APPENDIX G.3.2

Lake Sedimentation Monitoring Program Report

REPORT

Mary River Project – Lake Sedimentation Monitoring Program Report – 2024/2025

PREPARED FOR

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DATE

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Mary River Project –
Lake Sedimentation Monitoring Program
Report, 2024/2025

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EXECUTIVE SUMMARY

The Mary River Project (the “Project”), owned and operated by Baffinland Iron Mines Corporation (Baffinland), is an iron ore mining operation in the Qikiqtani Region of northern Baffin Island, Nunavut. Dust, sediment from erosion and runoff, and increased productivity (e.g., more phytoplankton) may result in increased sedimentation in nearby waterbodies. The Lake Sedimentation Monitoring Program (LSMP) at Sheardown Lake Northwest (NW) began in 2013, as part of Baffinland’s Aquatic Effects Monitoring Plan (AEMP). Since the start of LSMP, monitoring of sedimentation has been conducted at three locations within Sheardown Lake NW; two in shallow, nearshore (littoral) habitats and one in a deep (profundal) habitat. One littoral area represents suitable feeding habitat for arctic charr (SHAL-1), and the second littoral area represents habitat for arctic charr spawning and egg incubation (SHAL-2). The profundal (DEEP-1) area is in the deepest part of Sheardown Lake NW and represents conditions where rates of sediment deposition (“sedimentation rates”) and sediment accumulation thickness are expected to be highest in Sheardown Lake NW. The purpose of the LSMP is to evaluate whether mining activities at the Project influence sedimentation in Sheardown Lake NW and identify any Project-related influences on arctic charr habitat, including feeding, spawning, and egg incubation areas. This 2024/2025 report summarizes data on sedimentation rates, sediment accumulation thickness estimates, dustfall inputs, sediment chemistry, and benthic invertebrate community (BIC) relationships collected during the 2024/2025 ice cover period and the 2025 open water season.

Sedimentation rates during the 2024/2025 ice cover and the 2025 open water periods were higher than baseline (i.e., pre-mine; 2013/2014) conditions. However, the higher 2025 open water sedimentation rates were due to increased runoff, rainfall, and backflow of turbid water from the Mary River into Sheardown Lake SE and NW, during heavy rainfall events. The SHAL-2 littoral area, which represents a potential arctic charr spawning and egg incubation habitat, showed higher open water sedimentation in 2025, likely reflecting rainfall-driven backflow of turbid water. However, annual sedimentation rates remained similar to reported values for pristine Arctic lakes of similar size and depth.

Sediment accumulation thickness estimates for the 2024/2025 ice cover period were two to three times lower than the lowest threshold that would trigger additional studies, data analysis, or corrective action. In the Final Environmental Impact Statement (FEIS) for the Project (Baffinland 2012), sediment accumulation thickness estimates at or below 1 mm/year were predicted to have a negligible effect on the direct mortality of arctic charr and arctic charr eggs. Sediment accumulation thickness estimates during the combined 2024/2025 ice cover and 2025 open water periods were well below (approximately five to ten times less than) the 1

mm/year prediction in the FEIS at all littoral (SHAL-1 and SHAL-2) and profundal (DEEP-1) monitoring areas in Sheardown Lake NW. These findings indicated that sedimentation during egg incubation and the period when newly hatched arctic charr are still in the substrate is not expected to negatively affect arctic charr reproductive success in Sheardown Lake NW.

A comparison of dustfall measurements with lake sediment data from 2013 to 2025 showed that dustfall was not the main source of sediment accumulating in Sheardown Lake NW. During the open water periods, natural seasonal factors (e.g., heavy rainfall events) are likely to have a stronger influence on sedimentation in Sheardown Lake NW. Sediment chemistry analyses showed elevated concentrations of iron, chromium, and zinc relative to AEMP benchmarks in some sediment trap samples. However, comparisons with surface sediment data collected at the same time under the Core Receiving Environment Monitoring Program (CREMP) showed that concentrations of iron, chromium, and zinc were within applicable benchmarks (protective of the aquatic environment). The results of the 2025 CREMP indicated that there were no mine-related effects from elevated iron, chromium, and/or zinc in sediment in Sheardown Lake NW.

During the 2025 open water period, sedimentation rate and accumulation thickness estimates to BIC health endpoints (density, richness [number of species], or evenness [number of individuals per species]) were not well correlated at the littoral area representing arctic charr spawning habitat (SHAL-2). However, relative proportions of *Chironomidae* larvae (non-biting midges) decreased and *Ostracoda* (seed shrimp) increased with sedimentation rate and accumulation thickness, respectively, at the BIC monitoring station near SHAL-2 (littoral area representing arctic charr spawning habitat) during the 2025 open water period. Monitoring of BIC endpoints at stations (DD-HAB 9-STN2 and DL0-01-8) near the SHAL-1 area (representing Arctic charr feeding habitat) currently do not have enough years of data to allow statistical comparisons. Monitoring of BIC at DD-HAB 9-STN2 and DL0-01-8 will therefore continue, to allow these comparisons in future years. Although sedimentation appears to influence BIC endpoints within the areas examined, arctic charr are mobile and can access preferred food items throughout the broader lake, including Sheardown Lake SE, which is connected to Sheardown Lake NW. A broader annual assessment of lake-wide BIC and arctic charr population status is conducted in the 2025 CREMP.

Overall, the 2024/2025 LSMP results showed minimal evidence of negative mine-related effects from sedimentation rates, sediment accumulation thickness estimates, sediment quality, BIC, and arctic charr egg incubation success in Sheardown Lake NW. Although sedimentation rates and accumulation thickness estimates have increased relative to pre-mine conditions, sedimentation rates are within range of pristine Arctic lakes and sediment accumulation thickness estimates during the 2024/2025 ice cover period (i.e., arctic charr egg incubation period) are well below the most conservative threshold for further investigation and management.

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ACRONYMS AND ABBREVIATIONS

ABS – Acrylonitrile-Butadiene-Styrene

AEMP – Aquatic Effects Monitoring Plan

ALS – ALS Environmental

ANOVA – Analysis-of-Variance

BAFFINLAND – Baffinland Iron Mines Corporation

BD – Bulk Density

BIC – Benthic Invertebrate Community

CIRNAC – Crown-Indigenous Relations and Northern Affairs Canada

CREMP – Core Receiving Environment Monitoring Program

CV-AAS – Cold Vapour Atomic Absorption Spectrometer

FEIS – Final Environmental Impact Statement

FFG – Functional Feeding Groups

GPS – Global Positioning System

HSD – Honestly Significant Difference

ICP-MS – Inductively Coupled Plasma Mass Spectrometer

LPL – Lowest Practical Level

LSMP – Lake Sedimentation Monitoring Program

NIRB – Nunavut Impact Review Board

NW – Northwest

The Project – Mary River Project

PSD – Particle Size Distribution

PVC – Polyvinylchloride

QA/QC – Quality Assurance/Quality Control

SE – Southeast

SQG – Sediment Quality Guideline

SRC – Saskatchewan Research Council

TARP – Trigger, Action, Response Plan

TOC – Total Organic Carbon

1 INTRODUCTION

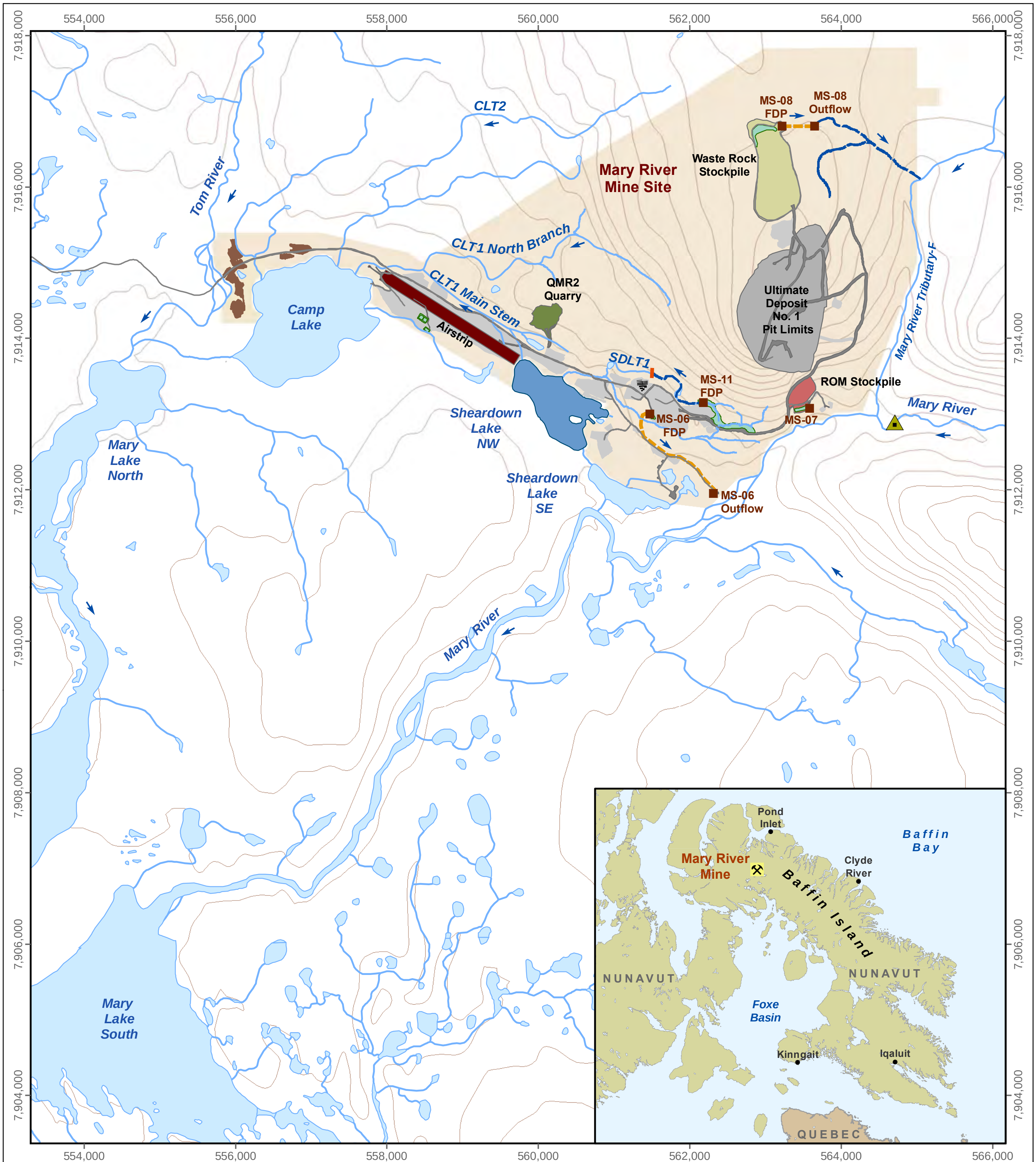
1.1 Background

The Mary River Project (herein referred to as "the Project"), owned and operated by Baffinland Iron Mines Corporation (Baffinland), is a high-grade iron ore mining operation located in the Qikiqtani Region of northern Baffin Island, Nunavut (Figure 1.1). Commercial open-pit mining, including pit bench development, ore haulage, and ore stockpiling, as well as the crushing and screening of high-grade iron ore, commenced at the Project site in 2015. Fugitive dust deposition and surface runoff/erosion from Project activities, and increased biological productivity (e.g., due to treated sewage discharge) have the potential to result in increased sedimentation in nearby waterbodies. In aquatic environments, these deposits may lead to physical habitat alteration (e.g., changes in substrate composition or embeddedness) and/or chemical alteration (e.g., changes in metal, nutrient, and/or organic matter concentrations) that, in turn, could alter biotic assemblages and lead to adverse ecological effects (e.g., physical smothering and reduced survival of organisms residing on/in existing substrate and effects to growth and reproduction of fish, respectively).

The Lake Sedimentation Monitoring Program (LSMP) was included as a special investigation component of the Project's Aquatic Effects Monitoring Plan (AEMP; Baffinland 2015, NSC 2014a) to better understand rates of sediment deposition associated with the Project and the potential implications of this sediment deposition on aquatic biota. The primary concern regarding Project-associated lake sedimentation is the potential for physical effects on arctic charr (*Salvelinus alpinus*) populations resulting from:

- changes to benthic invertebrate community (BIC) structure and/or density resulting from habitat alteration that, in turn, may alter food availability (quantity and/or quality) for arctic charr;
- loss or alteration of spawning habitat for arctic charr resulting from the accumulation of fine materials on and/or surrounding spawning substrates; and
- accumulation of fine material on and/or surrounding the spawning substrates used by arctic charr, which could limit the amount of oxygen available in spawning beds during the overwinter incubation period, thereby resulting in reduced egg hatching success and/or reduced larval survival following hatch (Berry et al. 2003).

The LSMP is a year-round sampling program that was designed to measure the sedimentation rate (i.e., total dry weight of sediment deposited per day) at Sheardown Lake Northwest (NW; DL0-01) separately over ice cover and open water periods (Baffinland 2015,



LEGEND

- Airstrip
- Mine Site Complex
- Pond
- ROM Stockpile
- Road
- Open Pit
- Waste Rock Facility
- Infrastructure
- Borrow Pit
- Quarry
- Mine Site Area
- Sheardown Lake NW
- Final Discharge Point (FDP)
- Mary River Cascade Barrier
- Fish Barrier
- Overland Surface Water Flow
- HDPE Pipe
- Contour (20m)

Note: CLT - Camp Lake Tributary
SDLT - Sheardown Lake Tributary

Sheardown Lake NW, Mary River Mine Site, Baffinland Iron Mines Corporation

0 1.25 2.5 5 km

N E S W

Map Projection: UTM Zone 17 W NAD 1983
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Figure 1.1

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Baffinland Iron Mines - 257202.5067 - 2025 AEMP\D - GIS\Lake Sedimentation\25-5067 Figure 1.1 Mary River Mine Site Location.mxd

NSC 2014a,b, NSC 2015, Minnow 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024a). Relative to other waterbodies near the Project, Sheardown Lake NW is expected to receive the highest particulate inputs (through dust deposition and site runoff) and was therefore selected for lake sedimentation monitoring (Figure 1.1; NSC 2014b).

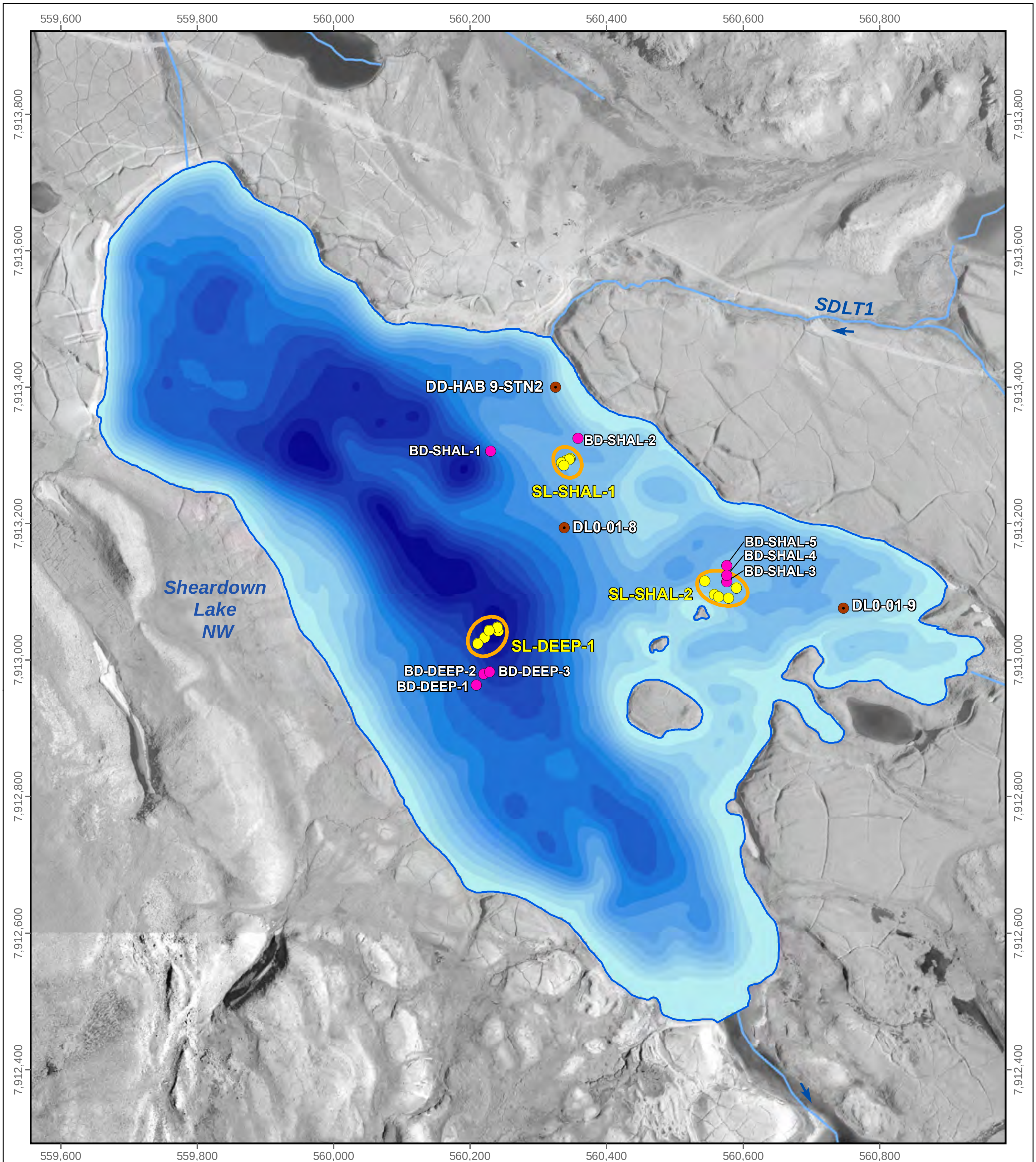
1.2 Program Overview

Sedimentation monitoring was initiated at Sheardown Lake NW in 2013; data collected from fall 2013 to fall 2014 represent one full ice cover period (September/October to June/July) and one full open water period (June/July to September/October). These data were collected to form the baseline for the annual evaluation of potential effects from Project activities to lake sedimentation (Minnow 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024a, 2025).

