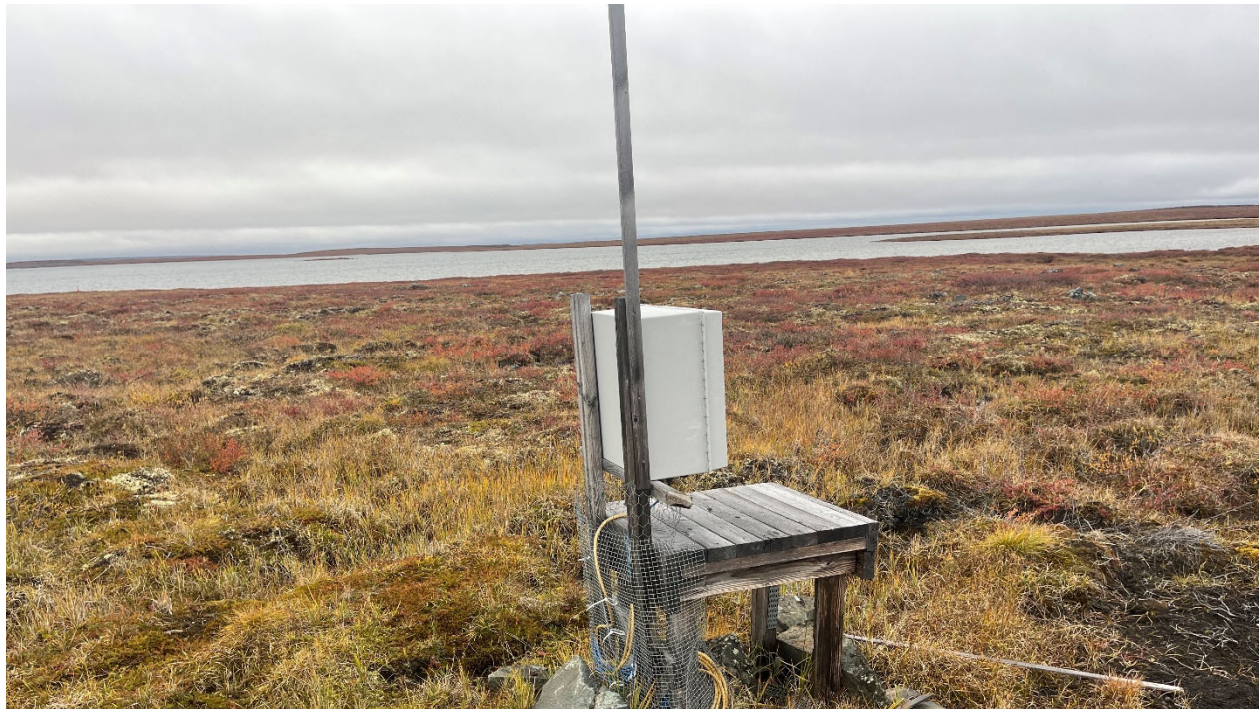


Revision 00

Back River Project: Site-wide Ground Thermal Monitoring Plan

Back River Project, Nunavut, Canada
B2Gold Corporation



SRK Consulting (Canada) Inc. ■ CAPR003102 ■ April 2024



Revision 00

Back River Project: Site-wide Ground Thermal Monitoring Plan

Back River Project, Nunavut, Canada

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Cover Image(s):

Historic ground temperature monitoring site with data logger housing at surface.

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Table of Revisions

Date	Revision	Remarks
April 1, 2024	Rev 00	Initial revision submitted as part of 2023 Annual Reporting Package

This document will be a ‘live’ document that will be continually updated as the Back River project advances, and as additional infrastructure on site is constructed. A history of the thermal monitoring plan report revisions is provided in the table above.

1 Introduction

1.1 Background

The Back River project (the project) is a proposed open pit and underground gold mining project in the West Kitikmeot region of Nunavut, approximately 520 km northeast of Yellowknife and 75 km south of Bathurst Inlet. The mine will consist of a Marine Laydown Area (MLA) at Bathurst Inlet and the mine located at the Goose property (Figure 1). The MLA will serve as the primary resupply point for the mine. B2Gold Corporation (B2Gold) began and are completing construction at the MLA and Goose site under their site Water License 2AM-BRP1831 – Amendment No. 1, issued by the Nunavut Water Board (NWB) on October 15, 2021.

A ground temperature monitoring plan and annual report is provided to meet the terms and conditions agreed to in the project certificate. In particular, the Project Certificate Terms and Conditions #11 states that “During construction, the Proponent shall, on an annual basis, provide additional permafrost mapping information documented in fulfillment of this Term and Condition in the Proponent’s annual report to the Nunavut Impact Review Board.”

This Plan provides a framework for monitoring ground temperature and changes to permafrost at the project site. Section 2 of this plan provides background information on site conditions and infrastructure. Section 3 reviews historical and current ground temperature sites used for baseline characterisation of the ground thermal regime. Section 4 identifies the long-term background and infrastructure monitoring sites. Section 5 provides guidance on implementation of the plan, data management, and instrument maintenance, followed by reporting requirements, presented in Section 6.

1.2 Monitoring Objectives

The ground temperature monitoring objectives include:

- Identifying natural climate-driven changes to the ground thermal regime and permafrost at background sites located outside of direct influence of mining activities; and
- Identifying changes to the ground thermal regime and permafrost immediately beneath or adjacent to mine infrastructure.

1.3 Key Elements

Key elements of the monitoring plan include:

- Ground temperature data collection from long-term monitoring stations;
- Data management and quality assurance;
- Instrument inspection and maintenance for ground temperature site; and
- Annual reporting requirements.

2 Site Conditions

2.1 Topography

The topography is characterized by low relief terrain at both the Goose property and MLA. At the Goose Property, the land is dominated by undulating or rolling landscapes, presented as a sequence of smooth, non-linear rises and hollows that are largely formed by glacial drumlines at the Goose Property. Frostboils form micro-relief at the ground surface and have developed from repeated freeze thaw cycle at the site. Drainage is variable from well to poorly drained ground depending on local topography, surficial material, and permafrost. The MLA is located near sea level and characterized by gentle slopes and level plains that drain toward Bathurst Inlet.

2.2 Climate

The region around the Back River project is characterized by long dark winters, shorter summers and generally gently rolling topography. Typically, the ground is covered in snow from October (and as early as September) to June (sometimes snow melting earlier in mid to late may). Similar to other Northern Canadian sites, Back River is subject to very cold weather and at times persistent Arctic winds.

In the winter the lakes and sea are covered with ice that can be greater than 2m in thickness. This can allow for on-ice activities such as diamond drilling, winter ice road, and airstrip construction and use. The mean annual air temperature (MAAT) is around -10°C at the Goose Station. The mean annual precipitation ranges from around 270 to 430mm (SRK 2021)

Meteorological data has been collected at the Goose Station (Lat. 65.54, Long. -106.41, Elev. 277 masl) since August 2004 and at the MLA Station (Lat. 66.65, Long. -107.69, Elev. 11 masl) since 2012. The stations are equipped with gauges to monitor air temperature, precipitation as rainfall and snowfall, solar radiation, wind speed, and wind direction (SRK 2021, Rescan 2014b). Meteorological data collected at these two stations will be used to support understanding of changes in ground temperature and permafrost (see Section 4).

2.3 Surficial and Bedrock Geology

Surficial geology at the project site is largely a reflection of the last advance of the North American Laurentide ice sheet during the Wisconsin Glaciation. The maximum extent of the continental glacier occurred approximately 21,000 years ago and began withdrawing from the Kitikmeot Region approximately 10,000 years ago.

The landscape is striated with overburden materials characteristic of a post-glacial environment. At the Goose property, the common surficial deposits include glacial till and drumlines. Glacial till consists of sand and variable amounts of silt and gravel. Drumlines also coarse sand, silt, and gravel compositions and are often associated with kettle lakes. Organic veneers (less than 1 m in depth) are also common, resulting from the accumulation of very slowly decomposing vegetation, typically in the wet lowlands.

The majority of the Goose Property is underlain by clastic meta-sedimentary rock types consisting of turbidites (greywacke and mudstone) of the Slave Province (Rescan 2013) Vol 5 EIS). This sequence is cut by felsic dikes and gabbroic dikes. From oldest to youngest, the sequence is composed of central greywacke, lower iron formation, middle mudstone, upper iron formation, and upper sediments. Exposed bedrock can be found throughout the Goose Property or immediately below a thin veneer of glacial sediments.

At the MLA, the surficial deposits include marine and morainal deposits. Marine and moraine deposits consist mainly of coarse sands. Poorly drained areas with accumulated organics may also have fine-grained soils and higher amounts of ground ice.

2.4 Ground Thermal Regime

Back River is located within a zone of Continuous permafrost, with an estimated 90 to 100% of the land area underlain by permafrost. Permafrost temperature has been measured to range from -4.7°C to -7.5°C at the Goose Property, with an average of -6.3°C (SRK 2015a). The seasonally thawed active layer ranges from approximately 1 to 4 m below ground surface (bgs). The greatest active layer depth occurs in areas with thin soil veneers above bedrock. The base of permafrost is estimated to range from 490 to 570 meters below ground surface (mbgs) using the 0°C isotherm, with a reported geothermal gradient of 0.013 to 0.014°C/m (SRK 2015a). The local groundwater chemistry results in a freezing point depression and unfrozen taliks at the base of permafrost, also referred to as basal cryopegs. The basal cryopeg has been estimated to be 100 m thick.

2.5 Infrastructure

Proposed surface infrastructure development to support the mining generally includes the following:

- Marine Laydown Area:
 - Laydown facilities
 - Fuel tank farm
 - Camp and ancillary facilities
 - Workshop and ancillary facilities
 - Airstrip
 - Fuel offloading and general site access roads linking the above elements
- Goose Site (primary focus of this report):
 - Processing plant and ancillary facilities
 - Mine equipment workshops, warehousing and ancillary facilities
 - Laydown facilities
 - Fuel tank farm

- Camp and ancillary facilities
- In-Pit tailings facilities
- Waste rock and overburden piles
- Ore stockpiles
- Airstrip
- Water management facilities (Primary Pond, Camp Pad, Echo Diversion etc.)
- Culvert crossings.
- All weather roads linking the above infrastructure elements.

The Back River site continues to be in a period of transition, in a pre-operation ramp up stage. This means that many of the pads, roads, ponds, and water conveyance (culvert) structures are currently at an interim state and / or were not yet completed at the end of 2023 (and at the time of writing this initial revision of the thermal monitoring plan). Therefore, there are many elements listed in bullets above that are not yet apparent on site. As later discussed, thermal monitoring is planned to be incorporated as part of much of the more critical infrastructure (e.g. ponds, in-pit tailings deposition, tank farms etc..) final designs and construction.

3 Ground Temperature Sites

3.1 Historic Sites

The ground thermal regime has been characterised as part of baseline studies completed at Goose and MLA (Rescan 2014a). Thermistor cables were installed in drillholes (and one test pit) at the Goose property in 1997, 2008, 2011, 2012, and 2013, 2015, and 2017 (Table 1). At the Goose property, a total of thirty-five thermistor cables were installed nearby the planned open pits and infrastructure sites. An additional six drillholes were instrumented with thermistor cables at the MLA.

Figure 2 shows the location of the historic ground temperature sites located at the Goose property by year of installation. Figure 3 shows the location of the historic ground temperature sites install at the MLA. At the time of reporting, the historic sites are considered to be inactive, and no recent measurements have been made from the sites. A portion of the historic site are planned to be used for long-term ground monitoring pending final determination of instrument function, as discussed in Section 4.

The thermistor cables installed at the historic ground temperature sites were manufactured by RST (SRK 2012, SRK 2015b, Rescan 2010, Rescan 2012), or by GKM (KP 2013a; 2013b). The cables were typically designed to characterise either shallow or deep ground temperature (see classification in Table 1). Most of the instruments were connected to data loggers manufactured by Campbell Scientific (Rescan 2010; 2012; KP 2013a; 2013b) or RST (SRK 2012). Manual temperature readings were collected from cables not connected to data loggers.

Ground temperature measurements collected at Goose and MLA are provided in Appendix B. The historic ground temperature records are often limited to measurements made several months to years following installation. The historic (pre-mining) baseline measurements will be used to evaluate change in permafrost temperature over the period of mining (see Section 4).

3.2 Recent Sites

In 2023 and 2024, recent ground temperature sites were installed at the Goose Camp Pad and Primary Pond Dam (Figure 2; Table 2). Drillholes were instrumented with calibrated digital ground temperature cables (GTCs) which provide analog to digital conversion of the measurements at the sensor. The read out of the cables is temperature using factory established calibration coefficients, which eliminates the need to convert measured resistance to temperature.

At the Goose Camp Pad, the GTCs were installed at SRK-23-CPI-DH1 and SRK-23-CPI-DH2 to monitoring ground temperature in the rock pad and foundation (Figure 2; Table 2). Manual measurements have been made since installation (Appendix B).

Six GTCs were installed at the Primary Pond Dam during the first season of construction. The GTCs are installed in vertically in the foundation and horizontal along the excavated and backfilled key trench (Figure 2; Table 2). An additional four temporary sites were instruments to characterise the foundation and support construction of the Primary Pond Dam. The temporary sites include SRK-24-PP-DH01, SRK-24-PP-DH02, SRK-24-PP-DH03, and SRK-24-PP-DH04 (Appendix B).

Table 1: Historic Ground Temperature Sites Installed Between 1997 and 2017

Location	Site ID	Year	Northing	Easting	Status	Monitoring Type	GTC Length [m] (Approx.)
Goose Property	13-GSE-261B	2013	7269381	433838	Inactive	Background	560
	13-GSE-286	2013	7269612	434066	Inactive	Background	210
	13-GSE-314	2013	7269764	434278	Inactive	Background	210
	11SRKGL-10	2011	7269557	433734	Inactive	Background	21.5
	08-GSE-009	2008	7269461	433904	Inactive	Background	300
	97-GO-14	1997	7269623	434056	Inactive	Background	7
	13-GSE-288	2013	7270686	430310	Inactive	Background	560
	13-GSE-279	2013	7270260	430189	Inactive	Background	560
	12-GSE-233C	2012	7270546	430544	Inactive	Background	565
	13-GSE-277B	2013	7272125	428852	Inactive	Background	265
	13-GSE-284	2013	7272370	428710	Inactive	Background	390
	13-GSE-289	2013	7272218	428790	Inactive	Background	660
	12-GSE-218	2012	7272301	428508	Inactive	Background	390
	12-GSE-223	2012	7272161	429104	Inactive	Background	285
	14-GSE-468	2014	7268705	432707	Inactive	Background	375
	14-GSE-472	2014	7268724	432957	Inactive	Background	375
	TIA-GT13-03	2013	7272636	430246	Inactive	Background	17
	TIA-GT13-10	2013	7273951	430604	Inactive	Background	17
	TIA-GT13-15	2013	7273180	431079	Inactive	Background	17
	TIA-GT13-16	2013	7272989	431079	Inactive	Background	17
	GAS-GT13-01	2013	7269913	432983	Inactive	Background	17
	GAS-GT13-02	2013	7269571	433495	Inactive	Background	27
	GAS-GT13-04	2013	7268574	434367	Inactive	Background	27

Location	Site ID	Year	Northing	Easting	Status	Monitoring Type	GTC Length [m] (Approx.)
	GAS-TP13-51	2013	7268379	434496	Inactive	Background	3
	GPS-GT13-01	2013	7271857	431171	Inactive	Background	17
	SRK-15-GSE-DH12	2015	7267857	434863	Inactive	Background	15
	SRK-15-GSE-DH13	2015	7267876	434944	Inactive	Background	15
	SRK-15-GSE-DH15	2015	7267916	435125	Inactive	Background	15
	SRK-15-GSE-DH16	2015	7267940	435231	Inactive	Background	15
	SRK-15-GSE-DH17	2015	7267942	435336	Inactive	Background	15
	SRK-15-GSE-DH18	2015	7267919	435427	Inactive	Background	15
	SRK-15-GSE-DH19	2015	7267905	435517	Inactive	Background	15
	SRK-15-GSE-DH20	2015	7267893	435603	Inactive	Background	15
	SRK-15-GSE-DH21	2015	7267877	435685	Inactive	Background	15
	SRK-15-GSE-DH26	2015	7266311	435268	Inactive	Background	15
MLA Property	17-ML_AA005	2017	7394381	381098	Inactive	Background	4.5
	17-ML_AA008	2017	7394715	381331	Inactive	Background	2.9
	17-ML_AA020	2017	7394872	380934	Inactive	Background	2.6
	17-ML_AA021	2017	7394212	381331	Inactive	Background	1.9
	17-ML_AA022	2017	7394185	381145	Inactive	Background	4.3
	17-ML_AA023	2017	7394530	381258	Inactive	Background	3.7

Table 2: Recent Ground Temperature Sites Installed Between 2023 and 2024

Location	Area	Drillhole ID	Year	Northing	Easting	Status	Monitoring Type	GTC Length [m] (Approx.)
Goose Property	Primary Pond Dam	PP-VTC-640-US	2023	7271205	429849	Active	Infrastructure	15.5
		PP-VTC-640-KT	2023	7271180	429830	Active	Infrastructure	12.9
		PP-VTC-640-DS	2023	7271168	429821	Active	Infrastructure	15.5
		PP-HTC-B1-KT	2023	7271196	429838	Active	Infrastructure	99
		PP-HTC-640-LN	2023	7271169	429912	Active	Infrastructure	22
		PP-HTC-B2-KT	2023	7271137	429963	Active	Infrastructure	131
	Umwelt Pit	22UMU004B	2023	7270357	430280	Active	Underground	430
	Camp Pad	SRK-23-CPI-DH1	2023	7270012	429952	Active	Infrastructure	13.4
		SRK-23-CPI-DH2	2023	7269927	430029	Active	Infrastructure	8.8
	Primary Pond Dam	SRK-24-PP-DH01	2024	7271328	429660	Inactive	Temporary	8
		SRK-24-PP-DH02	2024	7271366	429613	Inactive	Temporary	9
		SRK-24-PP-DH03	2024	7271323	429658	Inactive	Temporary	8
		SRK-24-PP-DH04	2024	7271319	429664	Inactive	Temporary	5

4 Long-term Monitoring

4.1 Background Sites

The long-term background sites will be established to monitor climate-driven changes in ground temperature at locations that are not directly impacted by mining. The background sites will be selected to capture representative ground conditions based on surficial geology, surface hydrology, vegetation, and expected ground temperature and active layer depth. Sites will be established at both the Goose property and MLA.

An attempt will be made in 2024 (likely in Q3 and Q4) to bring back online some of the historic ground temperature sites for background ground temperature monitoring. If the instruments are determined to not be operable, new background sites will be established in close proximity to the former background site or at new nearby locations which are representative of the range in ground conditions at the property. Three new background monitoring sites are planned for the MLA in 2024 (Figure 3). The planned sites are located within undisturbed terrain at the south end of the MLA airstrip (MLA-GTC-4), southeast side of the Shoreline Pad (MLA-GTC-5), and nearby the explosive storage berm (MLA-GTC-6) (Figure 3).

4.2 Infrastructure and Disturbance Sites

Long-term ground temperature monitoring will be established at infrastructure and ground disturbance sites to monitor changes in ground temperature at locations directly influenced by mining activity. At infrastructure sites, the change in ground temperature is expected to result from the combined effects of climate and the infrastructure. Disturbance site would include areas adjacent to mine infrastructure that are influence or directly impacted by mining activity.

At present, infrastructure monitoring sites included in this monitoring plan include two sites at the Goose Camp Pad (SRK-23-CPI-DH1 and SRK-23-CPI-DH2) and three of the sites at the Primary Pond Dam (PP-VTC-640-US, PP-VTC-640-KT, PP-VTC-640-DS). The three sites at the Primary Pond Dam consist of vertical GTCs installed in the foundation beneath the upstream (US), key trench (KT), and downstream (DS), respectively. In 2024 additional cables are planned to be installed at the Primary Pond dam location, and one cable is planned to be installed at the Goose Tank Farm. The exact location of the Goose Tank Farm cable will be determined after construction of additional tanks is completed. However this cable is likely to be installed near the south to south eastern extents of the facility, where either the fill thicknesses are greater and/ or where the foundation of the berms are not expected to be fully on bedrock (Goose Tanks are located on bedrock).

In 2024, three infrastructure and disturbance monitoring sites are planned for the MLA (Figure 3). One of the GTCs will be installed through the tank farm berm and 15 m into the foundation on the southwest side of the facility, where the berm is constructed on overburden (Figure 3; MLA-TF-GTC-1). The second GTC is planned to be installed on the north edge of the proposed Tank 5 and will extend 20 m deep in the ground (Figure 3; MLA-TF-GTC-2). The purpose of these cables will be to monitor berm

and foundation permafrost conditions. A third GTC is planned near MLA laydown pad where historic tundra disturbance has been noted (MLA-D-GT-3).

