, Arctic Char, and Round Whitefish,

2 - Field-test a variety of methods for filling data gaps.

3.2.4.2 Research Methods and Summary of Activities

This study was planned to be conducted over three years, from 2018 – 2020. Methods include a literature review, data gap analysis, and field programs to assess various sampling techniques for identifying fish habitat associations. Field surveys occurred in 2018 and 2019.

Literature Review and Gap Analysis - Following closely the Centre of Environmental Evidence guidelines for systematic literature review, a graduate student with Lakehead University under the co-supervision of Dr. Mike Rennie and Dr. Susan Doka reviewed primary and grey literature sources as well as unpublished data (e.g., Golder & Associates 2016, DFO FishOut database) on 11 northern species, including Lake Trout (*Salvelinus namaycush*) Burbot (*Lota lota*), Lake Whitefish (*Coregonus clupeaformis*), Lake Cisco (*Coregonus artedi*), Round Whitefish (*Prosopium cylindraceum*), Arctic Char (*Salvelinus alpinus*), Arctic Grayling (*Thymallus arcticus*), Slimy Sculpin (*Cottus cognatus*), Ninespine Stickleback (*Pungitius pungitius*), Dolly Varden (*Salvelinus malma*) and Bull Trout (*Salvelinus confluentus*) with current fish distributions in lakes of Nunavut and the Northwest Territories (Mandrak, et al. in review) and expert input from individuals that have been in the field in recent years (C. Portt & Associates, 2018b). The data extracted from the review has been analyzed using appropriate statistical methods to synthesize the information by life stage (3 stages: spawning, nursery, juvenile/adult habitats) for the 11 northern fish species.

Field Programs - Fisheries and Oceans in partnership with Lakehead University conducted ten days of sampling (August 20-30, 2018) in the vicinity of the Amaruq mine camp. The objective of this work was to perform reconnaissance sampling to test efficiencies and logistical challenges of using conventional methods used by scientific consultants and government researchers in the south to assess habitat and fish communities. A variety of equipment was used to meet this objective including, a multi-probe water quality sonde (EXO), passive and active fish sampling gears in both lakes and connecting channels (e.g., minnow traps, GoPro video footage, backpack electrofishing, drift nets) and hydroacoustic surveys (BioSonics MX) for physical habitat mapping (e.g., depth and substrate). The latter was conducted to complement hydroacoustic fish distribution data collected by Milne Technologies (mid-July 2018). Troubleshooting these methods in the field during 2018 informed how to

standardize methods for fish habitat sampling in the North (Arctic Region) and how to proceed with habitat and fish assessment pilot tests during the 2019 field season.

Based on year one field tests and literature review results, field work in year two (2019) focussed on pilot testing methods to fill data gaps around habitat associations for small-bodied fishes, while assessing novel or alternative sampling approaches. The 2019 field program consisted of an analysis of Visible Implant Elastomer tagging methods for use in mark-recapture studies to evaluate stream habitat preferences, as well as deep water electrofishing, near-shore electrofishing, and netting techniques. Those programs were conducted over two study periods, in late June and August/September. Analysis of the 2019 field trial results continues.

3.2.4.3 Study Completion

The MSc thesis fulfilling objective 1 of this study (literature data gap review) was completed in September, 2020 (Hancock, 2020). Final reporting for this study including results and recommendations of field trials was initially planned for 2020 but has been delayed. The target final report submission has now been extended to 2025. A plain-language newsletter-style summary (English and Inuktitut versions) was also provided to the MFRAG for distribution to members in December, 2024.

3.2.5 Study 4 – Arctic Grayling Occupancy Modelling (H. Swanson)

The objectives of this study were the development of occupancy models for Arctic grayling in the Meadowbank region, and a comparison of habitat predictors in this area with those observed in the NWT. Understanding the potential for occupancy of fluvial systems by fish species based on readily measurable habitat characteristics could facilitate and improve the accuracy of environmental impact assessment and offset planning.