Sedimentation studies at Sheardown Lake NW have been used to estimate sedimentation rate and derive sediment accumulation thickness estimates during ice cover and open water periods (Baffinland 2015, NSC 2014a,b, NSC 2015, Minnow 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024a). Monitoring of sedimentation rate ($mg/cm^2/day$) has been conducted using consistent monitoring locations, sampling equipment, and approach since 2013 (Figure 1.2; Minnow 2024a). Sediment accumulation thickness estimates were calculated starting in winter 2014/2015. Beginning in 2017/2018, the study design was modified to include methods for the direct collection of bulk density (BD) information from deposited sediment, in an effort to improve sediment accumulation thickness estimates (Minnow 2019, 2020, 2021, 2022, 2023, 2024a).

During review of the LSMP report in 2022, the Nunavut Impact Review Board (NIRB) requested a quantitative comparison between sedimentation rates observed at Sheardown Lake NW and dustfall deposition. Subsequently, an evaluation of the potential influence of aerial dustfall was integrated into the LSMP starting in 2022/2023 (refer to Section 2.2.4; Minnow 2024a, 2025). In the Final Environmental Impact Statement (FEIS) for the Project (Volume 7; Baffinland 2012), it was predicted that Sheardown Lake NW would receive 2.1×10^9 g of dust annually from direct aerial dustfall and surface runoff during mining operations.

During review of the LSMP report in 2023, Crown Indigenous Relations and Northern Affairs Canada (CIRNAC) recommended Baffinland 1) characterize the chemical composition of dustfall entering Sheardown Lake NW, and 2) discuss implications for BIC and arctic charr stemming from sediment accumulation at the silt-loam habitat in Sheardown Lake NW over the period of mine operations. In 2023, Baffinland committed to investigating correlations between dustfall and sediment trap chemistry; dustfall chemistry data collected for the 2022/2023, 2023/2024, and 2024/2025 Mary River Terrestrial Environment Annual Monitoring Project were



LEGEND

- Benthic Invertebrate Community Monitoring Station
- Bulk Density Replicate Station
- Sedimentation Rate Replicate Station
- Sedimentation Rate and Accumulation Thickness Estimate Monitoring Area

Bathymetry (m)

0- 2	6 - 8	14 - 16	22 - 24
2 - 4	8 - 10	16 - 18	24 - 26
4 - 6	10 - 12	18 - 20	26 - 28
	12 - 14	20 - 22	28 - 30

Note: SDLT - Sheardown Lake Tributary

Lake Sedimentation and Benthic Invertebrate Community Monitoring Stations, Sheardown Lake NW, 2024-2025

0 125 250 500 Meters

N W E S

Map Projection: UTM Zone 17N NAD 1983
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Figure 1.2

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Baffinland Iron Mines - 257202.5067 - 2025 AEMP\D - GIS\Lake Sedimentation\25-5067 Figure 1.2 Sheardown Lake NW Lake Sedimentation Monitoring Locations.mxd qualitatively compared to sediment trap chemistry data (when available[1]). The second request was addressed using data for BIC samples collected annually in August as part of the Mary River Project Core Receiving Environmental Monitoring Program (CREMP; Baffinland 2015). Specifically, correlation analyses were completed between BIC endpoints (e.g., density, richness, Simpson's Evenness, dominant taxonomic groups, and functional feeding groups [FFGs]) and sedimentation rate and accumulation thickness data (see Sections 2.2.5 and 2.3.3 for further details). Results from the BIC and sedimentation endpoint assessment are presented in this report, whereas the broader interpretation of these findings is provided in the 2025 CREMP report (TCC 2026 in prep.).

1.3 Objectives of the Lake Sedimentation Monitoring Program

The main objectives of the LSMP conducted at Sheardown Lake NW are (Baffinland 2024):

1) To evaluate and track potential changes in sedimentation rates and sediment accumulation thickness estimates for particulate matter originating from dustfall or other sources of suspended particulates (e.g., erosion) during the ice cover and open water periods. These changes are assessed relative to baseline conditions (2013 and 2014) and consider data during mine operation (2015 to 2025).
2) To assess sediment accumulation thickness estimates against Trigger, Action, Response Plan (TARP) thresholds that are derived from natural sedimentation rates and values reported to adversely affect salmonid egg survival during the ice cover period (refer to Section 2.3.1).

The following sections describe the current methodology for selecting monitoring areas, collection of field data, laboratory analyses, and data analyses (i.e., to evaluate sedimentation rate, sediment accumulation thickness estimates, sediment chemistry, and BIC endpoints). This report presents the results of the 2024 to 2025 LSMP, including the evaluation of potential Project-related influences on sedimentation at Sheardown Lake NW in the eleventh year following the commencement of commercial mine operation in 2015.

[1] Incorporation of sediment trap chemical analysis into the LSMP report is dependent on the mass of sediment material collected during the ice cover and open water monitoring periods.

2 METHODS

2.1 Areas

In 2024/2025, sedimentation was monitored at the same three annual monitoring areas established at Sheardown Lake NW during the initial 2013/2014 baseline study (Figure 1.2, Table 2.1). The initial selection of monitoring areas in 2013 accounted for dominant benthic habitat types present in the lake as well as habitats considered important for supporting the resident arctic charr population. These considerations resulted in the establishment of Shallow Depositional (SL-SHAL-1), Shallow Hard-bottom (SL-SHAL-2), and Deep Profundal (SL-DEEP-1) areas for sedimentation monitoring, based on the following rationale:

1. Shallow Depositional Area (SL-SHAL-1): Silt-loam represents the dominant substrate type in Sheardown Lake NW. Therefore, increased sedimentation in habitats with this substrate type has the greatest potential to affect overall benthic invertebrate density (i.e., productivity) and/or community composition within the lake. In turn, sedimentation-related changes to productivity and/or BIC composition (i.e., food resources) can affect the arctic charr population of Sheardown Lake NW. For these reasons, and to represent a potentially high sediment deposition habitat, SL-SHAL-1 (referred to as SHAL-1 in the text hereafter) was established within silt substrate in the lake's littoral zone[2] at approximately 10 metre (m) depth. Additionally, because SHAL-1 is located near the outlet from Sheardown Lake Tributary 1 (SDLT1; Figure 1.2), information acquired from this area also evaluates the extent to which sediment releases from key tributaries affect sedimentation at Sheardown Lake NW.
2. Shallow Hard-bottom Area (SL-SHAL-2): Increased sedimentation at hard-bottom areas could reduce the amount of habitat available to arctic charr for spawning and/or reduce arctic charr egg hatch/reproductive success. Therefore, SL-SHAL-2 (referred to as SHAL-2 hereafter) was established on coarse substrate (i.e., gravel and cobble) in the lake's littoral zone at approximately 6 m depth, within an area considered to provide suitable spawning and egg incubation habitat for arctic charr.
3. Deep Profundal Area (SL-DEEP-1): The profundal area[2] is the ultimate depositional area within lakes and the highest sediment deposition rate is expected to occur at the deepest point within the main basin of a lake. Monitoring area SL-DEEP-1 (referred to

[2] In the AEMP, areas with water depths between 2 and 12 m deep are classified as "littoral", whereas habitats with depths >12 m are classified as "profundal" (Baffinland 2015, 2024).

Table 2.1: Sedimentation Rate and Dry Bulk Density Trap Replicate Station Coordinates, Habitat Information, and Deployment and Retrieval Information, Sheardown Lake Northwest (NW) Sedimentation Monitoring Study, 2024/2025

Area	Station	Original Set Location (UTM; NAD83; Zone 17W)		Substrate	Ice Cover Period (2024 to 2025)			Open Water Period (2025)		
		Easting	Northing		Date Deployed	Date Retrieved	Set Duration (days)	Date Deployed	Date Retrieved	Set Duration (days)
Shallow 1 (SL-SHAL-1)	SL-SHAL-1A	560340	7913292	silt	5-Oct-24	6-Jul-25	274	6-Jul-25	25-Sep-25	81
	SL-SHAL-1B	560347	7913295	silt	5-Oct-24	5-Jul-25	273	5-Jul-25	25-Sep-25	82
	SL-SHAL-1C	560346	7913294	silt	5-Oct-24	8-Jul-25	276	8-Jul-25	25-Sep-25	79
	SL-SHAL-1D	560334	7913289	silt	5-Oct-24	5-Jul-25	273	5-Jul-25	25-Sep-25	82
	SL-SHAL-1E	560337	7913285	silt	5-Oct-24	8-Jul-25	276	9-Jul-25	25-Sep-25	78
Shallow 2 (SL-SHAL-2)	SL-SHAL-2A	560558	7913096	cobble	7-Oct-24	5-Jul-25	271	5-Jul-25	25-Sep-25	82
	SL-SHAL-2B	560564	7913093	cobble	5-Oct-24	7-Jul-25	275	7-Jul-25	25-Sep-25	80
	SL-SHAL-2C	560579	7913091	cobble	5-Oct-24	-	-	5-Jul-25	25-Sep-25	82
	SL-SHAL-2C-HIS	560579	7913092	cobble	19-Sep-23	5-Jul-25	655	-	-	-
	SL-SHAL-2D	560544	7913116	cobble	5-Oct-24	7-Jul-25	275	7-Jul-25	26-Sep-25	81
	SL-SHAL-2E	560590	7913106	cobble	5-Oct-24	5-Jul-25	273	5-Jul-25	26-Sep-25	83
Deep 1 (SL-DEEP-1)	SL-DEEP-1A	560242	7913042	silt	7-Oct-24	7-Jul-25	273	7-Jul-25	25-Sep-25	80
	SL-DEEP-1B	560240	7913048	silt	7-Oct-24	7-Jul-25	273	7-Jul-25	25-Sep-25	80
	SL-DEEP-1C	560222	7913033	silt	7-Oct-24	5-Jul-25	271	5-Jul-25	25-Sep-25	82
	SL-DEEP-1C-HIS	560235	7913051	silt	10-Jul-24	5-Jul-25	360	-	-	-
	SL-DEEP-1D	560211	7913024	silt	7-Oct-24	8-Jul-25	274	8-Jul-25	25-Sep-25	79
	SL-DEEP-1E	560228	7913043	silt	7-Oct-24	9-Jul-25	275	8-Jul-25	25-Sep-25	79
Bulk Density	BD-SHAL-1	560583	7913137	silt	5-Oct-24	7-Jul-25	275	7-Jul-25	26-Sep-25	81
	BD-SHAL-2	560570	7913136	silt	5-Oct-24	7-Jul-25	275	8-Jul-25	25-Sep-25	79
	BD-SHAL-3	560350	7913321	silt	5-Oct-24	7-Jul-25	275	7-Jul-25	25-Sep-25	80
	BD-SHAL-4	560352	7913306	silt	5-Oct-24	8-Jul-25	276	8-Jul-25	25-Sep-25	79
	BD-SHAL-5	560568	7913153	silt	7-Oct-24	8-Jul-25	274	8-Jul-25	26-Sep-25	80
	BD-DEEP-1	560210	7912963	silt	7-Oct-24	6-Jul-25	272	6-Jul-25	25-Sep-25	81
	BD-DEEP-2	560220	7912979	silt	7-Oct-24	7-Jul-25	273	7-Jul-25	25-Sep-25	80
	BD-DEEP-3-HIS	560220	7912979	silt	18-Sep-23	8-Jul-25	659	-	-	-
	BD-DEEP-3	560229	7912983	silt	-	-	-	8-Jul-25	25-Sep-25	79

Notes: UTM = Universal Transverse Mercator Coordinates. NAD = North American Datum.- = sediment trap not recovered or deployed. "HIS" = a trap was deployed for longer than one deployment period and excluded from analysis.

4. as DEEP-1 hereafter) was established on silt substrate within the profundal zone of the main lake basin (at approximately 25 m deep) to provide an estimate of maximum sedimentation for Sheardown Lake NW.

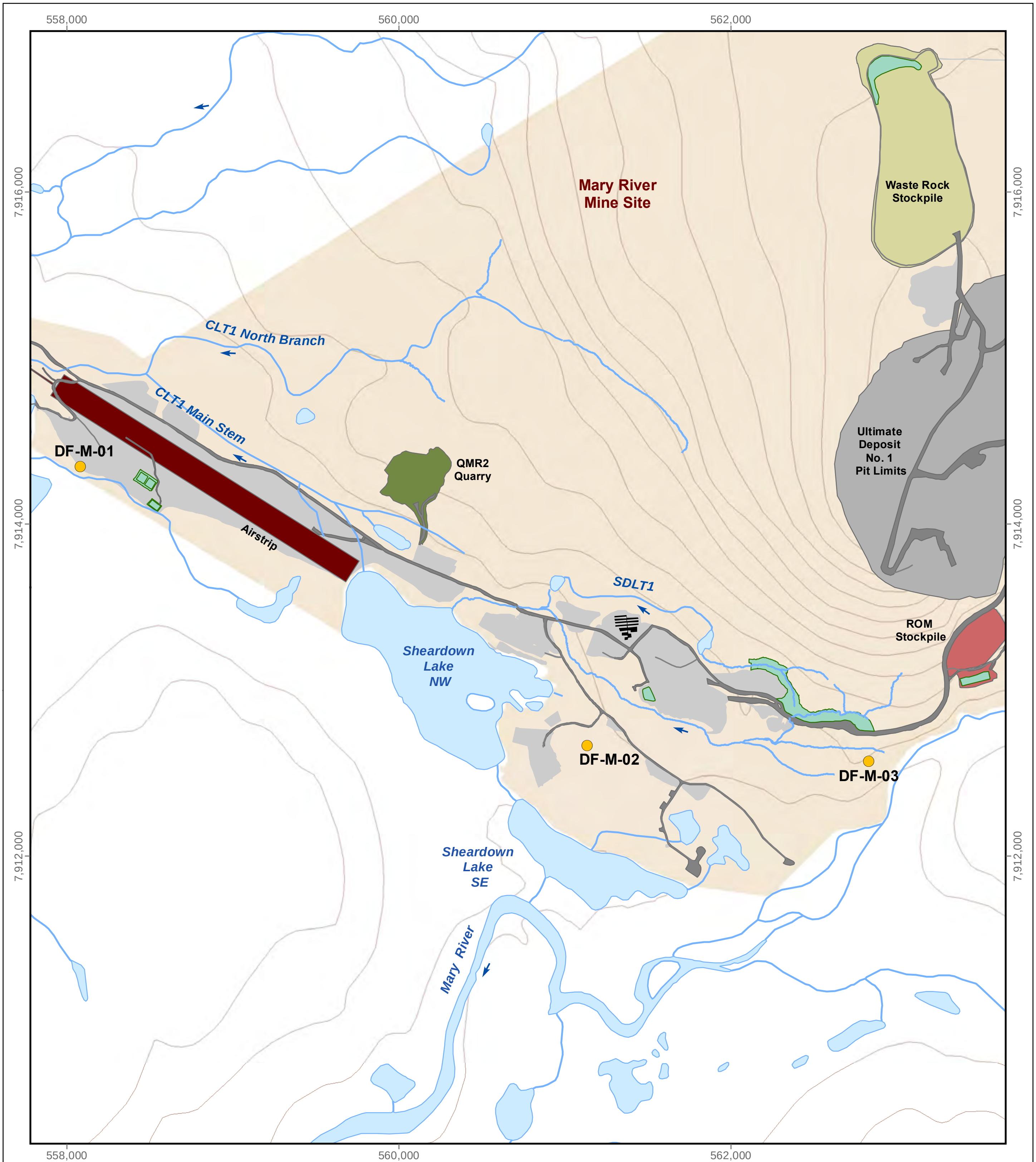
Baffinland has conducted passive dustfall monitoring at the Project site since 2013 as part of the Terrestrial Environment Annual Monitoring Project (EDI 2025). Three passive dustfall monitoring stations (Stations DF-M-01, DF-M-02, and DF-M-03) located near Sheardown Lake NW, and within the prevailing wind direction, were selected to support the assessment of potential influence from aerial dustfall deposition on sedimentation rates and sediment chemistry in Sheardown Lake NW (Figure 2.1). Additionally, to support the investigation of the relationship between sedimentation rates/accumulation thickness estimates and BIC endpoints in Sheardown Lake NW, three of the five BIC monitoring stations from the CREMP (Stations DL0-01-8, DL0-01-9, and DD-HAB 9-STN2) were paired with the two shallow/littoral sedimentation monitoring areas in Sheardown Lake NW (i.e., SHAL-1 and SHAL-2; Table 2.2, Figure 1.2). Following implementation of the Revision 2 AEMP study design, starting in spring 2025, profundal BIC sampling in Sheardown Lake NW was discontinued (i.e., no 2025 BIC data are available to pair with DEEP-1).[3]

2.2 Field and Laboratory Methods

2.2.1 Sedimentation Rate

Sediment traps were used to monitor sedimentation rates at Sheardown Lake NW during the 2024/2025 ice cover and 2025 open water periods; monitoring was completed by Baffinland staff. Sediment traps were constructed using the same materials and dimensions as those deployed annually since the initial study in 2013. Specifically, each sediment trap was constructed of three 50-centimetre (cm) long, 5-cm internal diameter polyvinylchloride (PVC) pipes (i.e., 58.9 cm^2 surface area) sealed at the bottom and clamped together to create a single trap unit. The sediment traps were designed to provide an aspect ratio of approximately 10:1, which meets the ≥ 5:1 aspect ratio generally recommended for cylindrical sediment traps to effectively monitor sediment deposition (Mudroch and MacKnight 1994). Each sediment trap unit was secured to a float-anchor system designed to maintain the trap in an upright position on the lake bottom for the duration of each deployment period. Under this system, the mouth of the sediment trap unit was situated approximately 1.5 m above the substrate.

[3] Although no comparisons of profundal BIC endpoints and sedimentation data for DEEP-1 were completed as part of this report, a fulsome assessment using existing profundal BIC and sedimentation data is provided in the annual LSMP report for the 2023/2024 ice cover and 2024 open water periods (Minnow 2025).