Additional GTCs will be installed at the Goose property and MLA as additional mine infrastructure is built. The GTCs will be installed during construction or shortly thereafter. In most cases, the instruments will be part of a larger network of instruments used to monitor infrastructure performance and therefore the locations are subject to change as design and construction advances.

4.3 Meteorological Stations

Climate data collected at the Goose and MLA stations will allow for changes in weather and longer term climate to be assessed against the measured ground temperature. The monitoring plan data management system includes the historical meteorological data from the Goose and MLA stations (Section 5.2, Appendix C). Appendix C provides the baseline measurements for select parameters collected at the stations. The data management system will be updated with the completed timeseries of historical and recent measurements for each parameter. The Goose weather station and climate data is available up to date of submission for this report and presented up until the end of 2023 in Appendix C.

5 Implementation and Maintenance

The operation and maintenance of the long-term ground temperature monitoring sites will be conducted by B2Gold or consultants. The following section provides guidelines for data collection, data management and quality assurance, and instrument inspection and maintenance.

5.1 Data Collection

A key consideration for long-term ground temperature monitoring is the method and frequency of data collection. Data collection will be through the use of data loggers or manual measurement at the frequency described below.

- Data Logger Collection
 - Measurement frequency every four hours (internally recorded)
 - Download of data logger once a quarter
- Manual Data Collection
 - Measurement frequency once a quarter

A standard operating procedures (SOPs) should be developed and appended to this monitoring plan once the sites and instruments have been established. The SOP will ensure consistent and complete data collection.

5.2 Data Management

A ground temperature monitoring database has now been developed in Microsoft PowerBI (data visualization and analytics tools and app) to support data storage, quality assurance and checks, analysis, and reporting. The database includes historic and recent ground temperature sites, along with the long-term ground temperature monitoring sites. The long-term monitoring sites (Background, Infrastructure, and Disturbance sites) for Goose and MLA will be added over time. Meteorological data from the Goose and MLA stations will also be maintained within the database.

Standardised data plots that have been developed to meet and assist with the annual reporting requirements. The data plots include graphical representation of the information as temperature timeseries and temperature versus depth plots. Standardized plots of the climate data for each of the meteorological stations will also be included in the database, such as graphical representation of year-over-year changes and calculated climate indices. The data plots may be expanded as required by data collection, analysis, and reporting.

The database should be updated within one month of manual data collection or data logger download. Climate data should be added to the database on a quarterly basis or at which time the quality checked data is made available.

5.3 Quality Checks

The data will be checked for erroneous (abnormal) readings. An abnormal instrument reading is one that is outside the historic range of measured values or shows a sudden change that is unexplainable. All data should be added to the database and then qualified by a subject matter expert. Abnormal readings will be flagged within the database.

5.4 Instrument Inspection and Maintenance

The instrument inspection and maintenance will be performed to ensure that the instruments are in good working condition to collect complete and accurate data. Prior to data collection (manual or download of the data logger), the instrument enclosure, data logger and components, and all exposed portions of the GTCs will be visually inspected for damage. Damage should be documented along with the need for repair or replacement.

It is inevitable that monitoring equipment will wear out and need to be replaced over time. These installations may require complete replacement in the event of equipment failure. If the equipment fails and requires replacement, B2Gold will make an effort to replace the equipment or the entire GTC cable in a timely fashion to ensure continuity with data collection. In some cases, it may not be practical to replace the instrument at the same location due to impacts on infrastructure or limitations with equipment and site access. If it is determined that the instruments cannot be replaced at the same location, a new installation will be located as close as possible and will be designed to collect the same data as the original installation.

6 Reporting

6.1 Annual Report

An annual ground temperature monitoring report, starting for the 2024 site annual reporting, will be issued with the annual geotechnical inspection report for the site. The report will be developed to:

- Summarise data collection for the year;
- Describe instrument maintenance or replacement that has occurred;
- Update graphical plots of the historic and recent measurements for the monitoring sites;
- Analysis of the ground temperature to identify changes in permafrost and longer term trends;
- Analysis of relevant climate parameters to support understanding of changes in permafrost; and
- Action plan for instrument repair or replacement for the upcoming year, as needed.

Closure

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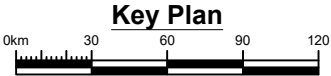
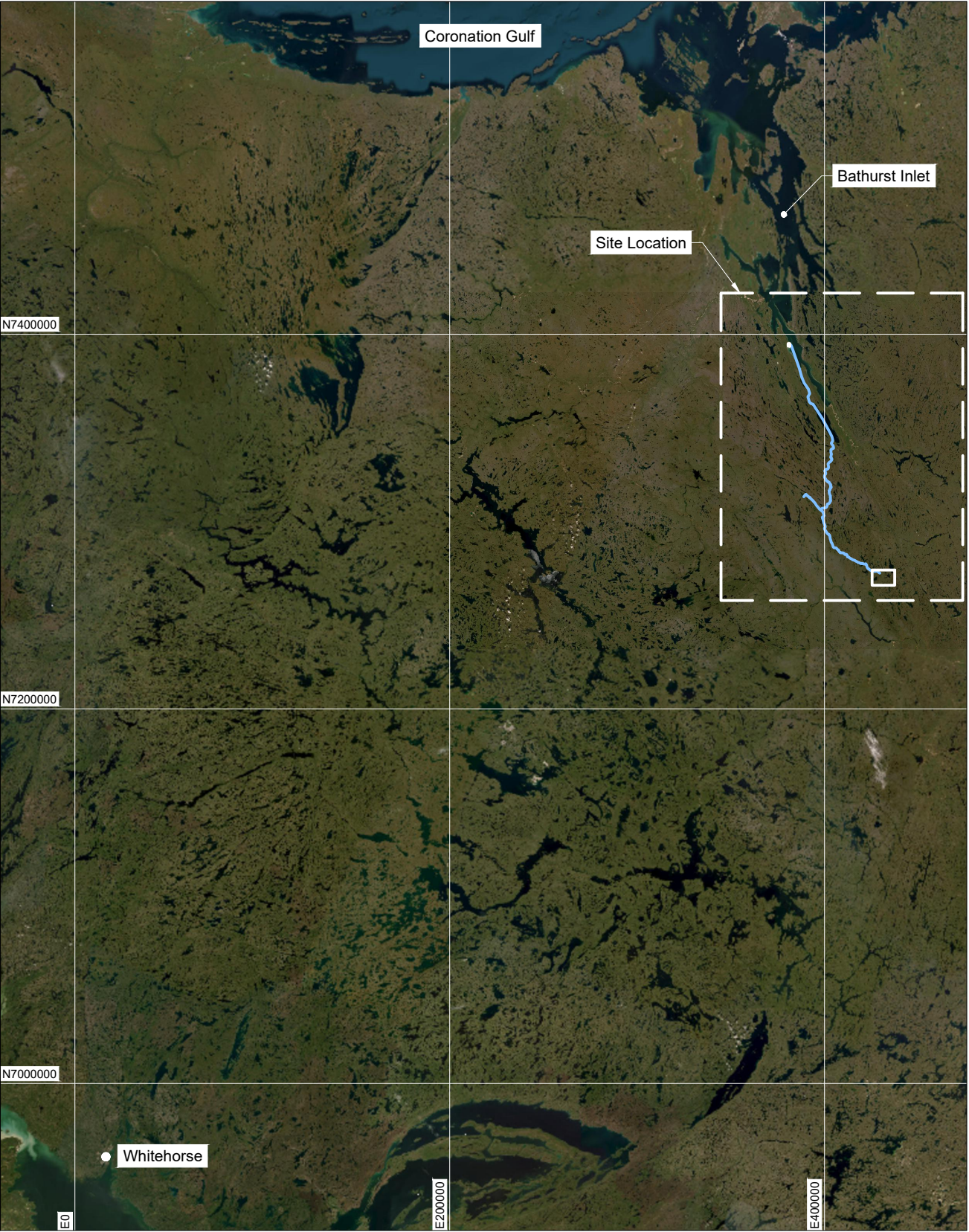
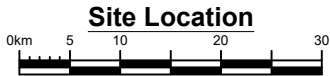
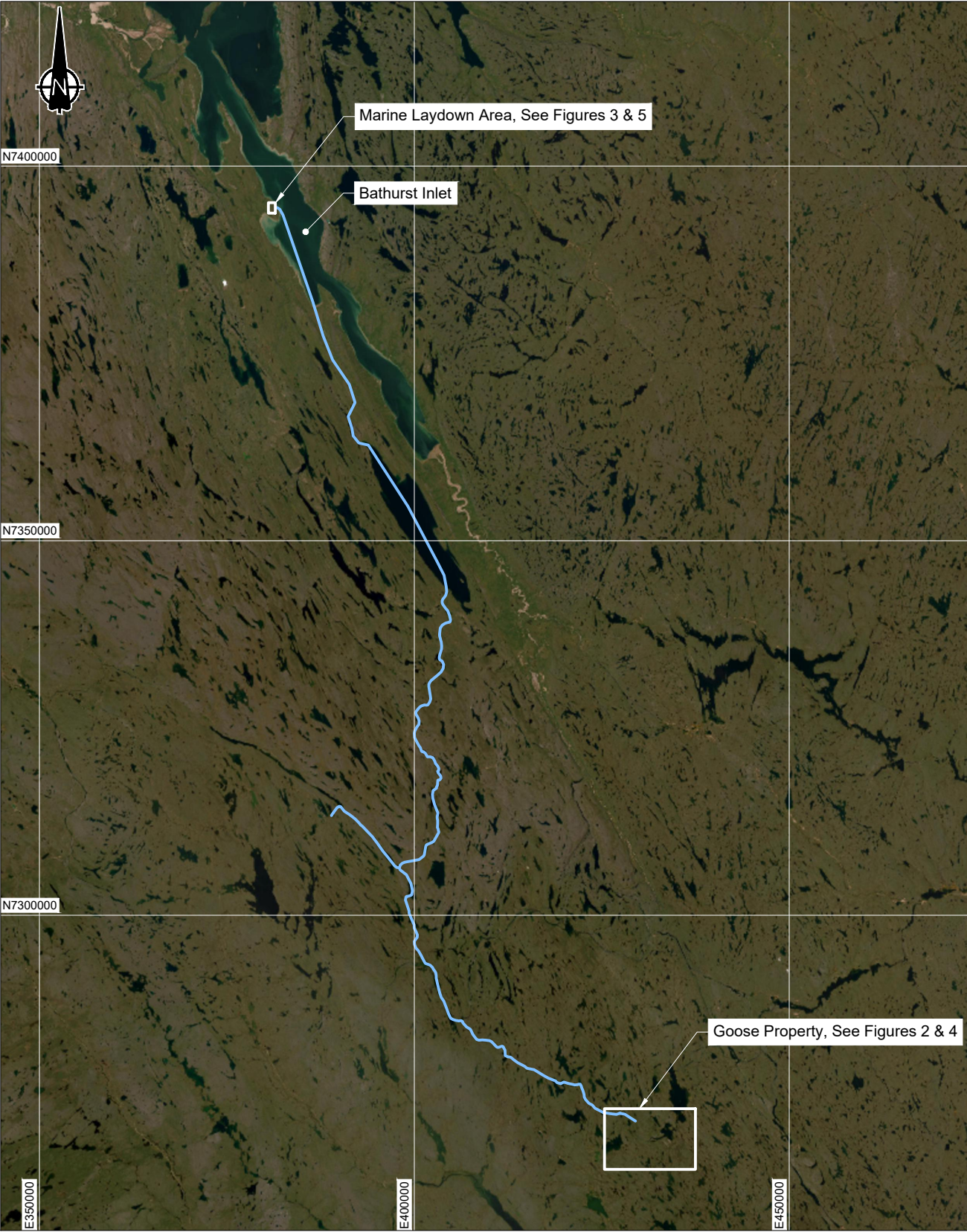
All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

References

- Rescan. 2010. Thermistor Data Summary, Back River Project. Prepared for Sabina Gold and Silver Corporation.
- Rescan. 2012. Thermistor Data Summary, Back River Project. Prepared for Sabina Gold and Silver Corporation.
- Rescan. 2014a. Back River Project Cumulative Permafrost Baseline Data Report (2007 to May 2014). Prepared for Sabina Gold & Silver Corp.
- Rescan. 2014b. Back River Project: 2006 to 2013 Meteorology Baseline Report. Prepared for Sabina Gold & Silver Corp.
- SRK Consulting (Canada) Inc. 2012. Back River 2012 Geotechnical and Hydrogeological Drilling Program Factual Data Report. Prepared for Sabina Gold and Silver Corporation.
- Knight Piésold (KP). 2013a. 2013 Geotechnical Site Investigation Summary. Prepared for Sabina Gold & Silver Corp.
- Knight Piésold (KP). 2013b. 2013 Geomechanical and Hydrogeological Site Investigation Summary. Prepared for Sabina Gold and Silver Corporation.
- SRK Consulting (Canada) Inc. 2015a. Thermal Modelling to Support Run-of-Quarry Pad Design. Prepared for Sabina Gold and Silver Corporation.
- SRK Consulting (Canada) Inc. 2015b. Back River Project: Goose Property Talik Thermal Modeling. Technical Memorandum Prepared for Sabina Gold & Silver Corp., October 2015.
- SRK Consulting (Canada) Inc. 2021. Back River: Updated Feasibility Study – Hydrology Update. Prepared for Sabina Gold and Silver Corporation.

Appendix A Figures

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LEGEND

— 2015 Winter Road Design

NOTES

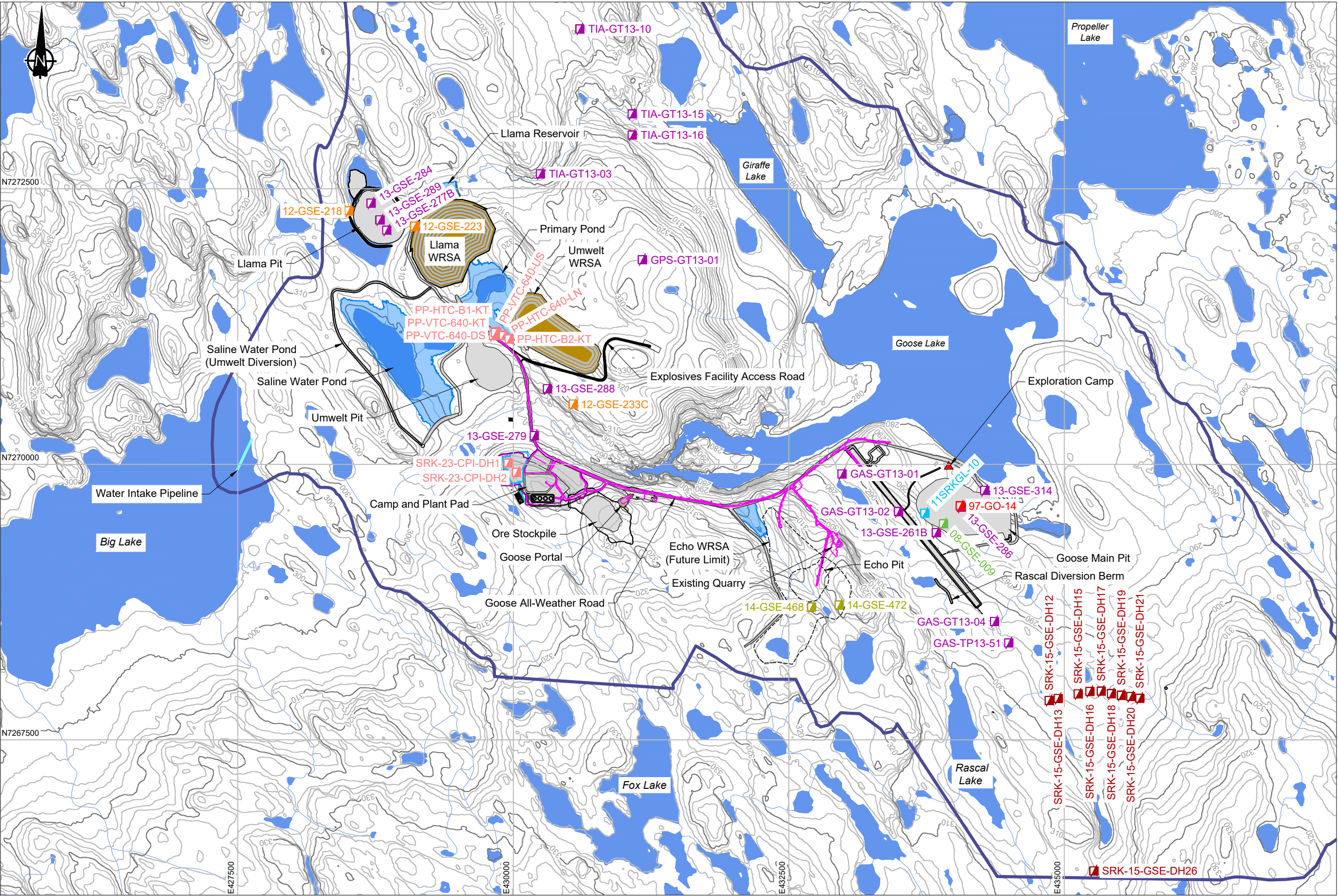
1. All units are in meters unless otherwise specified.

REFERENCES

NAD83 UTM Zone 13.
Imagery acquired from ESRI World Map on 20240203.

 SRK JOB NO.: CAPR003102 FILE NAME: CAPR003102_GA.dwg	 Back River	Site-wide Ground Thermal Monitoring Plan		
		Location Map		
		DATE: 2024-02-28	APPROVED: -	FIGURE: 1

C:\Users\backer\SRK Consulting\F5203 Goose Lake (Back River) - 10401_AutoCAD\ACAD_C3D\CAPR003102_GroundThermalMonitoringPlan\CAPR003102_GTC Locations.dwg



LEGEND

1997 GTC

2008 GTC

2011 GTC

2012 GTC

2013 GTC

2014 GTC

2015 GTC

2023 GTC

Meteorological Station

GTC Ground Temperature Cable

Crossing Location

As-built Infrastructure (2021)

Pipeline Access

Waterbody

Design Infrastructure

Design Stockpile Location

Project Boundary

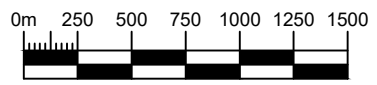
NOTES

1. All units are in meters unless otherwise specified.

2. Contours are shown at 2.0 m intervals.

REFERENCES

NAD83 UTM Zone 13.