This study was conducted from 2018 – 2021, and final reports consist of an MSc thesis submitted to the University of Waterloo in April, 2020 (Ellenor, 2020), and a peer- reviewed manuscript published in November, 2021 (Ellenor et al., 2021). These documents contain the complete research objectives, methods, and results. Briefly, from Ellenor et al. (2021):

> *Visual surveys of young-of-year Arctic grayling were conducted in 48 streams near Baker Lake, Nunavut, Canada. Occupancy modeling was used to relate stream habitat and landscape variables to fish presence/absence. The best predictors of occupancy were total area of contributing upstream lakes and landcover (upland/lowland); stream basins with larger contributing upstream lake area and more lowland cover were more likely to be occupied. Results suggest that occupancy reflects reliability of stream connectivity throughout the open water season and across years. The occupancy model developed here can adequately predict stream suitability for young-of-year Arctic grayling using lake area and land classification data that are remotely accessed. This may lessen the considerable*

financial and logistical constraints of conducting field research on Arctic grayling in the vast Barrenlands and facilitate more directed field programs to inform conservation and mitigation plans.

Publication of the peer-reviewed manuscript fulfills this study's criteria for success, and it is now considered complete.

3.2.6 Study 5 – End-pit Lake Habitat Suitability Assessment

Fish use of re-flooded pit areas with good connectivity to natural systems is not well understood, yet these areas may represent a significant opportunity for fish habitat offsetting. Since multiple pits of various sizes at the Meadowbank Complex were planned to be reflooded in the relatively near term (originally 2027 – 2029), an opportunity was identified to characterize fish use of pit lake habitat and population growth in re-flooded lakes through a research program. This study would aim to characterize fish use of new pit lake habitat in relation to habitat and water quality variables, and particularly in relation to reference systems.

With permitting of the Whale Tail Expansion Project in 2019 and changes to the Meadowbank life-of-mine and water management strategy in 2024, pits at the Meadowbank Complex are now planned to be accessible to fish beginning in 2040. With this extended timeline, Agnico Eagle, in consultation with the MFRAG, is now exploring three options for this study:

Option 1: No change to study plan, extend the timeline by approx. 10 years.

Option 2: Identify an alternate study site (partner site).

Option 3: Identify a new study goal.

These options were discussed at the December 2024 MFRAG meeting, and initial opinions by some parties were that Option 3 may be optimal. Agnico Eagle will continue to evaluate and consult with the MFRAG parties on possible revisions to this study plan in 2025, with the goal of approving a new study plan at the next annual MFRAG meeting (est. December, 2025).

3.2.7 Study 6 – eDNA Methods Development (J. Stetefeld and M. McDougall)

3.2.7.1 Research Objectives

eDNA methods present a potentially useful tool for rapid and non-invasive assessments of fish communities but have not been significantly developed or validated for Arctic systems. The main goal of this project is to develop and optimize monitoring tools based on eDNA metabarcoding technology to assess fish species assemblages (presence/absence and relative abundance) in the Kivalliq region.

Objectives are:

1. Development and optimization of the eDNA metabarcoding technique adapted for the arctic environment as a substitute for current fish species determination approaches.

2. Producing guidelines for handling and analyzing of samples and deliver the method and provide training to the local community.

3. Produce long-term reliable and precise baseline data on the distribution of aquatic associated fish species in the Amaruq mine site lakes using developed eDNA technology.

4. Producing data on the physiochemical properties of the lake water including dissolved mineral content to understand if any changes in stated parameters affect the eDNA/fish assemblage results.

5. Examine the impact of flooding Whale Tail Lake South Basin with the coincident changes in physiochemical properties of the aquatic area (e.g., increase in turbidity, dissolved solids) on the fish population using developed eDNA technique.

6. Collecting baseline eDNA and water quality data on lakes nearby Amaruq mine site outside the mining activity (potential candidates include B03 or DS1) and use them as a control for population changes.

3.2.7.2 Research Methods & Summary of Activities

This study planned to develop and utilize an eDNA metabarcoding approach to measure fish assemblages in the Whale Tail area. Environmental DNA metabarcoding technology was developed and optimized to detect fish species including Arctic Char, Arctic Grayling, Lake Trout, Round Whitefish, Burbot, Slimy Sculpin, Ninespine Stickleback, Hybridized Lake Trout/Arctic Char and analyze their relative abundances.