LEGEND

- Dustfall Monitoring Location
- Airstrip
- Mine Site Complex
- Pond
- ROM Stockpile
- Road
- Open Pit
- Waste Rock Facility
- Borrow Pit
- Quarry
- Infrastructure
- Project Development Area
- Contour (20m)

Note: SDLT - Sheardown Lake Tributary
CLT - Camp Lake Tributary

Sheardown Lake NW Dustfall Monitoring Locations, 2024-2025

0 0.5 1 2 km

Map Projection: UTM Zone 17 W NAD 1983
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Figure 2.1

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Baffinland Iron Mines - 257202.5067 - 2025 AEMP\D - GIS\Lake Sedimentation\25-5067 Figure 2.2 Sheardown Lake NW Lake Dust Fall Monitoring Locations, 2023-2024.mxd

Table 2.2: Benthic Invertebrate Community Monitoring Stations and Coordinates Used in the Lake Sedimentation Monitoring Program, 2025

Waterbody	Station Code	UTM Zone 17N, NAD83		Sampling Habitat
		Easting	Northing	
Sheardown Lake Northwest (NW; DL0-01)	DD-HAB 9-STN2	560325	7913400	littoral
	DL0-01-8	560338	7913194	littoral
	DL0-01-9	560747	7913076	littoral

Notes: UTM = Universal Transverse Mercator. NAD = North American Datum.

Sedimentation was assessed separately for ice cover and open water periods at Sheardown Lake NW. The seasonal timing of ice breakup and freeze-up at Sheardown Lake NW generally corresponds to mid-July and mid-September, respectively. For the 2024/2025 ice cover period, five sediment traps were deployed, over two days, at each of the three Sheardown Lake NW study areas (October 5th to 7h, 2024; Table 2.1). Sediment traps deployed over the ice cover period were individually fitted with a marker buoy and lowered to the bottom of the lake such that the marker buoy was submerged approximately 2 to 3 m below the water surface (i.e., to avoid entrapment of the buoy by ice during winter).

Sediment traps for the 2024/2025 ice cover period were retrieved from July 5th to July 9th, 2025 (271- to 276-day deployment duration, excluding the exceptions noted below; Table 2.1). Marker buoys were submerged and therefore required the use of a grappling tool to secure the marker buoy and retrieve the sediment trap at the time of collection. One of the 15 sediment traps deployed in October 2025 (Station SHAL-2C) was not located in July 2025, presumably due to the entrapment of the marker buoy by ice and subsequent relocation of the trap (Table 2.1). Two sediment traps, DEEP-1C-HIS and SHAL-2C-HIS, deployed in July and September 2024, respectively, were retrieved in October 2025 and were excluded from the data analysis (Table 2.1).

Sediment traps for the open water period were deployed from July 5th to 9th, 2025 and were retrieved from September 25th to 26th, 2025 (78- to 83- day deployment duration; Table 2.1). For the open water period, 15 traps were lowered to the lake bottom on individual lines fitted with a surface marker buoy so that they could be seen from the lake surface.

Global Positioning System (GPS) coordinates were recorded for all sediment traps at the time of deployment.

To retrieve each sediment trap, the entire unit was pulled to the surface very slowly to prevent sediment re-suspension in, and/or sediment loss from, each sediment trap. All contents of the trap, including all water and deposited sediment, were transferred into a 20 litre (L) plastic container pre-labelled with station identification and collection date information. Ambient water was used to rinse sediment from each sediment trap, applied as a pressurized spray, as appropriate. Residual material in each sediment trap was removed using a plastic spatula and/or a pressurized stream of water and then discarded. Upon complete removal of all material within the sediment trap, each sediment trap was redeployed at its approximate retrieval location. Following collection of all sediment from individual traps, the sample containers were sealed and stored upright on-site in a refrigerator at 4ºC until submission to the analytical laboratory. The lake sediment samples were shipped to ALS Environmental (ALS; Winnipeg, MB) for analysis of the sediment total dry weight and chemical characterization.

At the laboratory, the sedimentation samples were filtered through a pre-weighed 0.70 micrometre (µm) glass fiber filter. The filter apparatus and container were rinsed three times to ensure complete removal of all sediment. The filter and residual sample material were dried at 105°C for two hours, allowed to cool for one hour, and then weighed to the nearest milligram using an electronic balance with a draft shield.

2.2.2 Sediment Accumulation Thickness Estimates, Bulk Density, and Particle Size Distribution

Sediment BD information was collected to support sediment accumulation thickness estimates separately for the 2024/2025 ice cover and 2025 open water periods. The original sediment trap configuration (2013 to 2017) did not produce sufficient sample volume for BD analysis; therefore, sediment traps used for BD were subsequently modified to have larger dimensions than those used for the collection of sedimentation rate data (Section 2.2.1). The BD sediment traps were constructed of a single 75 cm long, 15.2 cm internal diameter acrylonitrile-butadiene-styrene (ABS) pipe (182 cm^2 surface area) that was capped at the bottom end.[4] Each BD sediment trap was secured to a float-anchor system designed to maintain the trap in an upright position on the lake bottom for the duration of the deployment period. The mouth of the BD sediment trap was designed to sit approximately 1.5 m above the substrate, to match the sedimentation rate traps.

[4] The resulting BD sediment traps had an aspect ratio of 5:1, meeting the recommended aspect ratio for cylindrical sediment traps to effectively monitor sediment deposition (Mudroch and MacKnight 1994).

The BD sediment traps for the 2024/2025 ice cover period were deployed on October 5^{th} and 7^{th}, 2024 and retrieved between July 6^{th} and 8^{th} 2025 (273- to 275-day deployment duration, excluding the exception noted below; Table 2.1). One BD sediment trap (BD-DEEP-3-HIS) deployed on September 18^{th}, 2023 was retrieved on July 8^{th}, 2025 and was not included in the data analysis (Table 2.1). Similar to the sediment traps deployed for sedimentation rate determination, BD sediment traps deployed over the ice cover period were individually fitted with a marker buoy that was submerged approximately 2 to 3 m below the water surface to avoid entrapment of the buoy by ice during winter. This configuration required the use of a grappling tool for trap retrieval.

The BD sediment traps for the open water period were deployed between July 6^{th} and 8^{th}, 2025 and retrieved between September 25^{th} and 26^{th}, 2025 (79- to 81-day deployment duration; Table 2.1). The BD sediment traps were lowered to the lake floor on individual lines fitted with a surface marker buoy so that they could be seen from the lake surface. Additionally, GPS coordinates were taken at each BD sediment trap location during deployment. All BD traps deployed in July 2025 were retrieved in September 2025 (Table 2.1).

The retrieval process involved pulling each BD sediment trap to the surface very slowly to prevent sediment re-suspension and/or sediment loss. The entire contents of the trap, including all water and deposited sediment, were transferred into a 4 L plastic container pre-labelled with the replicate station identification code. Residual material in each BD sediment trap was removed using a plastic spatula and/or a pressurized stream of water and then discarded. The BD samples were transported to an on-site laboratory and left undisturbed for approximately 48 hours to allow the sediment to settle. After 48 hours, the overlying water was siphoned and/or pipetted out, and the sediment was then transferred into a 50 millilitre (mL) glass collection jar.

To provide sufficient sample volume for BD analysis, BD samples collected from each monitoring area during the 2024/2025 ice cover period and 2025 open water period were combined to create three composite samples (i.e., BD-SHAL-A, BD-SHAL-B, and BD-DEEP). Each composite sample represents the two shallow littoral areas and one profundal area. The BD traps labelled BD-SHAL-1 and BD-SHAL-2 (composited to create sample BD-SHAL-A) corresponded to the SHAL-1 sediment monitoring area, and bulk density stations BD-SHAL-3, BD-SHAL-4, and BD-SHAL-5 (composited to create sample BD-SHAL-B) corresponded to the SHAL-2 sediment monitoring area (Figure 1.2). The BD traps labelled BD-DEEP-1, BD-DEEP-2, and BD-DEEP-3 (composited to create sample BD-DEEP) corresponded to the profundal DEEP-1 sediment monitoring area (Figure 1.2).

Following the collection of all sediment, sample containers were sealed and stored on-site in an upright position in a refrigerator at 4ºC until submission to the Saskatchewan Research Council

(SRC; Saskatoon, SK). At SRC, the analysis of BD was conducted using the pycnometer method[5].

After BD analysis, an aliquot of sediment was collected from each BD sample and submitted for particle size distribution (PSD) analysis. The sediment was analyzed by SRC (Saskatoon, SK) using a Microtrac Series 5000 (laser diffraction instrument) before and after ashing the sample at 550°C. The particle range analyzed was between 0.5 µm to 350 µm. Glass beads were analyzed for quality assurance/quality control (QA/QC).

2.2.3 Sediment Trap Chemistry

Sediment trap chemistry was incorporated into the LSMP in 2023/2024. Sediment trap material collected by Baffinland staff during the 2024/2025 ice cover and 2025 open water periods was submitted to ALS (Winnipeg, MB) for analysis of sample dry mass by gravimetry. Sediment material was collected on filters (Whatman Glass fiber 934-AH filters) and dried at 105°C. After filtration, drying, and weighing, the filters were sent to ALS in Waterloo, ON and sediment (approximately one gram) was scraped from the filter for digestion and analysis of total organic carbon (TOC), organic matter content, and metal concentrations. Total organic carbon was determined by wet oxidation digestion and the oxidized carbon content was determined by back-titration. Organic matter content was estimated from the TOC content using a Van Bemmelon factor. Blank filters were digested as method blanks. Sediment material that was less than 2 mm in size was digested using a mixture of nitric and hydrochloric acids. The selected sediment digestion procedure was consistent with the digestion procedure for dustfall material (Section 2.2.4). All metals were analyzed using an inductively coupled plasma mass spectrometer (ICP-MS), except mercury, which was analyzed using cold vapour atomic absorption spectroscopy (CV-AAS).

2.2.4 Dustfall Collection

The Terrestrial Environment Annual Monitoring Project monitors passive dustfall at 43 stations in and around the Project (EDI 2025). Three passive dustfall monitoring stations (Stations DF-M-01, DF-M-02, and DF-M-03; Figure 2.1) located near Sheardown Lake NW and within the prevailing wind direction (northwest and southeast axis) were incorporated into the lake sediment monitoring program to support interpretation of lake sedimentation data and sediment trap chemistry. A comparison of data from these dustfall monitoring stations and sediment trap data from

[5] The pycnometer method uses volume displacement to determine bulk density (see Appendix D for a summary of the laboratory method used).

Sheardown Lake NW offers insight into whether dust deposition rates during the ice cover[6] and/or open water periods influence seasonal sedimentation rates, accumulation thickness estimates, and potentially sediment trap chemistry. Based on the proximity of the three dustfall monitoring stations to Sheardown Lake NW (Figures 1.2 and 2.1), it was expected that historical and current data from these monitoring stations would be sufficient for a comparison between the two datasets.

Dustfall material collected monthly as part of the Terrestrial Environment Annual Monitoring Project was suspended in a liquid (isopropyl alcohol or algaecide), and then submitted to ALS (Waterloo, ON) for digestion. Dustfall material was digested at the analytical laboratory using a mixture of nitric and hydrochloric acids and then analyzed for total suspended particulates, metals by ICP-MS, and total mercury by CV-AAS (EDI 2025, Hawthorne 2024).

2.2.5 Benthic Invertebrate Community

Benthic invertebrate community samples are collected annually in August at five[7] established stations in Sheardown Lake NW as part of the CREMP; data from three of these monitoring stations (located proximal to the sediment trap monitoring areas) were used for this study and are presented herein (Section 2.3.3; Baffinland 2015, 2024). One of these four stations (DL0-01-8) was incorporated into the CREMP for the first time in 2024 (Table 2.2), to support collection of BIC data from an area that is monitored for potential changes in sedimentation rate. No BIC samples were collected from historical monitoring Stations DL0-01-2, DL0-01-4, or DL0-01-12 in 2025 following implementation of AEMP Study Design Revision 2, which removed profundal BIC monitoring in the Sheardown Lake NW (Baffinland 2024).

Benthic invertebrate community sampling was conducted using a Petite Ponar grab sampler (15.24 x 15.24 cm; 0.023 m^2 sampling area) and targeted areas of the lake with predominantly soft silt-sand, silt, and/or clay substrates. Successful recovery of a complete Petite Ponar grab sample (i.e., such that surface material is collected and the sampler is full to each edge) is influenced by substrate particle sizes. Specifically, coarser substrates (e.g., pebbles and cobbles) often prevent the sampler from closing, resulting in loss of material or incomplete/unsuccessful grabs. Therefore, identified BIC stations typically have softer/finer substrates like sand, silt, and clay compared to the lake sedimentation monitoring stations

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[6] Although ice coverage limits the direct input of dust, dustfall material may become entrapped in and/or deposited on ice and snow and may enter the lake during spring melt.

[7] Under Revision 1 of the AEMP study design, BIC monitoring was completed at n = 10 stations (i.e., five littoral and five profundal) within Sheardown Lake NW (Baffinland 2015). Under Revision 2 of the AEMP study design, which was implemented starting in spring 2025, a total of n = 5 littoral BIC monitoring stations were targeted for sampling (Baffinland 2024).

(Section 2.2). A single composite sample, consisting of five grabs (i.e., 0.115 m^2 sampling area), was collected at each station, ensuring that each grab was acceptable (i.e., captured enough surface material to fill to the edges of the Petite Ponar). Any incomplete grabs were discarded. For each acceptable grab, the Petite Ponar was thoroughly rinsed, and the material was then field-sieved through a 500-µm mesh. After sieving all five grabs at a given station, the retained material was carefully transferred into a plastic sampling jar, which was labelled externally and internally with the station identifier, while working over a clean plastic catch-tote.

Following collection, the BIC samples were preserved in 10% buffered formalin in ambient water. Supporting information, including substrate descriptions, presence of aquatic vegetation/algae, sampling depths, *in situ* water quality at both the surface and bottom of the water column, and GPS coordinates, was recorded on field sheets.

The BIC samples were submitted to Zeas Inc. (Nobleton, ON), where they were processed using standard sorting, identification, and counting methods (Environment Canada 2014). Upon arrival at the laboratory, a biological stain was added to each sample to enhance sorting accuracy. The samples were first washed free of formalin in a 500-µm sieve and then a technician examined the remaining sample material under a stereomicroscope at a magnification of at least 10 times. Benthic invertebrates were carefully removed from the sample debris and placed into vials containing 70% ethanol. Organisms were sorted by major taxonomic groups (typically at the order or family level). A senior taxonomist later identified and enumerated the organisms to the lowest practical level (LPL) of taxonomy (usually genus or species) using up-to-date taxonomic keys. QA/QC control procedures employed during laboratory processing included assessments of organism recovery and sub-sampling checks on up to 10% of the total samples collected for the 2025 CREMP report (TCC 2026 in prep.).

2.3 Data Analysis

2.3.1 Sedimentation Rate and Sediment Accumulation Thickness Estimates

Sedimentation (deposition) rate was calculated for each replicate sediment trap using the equation (Kemp et al. 1974):

$$\text{Sedimentation rate (mg/cm}^2\text{/day)} = \frac{\text{dry weight (mg)}}{\text{total area (cm}^2\text{)}} \div \text{deployment time period (day)}$$

Where the dry weight is the total mass of dry sediment material collected during the ice cover or open water period, the total area is the surface area of the sediment trap, and the deployment period reflects the number of days the trap was deployed.

The sedimentation rate information was evaluated statistically as follows:

1) spatial comparisons among the three areas (SHAL-1, SHAL-2 and DEEP-1) for separate ice cover and open water periods;
2) comparisons of interannual variations in sedimentation at each area relative to the baseline year;
3) comparisons between the ice cover and open water periods at each area for the current study year;

4) correlation analysis between sedimentation data and year, to identify potential temporal patterns (e.g., a general increase or decrease in sedimentation rates over time);

5) correlation analysis between sedimentation rate and aerial dustfall deposition during the ice cover and open water periods; and

6) visualization and qualitative comparison between aerial dustfall chemistry and sediment trap chemistry.

For the statistical analysis, raw data were assessed for normality and homogeneity of variance and log-transformed as necessary to meet test assumptions before conducting a two-way Analysis of Variance (ANOVA) with *Area* and *Year* as factors or conducting t-tests between seasons within each area. In instances where normality could not be achieved through data transformation, Kruskal-Wallis H-tests were used for multiple group (i.e., ANOVA analysis) comparisons using rank transformed data. When ANOVA showed significant differences, post-hoc pair-wise comparisons were assessed using Tukey's Honestly Significant Difference (HSD) tests, or in cases where non-parametric analysis was required, Dunn's test. For comparisons of sediment deposition between seasons (e.g., t-test), when normality could not be achieved through data transformation, a non-parametric Mann-Whitney U test was used for analysis. Additionally, if variance was unequal between groups based on Levene's Test for Equality of Variance, Welch's t-test was used for comparisons between seasons. Temporal trends in sedimentation rate for the open water and ice cover periods were evaluated using non-parametric Spearman's ρ rank correlation and p-values less than 0.05 were considered statistically significant. All statistical comparisons were conducted using R (R Core Team 2023).

An estimate of the uncompacted thickness (mm) of sediment (referred herein as sediment accumulation thickness estimates) was calculated separately for each of the ice cover and open water periods using the equation (Kemp et al. 1974):

$$\text{Sediment accumulation thickness (mm/deployment period)} = \frac{\text{sedimentation rate (mg/mm}^2/day)}{\text{bulk density (mg/mm}^3)} \text{ x deployment time period (day)}$$

Uncompacted thickness (i.e., sediment accumulation thickness estimates) represents the thickness of sediment accumulated during the ice cover (September/October to July) or open water (July to September/October) periods (i.e., the deployment period). For this study, sediment accumulation thickness estimates are calculated on a period basis (i.e., ice cover or open water) unless otherwise noted. Sedimentation BD results were used to calculate sediment accumulation thickness estimates at shallow (littoral) and deep (profundal) areas of Sheardown Lake NW for each of the 2024/2025 ice cover and 2025 open water periods. The sediment thickness information was evaluated statistically between the profundal (DEEP-1) and the two littoral (SHAL-1 and SHAL-2) habitats separately for the ice cover and open water periods, and between the ice cover and open water periods separately for each area using the same statistical methods described above for comparisons of sedimentation rates.