Back River

SRK JOB NO.: CAPR003102

FILE NAME: CAPR003102_GTC Locations.dwg

Site-wide Ground Thermal Monitoring Plan

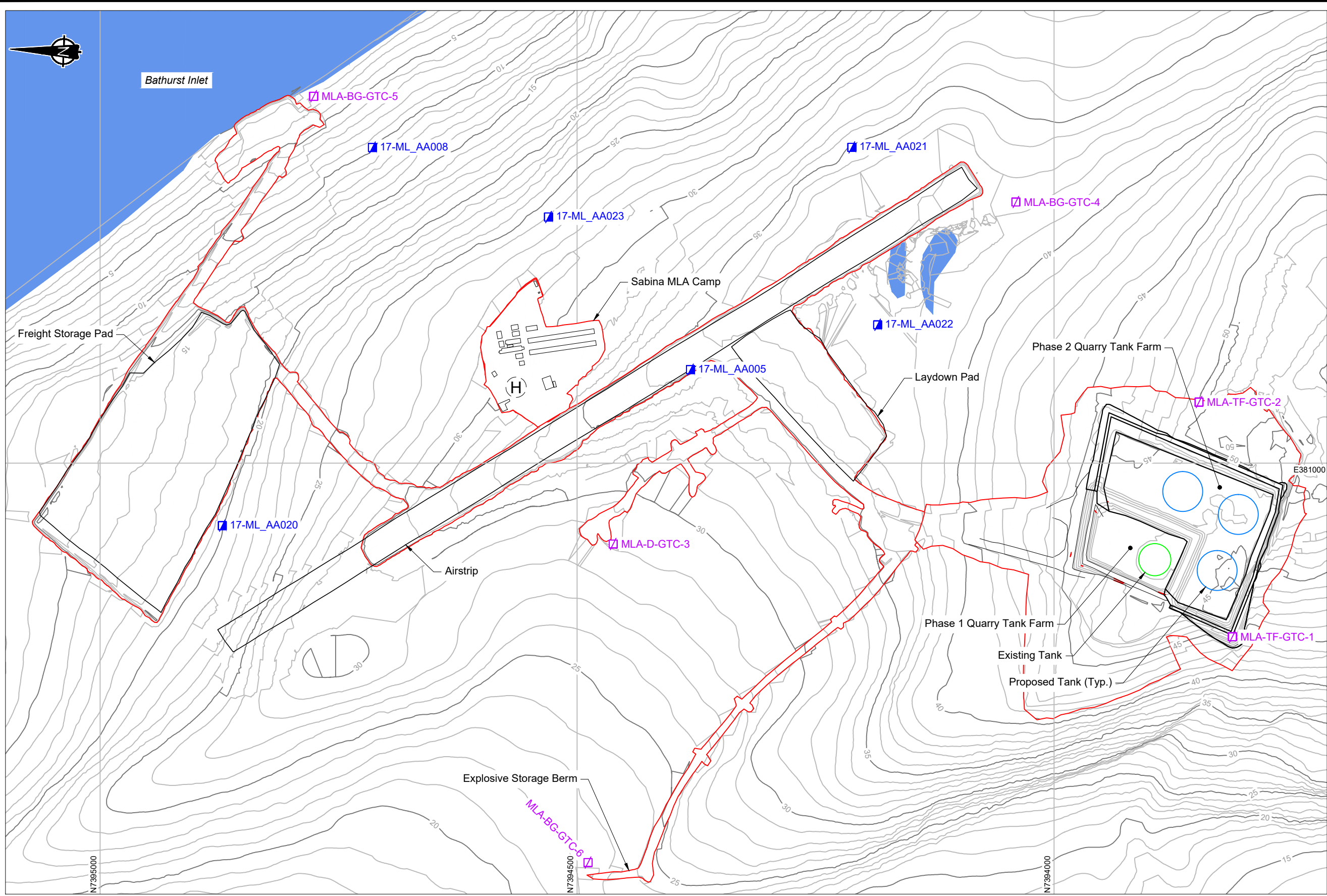
Goose Property - Historic and Recent Ground Temperature Sites

DATE: 2024-02-28

APPROVED: -

FIGURE: 2

C:\Users\jboke\SRK Consulting\F5203 Goose Lake (Back River) - 10401_AutCADACAD_C3D\CAPR003102_GroundThermalMonitoring Plan\CAPR003102_GTC Locations.dwg



LEGEND

- 2017 GTC
- 2024 (Planned GTC)
- Meteorological Station
- GTC Ground Temperature Cable
- Waterbody
- As-Constructed Infrastructure Boundaries

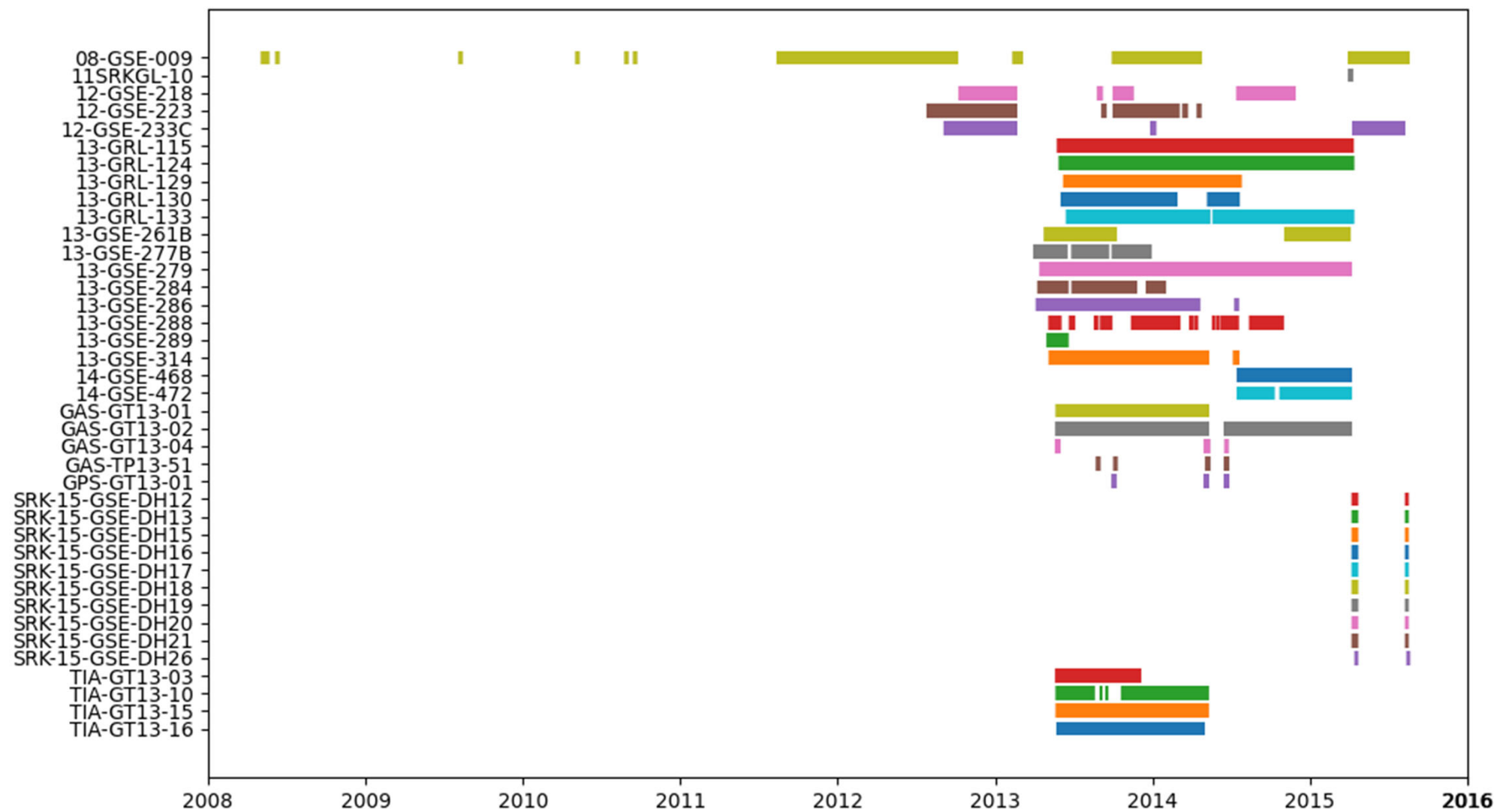
NOTES

- All units are in meters unless otherwise specified.
- Contours are shown at 1.0 m intervals.

REFERENCES

NAD83 UTM Zone 13.

Appendix B Ground Temperature Data



Notes:
1. Data record for inactive ground temperature site (historic sites).



Site-wide Ground Thermal Monitoring Plan

Historic Ground Temperature Sites –
Data Record

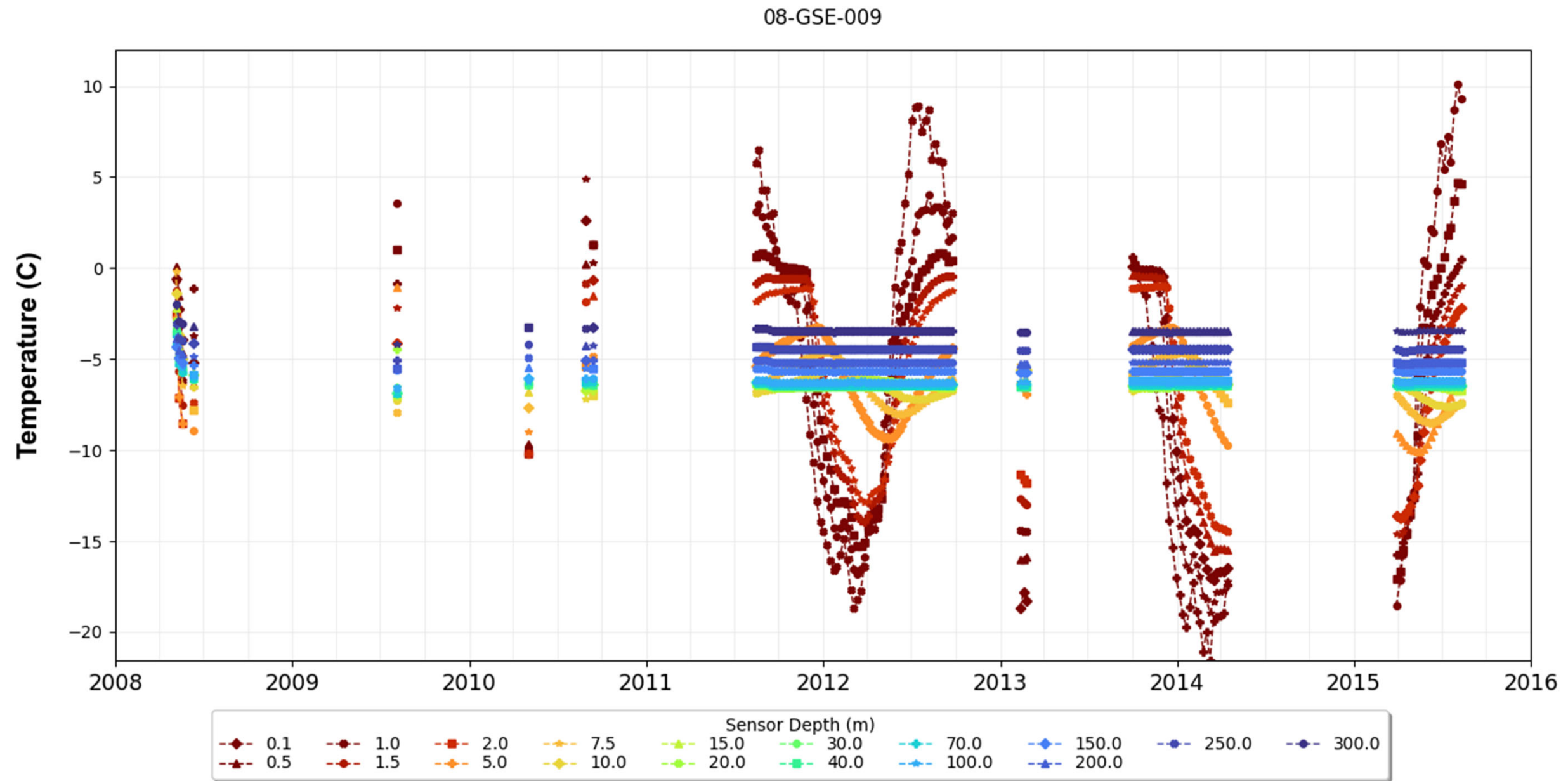
Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx

Back River

Date:
March 2024

Approved:
CWS

Figure: **B-1**



Notes:
1. Average weekly ground temperature shown.

 **srk consulting**

Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

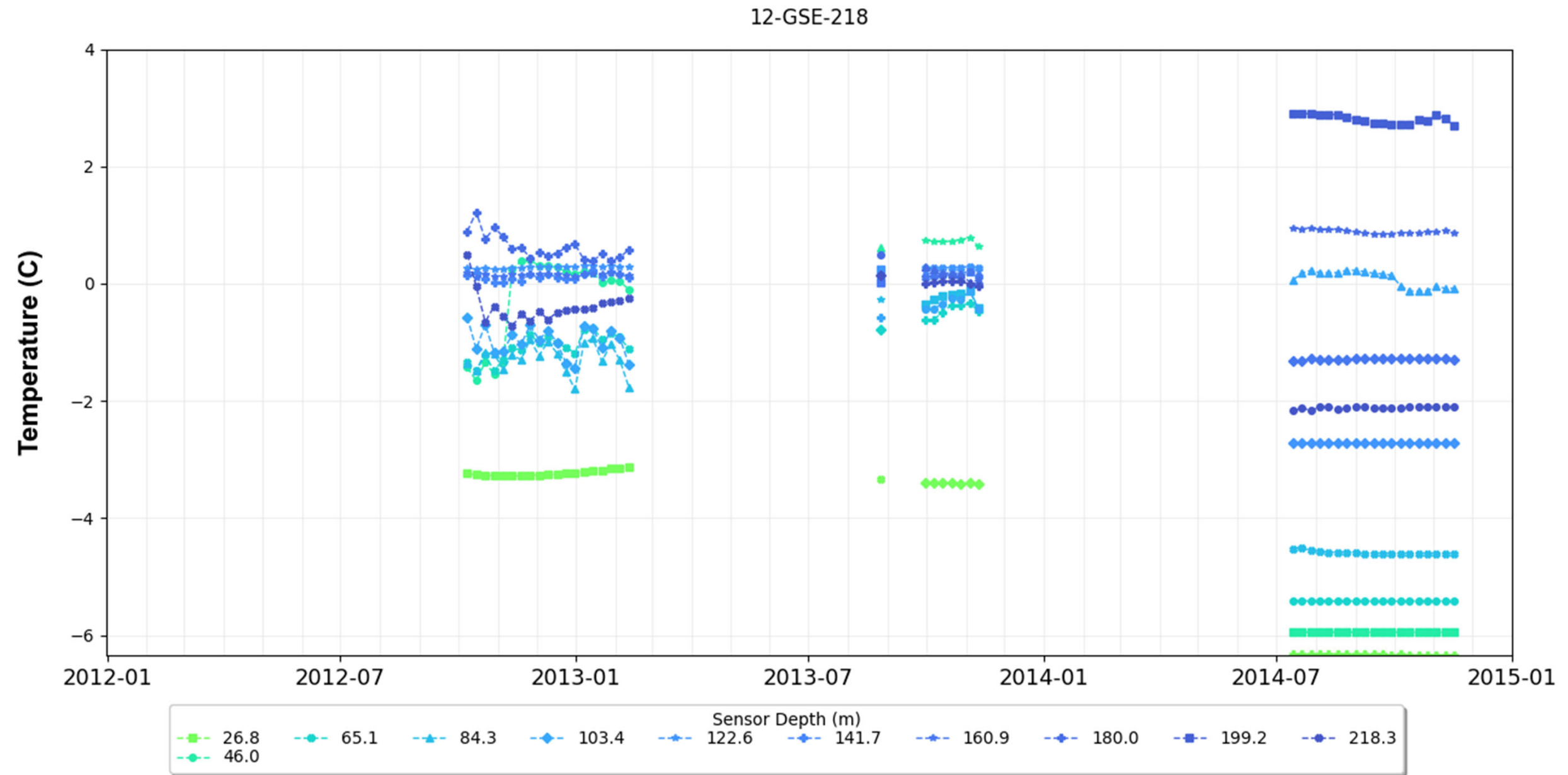
Site-wide Ground Thermal Monitoring Plan

Historic Ground Temperature Site –
08-GSE-009

Date:
March 2024

Approved:
CWS

Figure: **B-2**



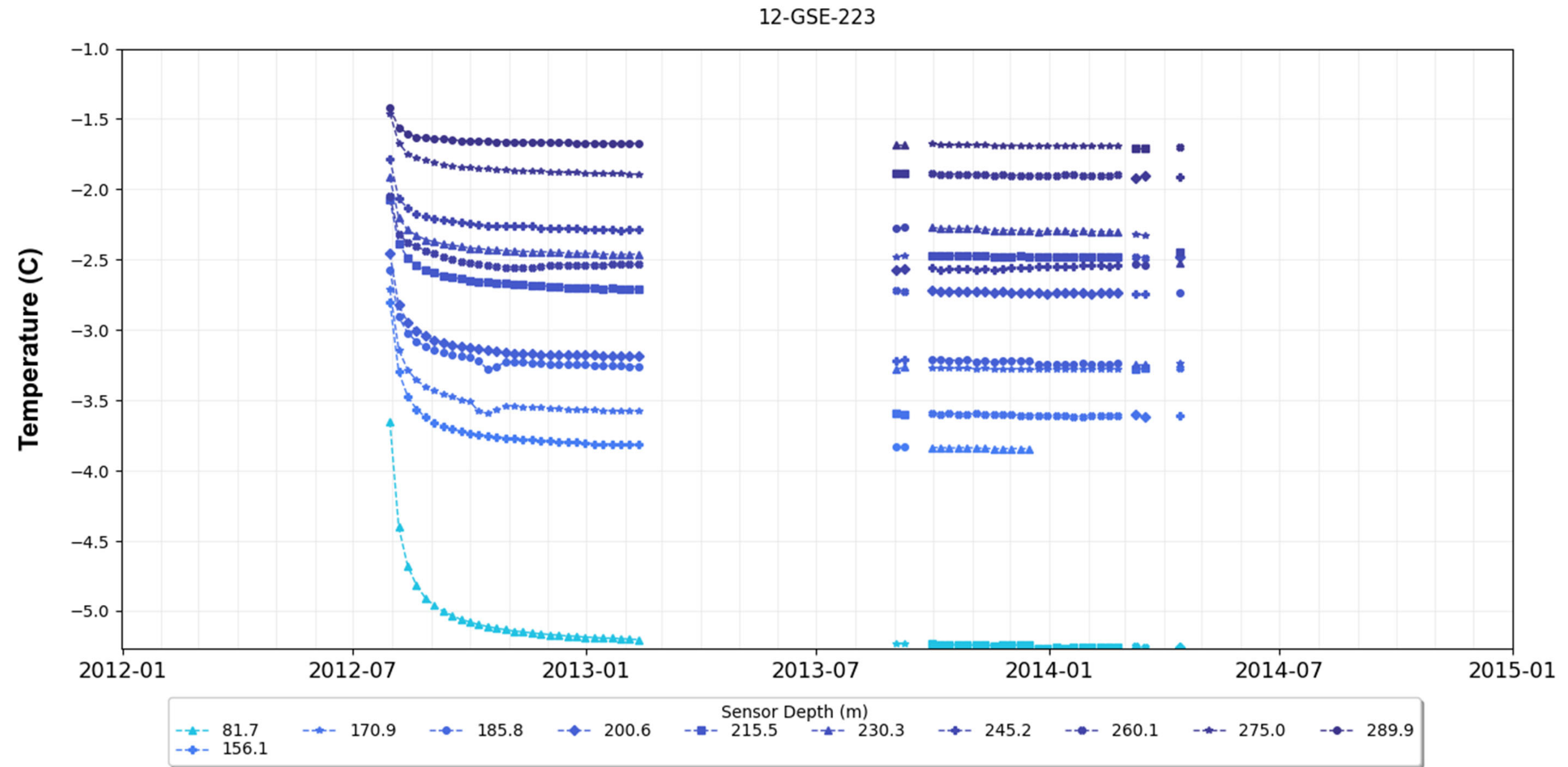
Notes:
1. Average weekly ground temperature shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx

Back River

Site-wide Ground Thermal Monitoring Plan		
Historic Ground Temperature Site – 12-GSE-218		
Date: March 2024	Approved: CWS	Figure: B-3



Notes:
1. Average weekly ground temperature shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

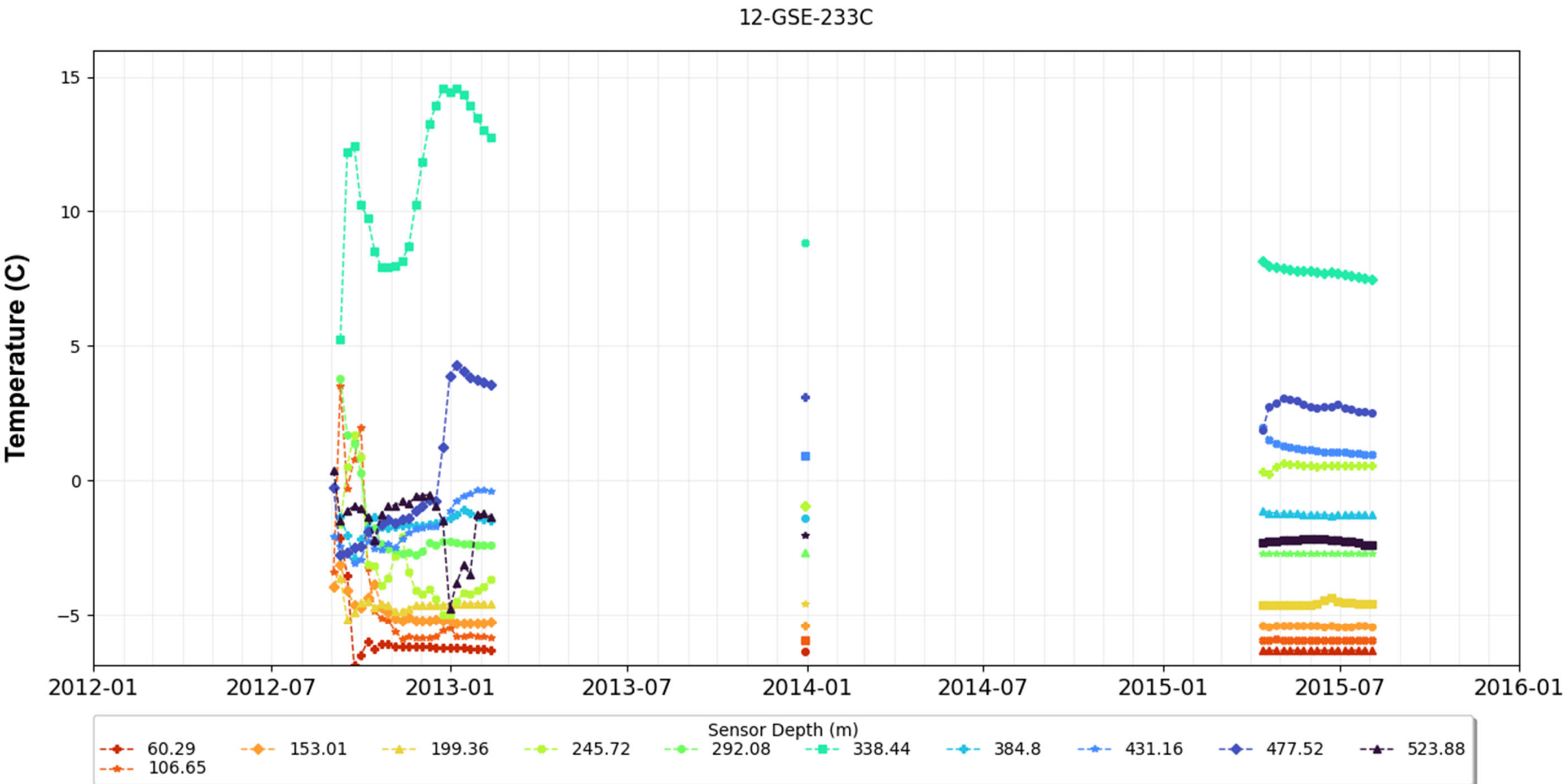
Site-wide Ground Thermal Monitoring Plan