Field analyses (water sampling for eDNA and chemistry) occurred in 2017, 2018, 2019, and 2021 in the Meadowbank and Whale Tail areas. Data analyses are largely complete, and an MSc Thesis was completed by Wesley Johnson in 2024 (“*Environmental DNA as an Ecological Monitoring Tool for the Canadian Arctic”; University of Manitoba*[1]*)*. Manuscript preparation for peer-reviewed publication is ongoing, with submission targeted for May, 2025. Briefly, from Johnson (2024):

> *Environmental DNA is a method where DNA shed by organisms into the environment is captured and analysed to give insights into various aspects of the ecosystem. Since detection of organisms is based on capturing theoretically as little as a single strand of shed DNA, the method is highly sensitive, cost-effective, and can be applied to any target organism or groups of organisms. These advantages, among others, have led eDNA methods*

[1] The document is not yet publicly available. A link will be provided in the 2025 version of this report.

> *to become a popular tool in environmental monitoring programs. Recent advances in DNA sequencing technologies have lowered the cost of analysis and allowed for many different applications of eDNA to become viable. Despite its widespread use, there are still a limited number of studies that have been conducted in remote regions such as the Canadian Arctic. This project aims to adapt eDNA methods for use in the Canadian Arctic, specifically in the monitoring of several lakes in the vicinity of established and developing mining sites through metabarcoding. Six of the eight target fish species were detected throughout the project, with the addition of one unanticipated species. The established mine site showed little change, while the developing site showed indications of fish movement that were consistent with the change in affected water bodies. Additional work supported the use of eDNA methods in frozen environments where sampling is required through ice. Overall, eDNA sampling was successfully employed in monitoring for fish presence near an active and developing mine in the Canadian Arctic.*

In furthering the training objectives of this project, eDNA sampling workshops were held at the University of Manitoba in February 2019 and 2020, with 4 and 7 members of the Kivalliq Inuit community in attendance, respectively. The 3-day workshops featured of number of lecturers in the eDNA community, as well as a hands-on DNA extraction laboratory, and a foundation for further involvement of the Inuit community in eDNA sampling was laid. In the 2019 season, two of the trainees from the program also assisted in sample collection.

3.2.7.3 Study Completion

This study was substantially complete in 2024, with finalization of the MSc thesis document, pending online publication in 2025. During manuscript preparation in mid-2023, the research team lead was advised by others in the field that the material was no longer suitable for peer-review publication, since techniques were not considered sufficiently novel at this point. However, in 2024, the research team determined an alternate approach to facilitate publication, and manuscript preparation is in progress with submission targeted for May 2025.

SECTION 4 • SUMMARY AND EVALUATION OF SUCCESS

4.1 CONSTRUCTED OFFSETS

No monitoring was specifically required in 2024 for constructed offsets, though water level monitoring and water quality monitoring programs continued.

An evaluation of the ability of the newly flooded habitat in the Whale Tail Lake area to support fish (C. Portt & Associates, 2024) was provided to DFO in fulfillment of Condition 5.3.1 of FAA *20-HCAA-00275*.

Offsets monitoring is scheduled to resume after construction of permanent offsetting features (shoals, road scarification, water retention sills).

4.2 COMPLEMENTARY MEASURES

Criteria for success for each research project are focussed on publication of study results in the peer-reviewed literature, or similar primary sources. In 2021, Study 4 – *Arctic Grayling Occupancy Modelling* was completed and met these criteria with manuscript submission (Ellenor et al. 2022).

With various delays, original timelines for study completion have been extended for four of the six studies (Table 3). In the interim, several studies have been presented at academic conferences, and four MSc theses have been completed.

Table 3. Target study publication dates and publication or presentation references. *Current as of December 2024.