Baffinland has proposed sediment accumulation thickness estimate thresholds to guide management response decisions as part of a TARP for the Mary River Project AEMP (Minnow 2021, Baffinland 2024). The proposed thresholds include:

- a Low Action response threshold of 0.15 mm of sediment deposition during the ice cover period based on the upper range of the natural sedimentation rate of 50 mg/cm^2/year converted to a sediment accumulation thickness estimate using the BD of deposited sediment at Sheardown Lake NW;
- a Moderate Action response threshold of 0.54 mm of sediment deposition during the ice cover period based on the sediment accumulation thickness estimate predicted in the FEIS for the Project; and
- a High Action response threshold of 1 mm sediment deposition during the ice cover period based on the threshold presented in the FEIS for the Project.

The High Action response threshold was adopted from, and supported by, Morgan et al. (1983), Fudge and Bodaly (1984), and Berry et al. (2011) as the sediment accumulation thickness estimates over the egg incubation period at which adverse effects on fish egg survival may occur. On Baffin Island, arctic charr spawning occurs in autumn (September and October) and, although egg hatch occurs in early April, larval emergence generally does not occur until ice breakup in mid-July (Scott and Crossman 1998). Because the egg incubation and larval swim-up periods correspond to the ice cover period used in this study, sediment accumulation thickness estimates for the ice cover period were used to evaluate the potential effects of depositing sediment on arctic charr egg survival at Sheardown Lake NW. Sediment accumulation thickness estimates for the 2024/2025 ice cover period were compared to the Low, Moderate, and High Action response thresholds proposed by Baffinland (2024) and Minnow (2021) to identify potential effects to arctic charr egg incubation and to guide management decisions in accordance with the TARP framework.

2.3.2 Aerial Dustfall Deposition and Chemistry

Dustfall data were compared to sedimentation rates and sediment accumulation thickness estimates by grouping corresponding dustfall data collected every month to the respective ice cover and open water periods. These data were then compared to the sedimentation rate and accumulation thickness estimates for the ice cover and open water periods. Spearman's ρ ($\alpha = 0.05$) was used to assess correlations between dustfall data and sedimentation rate data from 2013 to 2025. For visual comparisons between sediment trap and dustfall chemistry, parameters were selected for graphical presentation if they had applicable AEMP sediment quality benchmarks (i.e., arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, phosphorus, and zinc) or if there was an indication of potential mine-related effects based on previous water quality results (e.g., molybdenum and uranium) in Sheardown Lake NW (Minnow 2024b).

2.3.3 Benthic Invertebrate Community

Statistical analyses of littoral BIC data were conducted for the mine operation period (i.e., 2015 to 2025). The BIC endpoints assessed included:

- mean invertebrate densities (i.e., the average number of organisms per m^2);
- mean taxonomic richness (number of taxa identified to the LPL of taxonomy);
- Simpson's Evenness Index; and
- relative abundance of dominant/indicator taxa and FFG.

Simpson's Evenness was calculated using the Krebs method (Smith and Wilson 1996). Relative abundances of dominant/indicator taxa and FFG were calculated as the raw abundance (i.e., total number of organisms counted) of each respective group relative to the total number of organisms in the parent BIC sample. Dominant/indicator taxonomic groups were defined as those groups representing, on average, greater than 5% of the raw total organism count for a study area or any groups considered to be important indicators of environmental stress. The FFG were assigned based on Pennak (1989), Mandaville (2002), and/or Merritt et al. (2008) descriptions/designations for each taxon.

Historically, BIC endpoints were calculated separately for both littoral and profundal areas using CREMP data; however, following implementation of AEMP Study Design Revision 2, profundal stations were removed from sampling and only littoral endpoints were calculated and reported in the 2025 CREMP report (TCC 2026 in prep.). Comparisons of profundal BIC and sedimentation data can be found in the 2024 Lake Sedimentation Monitoring report (Minnow 2025).

Potential relationships between littoral BIC endpoints and sedimentation rates and accumulation thickness estimates were examined visually and, as data allowed, by correlation analysis. Correlation analysis could not be completed for BIC stations DD-HAB 9-STN2 and DL0-01-8 and their corresponding sediment monitoring area (i.e., SHAL-1, the area in closest proximity to the BIC stations and representing the same habitat type [littoral]; Figure 1.2). This is because DD-HAB 9-STN2 and DL0-01-8 had only two years of data each (2016/2025 and 2024/2025, respectively). Instead, the BIC data from DD-HAB 9-STN2 and DL0-01-8 were added to the data plots, along with sedimentation data from SHAL-1, to support visual examination of the data. Benthic invertebrate community station DL0-01-9 was paired with sediment trap area SHAL-2 and, for each set of paired data, Spearman's Rank correlations were conducted between the BIC endpoints and sediment endpoints. Significance was assessed at alpha of $p < 0.1$ and the comparisons were plotted for qualitative analysis.

3 RESULTS

3.1 Sedimentation Rate

3.1.1 Spatial Comparisons for the 2024 to 2025 Ice Cover and Open Water Periods

The amount of sediment collected (i.e., based on dry weight) at all areas during the 2024/2025 ice cover period was less than that collected during the 2025 open water period (Appendix Table B.1). During the 2024/2025 ice cover period, the mean sedimentation rates at the two littoral areas (SHAL-1 and SHAL-2) were similar (Table 3.1, Appendix Tables A.1 and A.2). These results suggested that sedimentation was uniform between the silt-loam habitat located close to the SDLT1 outlet (SHAL-1) and habitat characterized by hard substrate potentially used by arctic charr for spawning and egg incubation (SHAL-2). During the 2024/2025 ice cover period, the mean sedimentation rate at the profundal area (DEEP-1) was significantly higher relative to the two littoral areas (SHAL-1 and SHAL-2; Table 3.1, Appendix Tables A.1 and A.2). The profundal area, DEEP-1, is located within the deepest[8] part of Sheardown Lake NW and is considered representative of conditions of maximum sediment deposition within the lake.

During the 2025 open water period, mean sedimentation rate at SHAL-2, which was identified as a potential spawning and egg incubation location for arctic charr, was significantly higher relative to SHAL-1, but comparable to the deep profundal area of the lake (i.e., DEEP-1; Figure 3.1, Appendix Table A.3). The higher sedimentation rate at SHAL-2 than SHAL-1 may be due to backflow of turbid water from Mary River into Sheardown Lake Southeast (SE) and then Sheardown Lake NW during heavy rain events. Specifically, plumes of turbid water, similar to that observed and documented in July 2025, are often observed visually near SHAL-2 and DEEP-1 following heavy or prolonged rainfall (Figure 3.2).

Mean sedimentation rates in the littoral area SHAL-1 (located near SDLT1) were lower than SHAL-2 and DEEP-1, indicating that inputs from key tributaries reporting to Sheardown Lake NW are not likely contributing to higher sedimentation rates in the lake (Table 3.2; Appendix Table A.3). Finally, it is noteworthy the open water results were within normal and typical sedimentation rates for Arctic lakes (Wetzel 2001).

Mean annual sedimentation rates at Sheardown Lake NW in 2024/2025 were 36 mg/cm^2/year and 42 mg/cm^2/year for the littoral areas SHAL-1 and SHAL-2, respectively (Appendix Table A.1). The profundal area (DEEP-1) had the highest mean annual sedimentation rate of

[8] The depth of the two littoral stations, SHAL-1 and SHAL-2, are approximately 10 m and 6 m, respectively. The profundal area, DEEP-1, is approximately 25 m deep.

Table 3.1: Sedimentation Rate and Sediment Accumulation Thickness Estimate Data for the 2024 to 2025 Ice Cover Period at Sheardown Lake Northwest (NW)

Station ID	Original Set Location		Date		Set Duration (days)	Total Dry Weight (g)	Sedimentation Rate (mg/cm²/day)	Sedimentation Rate (mg/cm²/ice cover period)	Sediment Accumulation Thickness Estimate [a] (mm)
	Easting	Northing	Deployed	Retrieved					
Shallow 1 (SL-SHAL-1)									
SL-SHAL-1A	560338	7913292	5-Oct-24	6-Jul-25	274	1.06	0.0657	18.0	0.0634
SL-SHAL-1B	560345	7913292	5-Oct-24	5-Jul-25	273	0.990	0.0616	16.8	0.0592
SL-SHAL-1C	560342	7913292	5-Oct-24	8-Jul-25	276	1.05	0.0646	17.8	0.0628
SL-SHAL-1D	560350	7913283	5-Oct-24	5-Jul-25	273	1.06	0.0659	18.0	0.0634
SL-SHAL-1E	560345	7913282	5-Oct-24	8-Jul-25	276	0.830	0.0511	14.1	0.0496
				Mean	**274**	**0.998**	**0.0618**	**16.9**	**0.0597**
				Median	**274**	**1.05**	**0.0646**	**17.8**	**0.0628**
				Standard Deviation	**1.52**	**0.0983**	**0.00623**	**1.67**	**0.00588**
Shallow 2 (SL-SHAL-2)									
SL-SHAL-2A	560557	7913089	7-Oct-24	5-Jul-25	271	1.06	0.0664	18.0	0.0584
SL-SHAL-2B	560553	7913097	5-Oct-24	7-Jul-25	275	1.05	0.0648	17.8	0.0579
SL-SHAL-2C-HIS [b]	560579	7913092	19-Sep-23	5-Jul-25	655	-	-	-	-
SL-SHAL-2D	560544	7913108	5-Oct-24	7-Jul-25	275	1.06	0.0654	18.0	0.0584
SL-SHAL-2E	560580	7913110	5-Oct-24	5-Jul-25	273	0.790	0.0491	13.4	0.0435
				Mean	**274**	**0.990**	**0.0615**	**16.8**	**0.0546**
				Median	**274**	**1.06**	**0.0651**	**17.9**	**0.0582**
				Standard Deviation	**1.91**	**0.133**	**0.00824**	**2.27**	**0.00735**
Deep 1 (SL-DEEP-1)									
SL-DEEP-1A	560240	7913046	7-Oct-24	7-Jul-25	273	1.42	0.0883	24.1	0.0780
SL-DEEP-1B	560232	7913064	7-Oct-24	7-Jul-25	273	1.35	0.0840	22.9	0.0742
SL-DEEP-1C	560235	7913051	7-Oct-24	5-Jul-25	271	2.38	0.149	40.4	0.131
SL-DEEP-1C-HIS [b]	560235	7913051	10-Jul-24	5-Jul-25	360	-	-	-	-
SL-DEEP-1D	560227	7913059	7-Oct-24	8-Jul-25	274	1.42	0.0880	24.1	0.0780
SL-DEEP-1E	560223	7913039	7-Oct-24	9-Jul-25	275	1.32	0.0815	22.4	0.0725
				Mean	**273**	**1.58**	**0.0982**	**26.8**	**0.0867**
				Median	**273**	**1.42**	**0.0880**	**24.1**	**0.0780**
				Standard Deviation	**1.48**	**0.450**	**0.0286**	**7.65**	**0.0248**

Notes: ID = identifier. g = grams. mg/cm^2 = milligrams per square centimetre. mm = millimetres. - = a sediment trap that was not submitted to the laboratory because it was deployed for more than one ice cover period. Surface area of the sediment trap is 58.9 cm^2.

[a] Sediment accumulation thickness estimates are for the entire ice cover period and calculated using the composite bulk density data for a given area (Table B.1).

[b] Data excluded from the statistical analysis as the sediment trap was deployed for more than one ice cover period.

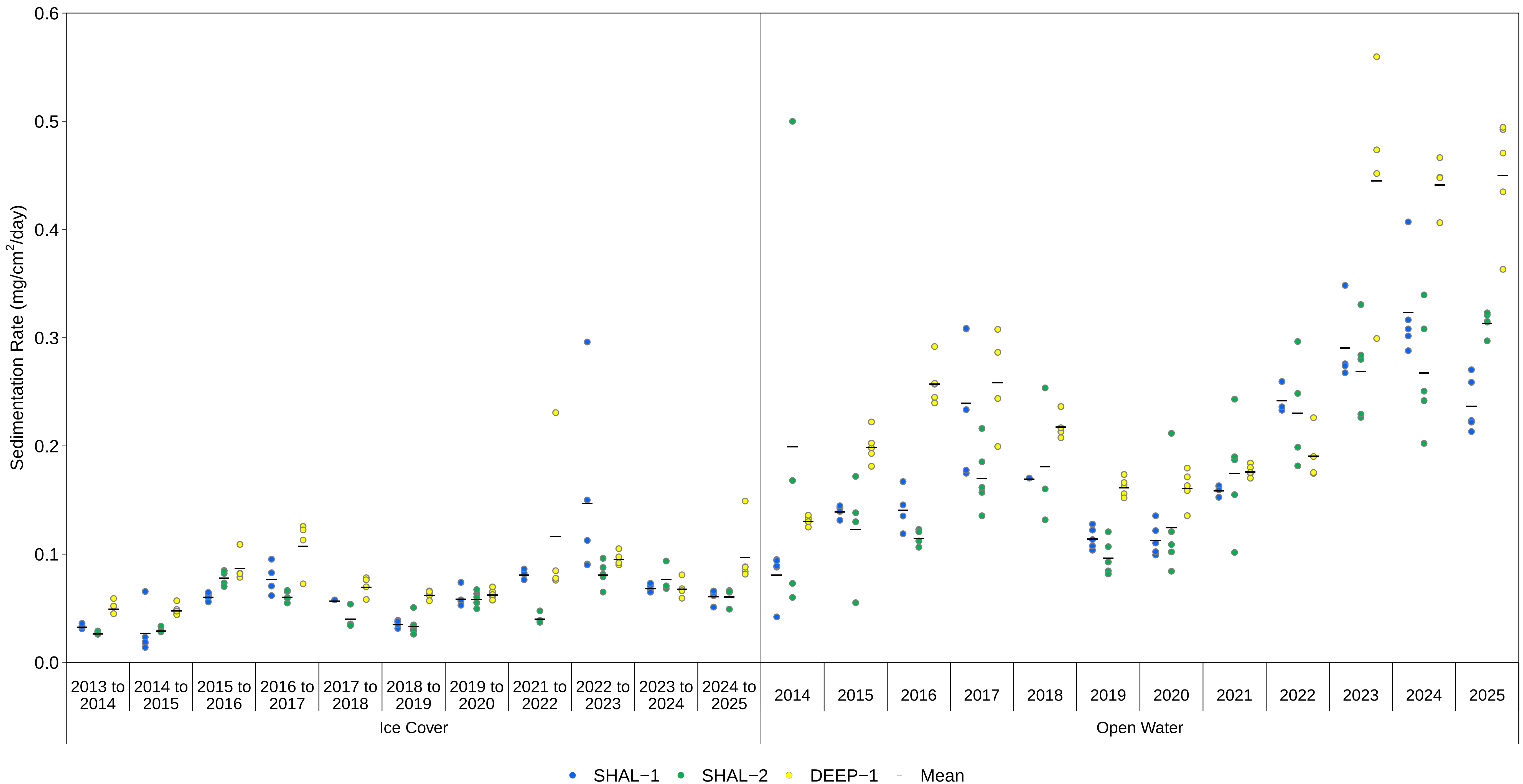
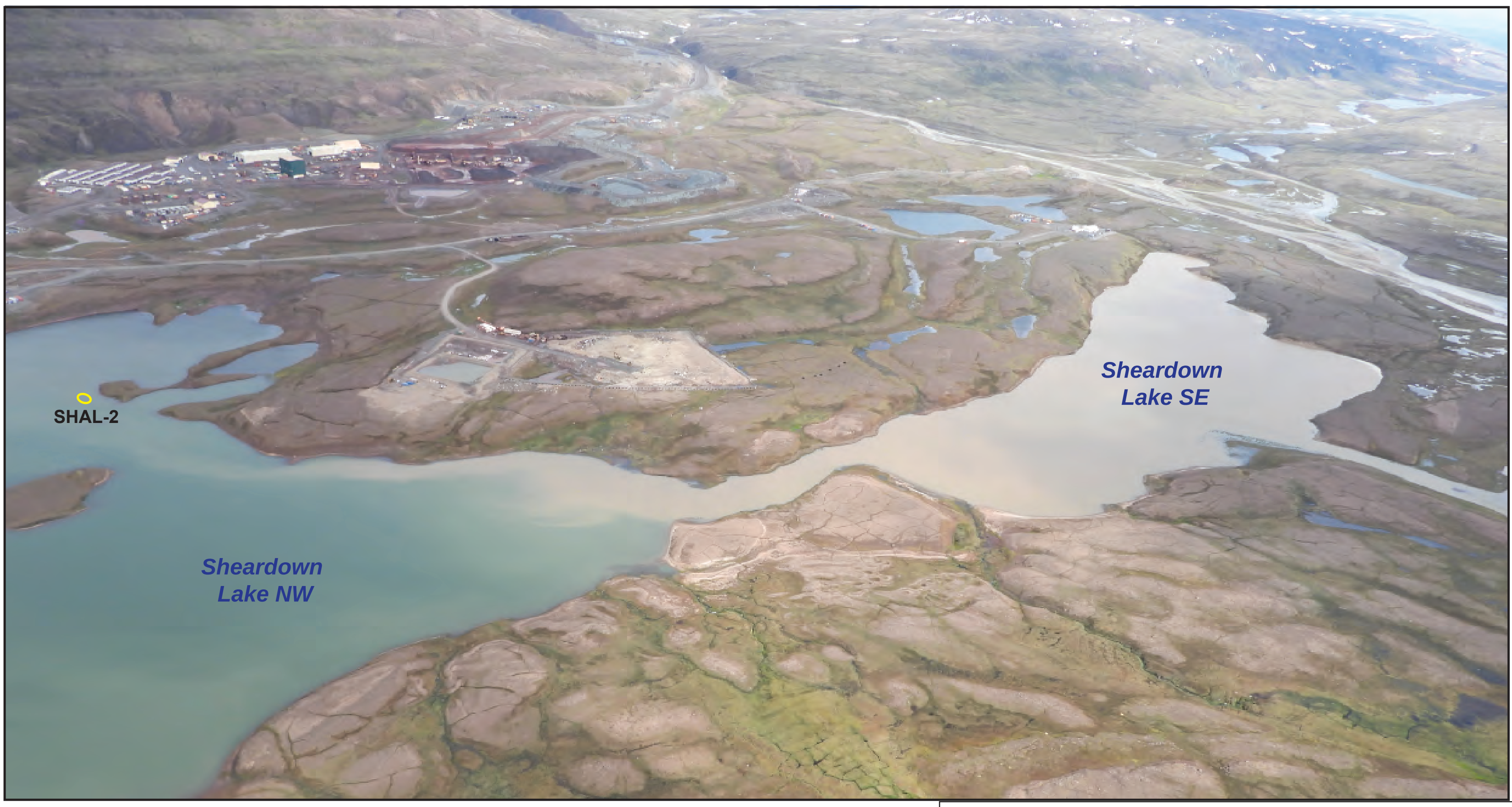


Figure 3.1: Sedimentation Rates During Ice Cover and Open Water Periods at Sheardown Lake Northwest (NW) over Mine Baseline (2013 to 2014) and Operational Phases (2015 to 2025), Sheardown Lake NW Sedimentation Monitoring Study

Note: Black lines indicate the mean sedimentation rate of a station for a given year/season.