Historic Ground Temperature Site –
12-GSE-223

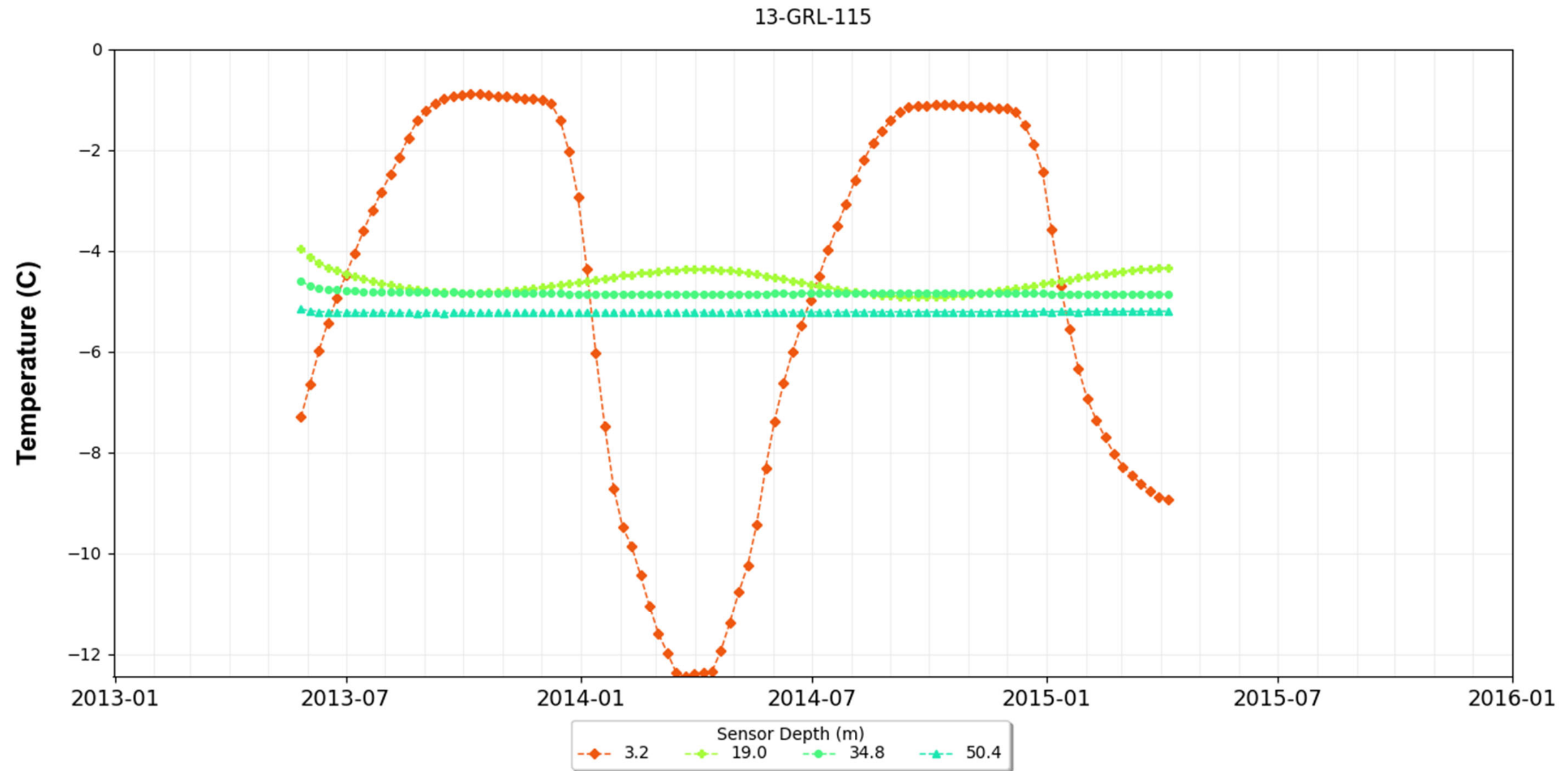
Date:
March 2024

Approved:
CWS

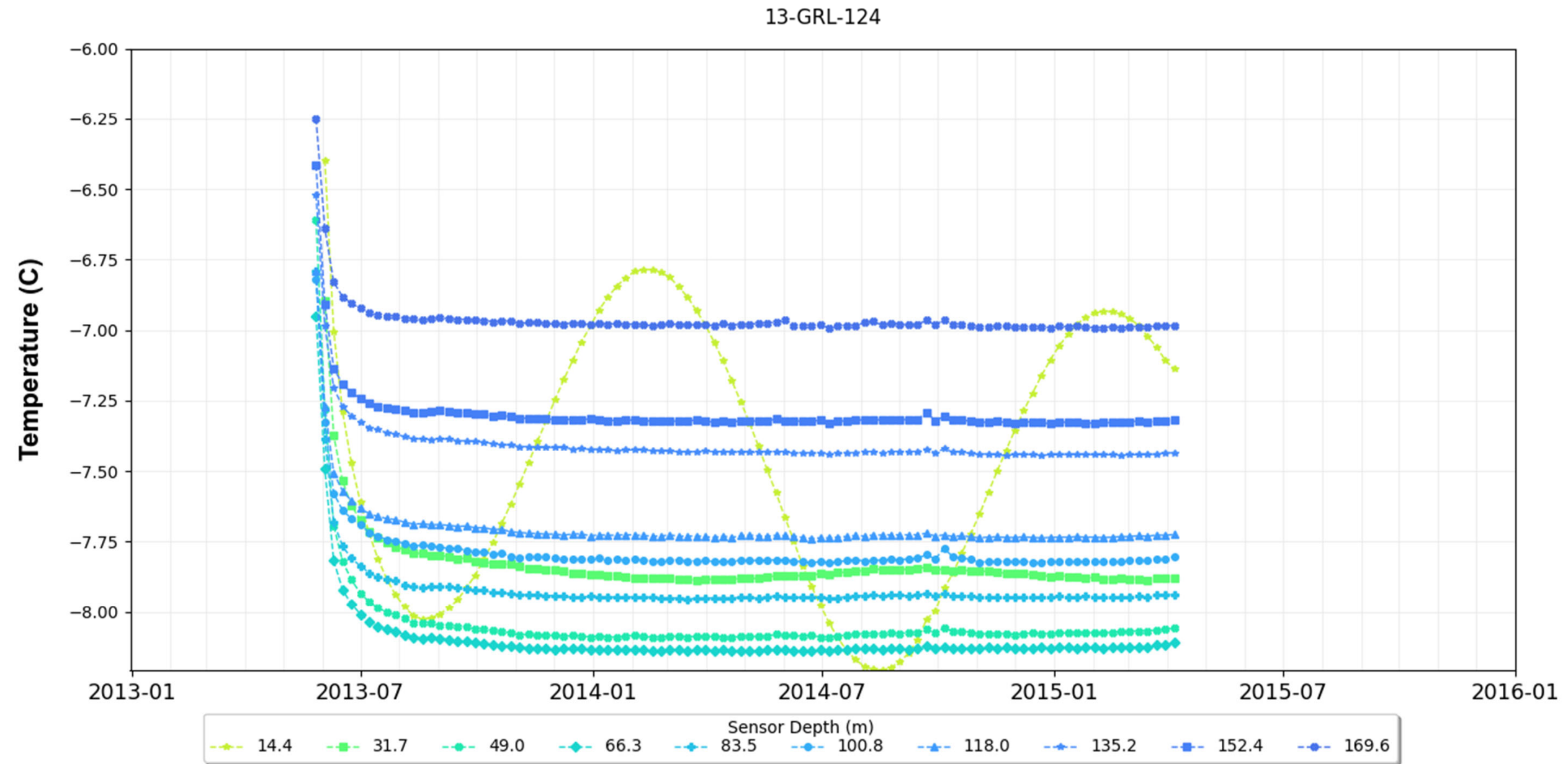
Figure: **B-4**



Notes:
1. Average weekly ground temperature shown.



Notes:
1. Average weekly ground temperature shown.



Notes:
1. Average weekly ground temperature shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

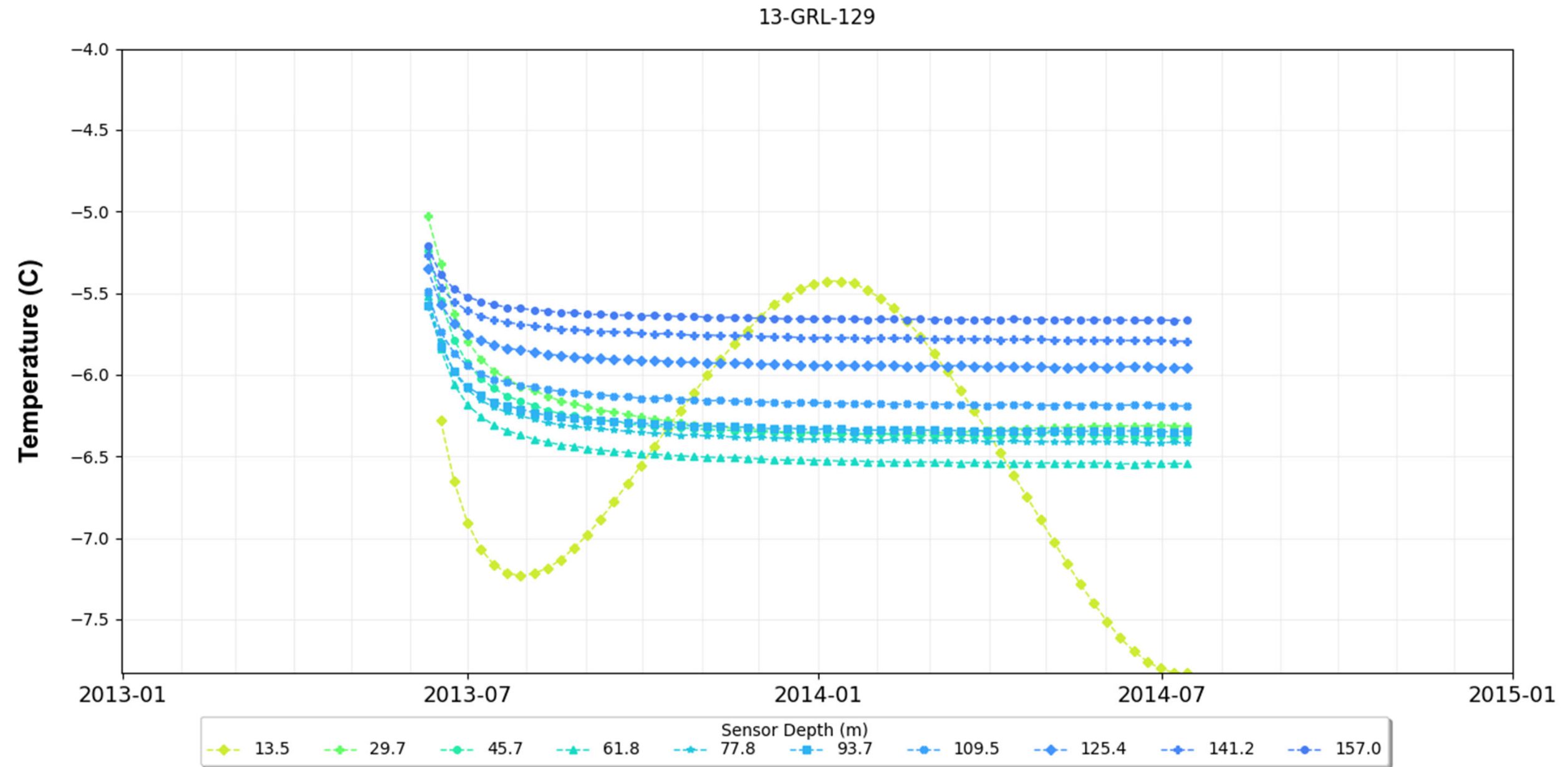
Site-wide Ground Thermal Monitoring Plan

Historic Ground Temperature Site –
13-GRL-124

Date:
March 2024

Approved:
CWS

Figure: **B-7**



Notes:
1. Average weekly ground temperature shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

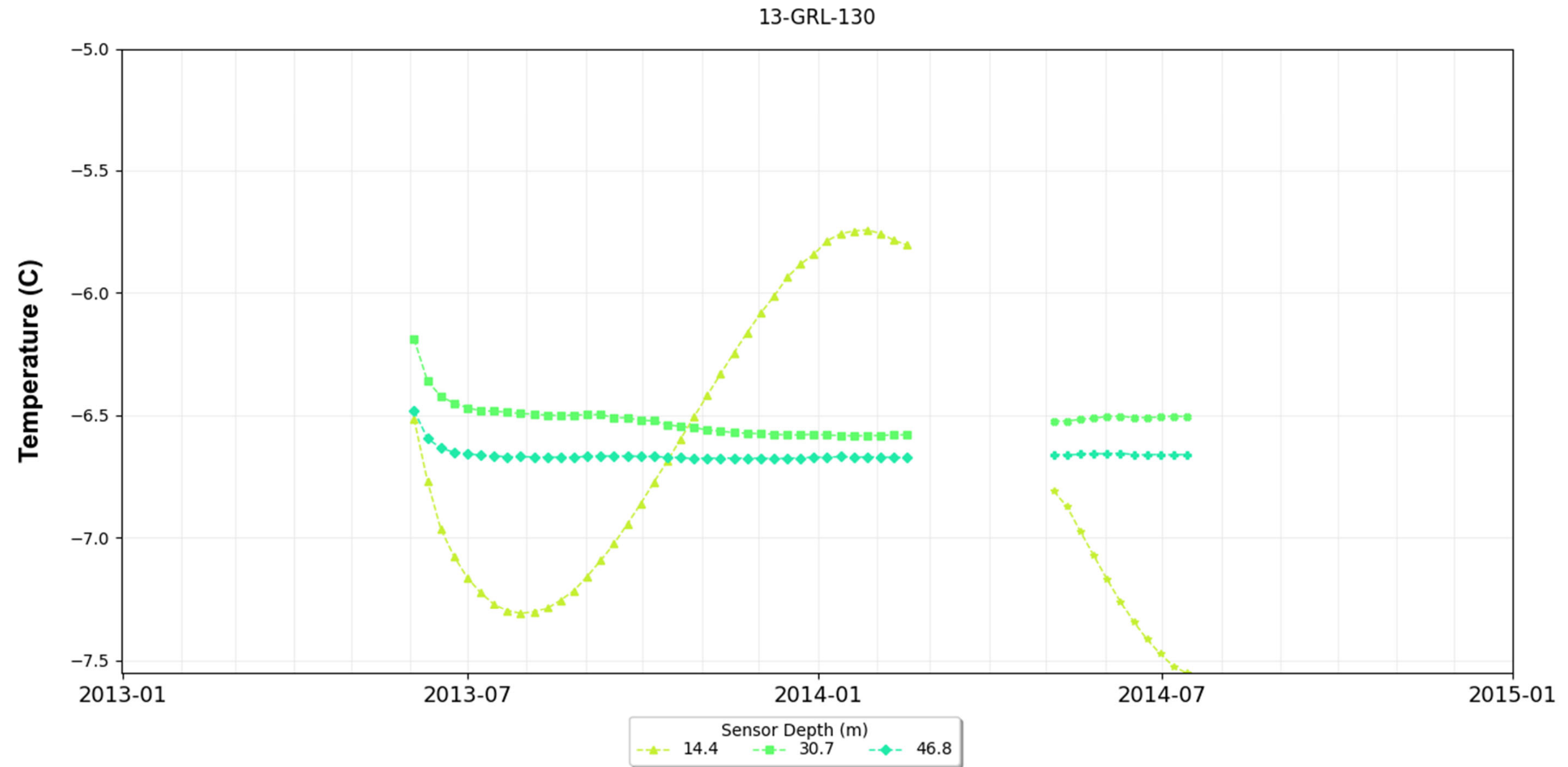
Site-wide Ground Thermal Monitoring Plan

Historic Ground Temperature Site –
13-GRL-129

Date:
March 2024

Approved:
CWS

Figure: **B-8**



Notes:
1. Average weekly ground temperature shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

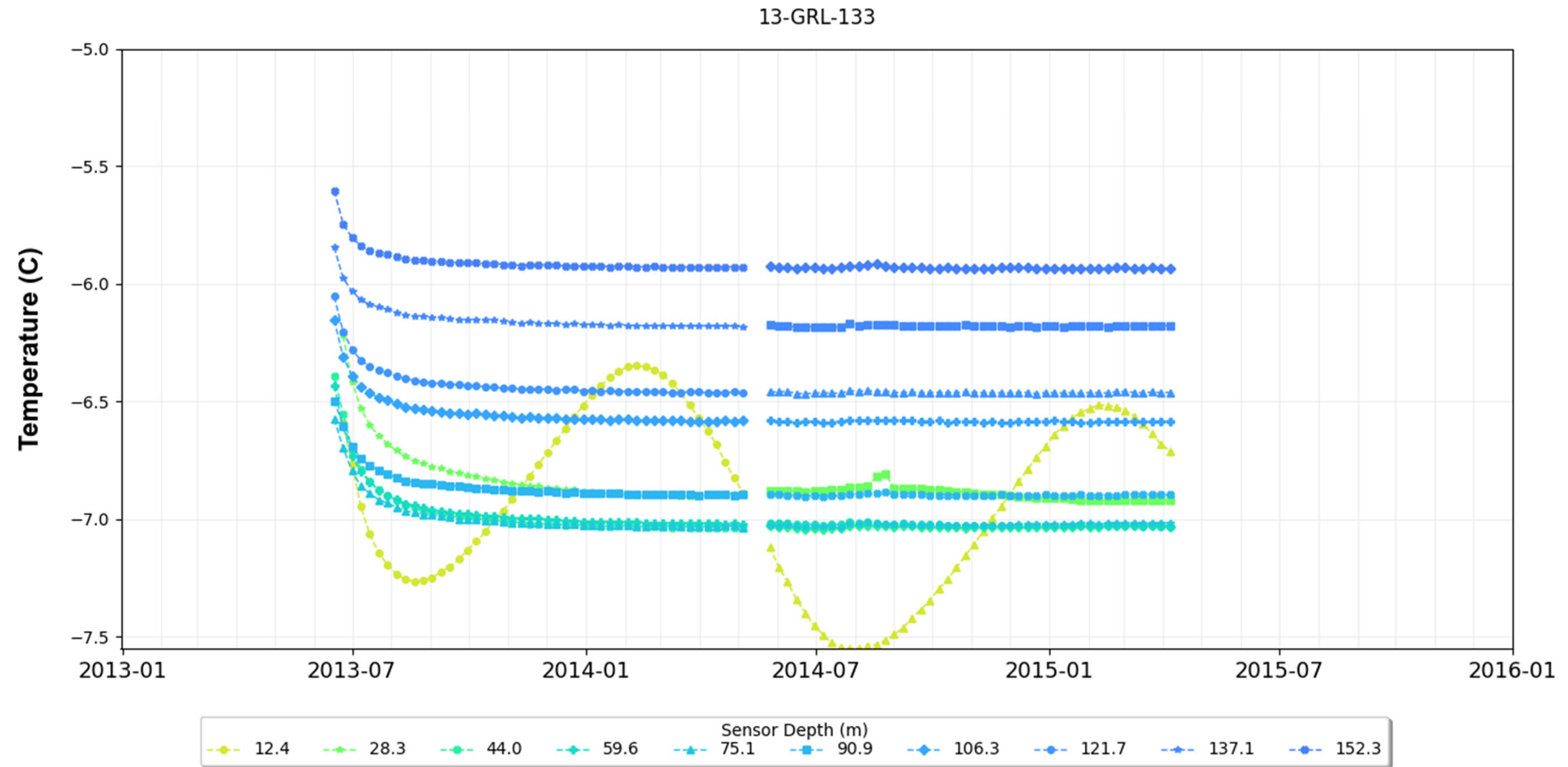
Site-wide Ground Thermal Monitoring Plan

Historic Ground Temperature Site –
13-GRL-130

Date:
March 2024

Approved:
CWS

Figure: **B-9**



Notes:
1. Average weekly ground temperature shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