Study	Study Initiation	Target Final Publication Submission Date		Publications and Presentations to Date
		Original	Current*	
Study 1: Productivity (H. Swanson)	2018	2022	2025	Ellenor, J., Portt, C., and Swanson, H.K. 2019. Variation in Slimy Sculpin (*Cottus cognatus*) monitoring endpoints at six Barrenland lakes in central Nunavut. Poster presentation. Canadian Conference for Fisheries Research on January 3-6, 2019.
Study 2: Wastewater (H. Swanson and M. Hanson)	2019	2021 & 2024	2026	Bronte McPhedran presented preliminary findings and research methods at Young Environmental Scientists SETAC conference in Texas, on March 9-11, 2020. **MSc Thesis**: McPhedran, B. 2024. Metal Concentrations in an Arctic Wastewater Wetland: Insights and Innovations from Baker Lake, Nunavut, Canada. MSc Thesis presented to the University of Waterloo, Waterloo, Ontario. Available at: https://uwspace.uwaterloo.ca/items/67db0053-d7ac-4065-8183-dcdd19fdb546
Study 3: Habitat Preferences (S. Doka)	2018	2020	2025	**MSc Thesis**: Hancock H., 2020. Physical habitat associations of fish species in the Kivalliq region of Nunavut, Canada. MSc Thesis presented to Lakehead University, Orillia, Ontario. Available at: http://ceelab.ca/wpcontent/uploads/2020/10/Hannah final- thesis-10132020.pdf Two presentations have been given at scientific fora by the graduate student, Hannah Hancock of Lakehead University: at Canadian Conference for Fisheries Research in London ON in January, 2019 and at the American Fisheries Society - Ontario Chapter meeting in Orillia ON in February, 2019.

Study	Study Initiation	Target Final Publication Submission Date		Publications and Presentations to Date
		Original	Current*	
				A plain-language summary document (English and Inuktitut) was also provided for public distribution (December, 2024).
Study 4: Arctic Grayling Occupancy (H. Swanson) - **COMPLETE**	2018	2021	2021	**Manuscript**: Ellenor, J.R., P.A. Cott and H.K. Swanson (2021). Occupancy of young-of-year Artic grayling (*Thymallus arcticus*) in Barrenland streams. Hydrobiologia (published online 15 November 2021). Available at: https://link.springer.com/article/10.1007%2Fs10750-021-04742-3 **MSc Thesis**: Ellenor, J. 2020, June. Habitat use of young-of-year Arctic Grayling (*Thymallus arcticus*) in Barrenland streams of central Nunavut, Canada. MSc Thesis presented to the University of Waterloo, Waterloo, Ontario. Available from http://hdl.handle.net/10012/15969. **Conference presentation**: Ellenor J., Swanson, H. K., 2019. Factors influencing how Arctic Grayling (*Thymallus arcticus*) use Barrenland streams near Baker Lake, Nunavut. Platform presentation. ArcticNet Annual Scientific Meeting on December 2-5, 2019.
Study 5: End Pit Lake Habitat Use (Researcher TBD)	TBD	2030-2034	TBD	-
Study 6: eDNA Study (J. Stetefeld/M. McDougall)	2018	2020 (interim), 2023 (final)	2025	**MSc Thesis**: Johnson, W. 2024. Environmental DNA as an Ecological Monitoring Tool for the Canadian Arctic. MSc Thesis presented to the University of Manitoba, Winnipeg, Manitoba. (Not yet publicly available)

SECTION 5 • NEXT STEPS

5.1 CONSTRUCTED OFFSETS

Under the FHOMP, monitoring of fish populations is next scheduled to resume following construction of the offsetting features, including shoals, road scarification, and the water retention sills. However, in the meantime, water levels will continue to be measured in the Whale Tail flood zone through piezometric measurement. Annual CREMP evaluations in a subset of FHOMP study lakes (A20 and WTS) will also continue (water quality, sediment quality, phytoplankton community, benthic invertebrate community).

5.2 COMPLEMENTARY MEASURES

In 2025, field programs will continue for Study 2 (Baker Lake wastewater assessment).

Final reporting or peer-review manuscript submission is scheduled for Studies 1, 3, and 6.

An option for changes to Study 5 (end pit lake habitat use) will be selected.

A seventh meeting of the MFRAG is planned for November or December 2025.

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