LEGEND

Approximate Location of Sedimentation Monitoring Area

July 2025 Aerial View of Sheardown Lake Northwest and Sheardown Lake Southeast and Approximate Location of Lake Sedimentation Monitoring Areas

Date: March 2026 Project 257202.5067	Trinity Consultants CANADA	**Figure 3.2**

Document Path: Baffinland Iron Mines - 257202.5067 - 2025 AEMP\D - GIS\Lake Sedimentation\Graphics\25-5067 Figure 3.3.ai

Table 3.2: Sedimentation Rate and Sediment Accumulation Thickness Estimate Data for the 2025 Open Water Period at Sheardown Lake Northwest (NW)

Station ID	Original Set Location		Date		Set Duration (Days)	Total Dry Weight (g)	Sedimentation Rate ($mg/cm^2/day$)	Sedimentation Rate (mg/cm^2/open water period)	Sediment Accumulation Thickness Estimate [a] (mm)
	Longitude	Latitude	Deployed	Retrieved					
Shallow 1 (SL-SHAL-1)									
SL-SHAL-1A	560340	7913292	6-Jul-25	25-Sep-25	81.0	1.29	0.270	21.9	0.0802
SL-SHAL-1B	560347	7913295	5-Jul-25	25-Sep-25	82.0	1.03	0.213	17.5	0.0641
SL-SHAL-1C	560346	7913294	8-Jul-25	25-Sep-25	79.0	1.04	0.224	17.7	0.0647
SL-SHAL-1D	560334	7913289	5-Jul-25	25-Sep-25	82.0	1.25	0.259	21.2	0.0777
SL-SHAL-1E	560337	7913285	9-Jul-25	25-Sep-25	78.0	1.02	0.222	17.3	0.0634
				Mean	**80.4**	**1.13**	**0.238**	**19.1**	**0.0700**
				Median	**81.0**	**1.04**	**0.224**	**17.7**	**0.0647**
				Standard Deviation	**1.82**	**0.132**	**0.0253**	**2.25**	**0.00823**
Shallow 2 (SL-SHAL-2)									
SL-SHAL-2A	560558	7913096	5-Jul-25	25-Sep-25	82.0	1.55	0.321	26.3	0.152
SL-SHAL-2B	560564	7913093	7-Jul-25	25-Sep-25	80.0	1.40	0.297	23.8	0.137
SL-SHAL-2C	560579	7913091	5-Jul-25	25-Sep-25	82.0	1.56	0.323	26.5	0.153
SL-SHAL-2D	560544	7913116	7-Jul-25	26-Sep-25	81.0	1.50	0.314	25.5	0.147
SL-SHAL-2E	560590	7913106	5-Jul-25	26-Sep-25	83.0	1.54	0.315	26.1	0.151
				Mean	**81.6**	**1.51**	**0.314**	**25.6**	**0.148**
				Median	**82.0**	**1.54**	**0.315**	**26.1**	**0.151**
				Standard Deviation	**1.14**	**0.0656**	**0.0102**	**1.11**	**0.006**
Deep-1 (SL-DEEP-1)									
SL-DEEP-1A	560242	7913042	7-Jul-25	25-Sep-25	80.0	2.32	0.492	39.4	0.143
SL-DEEP-1B	560240	7913048	7-Jul-25	25-Sep-25	80.0	2.33	0.494	39.6	0.143
SL-DEEP-1C	560222	7913033	5-Jul-25	25-Sep-25	82.0	2.10	0.435	35.7	0.129
SL-DEEP-1D	560211	7913024	8-Jul-25	25-Sep-25	79.0	1.69	0.363	28.7	0.104
SL-DEEP-1E	560228	7913043	8-Jul-25	25-Sep-25	79.0	2.19	0.471	37.2	0.135
				Mean	**80.0**	**2.13**	**0.451**	**36.1**	**0.131**
				Median	**80.0**	**2.19**	**0.471**	**37.2**	**0.135**
				Standard Deviation	**1.26**	**0.110**	**0.0547**	**4.44**	**0.0161**

Notes: ID = identifier. g = grams. mg/cm^2 = milligrams per square centimetre. mm = millimetre. Surface area of the sediment trap is 58.9 cm^2.
[a] Sediment accumulation thickness estimates are for the entire open water period and calculated using the mean bulk density for an area (Table B.1).

approximately 63 mg/cm²/year (Appendix Table A.1). These annual sedimentation rates are generally within the range of those observed at other Canadian Arctic lakes (e.g., 7 to 50 mg/cm²/year; Lockhart et al. 1998) and much lower than at proglacial lakes in southeast Greenland (e.g., mean of 790 mg/cm²/year; Hasholt et al. 2000). Therefore, observed annual sedimentation rates at Sheardown Lake NW over the study period were within a range that is typical for lakes in the Canadian Arctic that are free from potential influence by mining or industrial activities.

3.1.2 Temporal Comparisons for the 2024 to 2025 Ice Cover and Open Water Periods

Average sedimentation rates at the littoral (SHAL-1 and SHAL-2) and profundal (DEEP-1) monitoring areas in Sheardown Lake NW were significantly higher during the ice cover period in 2024/2025 relative to baseline (i.e., 2013/2014) consistent with the results for 2022/2023 and 2023/2024 (Appendix Table A.2). However, comparisons of 2024/2025 sedimentation rates for ice covered periods of mine operations showed that (Appendix Table A.2):

- average sedimentation rates at the littoral SHAL-1 area were similar to or lower than seven (2015/2016 to 2017/2018, 2019/2020, and 2021/2022 to 2023/2024) of nine ice cover monitoring periods;
- average sedimentation rates at the littoral SHAL-2 area were similar to or lower than six (2016/2017, 2017/2018, 2019/2020, and 2021/2022 to 2023/2024) of nine ice cover monitoring periods; and
- average sedimentation rates at the profundal DEEP-1 area were similar to five (2015/2016 to 2017/2018, 2021/2022, and 2022/2023) of nine ice cover monitoring periods.

The results of temporal comparisons between individual monitoring periods and the 2024/2025 ice cover period indicates that sedimentation rates at SHAL-1, SHAL-2, and DEEP-1 fluctuate among years and may be influenced by seasonal and/or environmental conditions (e.g., spring melt). However, significant moderate (SHAL-1, SHAL-2, and DEEP-1; Spearman's ρ of 0.49 to 0.58, $p < 0.05$) correlations between sedimentation rates during the ice cover period suggested there may be an overall increase in sedimentation rate since the onset of mining (Figure 3.1, Appendix Figure A.1, Appendix Table A.2). Despite these changes over time, sediment accumulation thickness estimates during the 2024/2025 ice cover period were below the Low Action TARP threshold of 0.15 mm (discussed in further detail in Section 3.2; Figure 3.3).

For the open water period, average sedimentation rates at all littoral (SHAL-1 and SHAL-2) and profundal (DEEP-1) areas were significantly higher in 2025 relative to 2014 (Appendix Table A.3). The average sedimentation rates during the open water period have been higher than 2014 for the previous four monitoring periods (2022 to 2025) for all littoral and

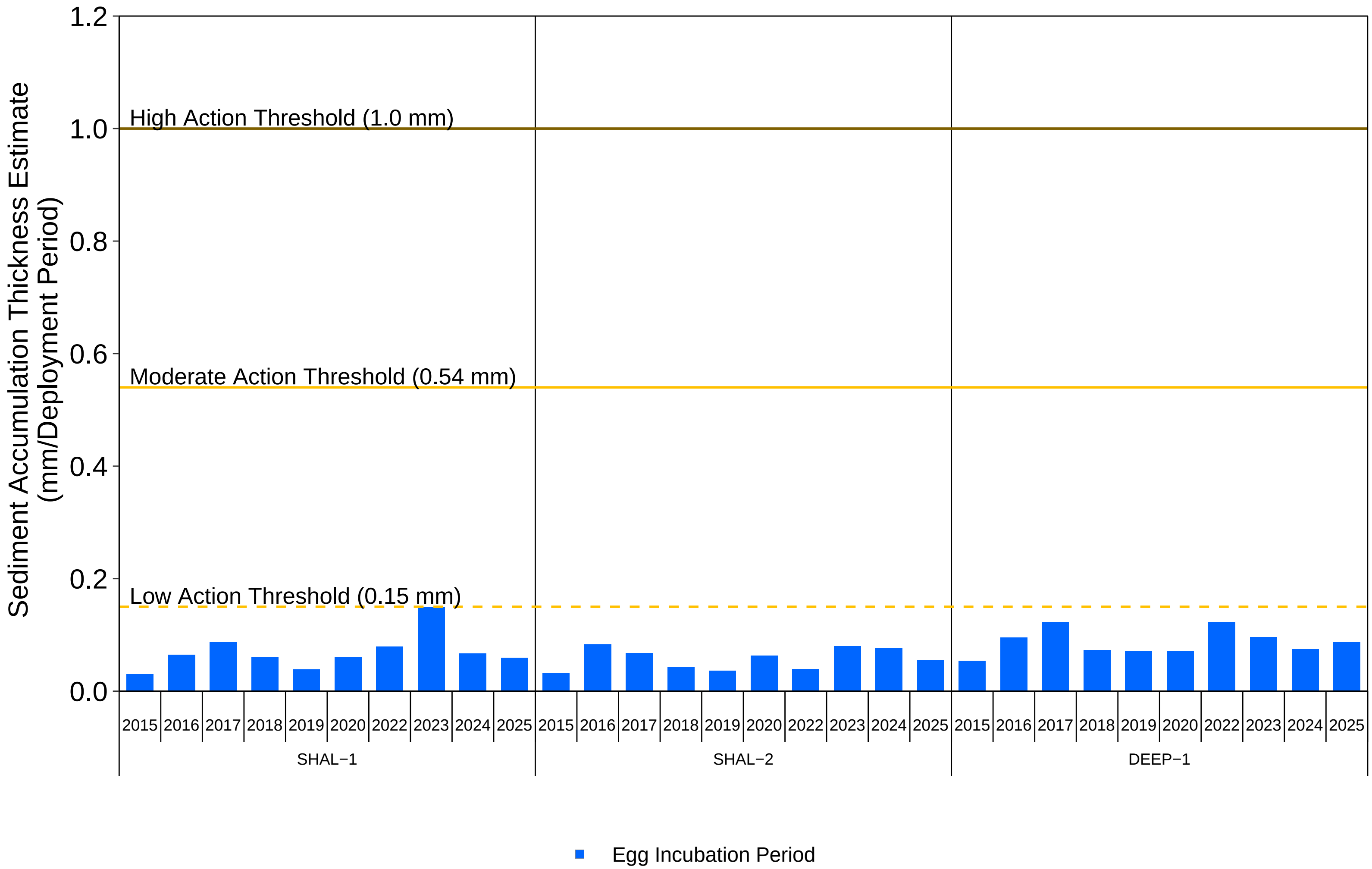


Figure 3.3: Mean Sediment Accumulation Thickness Estimates (mm/Deployment Period) for the Arctic Charr Egg Incubation Period (Ice Cover), Sheardown Lake Northwest (NW), 2015 to 2025

Notes: Dashed orange line represents the sediment accumulation thickness estimate for the Low Action Threshold of 0.15 mm, the solid orange line represents the Moderate Action Threshold of 0.54 mm, and the solid brown line represents the High Action Threshold of 1.0 mm. Action Thresholds are based on the egg incubation period only. The egg incubation period corresponds to the ice cover period (e.g., October 2024 to July 2025). Sediment accumulation thickness estimate data were not collected during the ice cover period of 2021.

profundal monitoring areas (Appendix Table A.3). At the littoral monitoring areas and during the open water period, strong (SHAL-1, Spearman's ρ of 0.67, and $p<0.001$; SHAL-2, Spearman's ρ of 0.64, and $p<0.001$) significant positive correlations between sedimentation rates and year suggested an overall increase in sedimentation rate since the onset of mining (Appendix Figure A.1). At the profundal area (DEEP-1) and during the open water period, there was a moderately strong significant correlation (Spearman's ρ of 0.51, and $p<0.001$) between sedimentation rate and year, indicating an increase in sedimentation rates since the onset of mining (Appendix Figure A.1). Despite the observed increases in lake sedimentation rates, accumulation thickness estimates during in the 2025 open water period were below the Low Action TARP threshold of 0.15 mm (discussed in further detail in Section 3.2). During the 2025 open water period, heavy regional rainfall caused backflow from Mary River into Sheardown Lakes SE and NW, resulting in the transport of naturally occurring highly turbid water into Sheardown Lake NW (Figure 3.2). Backflow of turbid water from Mary River may be also contributing to the increasing sedimentation rates observed during the open water periods. Baffinland will continue to monitor this in subsequent years.

Within Sheardown Lake NW, mean sedimentation rates were four- to five- times higher during the open water period, relative to the ice cover period, for all sampling areas (Appendix Tables A.1 and A.4). Higher sedimentation rates during the open water period versus ice cover periods during baseline were also observed in Sheardown Lake NW. Sheardown Lake NW tributaries freeze to the bottom in the winter and therefore limit sediment material entering Sheardown Lake NW from tributary sources (e.g., sediments sourced from erosion). The deposition of high turbidity water from Mary River into Sheardown Lake NW in the 2025 open water period and deposition of more allochthonous sediment from surface runoff has contributed to the higher sedimentation rates observed during the open water period (Figure 3.2).

3.2 Sediment Accumulation Thickness Estimates

3.2.1 Spatial Comparisons for the 2024 to 2025 Ice Cover and Open Water Periods

During the 2024/2025 ice cover period and 2025 open water period, BD ranged from 1.73 to 3.09 g/cm^3 (Appendix Table B.2). The BD was consistent with BD collected in sediment trap material from 2018 to 2024 (Appendix Table B.2). The composite produced from stations BD-SHAL-3, BD-SHAL-4, and BD-SHAL-5 in the 2025 open water period had the lowest reported BD since 2018 (Appendix Table B.2). The mean organic matter and total organic carbon content were higher at SHAL-2 relative to SHAL-1 and DEEP-1 during the 2025 open water period (Appendix Table B.6) and likely contributed to the lower relative BD.

During the 2025 open water period, PSD was heterogeneous among replicate BD traps corresponding to littoral monitoring areas SHAL-1 (i.e., BD-SHAL-1 and BD-SHAL-2) and SHAL-2 (i.e., BD-SHAL-3, BD-SHAL-4, and BD-SHAL-5; Figure 1.2 and Appendix Table B.4). Generally, during the 2025 open water period, the littoral areas consisted of fine sand (50 to 68%) and less silt and/or clay (31%) relative to the deep area in BD traps (Appendix Table B.4). Particle size distribution at the profundal area during the 2025 open water period was composed predominantly of fine sand and silt and/or clay (Appendix Table B.4).

During the 2024/2025 ice cover period, the PSD of sediment in the traps from the two littoral areas (SHAL-1 and SHAL-2) and the profundal (DEEP-1) area were dominated by fine sand-sized and silt and/or clay sized grains and were more homogenous between areas than the open water period (Appendix Table B.3). The littoral area SHAL-2, which is expected to represent a favourable habitat for arctic charr spawning and egg incubation, had a slightly lower proportion of fine sand sized particles in the trap material and slightly higher proportion of silt and/or clay compared to SHAL-1 (Appendix Table B.3). The sediment trap material from littoral area SHAL-2 was composed primarily of fine sand and silt and/or clay (Appendix Table B.3). Generally, sediment material was consistent between the two littoral areas, likely due to minimal influence of sediment inputs during the winter (e.g., in the absence of sedimentation from tributaries, potential backflow from Mary River, and runoff). The sediment trap material from the profundal DEEP-1 monitoring area had finer sediment (dominated by fine sand and silt an/or clay) than the two littoral monitoring areas. The profundal monitoring area represents the deepest portion of the lake (approximately 25 m deep) and represents the maximum depositional zone within the lake, where finer-grained sediment would be expected to be deposited.

During the 2024/2025 ice cover period, average sediment accumulation thickness estimates for littoral sediment monitoring areas (SHAL-1 and SHAL-2) were comparable (Appendix Tables A.5 and A.6) and lower relative to the profundal monitoring area (DEEP-1; Appendix Table A.6).

During the 2025 open water period, average sediment accumulation thickness estimates were higher at SHAL-2 relative to SHAL-1 (discussed in further detail below; Appendix Tables A.5 and A.7). There were no significant differences between sediment accumulation thickness estimates for the littoral area SHAL-2 and the profundal monitoring area DEEP-1 during the 2025 open water period (Appendix Table A.7). In July 2025, following a significant rainfall event, it was observed that there was backflow from the Mary River system upstream into Sheardown Lake SE, and this backflow eventually reported to Sheardown Lake NW (Figure 3.2). Aerial photographs taken following the event documented highly (visible) turbid water in Sheardown Lake NW; the area near SHAL-2 had the appearance of more turbid water than what was observed near DEEP-1 (Figure 3.2).