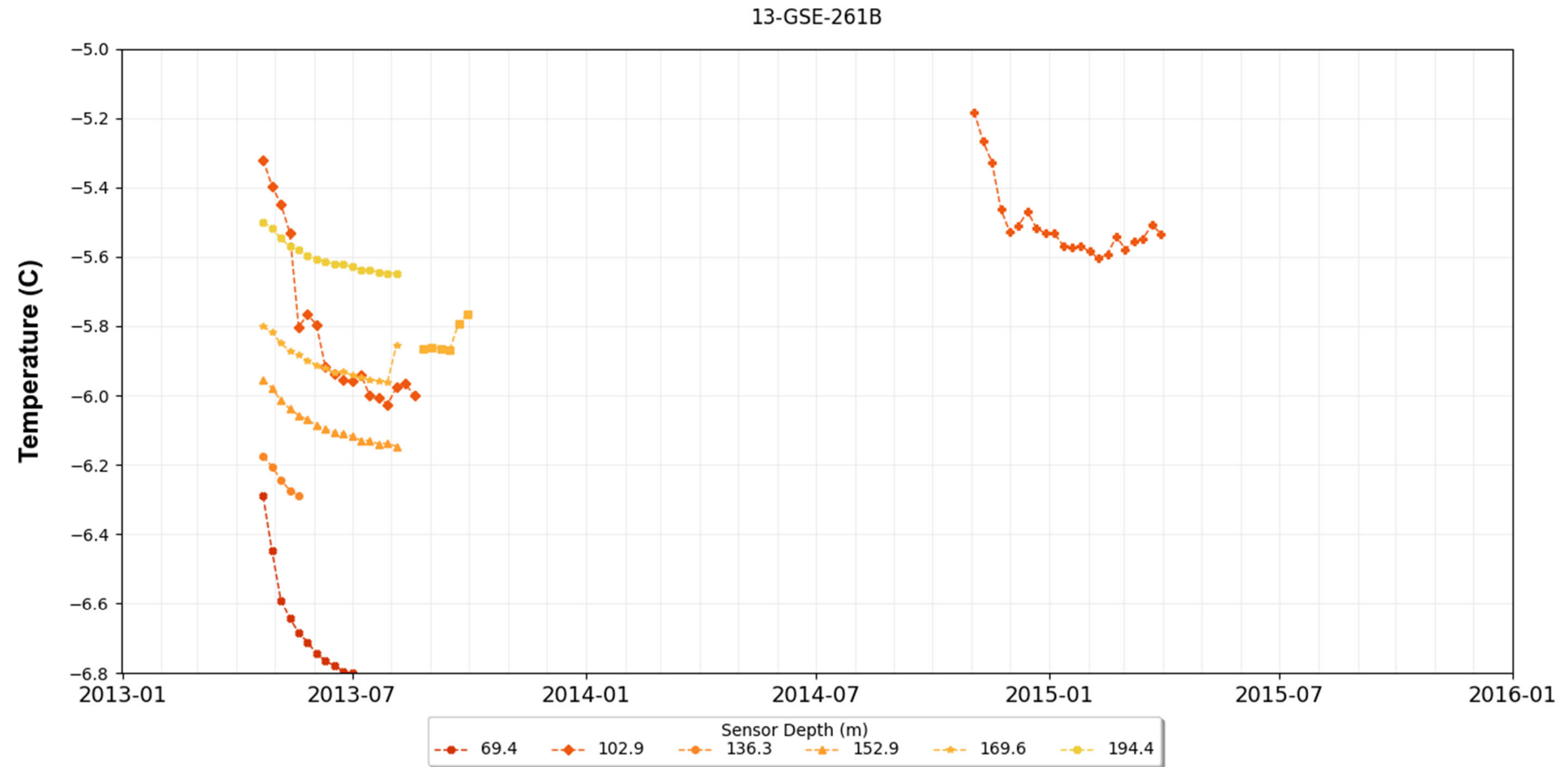
Site-wide Ground Thermal Monitoring Plan

Historic Ground Temperature Site –
13-GRL-133

Date:
March 2024

Approved:
CWS

Figure: **B-10**



Notes:
1. Average weekly ground temperature shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

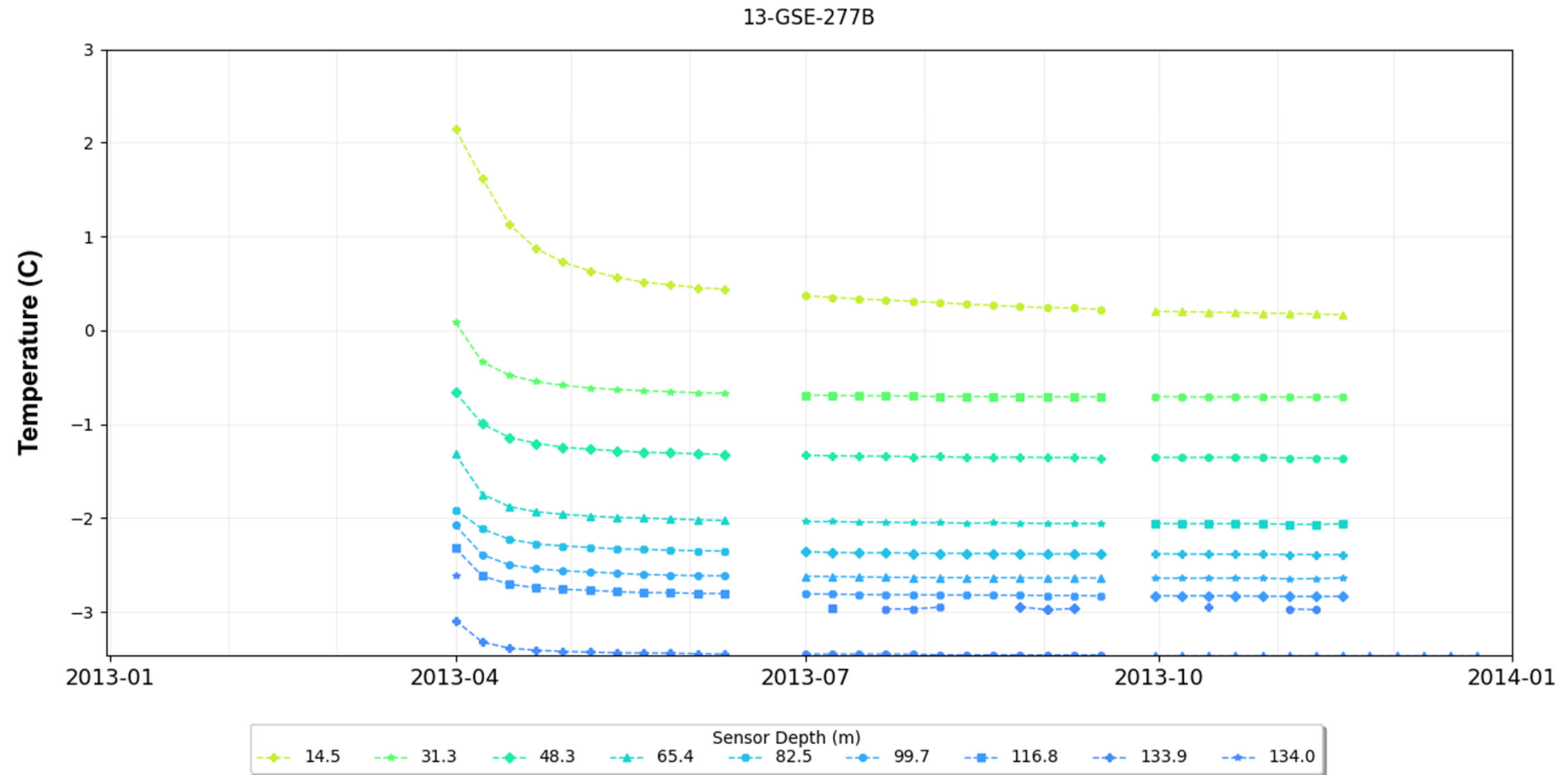
Site-wide Ground Thermal Monitoring Plan

Historic Ground Temperature Site –
13-GSE-261B

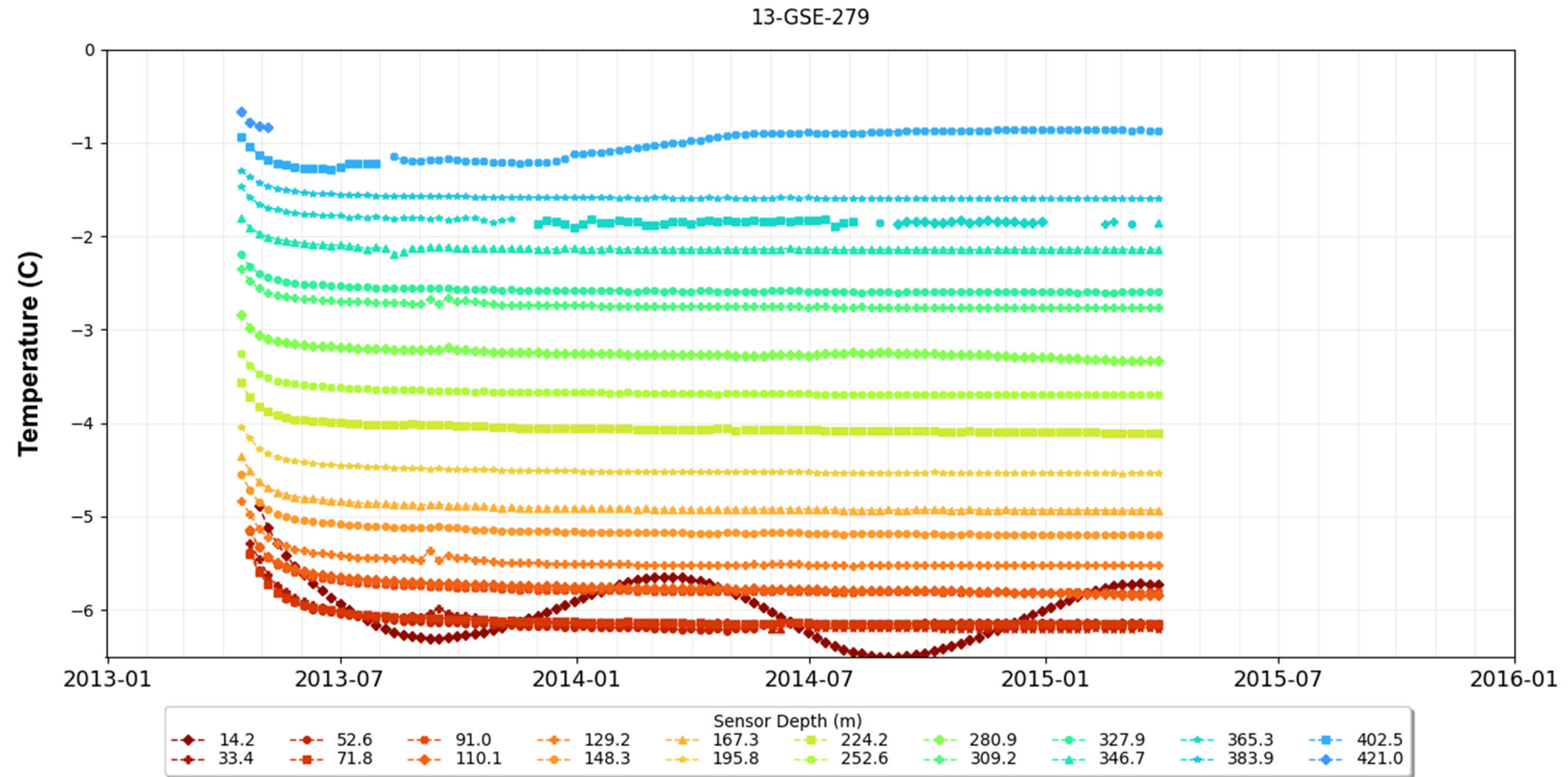
Date:
March 2024

Approved:
CWS

Figure: **B-11**



Notes:
1. Average weekly ground temperature shown.



Notes:
1. Average weekly ground temperature shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

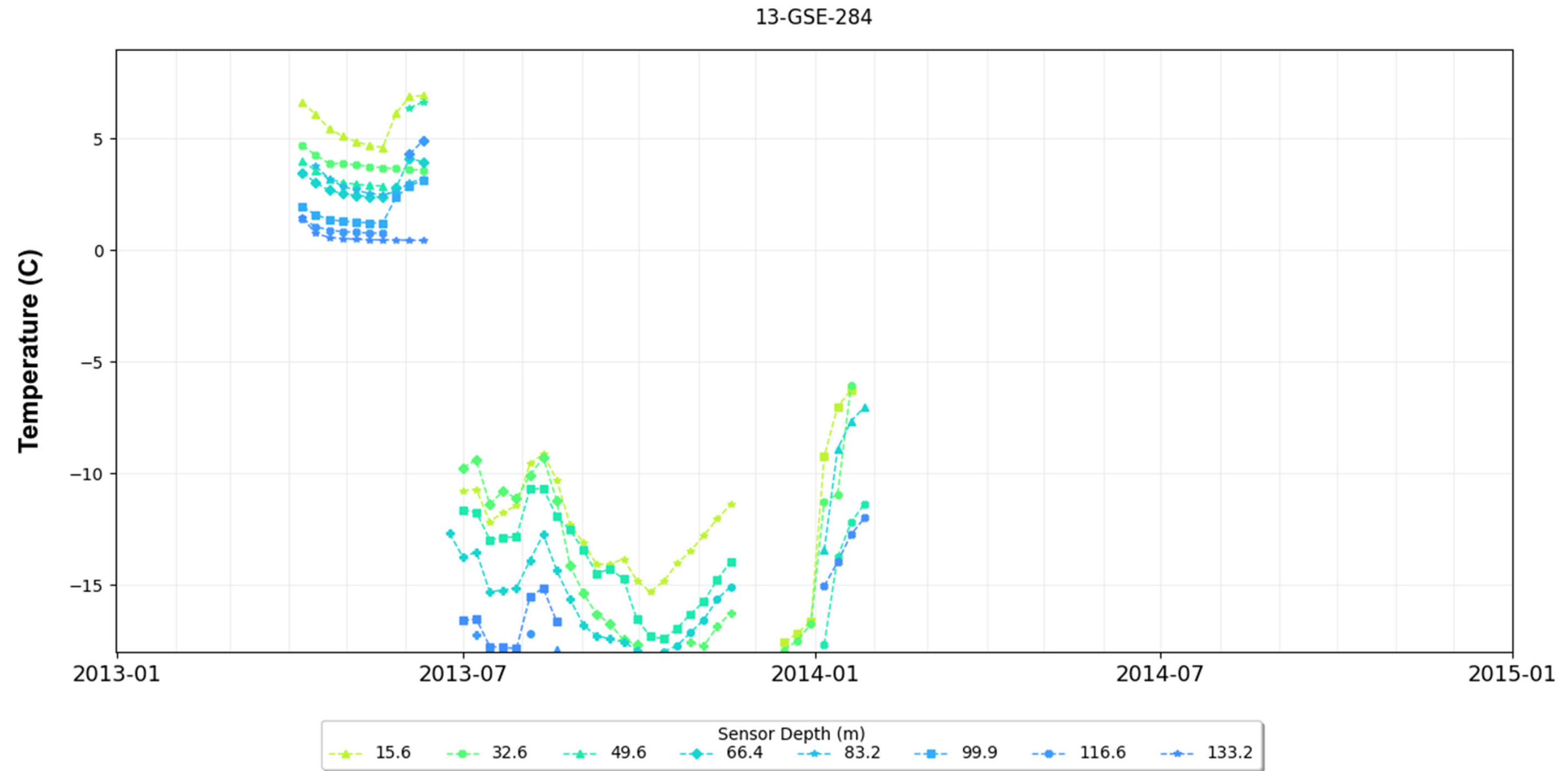
Site-wide Ground Thermal Monitoring Plan

Historic Ground Temperature Site –
13-GSE-279

Date:
March 2024

Approved:
CWS

Figure: **B-13**



Notes:
1. Average weekly ground temperature shown.



Site-wide Ground Thermal Monitoring Plan

Historic Ground Temperature Site –
13-GSE-284

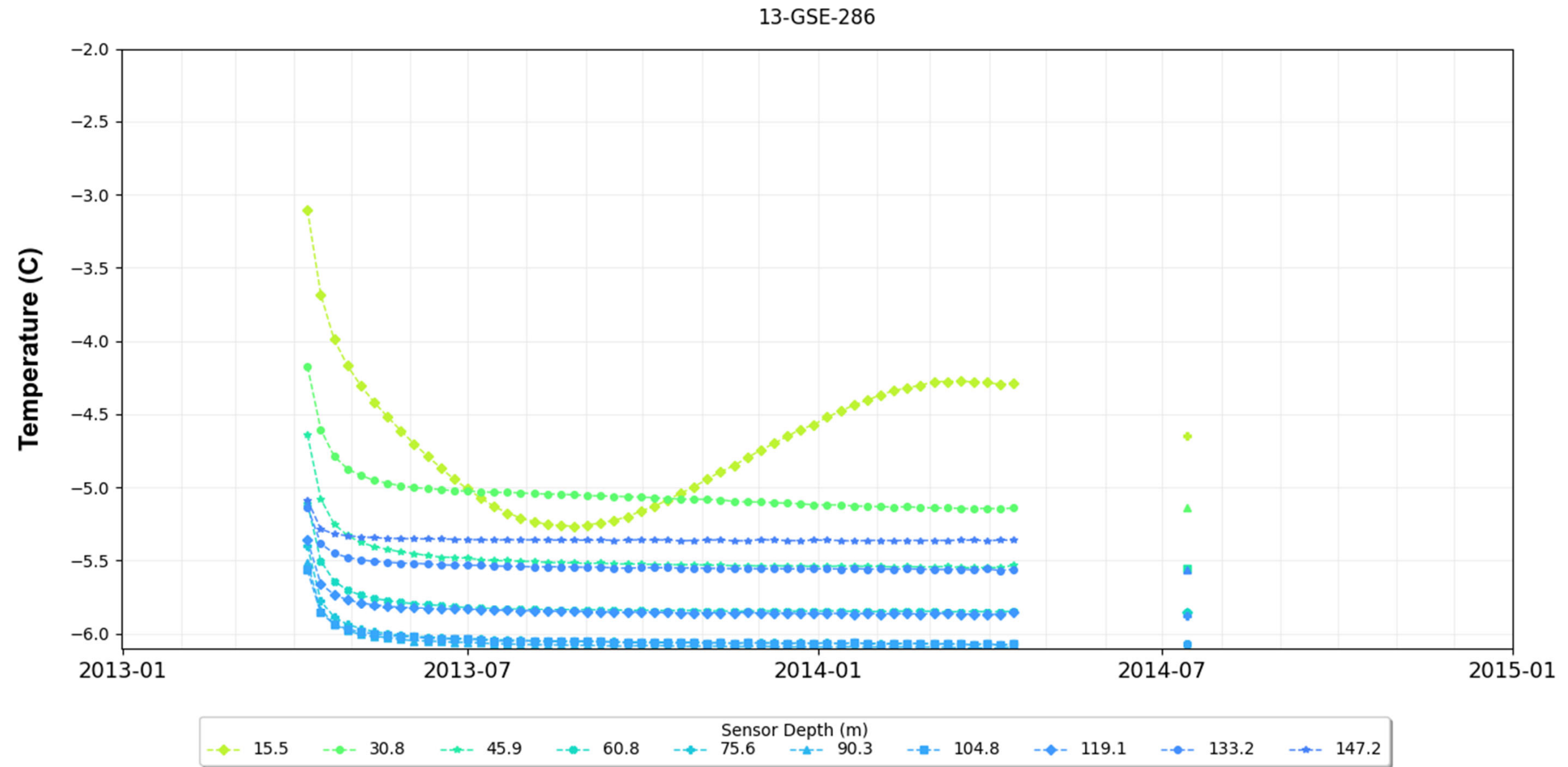
Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx

Back River

Date:
March 2024

Approved:
CWS

Figure: **B-14**



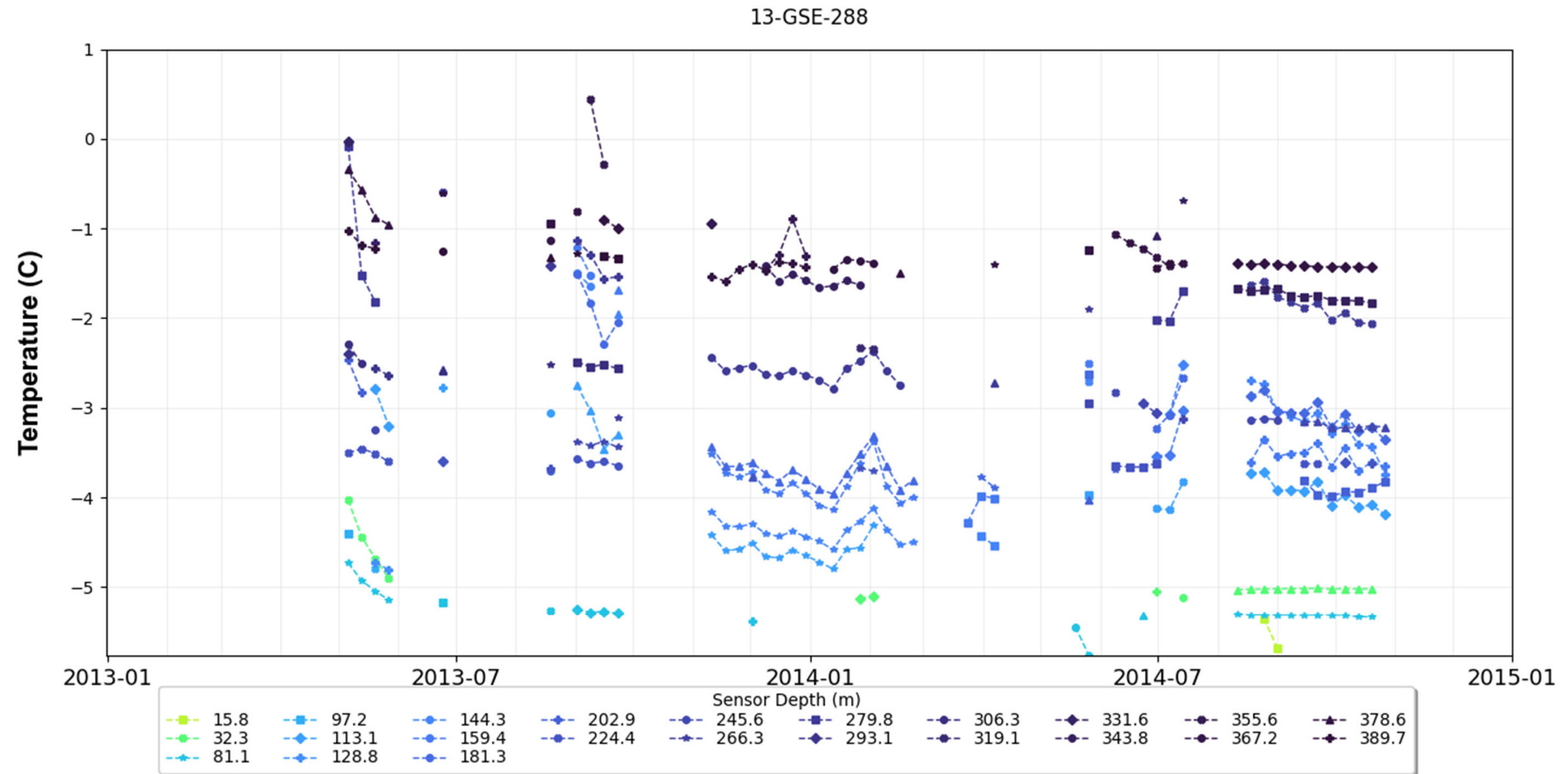
Notes:
 1. Average weekly ground temperature shown.