Sediment accumulation thickness estimates at the littoral area SHAL-2 and profundal DEEP-1 area were significantly higher during the 2025 open water period than the 2024/2025 ice cover period (Appendix Table A.8). Mean sediment accumulation thickness estimates at the littoral SHAL-1 area were similar during the 2025 open water and 2024/2025 ice cover periods (Appendix Table A.8). Among the three monitoring areas, 54 to 73% of the total annual (from September 2024 to October 2025) sediment accumulated during the open water period (Appendix Table A.5).

The mean annual sediment accumulation thickness estimates (September 2024 to October 2025) at all monitoring areas (0.18 ± 0.05 mm/year; Figure 3.3, Appendix Table A.5) at Sheardown Lake NW were approximately two times lower than other Arctic lakes in western Greenland (mean of 0.54 mm/year; Sobek et al. 2014, Brothers et al. 2008). The sediment accumulation thickness estimates in Sheardown Lake NW at all monitoring areas were comparable to an Alaskan Arctic lake (0.16 mm/year) of similar depth (30 m depth), and lower than lakes that are deeper than 10 m (range from 0.3 to 1.5 mm/year) north of the 65° latitude[9] (O'Brien et al. 1997, Sobek et al. 2014, Brothers et al. 2008). The mean annual sediment accumulation thickness estimate (0.22 ± 0.03 mm/year) for the profundal DEEP-1 area was similar to annual accumulation thicknesses observed at profundal depths in Alaskan Arctic lakes (0.16 ± 0.08 mm/year; Cornwell 1985, O'Brien et al. 1997).

Project-related sedimentation accumulation thickness estimates less than 1 mm/year were predicted in the FEIS to have negligible effects on the direct mortality of arctic charr and arctic charr eggs (Fudge and Bodaly 1984, Baffinland 2012). The sediment accumulation thickness estimates corresponding to the 2024/2025 arctic charr egg incubation period were well below 1 mm/year at Sheardown Lake NW (approximately five to ten times less; Figure 3.3) at all monitoring stations (Baffinland 2012). The TARP Low Action response threshold of 0.15 mm corresponds to the ice cover period and egg incubation/larval pre-emergence period for arctic charr (Scott and Crossman 1998, Baffinland 2024). The mean sediment accumulation thicknesses estimated for the 2024/2025 ice cover period at all areas (SHAL-1, SHAL-2, and DEEP-1) were approximately two to three times below the TARP Low Action response threshold (Figure 3.3).

3.2.2 Temporal Comparisons for the 2024 to 2025 Ice Cover and Open Water Periods

Ice cover and open water sediment accumulation thickness estimates from 2024/2025 were compared to previous seasons starting with the 2014/2015 ice cover and 2015 open water periods. During the 2024/2025 ice cover period, average sediment accumulation thickness

[9] The sediment monitoring areas at Sheardown Lake NW have a latitude of 71.31°N.

estimates for the littoral areas (SHAL-1 and SHAL-2) were statistically comparable to baseline (2014/2015), whereas estimates for the profundal area (DEEP-1) were significantly higher than baseline (Appendix Table A.6). However, average sediment accumulation thickness estimates at the littoral areas SHAL-1 and SHAL-2 (area selected as a favourable habitat for arctic charr spawning/egg incubation) and the profundal DEEP-1 area were similar to or lower than estimates for intervening ice cover monitoring periods (i.e., from 2015 to 2024; Appendix Table A.6). Although a weak positive (Spearman's ρ of 0.32, $p < 0.05$) correlation between sediment accumulation thickness estimates and year was identified for SHAL-1, based on data for the ice-covered period, the results of the ANOVA and Figure A.2 demonstrate sediment accumulation thickness estimates for winter have followed a cyclical pattern over time. The temporal pattern at SHAL-1 also indicates a decrease in sediment accumulation thickness estimates during the ice cover period since the 2022/2023 monitoring period (Appendix Figure A.2). There were no significant correlations between sediment accumulation thickness estimates and year at the littoral SHAL-2 area (area favourable for arctic charr spawning and egg incubation) or DEEP-1 (most depositional zone in the lake) during the ice cover periods (Appendix Figure A.2).

Average sediment accumulation thickness estimates for each of the littoral and profundal areas (i.e., SHAL-1, SHAL-2, and DEEP-1) in Sheardown Lake NW were significantly higher during the 2025 open water period relative to 2015 (Appendix Table A.7). The average sediment accumulation thickness estimates during the open water period have been higher than 2015 for the previous four monitoring periods (2022 to 2025) for all littoral and profundal monitoring areas (Appendix Table A.3). The significant, strong, positive correlations (Spearman's ρ of 0.70 to 0.82, $p < 0.05$; Appendix Figure A.2) between sediment accumulation thickness estimates for the open water period and year indicate an overall increase in sediment accumulation thickness estimates at Sheardown Lake NW over time since mine operation began, and specifically during the open water period (Appendix Figure A.2). As discussed in Section 3.1.2, the deposition of turbid water from Mary River and surface runoff during heavy rain events may have contributed to the higher sedimentation rates observed during the open water period. However, there has been overall increase in sediment accumulation thickness estimates for the open water period since the onset of mining, indicating a potential mine-influence. Aerial imagery indicates that area SHAL-2 (area favourable for arctic charr spawning and egg incubation; Figure 3.2) exhibited the greatest extent of Mary River backflow exposure during the 2025 open water period. This interpretation is consistent with the marked increase in accumulation thickness estimates at that location in 2025 relative to 2024 (Figure A.2).

Overall, results of the temporal comparisons suggest an increase in sediment accumulation thickness estimates over time at all monitoring areas during the open water period, but not during the ice cover period. Regardless, the sediment accumulation thickness estimates are within the range of Arctic lakes and below the most conservative (Low Action) TARP threshold (Baffinland 2024).

3.3 Aerial Dustfall and Sediment

3.3.1 Comparisons to Aerial Dustfall Deposition

Sedimentation rate and accumulation thickness estimate data for all the Sheardown Lake NW study areas from 2013 to 2025 were evaluated relative to dustfall deposition rates from proximal dustfall monitoring stations (DF-M-01, DF-M-02, and DF-M-03) to explore potential relationships (Appendix Figures A.4 and A.5, Appendix Table A.9). For the ice cover and open water periods, there were no statistically significant correlations ($p > 0.05$) between sedimentation rates or sediment accumulation thickness estimates and cumulative total dustfall rates for any of the Sheardown Lake NW sediment trap monitoring areas (Appendix Figures A.4 and A.5, Appendix Table A.9). Further, sediment accumulation thickness estimates in Sheardown Lake NW were below the 0.54 mm/year predicted in the FEIS (Baffinland 2012). These results indicated that aerial dustfall had no demonstrable influence on accumulated sediment during the year. In addition to dustfall, sedimentation rates in Sheardown Lake NW have other seasonally variable input sources that may introduce suspended sediment (e.g., backflow during heavy rain events), and the deposition of organic material, which varies seasonally (e.g., organic material that is autochthonous [e.g., plankton] or allochthonous [e.g., terrestrial organic detritus in run-off]).

3.3.2 Sediment Trap Chemistry

AEMP benchmarks for sediment chemistry and generic sediment quality guidelines (SQG) were derived from data for bulk sediments that may represent more than one year's worth of sediment deposition (e.g., baseline and reference data for the top 2 cm of sediment cores; Baffinland 2024). Therefore, comparisons of sediment trap chemistry data, which represent discrete intervals of sediment deposition (e.g., one ice cover period), to AEMP benchmarks and SQG can help contextualize metal concentrations in sediment trap material. These comparisons should be interpreted with caution as they do not directly reflect the surface sediment composition (see also Section 3.3.3).

For the 2024/2025 ice cover period and 2025 open water period, mean metal concentrations in sediment trap material from SHAL 1, SHAL-2, and DEEP-1 were generally lower than applicable AEMP benchmarks and SQG (Appendix Figures A.6 and A.7, Appendix Tables B.5 and B.6; Baffinland 2024). However, the mean concentration of (Appendix Figures A.6 and A.7, Appendix Tables B.5 and B.6):

- iron was higher than the AEMP benchmark and baseline at all monitoring areas during the ice cover and open water monitoring periods;
- zinc was higher than the AEMP benchmark and baseline data during the 2024/2025 ice cover period at one littoral area (SHAL-1); and
- chromium was above the AEMP benchmark and baseline at the profundal monitoring area (DEEP-1) during the open water period.

Higher iron concentrations (relative to AEMP benchmarks) in sediment trap material is generally consistent with higher iron concentrations observed in surface sediments (i.e., top 2 cm) monitored in the CREMP (e.g., Minnow 2025, TCC 2026 in prep.). Sheardown Lake NW is influenced by the regional geology (which is attractive for mining due to the naturally high iron content); therefore, it is anticipated that geogenic enrichment may be contributing to naturally high iron concentrations in surface sediment/sediment trap materials. This conclusion is supported by high mean iron and concentrations in Reference Lake 3 sediments in 2025 (discussed in further detail in Section 3.3.3 and TCC 2026 in prep.). In the 2025 CREMP, mean concentrations of zinc and chromium were below AEMP benchmarks in littoral and profundal sediments from Sheardown Lake NW (TCC 2026 in prep.).

3.3.3 Metal Concentrations in Sediment Trap Material Compared to Surface Sediments

Metals with mean concentrations in sediment trap material that were above AEMP benchmarks during the 2024/2025 ice cover period and 2025 open water period (i.e., chromium, iron, and zinc) were examined relative to the surface sediment chemistry results reported in the 2025 CREMP (referred to as surface sediment; TCC 2026 in prep.). As indicated above in Section 3.3.2, sediment trap material represents freshly deposited material during discrete periods of mine operations (e.g., open water period of 2025), whereas surface sediments (i.e., the upper 2 cm) from the CREMP represent sediment quality integrated over time, and sediments that have started to undergo early sediment diagenesis. Therefore, metal concentrations in sediment trap material are not expected to be comparable to surface sediments. Rather, the comparison between metal concentrations in sediment trap materials and surface sediments is intended to support identification of similar patterns between the two sample types (e.g., concentrations of a particular metal being above AEMP benchmarks in sediment trap material and co-located surface sediments).

As noted in Section 3.3.2, mean iron concentrations in the sediment trap material of littoral (SHAL-1 and SHAL-2) and profundal (DEEP-1) monitoring areas in Sheardown Lake NW were above the AEMP benchmark and higher relative to baseline (Appendix Tables B.5 and B.6). In the 2024 CREMP, iron concentration in surface sediments suggested the emergence of a mine-related influence on sediment quality in Sheardown Lake NW (Minnow 2025). Results of the 2025 CREMP indicated iron concentrations in surface sediments of Sheardown Lake NW and Reference Lake 3 were elevated relative to AEMP benchmarks in littoral sediments but not profundal sediments (TCC 2026 in prep.).

The mean concentration of zinc in sediment trap material was above AEMP benchmarks during the 2024/2025 ice cover period in Sheardown Lake NW at one littoral station (SHAL-1; Appendix Figures A.6 and A.7, Appendix Tables B.5 and B.6), but in the 2025 CREMP, littoral and profundal surface sediments from Sheardown Lake NW had mean concentrations of zinc that were below AEMP benchmarks and lower than the reference lake (TCC 2026 in prep.). Visual evaluation of temporal patterns in zinc concentrations in surficial sediments in the 2025 CREMP did not indicate an increase in zinc concentration with time and zinc concentrations in littoral sediments have consistently been within range of baseline conditions (TCC 2026 in prep.).

At the profundal (DEEP-1) sediment trap monitoring station during the 2025 open water period, the mean concentration of chromium was above the AEMP benchmark, higher than the reference lake, and baseline conditions (TCC 2026 in prep.). The mean concentration of chromium in surface sediments in 2025 was below the AEMP benchmarks (TCC 2026 in prep.). Although the mean chromium concentration in the sediment trap material at DEEP-1 exceeded the AEMP benchmark, results from the 2025 CREMP indicate no mine-related influence on chromium levels in the profundal surface sediments of Sheardown Lake NW. Furthermore, visual assessment of temporal patterns in surficial sediments since 2015 indicated no increase in chromium concentrations over time (TCC 2026 in prep.).

The observed concentrations of metals that were above AEMP benchmarks (e.g., chromium, iron, and zinc) in sediment trap material (Section 3.3.2) may not reflect sediment material on the lake bottom, which will have accumulated over several years (top 2 cm). Metal concentrations in sediment trap materials may be higher than could be expected in surface sediment because the sediment quality samples collected in the CREMP are an average concentration from the upper 2 cm of core, whereas the sediment trap material is fresh seasonal material that represents parameter concentrations accumulated over the monitoring period (TCC 2026 in prep.). Sediment trap chemistry will continue to be monitored to evaluate potential spatial and temporal variations in sediment composition.

3.3.4 Sediment Trap Chemistry Comparisons to Aerial Dustfall Chemistry

Direct statistical comparisons of sediment trap material chemistry with dustfall chemistry require that additional years of monitoring be completed (i.e., sample sizes are currently insufficient because only two years of data are available for sediment trap chemistry).

During the 2024/2025 ice cover and 2025 open water periods, the range of metal concentrations were generally similar among the three terrestrial dustfall monitoring stations DF-M-01, DF-M-02, and DF-M-03; Appendix Figure A.8). Visual examination of sediment trap and dustfall chemistry data suggested that metals present in dustfall (exceptions included cadmium and phosphorus[10]) were also elevated in sediment trap material Appendix Figures A.6 to A.9, Appendix Tables B.5 to B.7). For example, chromium (open water period), iron (ice cover and open water periods), and zinc (ice cover and open water periods) are present in dustfall material during the ice cover and open water periods; therefore, dustfall may be a potential source of these parameters in the sediment either by direct deposition, spring melt, or surface runoff of aerial dustfall. However, due to the lack of temporal data further monitoring is required.

3.4 Benthic Invertebrate Community Relationships with Sedimentation Rate and Thickness and the Potential Effects to Arctic Charr

No statistically significant relationships were identified between benthic invertebrate density, taxonomic richness, or Simpson's Evenness and sedimentation endpoints (rate or accumulation thickness estimates) in the littoral area, SHAL-2, of Sheardown Lake NW during the open water season over the mine operational period (2015 to 2025; Table 3.3, Appendix Table C.1, Appendix Figures C.1 to C.2). However, the relative proportion of *Chironomidae* at littoral BIC station DL0-01-9 had a significant strong negative relationship ($p<0.1$, $r= -0.72$ to -0.83) with sedimentation rate and accumulation thickness estimates (Table 3.3, Appendix Table C.1, Appendix Figures C.1 to C.2). In contrast, visual assessment of newly collected data from Station DL0-01-8, when paired with the nearest sedimentation area (SHAL-1, the station selected as a potential habitat for supporting arctic charr prey availability), indicated a higher relative abundance of *Chironomidae* with higher sedimentation rates and accumulation thickness estimates than would be predicted based on the established DL0-01-9 and SHAL-2 relationships (Appendix Figures C.1 to C.2). Given that only two years of data (2024 and 2025) are available for DL0-01-8, this assessment is preliminary and continued monitoring is recommended to better characterize potential relationships between sedimentation endpoints and chironomid predominance.

Additionally, a significant and strong positive correlation ($p<0.1$, $r= 0.65$) between the relative abundance of *Ostracoda* and sediment accumulation thickness estimates was identified for the paired DL0-01-9 (BIC) and SHAL-2 (sediment trap) areas over the 2015 to 2025 period (Table 3.3,

[10] Cadmium and phosphorus concentrations in dustfall material were generally below the LRLs during the 2024/2025 ice cover and 2025 open water periods.

Table 3.3: Spearman's Rank Correlations between Sedimentation Rate and Accumulation Thickness During the Open Water Period and Benthic Invertebrate Community Endpoints in Littoral Areas of Sheardown Lake Northwest, Lake Sedimentation Monitoring Study, 2015 to 2025

Comparison	Benthic Invertebrate Community Endpoint	Sedimentation Rate ($mg/cm^2/d$)		Sediment Accumulation Thickness Estimate (mm/Deployment Period)	
		P-value	Rho	P-value	Rho
DL0-01-9/SHAL2	Density (organism/m^2)	0.839	-0.0727	0.694	-0.136
	Richness (No. Taxa)	0.544	0.205	0.831	0.0731
	Simpson's Evenness (Krebs)	0.521	0.218	0.924	0.0364
	% Nematoda	0.095	0.528	0.346	0.314
	% Ostracoda	0.082	0.555	0.037	0.645
	% Chironomidae	0.009	-0.764	0.003	-0.827
	% Metal Sensitive Chironomidae	0.558	-0.2	0.299	-0.345
	% Collector Gatherers	0.881	0.0545	0.503	0.227
	% Filterers	0.755	-0.109	0.418	-0.273

[grey shading] P-value <0.1.

[blue shading] abs(Rho) > 0.6.

Notes: $mg/cm^2/d$ = milligrams per square centimetre per day. mm = millimetres. m^2 = square metres. No. = number. % = percent. < = less than. > = greater than.

Appendix Table C.1, Appendix Figure C.2). Visual comparison of DL0-01-8 (paired with SHAL-1) showed a lower relative proportion of *Ostracoda* at higher sediment accumulation thickness estimates compared to proportions observed at DL0-01-9/SHAL-2 (Appendix Figure C.2). However, due to limited temporal data at DL0-01-8, continued monitoring is recommended to confirm whether these observed differences represent true site-specific patterns or short-term variability.

Correlations presented in this report are derived from a limited subset of BIC data collected from Sheardown Lake NW and therefore represent a small portion of the overall lake system. Although sedimentation appears to influence BIC community composition endpoints within the areas examined, arctic charr are not sedentary and can access preferred prey resources throughout the broader lake, including Sheardown Lake SE, which is connected to Sheardown Lake NW. In addition, a more comprehensive annual assessment of lake-wide BIC communities and arctic charr population status is conducted through the CREMP. The broader context of sedimentation and potential effects to BIC endpoints is discussed in the 2025 CREMP (TCC 2026 in prep.). Continued monitoring of relationships among BIC, sedimentation rates, and sediment accumulation thickness estimates will be continued for improving understanding, enabling early detection of potential effects, and supporting timely mitigation should issues arise.

4 CONCLUSIONS

The LSMP has been included as a special investigation component of the Mary River Project AEMP since 2013. The objective of this monitoring program is to track sedimentation and evaluate the potential for adverse influences on resident arctic charr populations due to sedimentation at a representative lake (Sheardown Lake NW) within the immediate area of mine influence. The principal conclusions of the 2024/2025 LSMP were:

- Sedimentation rates at all littoral (SHAL-1 and SHAL-2) and profundal (DEEP-1) monitoring areas were significantly higher during the 2025 open water period compared to the 2024/2025 ice cover period. Sediment accumulation thickness estimates were significantly higher at SHAL-2 (area favourable for arctic charr spawning and egg incubation) during the 2025 open water period compared to the 2024/2025 ice cover period but were similar to the previous three (2022 to 2024) open water monitoring periods. During the 2025 open water period, sediment accumulation thickness estimates were significantly lower at the profundal (DEEP-1, deepest area of the lake) monitoring area compared to the 2024/2025 ice cover period.
- Sedimentation rates at Sheardown Lake NW during the 2024/2025 ice cover and 2025 open water periods at all littoral (SHAL-1 and SHAL-2) and profundal (DEEP-1) habitats were significantly higher in 2025 compared to baseline.
- Annual sediment accumulation thickness estimates for Sheardown Lake NW, based on the combined ice cover and open water conditions during 2024/2025, were within the range reported for Arctic lakes of comparable size and/or depth and were below the FEIS prediction of 1 mm/year associated with negligible effects on direct mortality of arctic charr and arctic charr eggs. The mean sediment accumulation thicknesses estimated for the 2024 to 2025 arctic charr egg incubation/larval pre-emergence period (i.e., ice cover period) at Sheardown Lake NW were 0.060 mm/ice cover period, 0.055 mm/ice cover period, and 0.087 mm/ice cover period at SHAL-1, SHAL-2, and DEEP-1, respectively. Sediment accumulation thickness estimates during the ice cover period were below the TARP Low Action threshold of 0.15 mm/ice cover period and approximately 6 to 10% of the threshold level of 1 mm/year of sediment accumulation thickness purported to affect egg incubation success (Baffinland 2024). Overall, these results suggested no anticipated mine-related effects on arctic charr reproductive success at Sheardown Lake NW as the result of sedimentation rates and/or estimated sediment accumulation thicknesses over the 2024 to 2025 egg incubation/larval pre-emergence period.

- Comparisons between cumulative dustfall deposition rates (i.e., amount of dustfall deposited during the ice cover or open water period) and sedimentation rates and sediment accumulation thickness estimates indicated no significant positive temporal correlations between dustfall and sediment endpoints, indicating that dustfall is not likely the main source of sediment into Sheardown Lake NW.
- Sediment trap material had elevated mean concentrations of iron (all monitoring areas), chromium (open water only), and zinc during the 2024/2025 ice cover and 2025 open water periods, relative to AEMP benchmarks that were derived for surface sediment deposits. Although mean metal concentrations were elevated relative to AEMP benchmarks, assessment of sediment quality data collected in the 2025 CREMP did not indicate increasing temporal trends, and concentrations of chromium or zinc were within range of baseline conditions. In the 2024 CREMP, iron was identified as exhibiting a mine-related influence on sediment quality in Sheardown Lake NW. However, results from the 2025 CREMP did not indicate any mine-related effects associated with elevated metal concentrations (relative to AEMP benchmarks) in sediment, water chemistry, or biota in Sheardown Lake NW.
- Visual comparison between dustfall and sediment chemistry data indicated that dustfall may be a potential source of metals in newly accumulated sediment in Sheardown Lake NW, but further monitoring and data analysis are required and will continue.
- No significant relationships were identified between sedimentation endpoints and density, richness, or Simpson's Evenness in littoral habitat SHAL-2 (2015 to 2025). In the littoral zone, relative proportions of *Chironomidae* were significantly and negatively correlated with sedimentation rate and accumulation thickness at DL0-01-9, whereas relative proportions of *Ostracoda* were positively correlated with accumulation thickness at DL0-01-9/SHAL-2.

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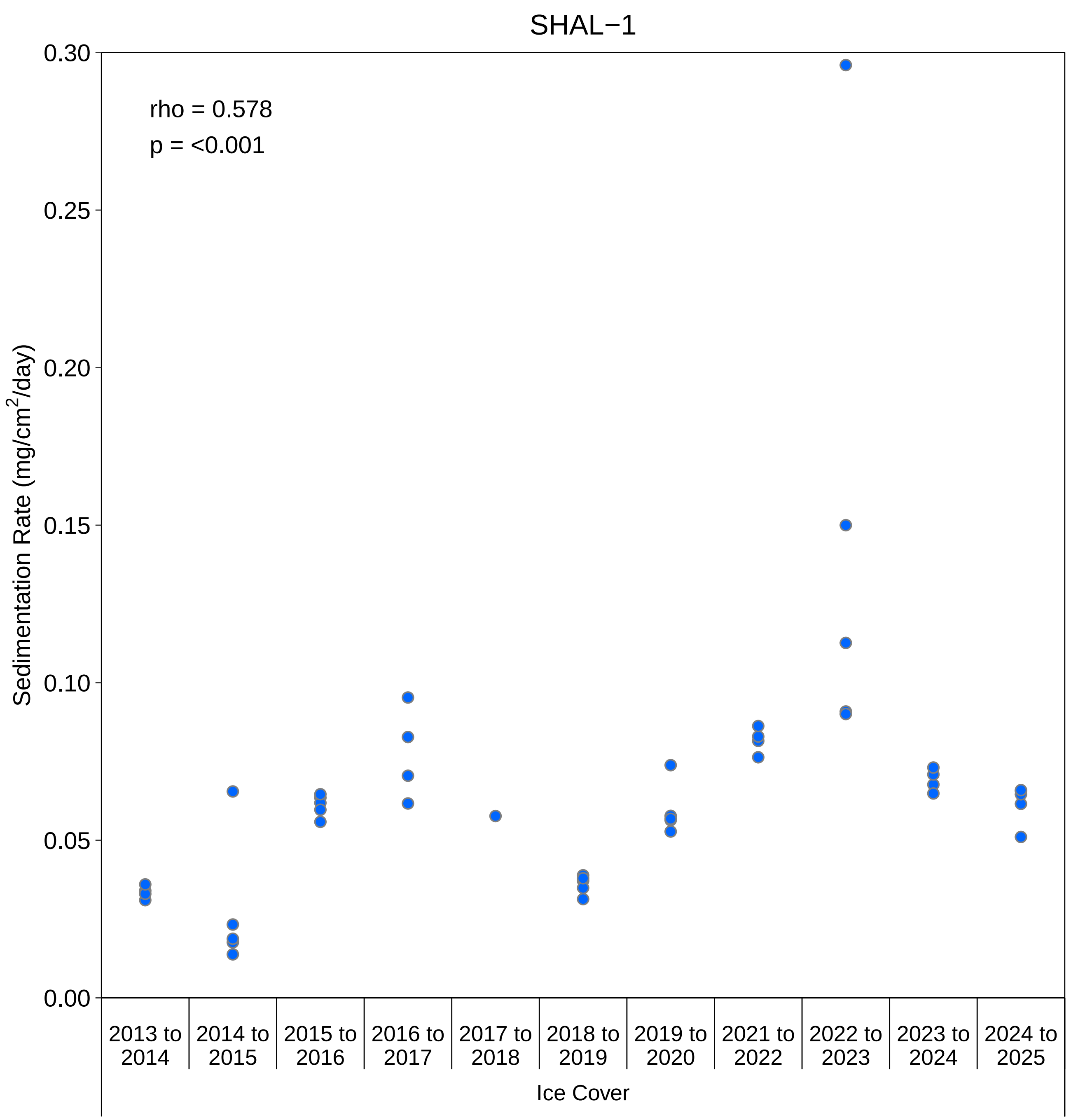
APPENDIX A
SEDIMENTATION DATA



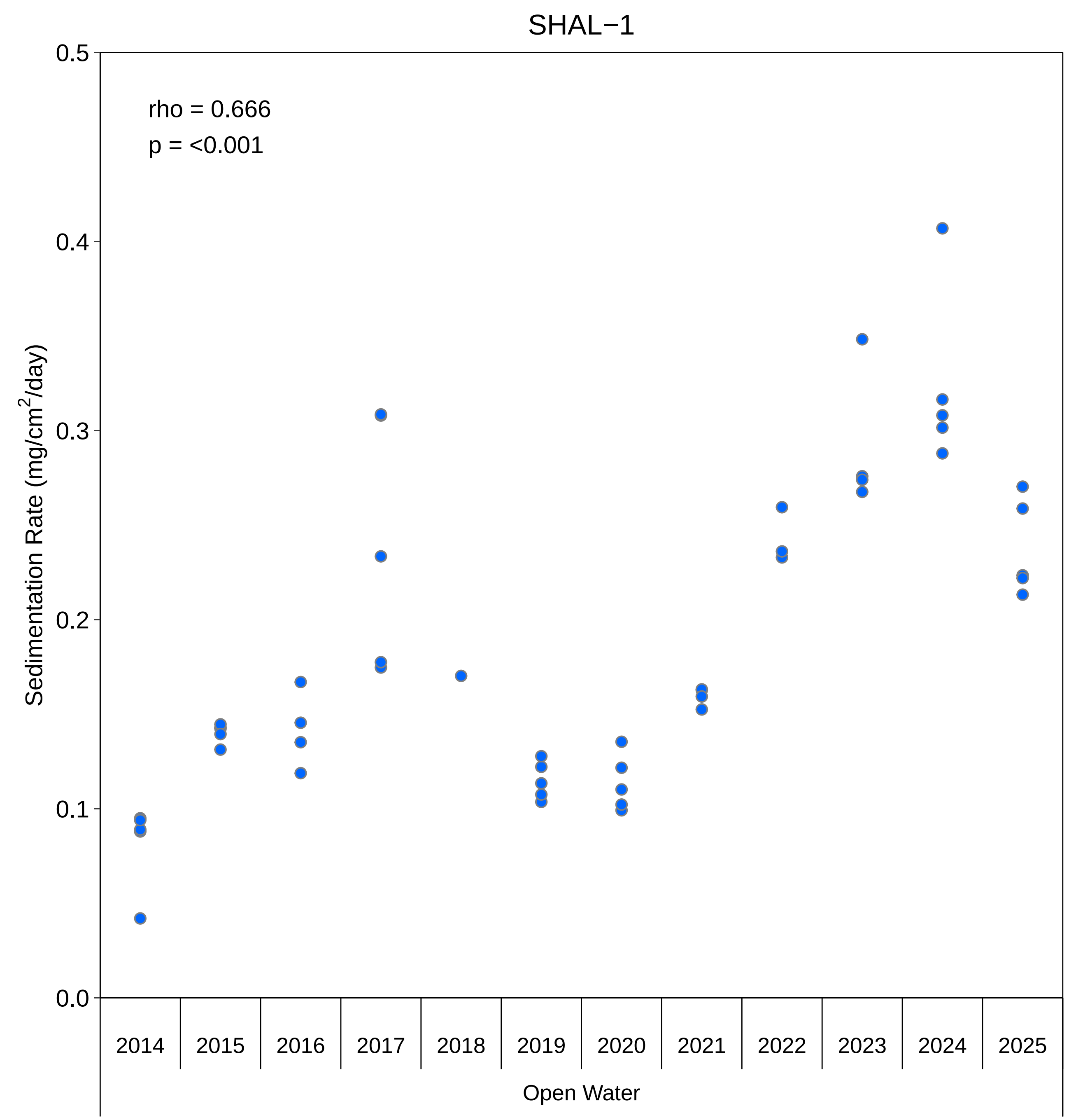
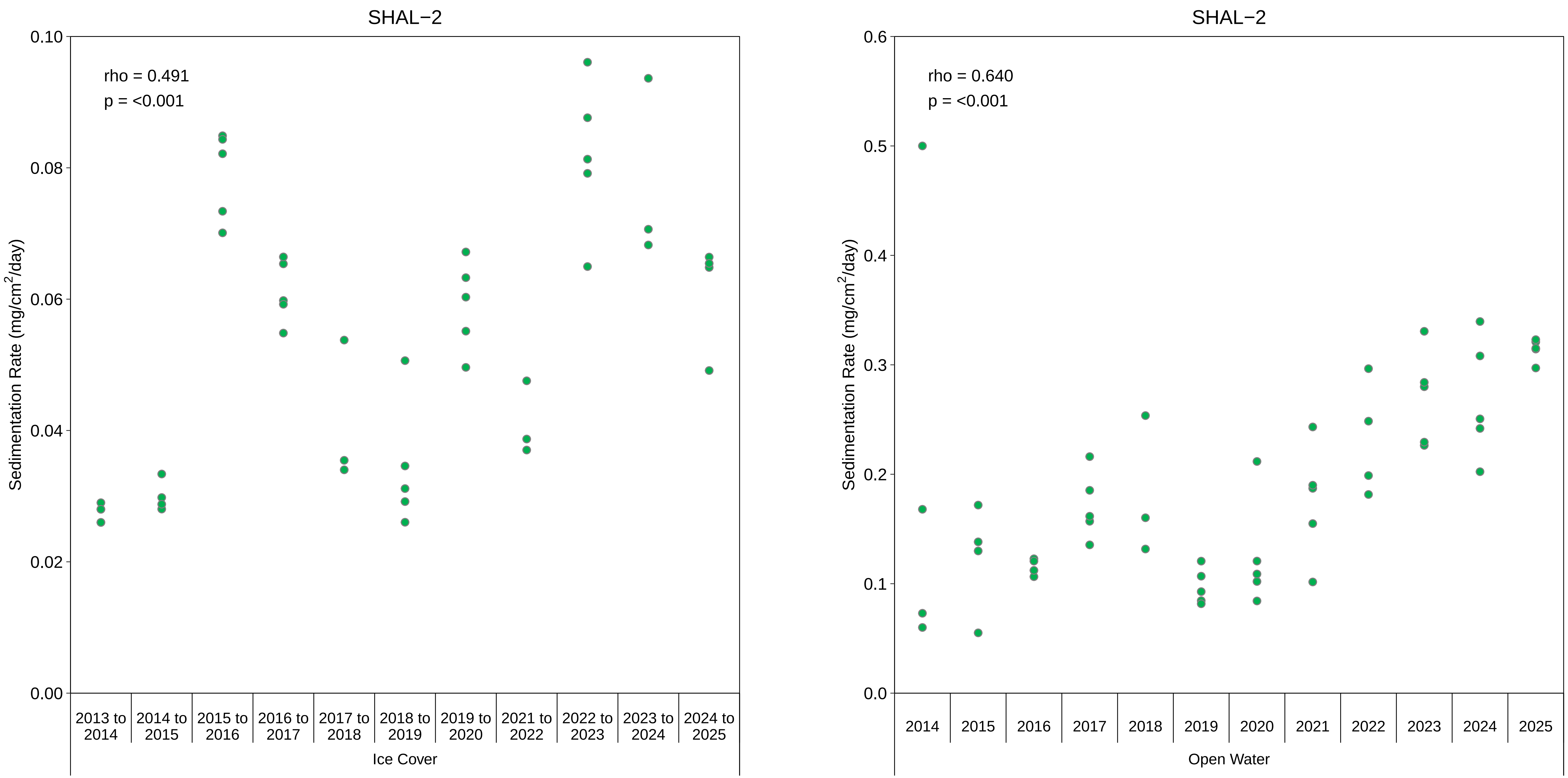


Figure A.1: Sedimentation Rates (mg/cm^2/day) During Periods of Ice Cover and Open Water at Sheardown Lake Northwest (NW), Sheardown Lake NW Sedimentation Monitoring Study, 2013 to 2025

Notes: P−values and rho values are calculated using a Spearman's correlation. SHAL−1 and DEEP−1 correlations were run without the anomalously high values in 2022/2023 and 2021/2022, respectively, and this did not change the outcome of the correlation.