Job No: CAPR003102
 Filename: Appendix_GroundThermal.pptx

Back River

Site-wide Ground Thermal Monitoring Plan		
Historic Ground Temperature Site – 13-GSE-286		
Date: March 2024	Approved: CWS	Figure: B-15



Notes:
1. Average weekly ground temperature shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx

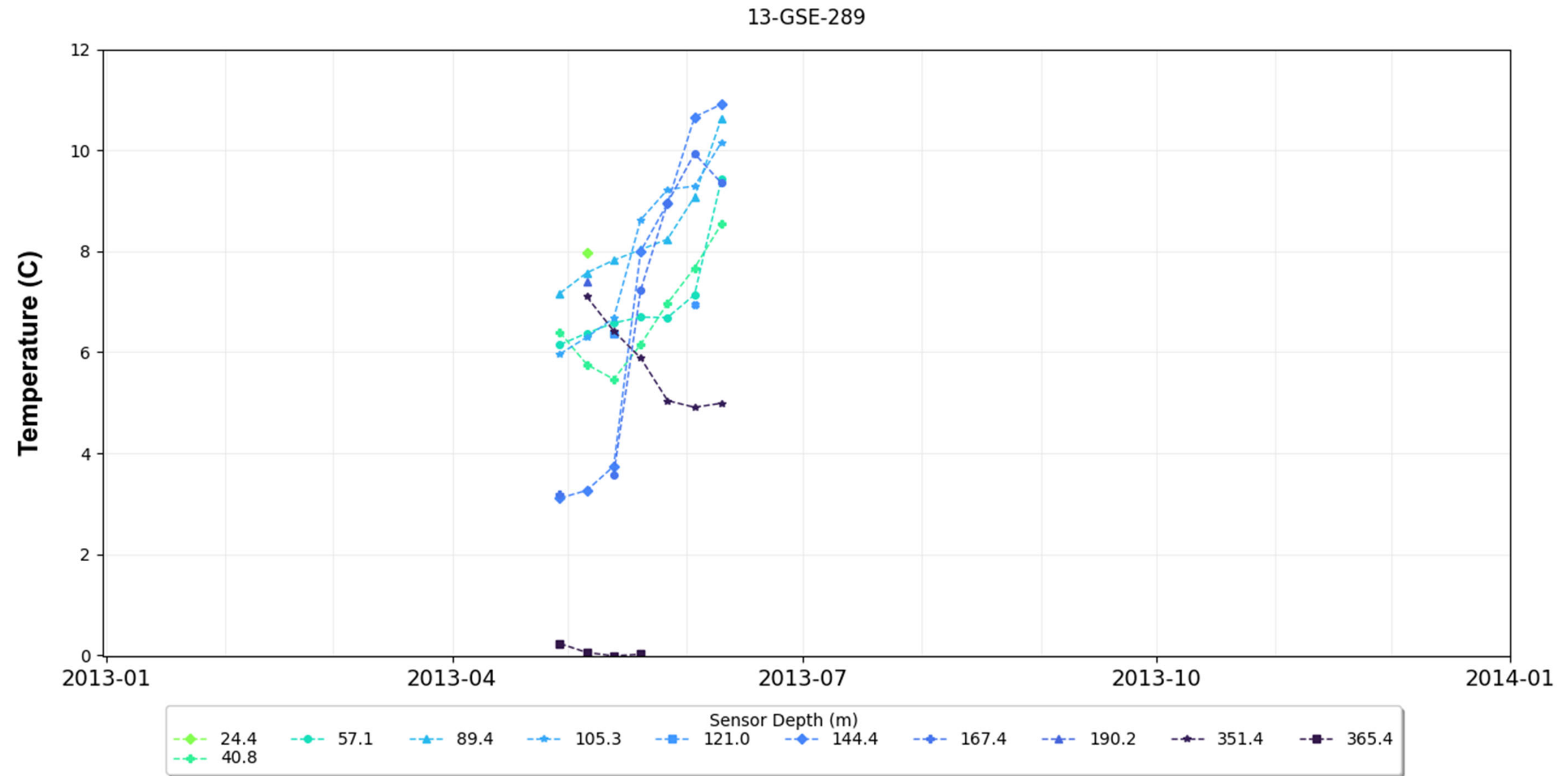


Back River

Site-wide Ground Thermal Monitoring Plan

Historic Ground Temperature Site –
13-GSE-288

Date: March 2024	Approved: CWS	Figure: B-16
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Notes:
1. Average weekly ground temperature shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

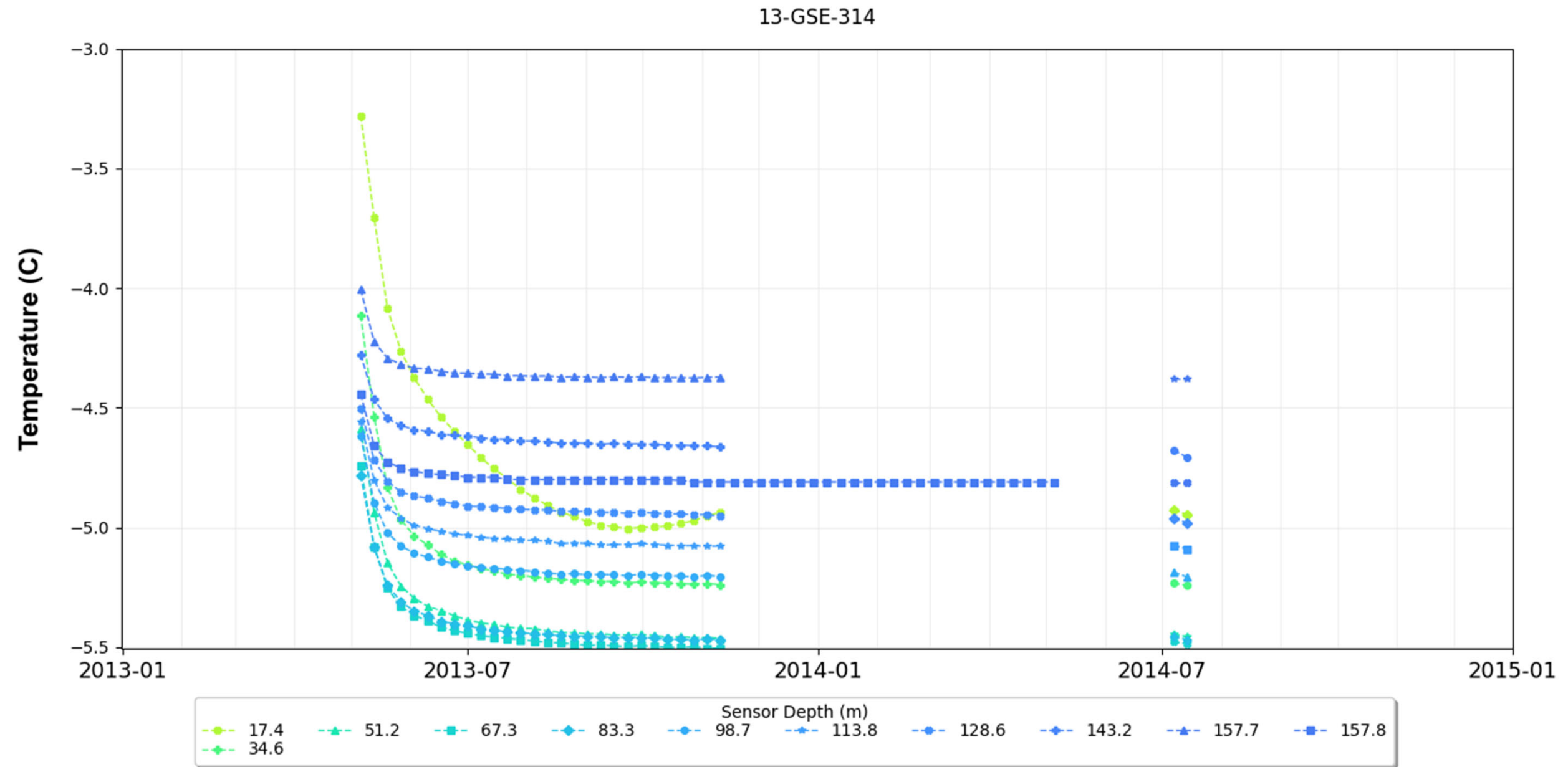
Site-wide Ground Thermal Monitoring Plan

Historic Ground Temperature Site –
13-GSE-289

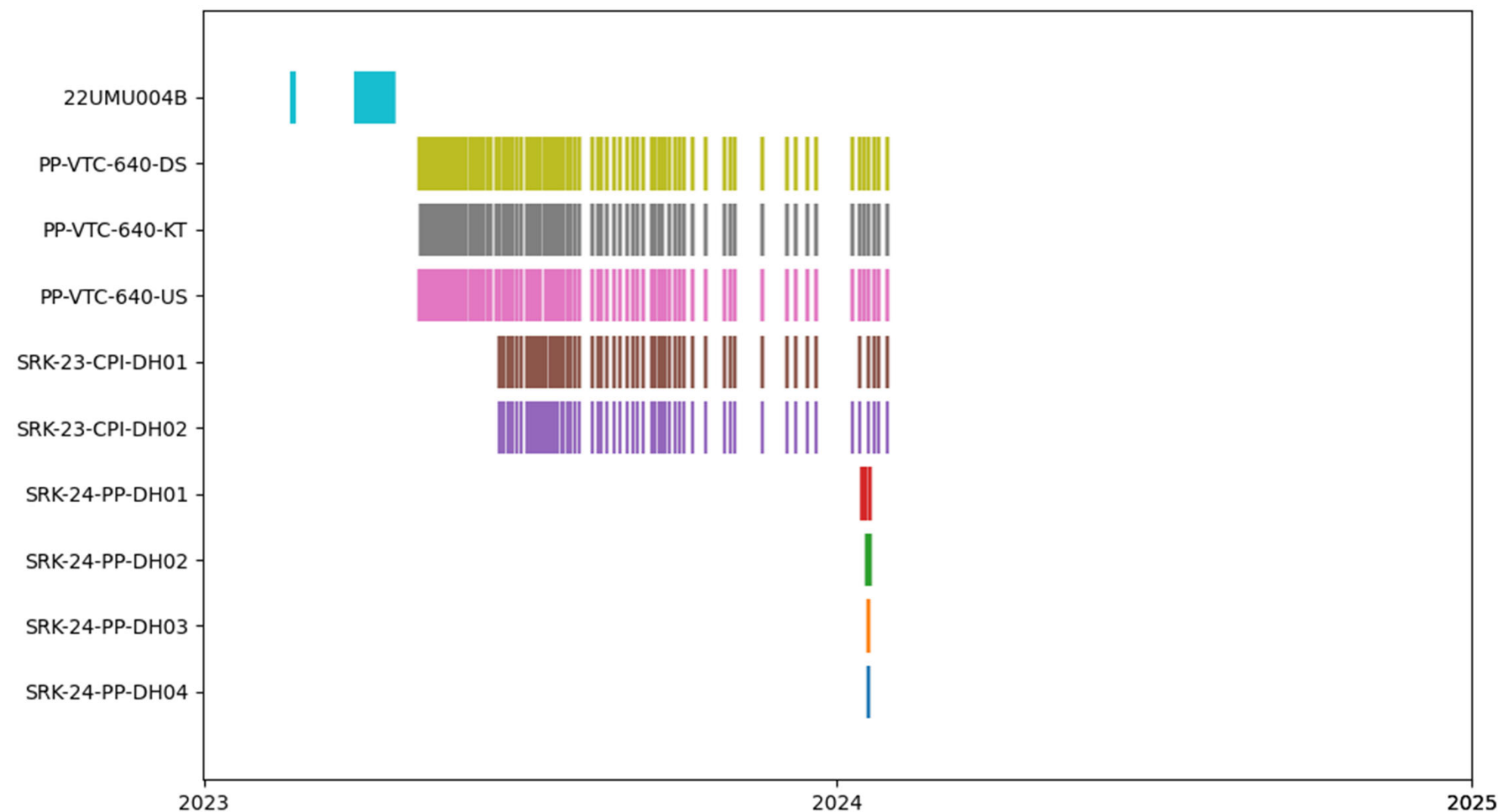
Date:
March 2024

Approved:
CWS

Figure: **B-17**



Notes:
1. Average weekly ground temperature shown.



Notes:

1. Data record for active and temporary ground temperature site (recent sites).
2. Temporary ground temperature sites installed to support Primary Pond Dam construction include SRK-24-PP-DH01, -DH02, -DH03, and -DH04.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

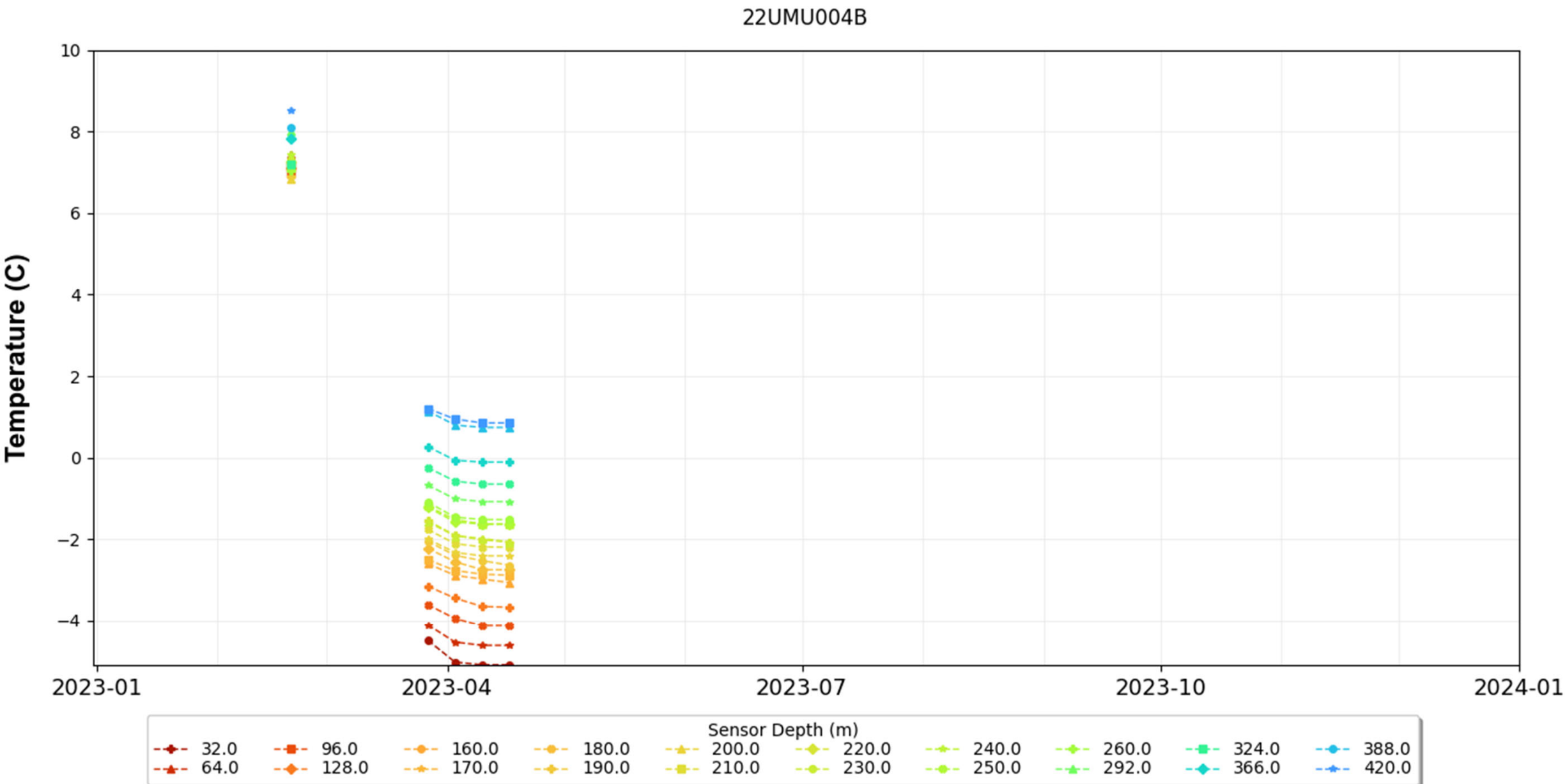
Site-wide Ground Thermal Monitoring Plan

Recent Ground Temperature Sites –
Data Record

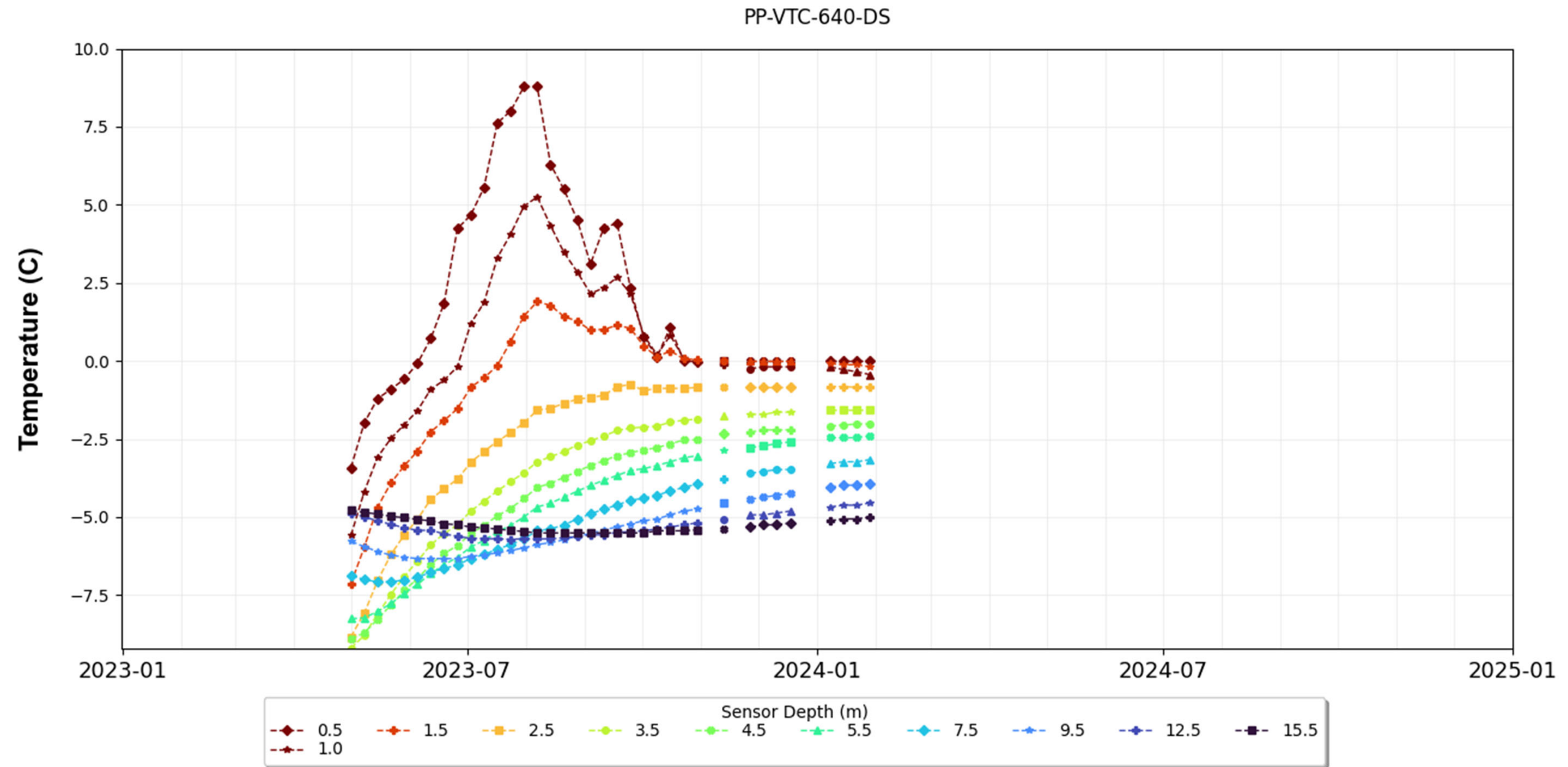
Date:
March 2024

Approved:
CWS

Figure: **B-19**



Notes:
1. Average weekly ground temperature shown.