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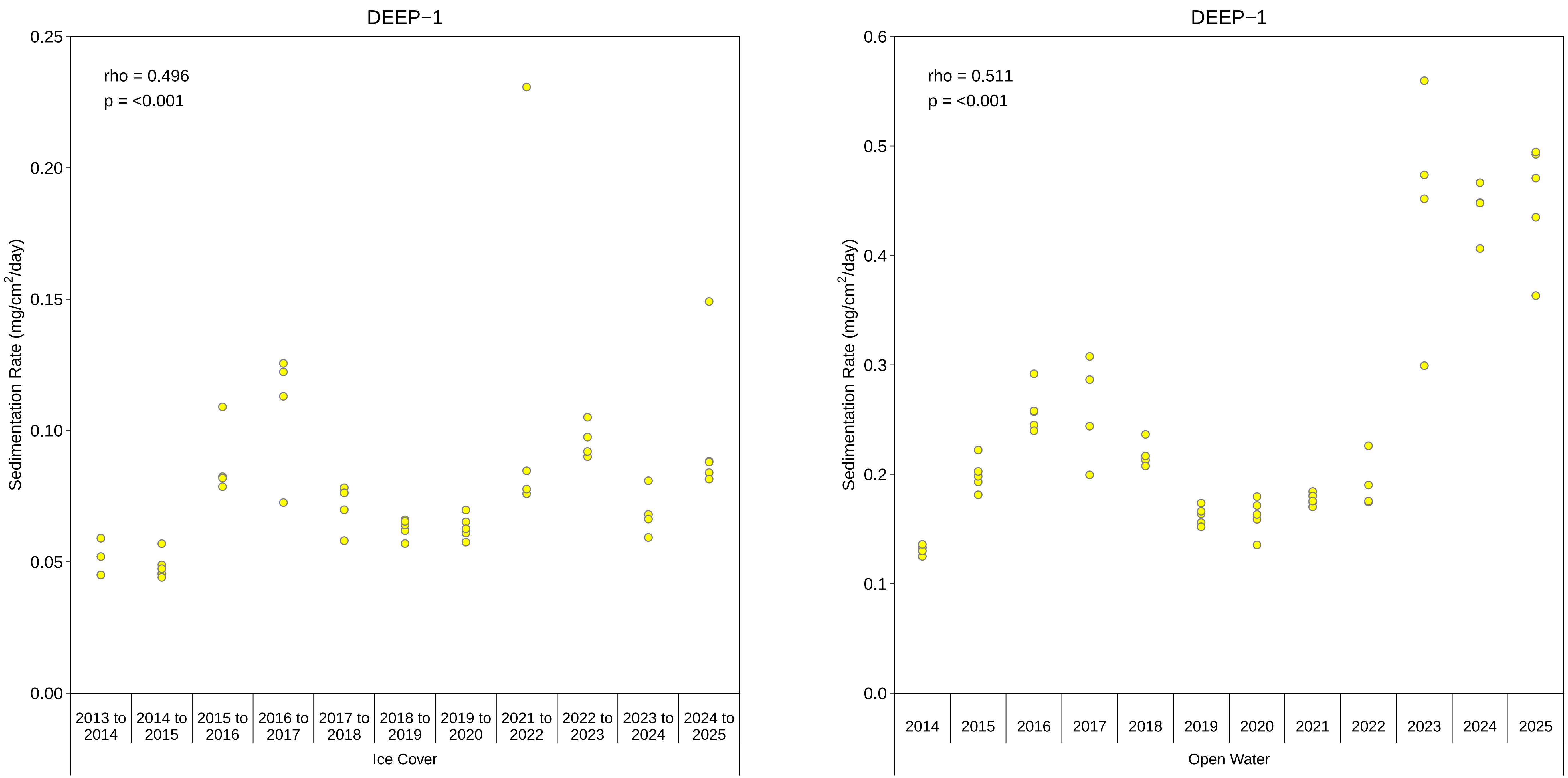

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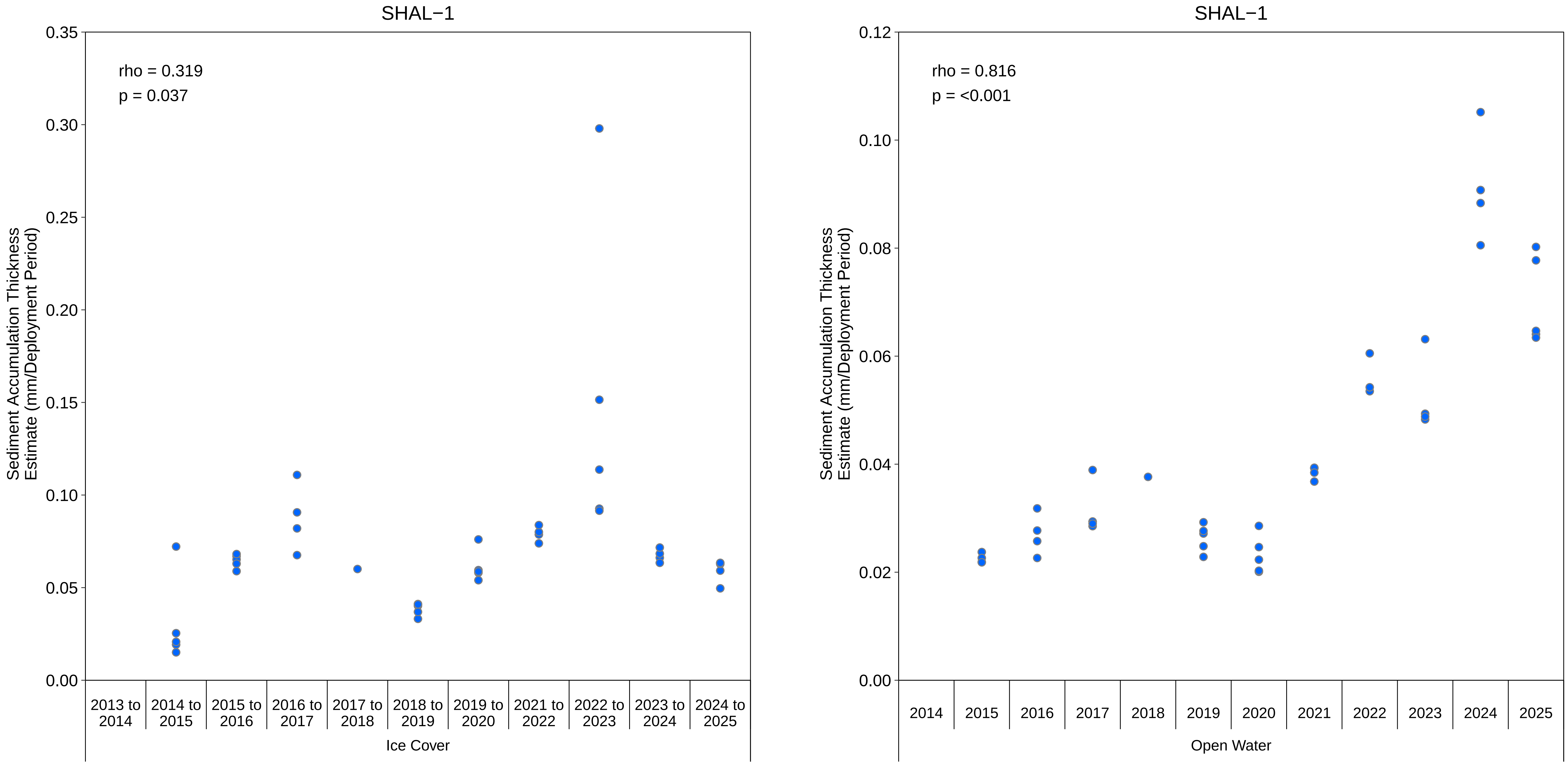
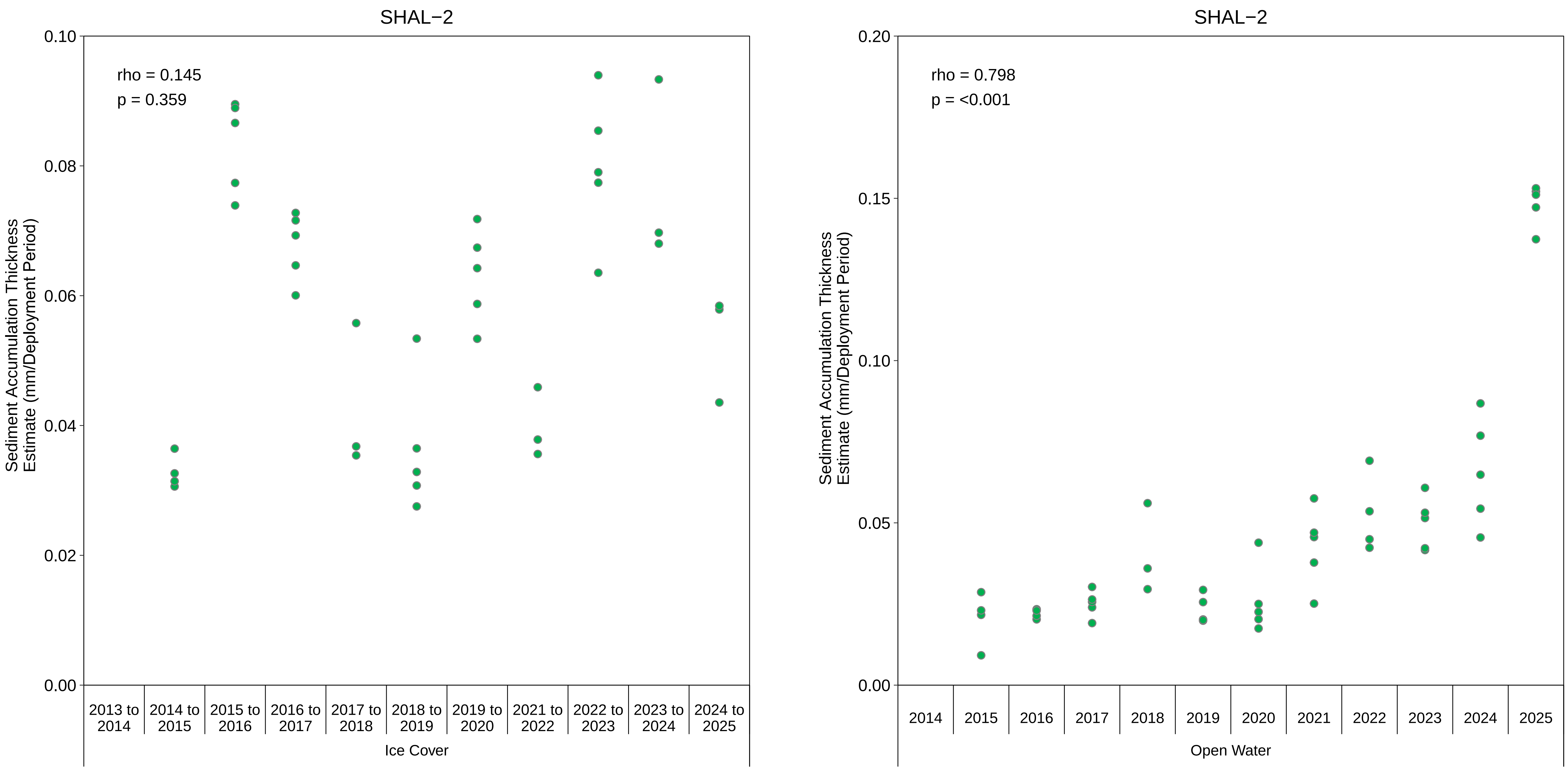


Figure A.2: Sedimentation Accumulation Thickness Estimates (mm/Deployment Period) During Periods of Ice Cover and Open Water at Sheardown Lake Northwest (NW), Sheardown Lake NW Sedimentation Monitoring Study, 2013 to 2025

Notes: P−values and rho values are calculated using a Spearman's correlation. SHAL−1 and DEEP−1 correlations were run without the anomalously high values in 2022/2023 and 2021/2022, respectively, and this did not change the outcome of the correlation.



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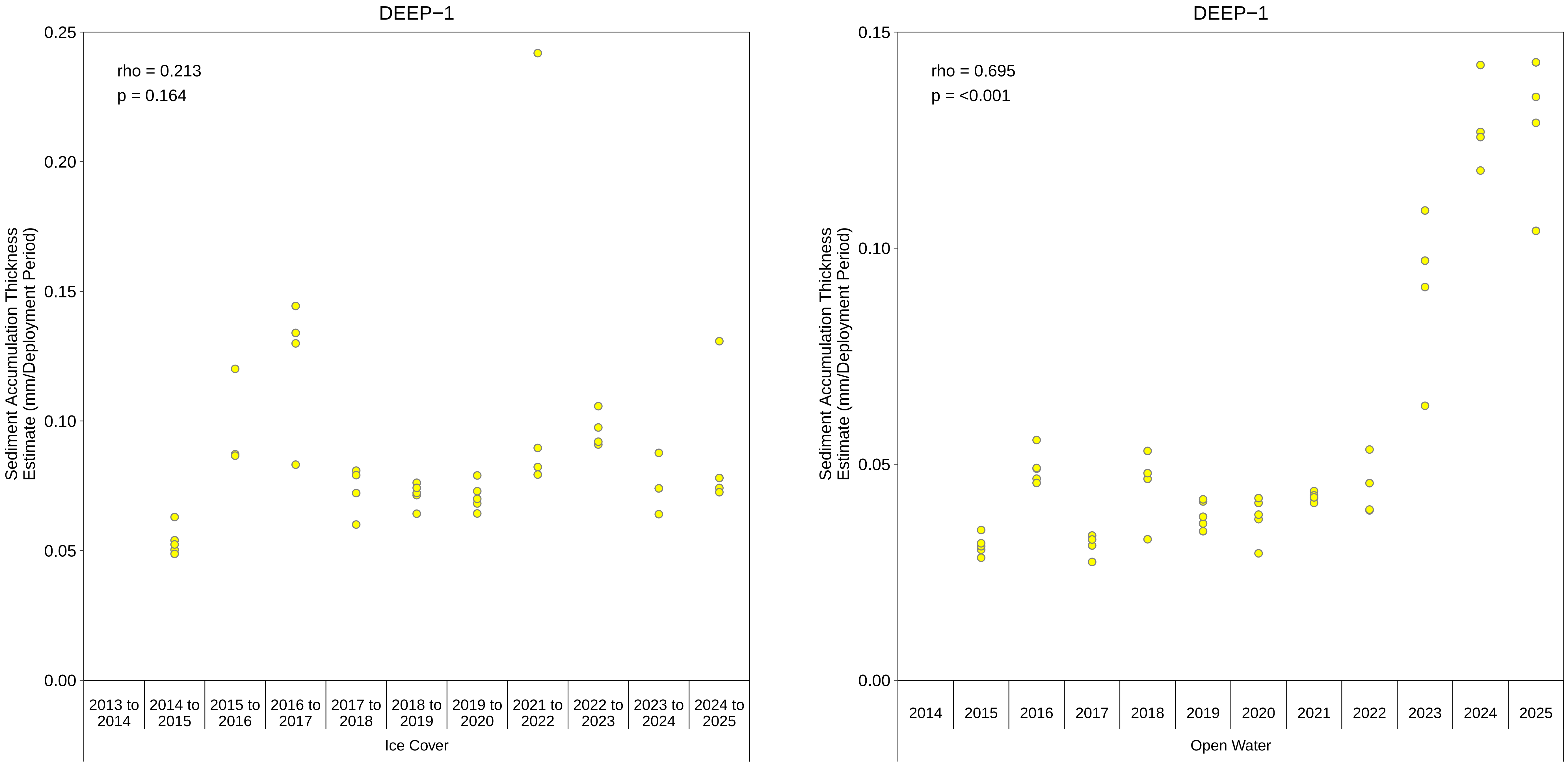

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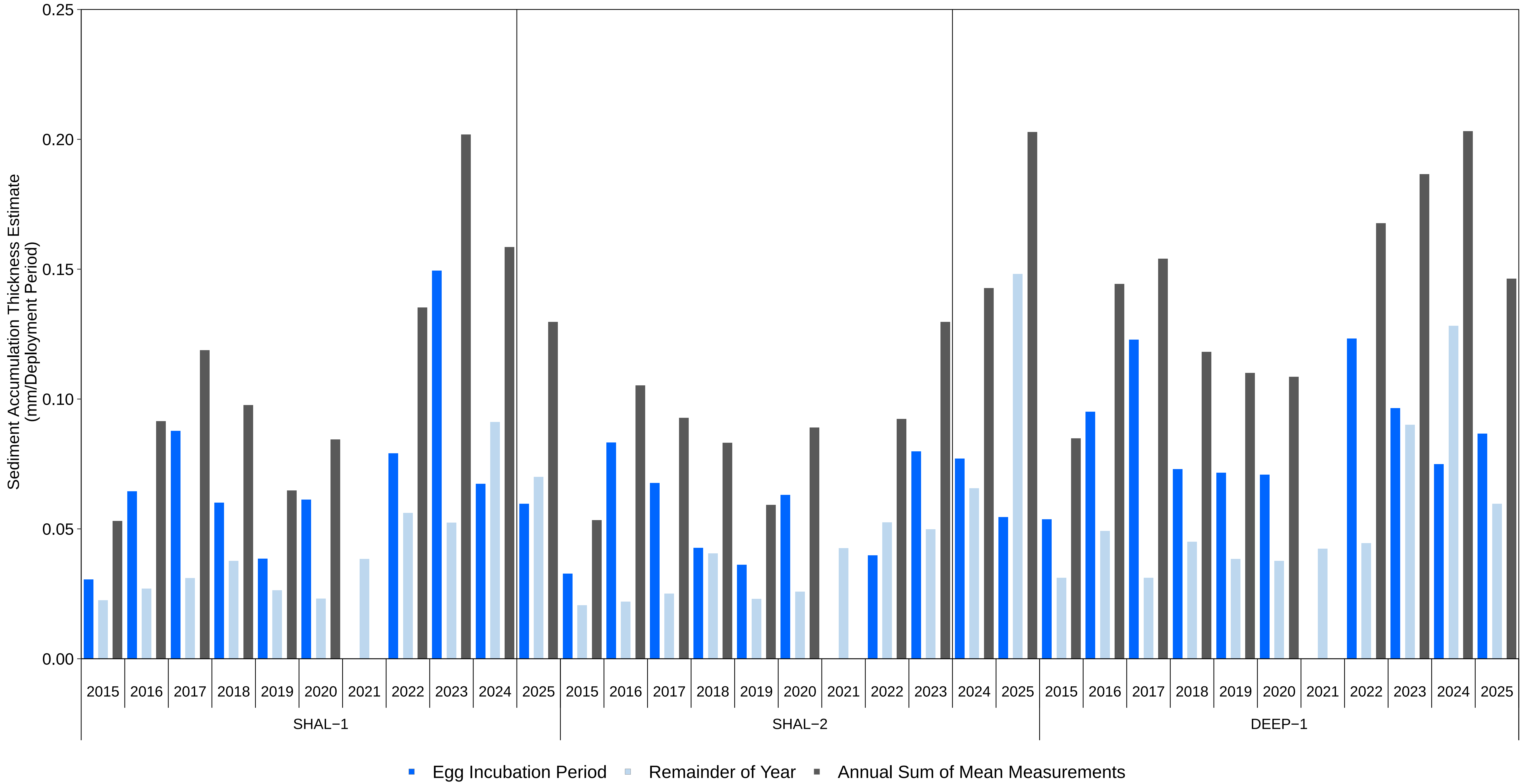

Figure A.3: Mean Sediment Accumulation Thickness Estimates (mm/Deployment Period) for the Arctic Charr Egg Incubation Period (Ice Cover) and the Remainder of the Year (Open Water), Sheardown Lake Northwest (NW), 2015 to 2025

Notes: The egg incubation period corresponds to the ice cover period (October to July). Sediment accumulation thickness estimate data were not available for the ice cover period of 2021.