Notes:
1. Average weekly ground temperature shown.

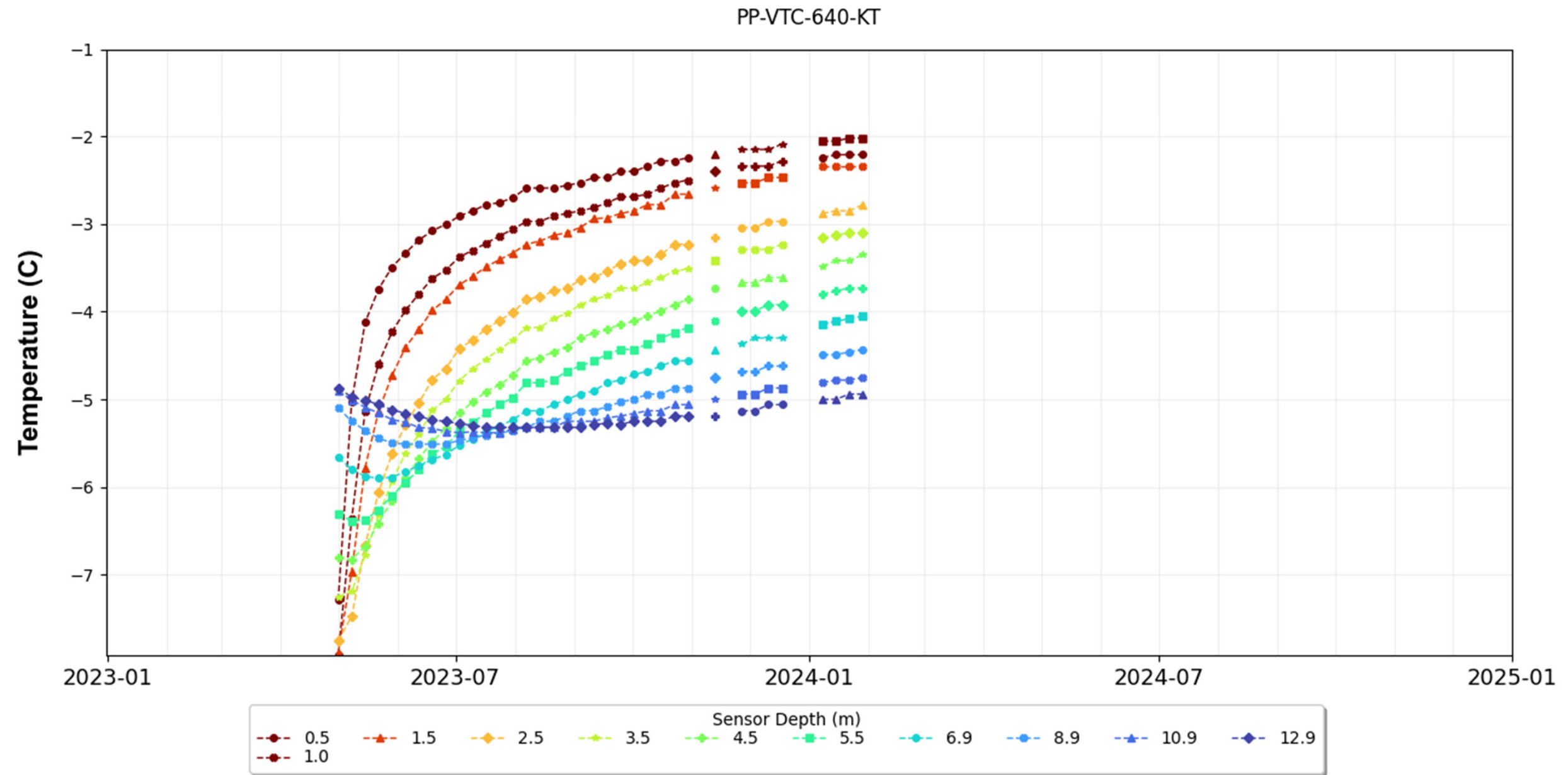


Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

Site-wide Ground Thermal Monitoring Plan		
Recent Ground Temperature Site – PP-VTC-640-DS		
Date: March 2024	Approved: CWS	Figure: B-21



Notes:
1. Average weekly ground temperature shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

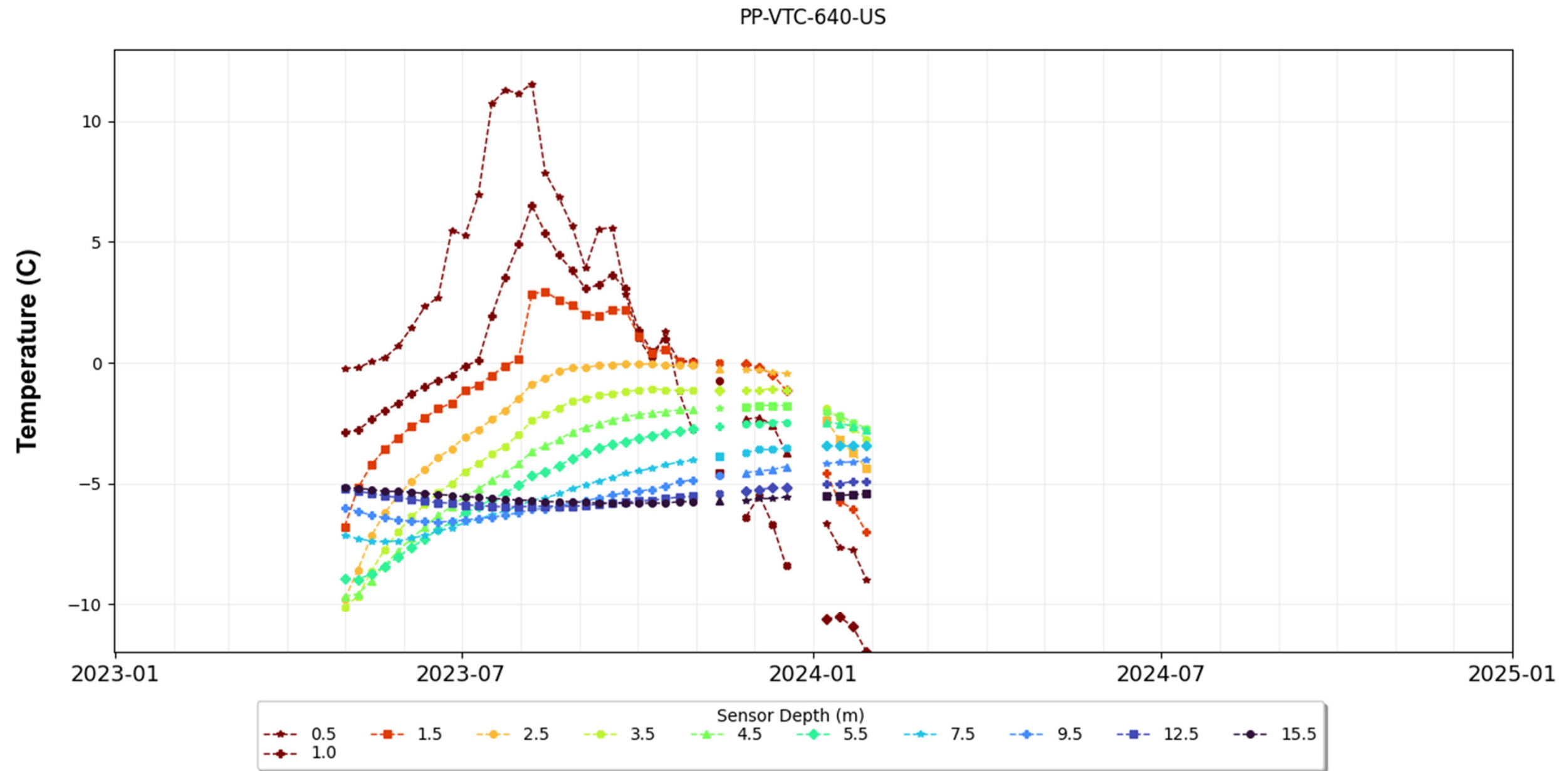
Site-wide Ground Thermal Monitoring Plan

Recent Ground Temperature Site –
PP-VTC-640-KT

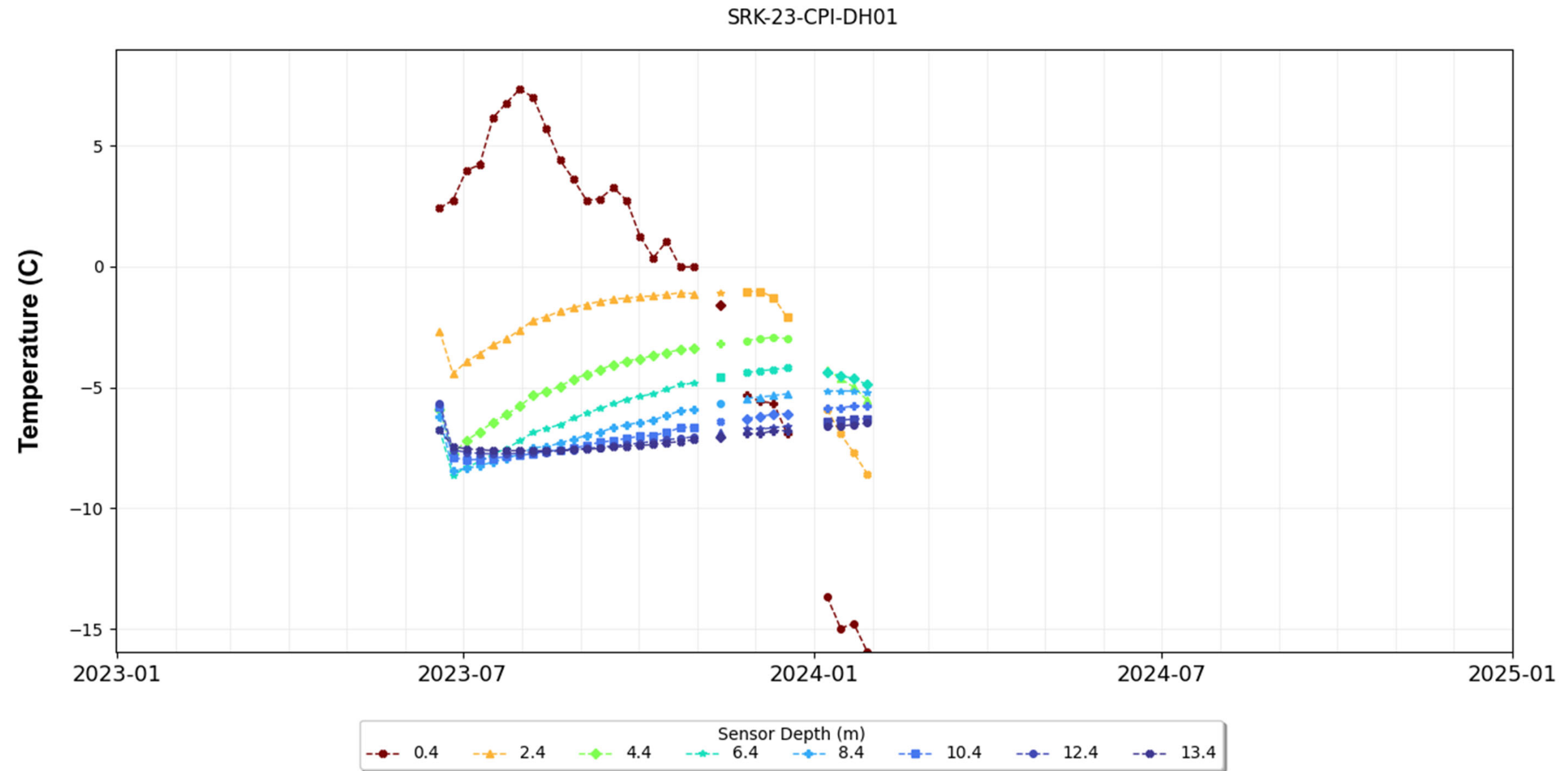
Date:
March 2024

Approved:
CWS

Figure: **B-22**



Notes:
1. Average weekly ground temperature shown.



Notes:
1. Average weekly ground temperature shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

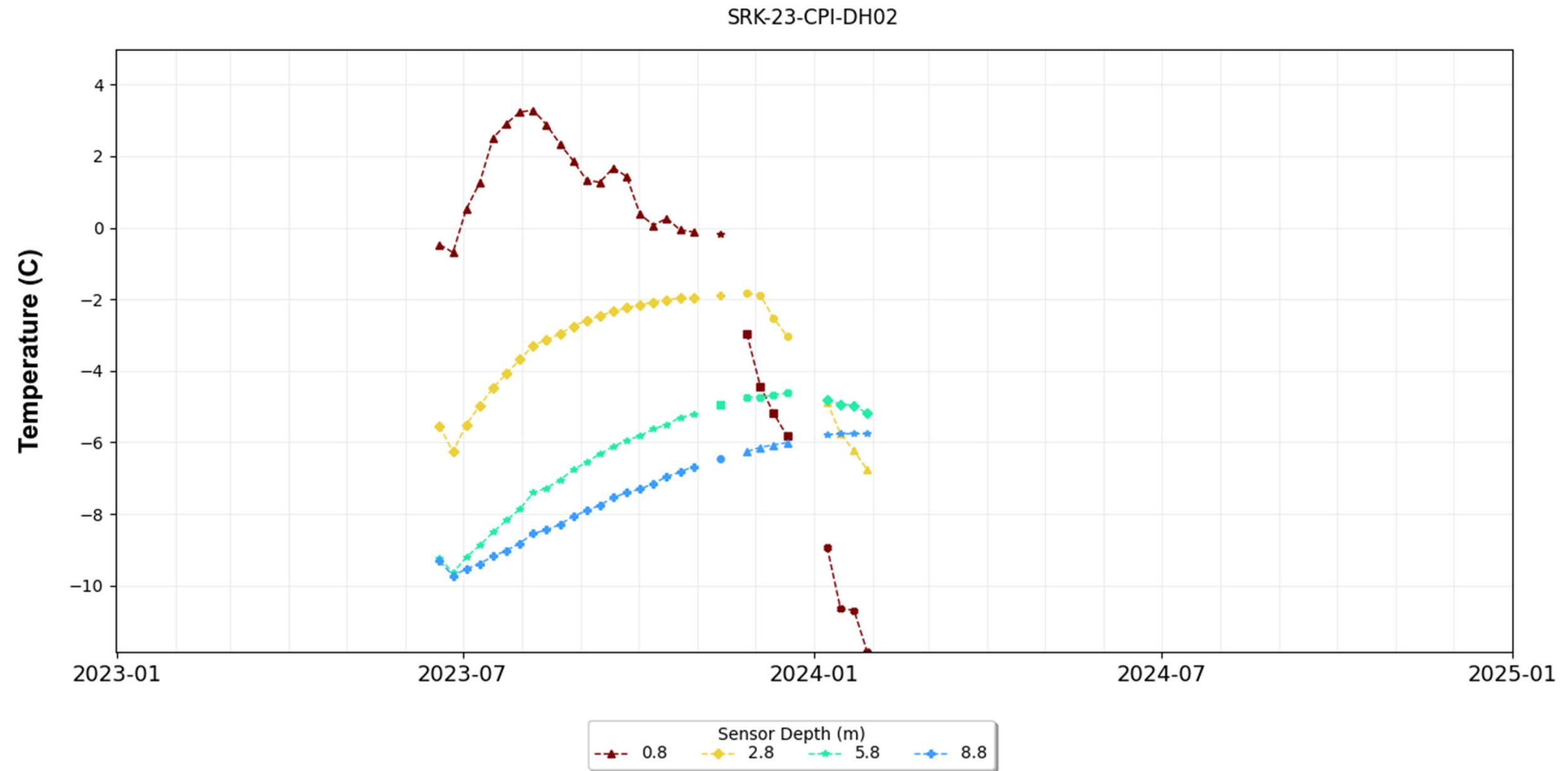
Site-wide Ground Thermal Monitoring Plan

Recent Ground Temperature Site –
SRK-23-CPI-DH01

Date:
March 2024

Approved:
CWS

Figure: **B-24**



Notes:
1. Average weekly ground temperature shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

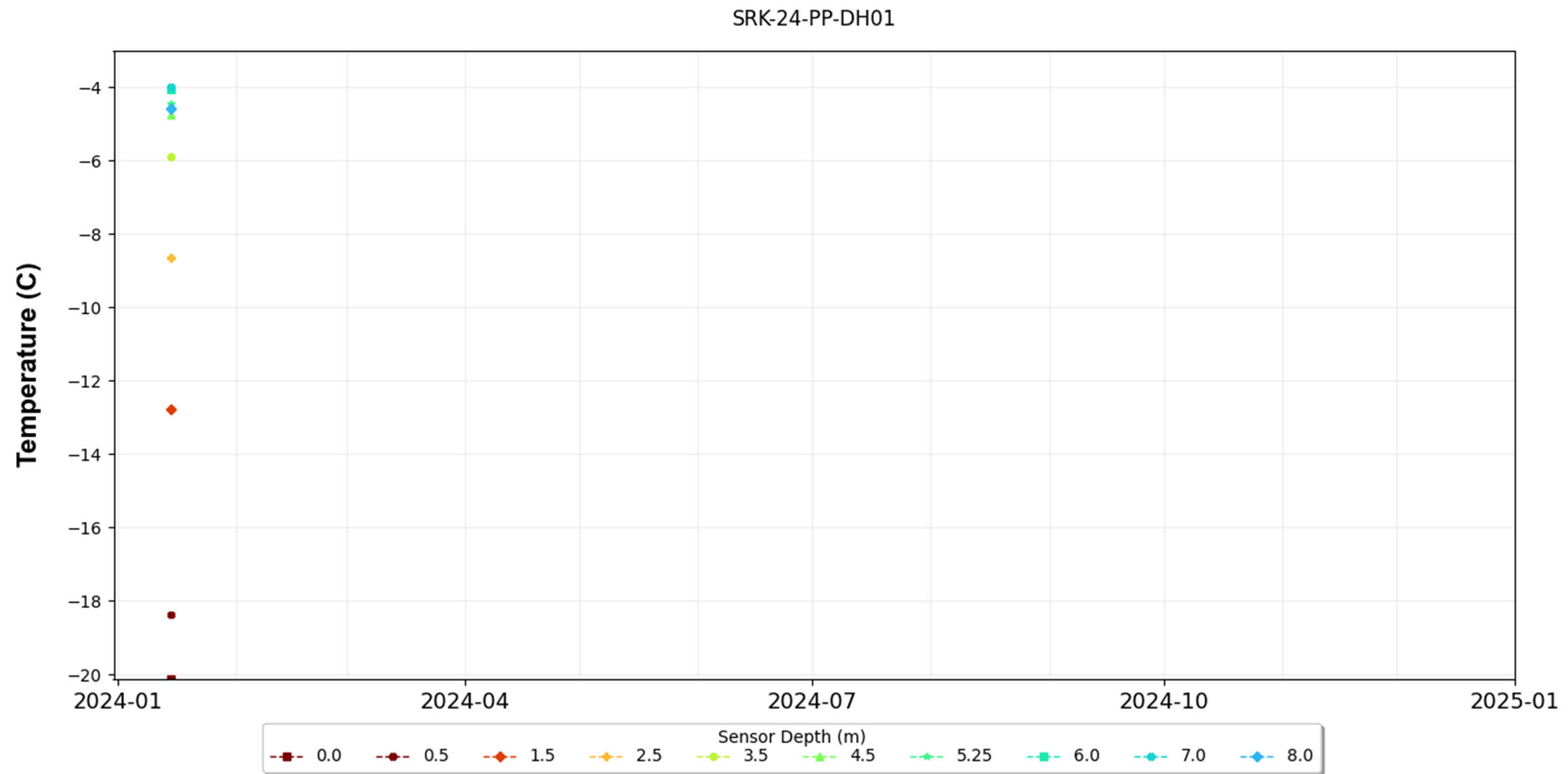
Site-wide Ground Thermal Monitoring Plan

Recent Ground Temperature Site –
SRK-23-CPI-DH02

Date:
March 2024

Approved:
CWS

Figure: **B-25**



Notes:
1. Average weekly ground temperature shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

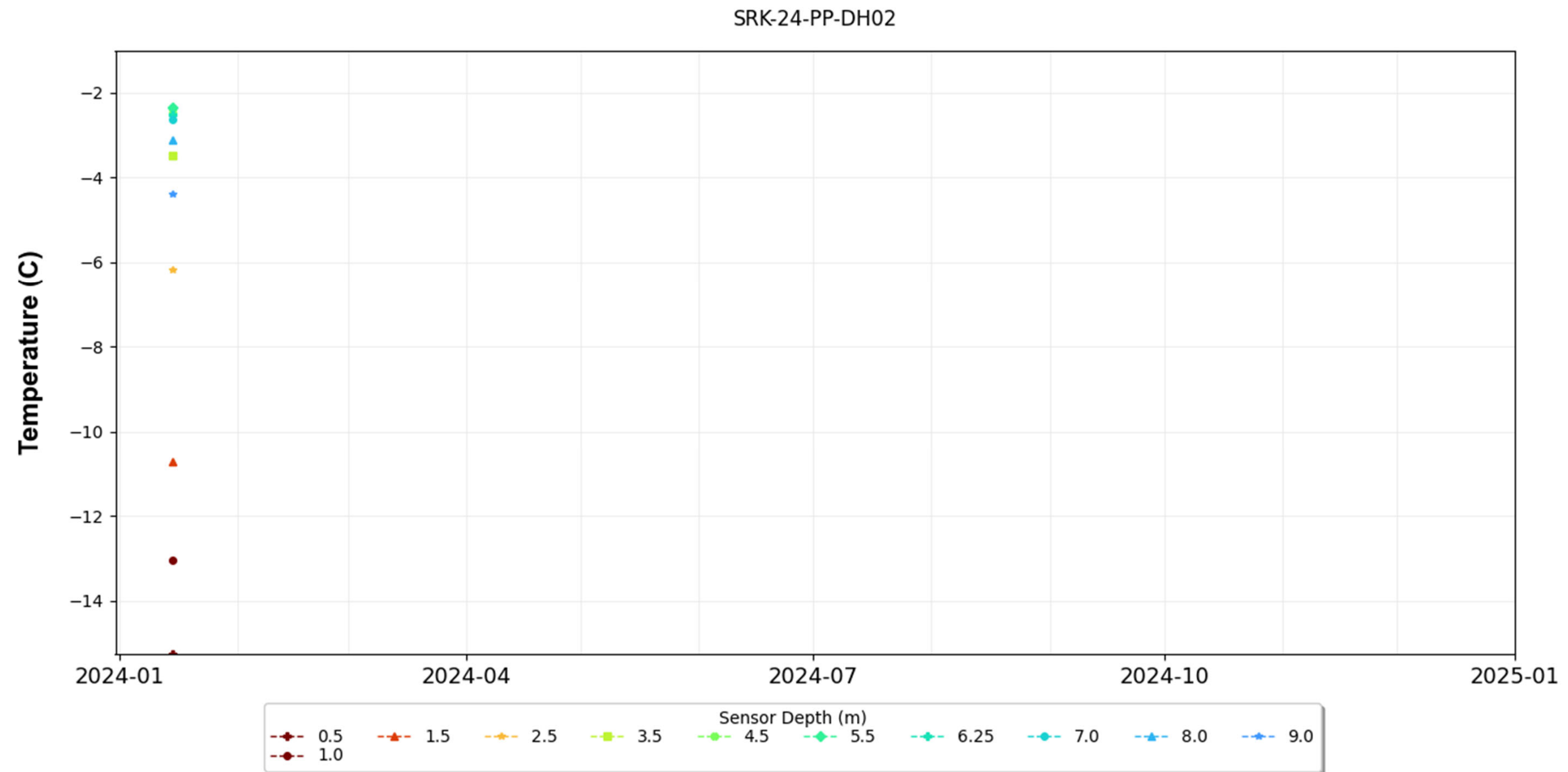
Site-wide Ground Thermal Monitoring Plan

Recent Ground Temperature Site –
SRK-24-PP-DH01

Date:
March 2024

Approved:
CWS

Figure: **B-26**



Notes:
1. Average weekly ground temperature shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

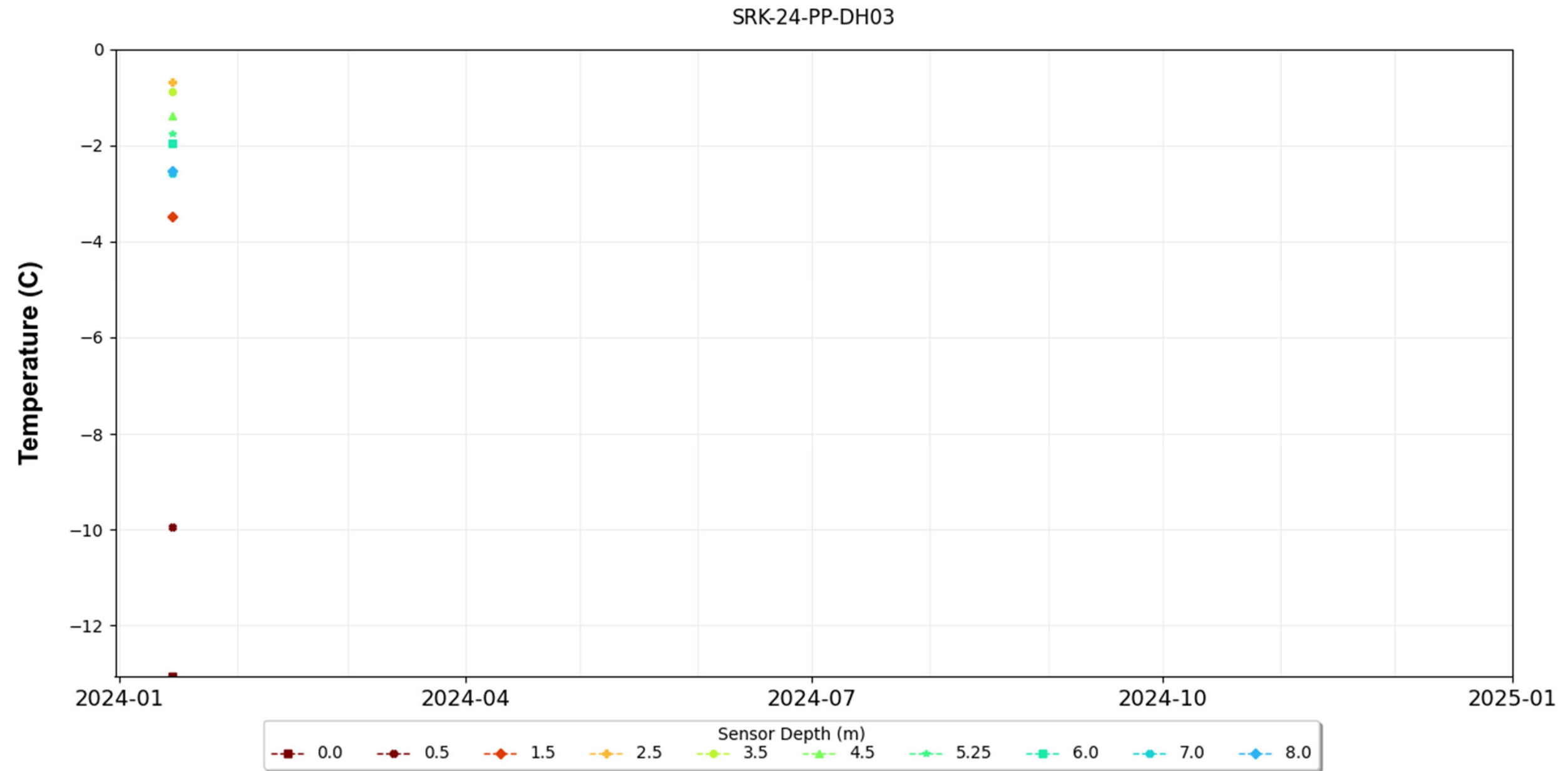
Site-wide Ground Thermal Monitoring Plan

Recent Ground Temperature Site –
SRK-24-PP-DH02

Date:
March 2024

Approved:
CWS

Figure: **B-27**



Notes:
1. Average weekly ground temperature shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx



Back River

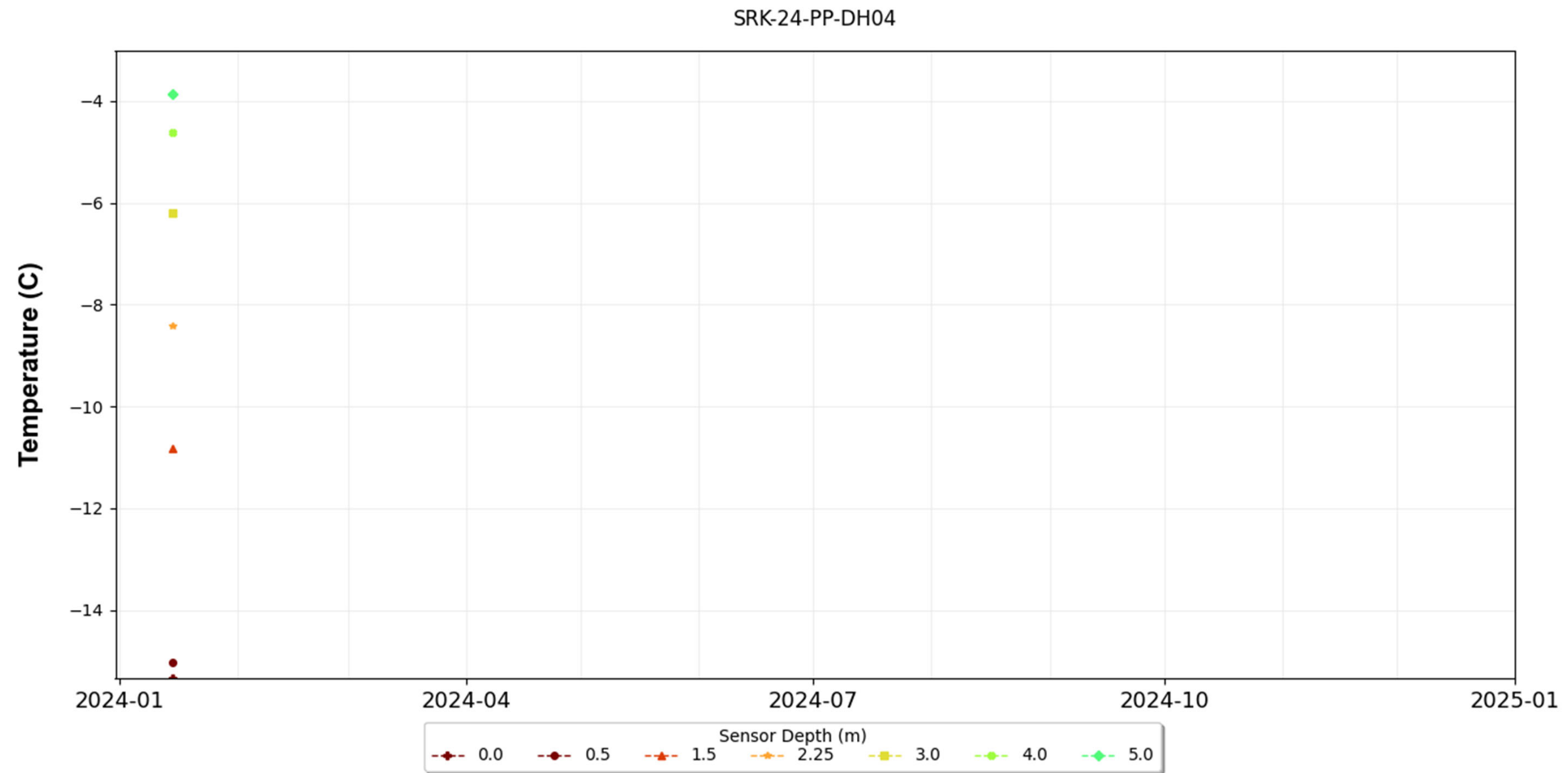
Site-wide Ground Thermal Monitoring Plan

Recent Ground Temperature Site –
SRK-24-PP-DH03

Date:
March 2024

Approved:
CWS

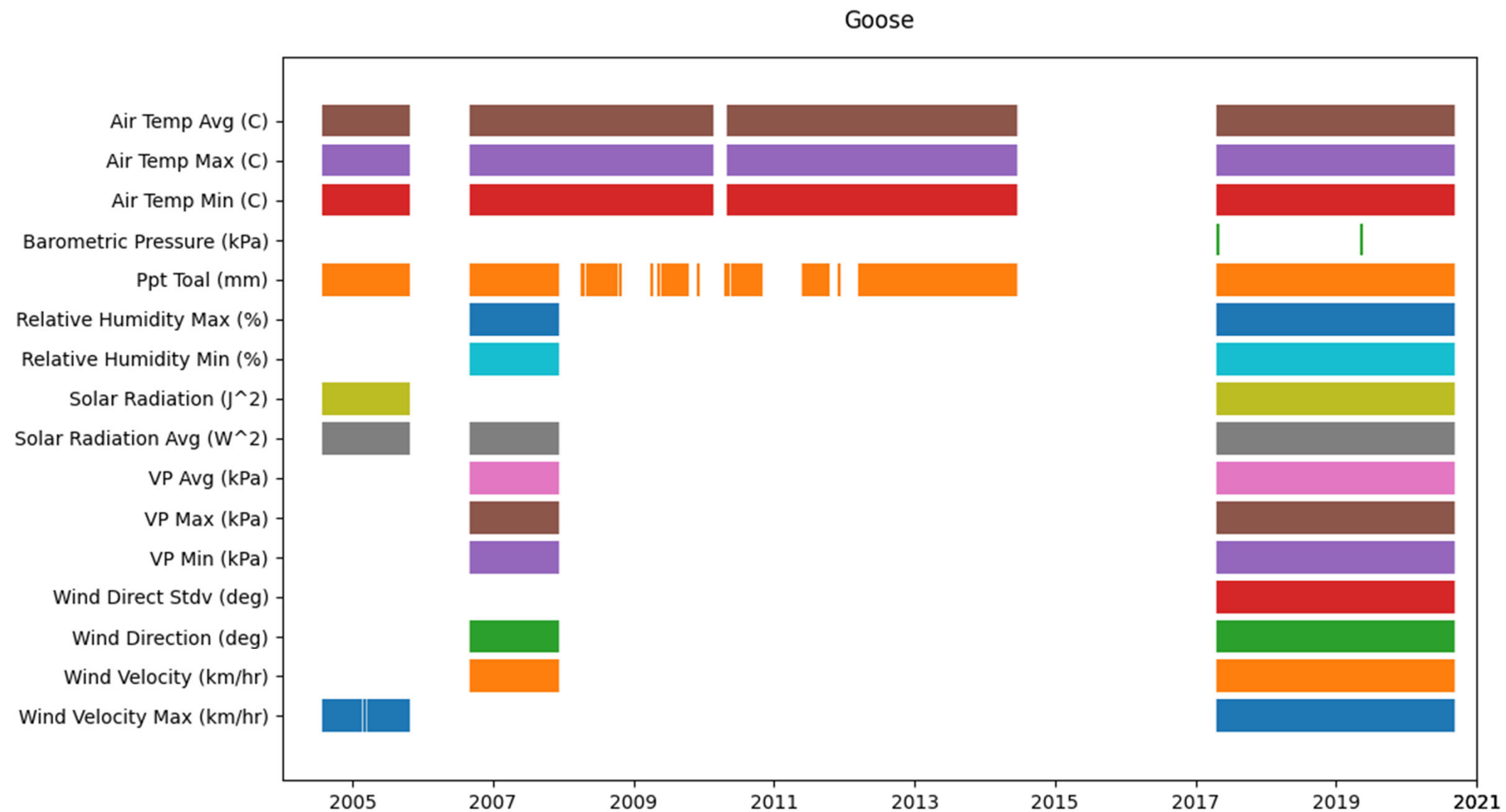
Figure: **B-28**



Notes:
1. Average weekly ground temperature shown.

 Job No: CAPR003102 Filename: Appendix_GroundThermal.pptx	 Back River	Site-wide Ground Thermal Monitoring Plan		
		Recent Ground Temperature Site – SRK-24-PP-DH04		
		Date: March 2024	Approved: CWS	Figure: B-29

Appendix C Meteorological Station Data



- Notes:
1. Data record for Goose weather station.
 2. Current measurement not shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx

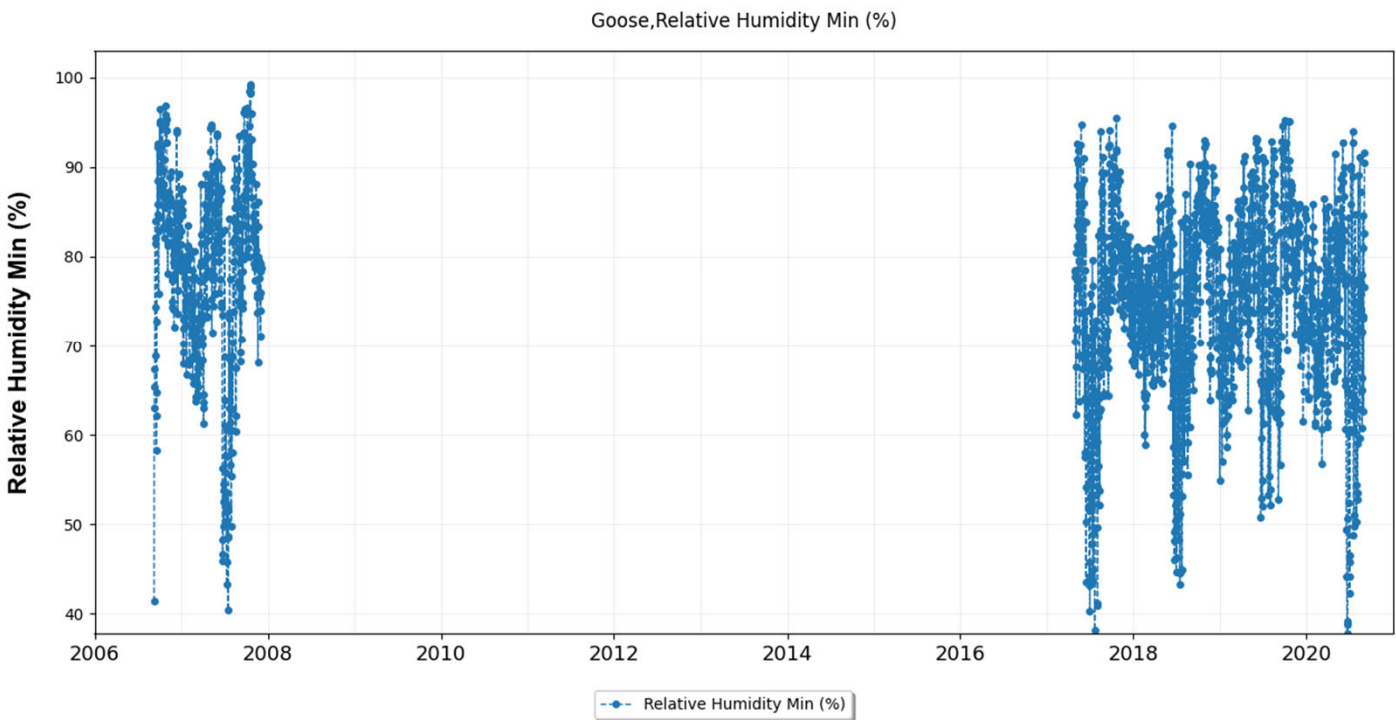
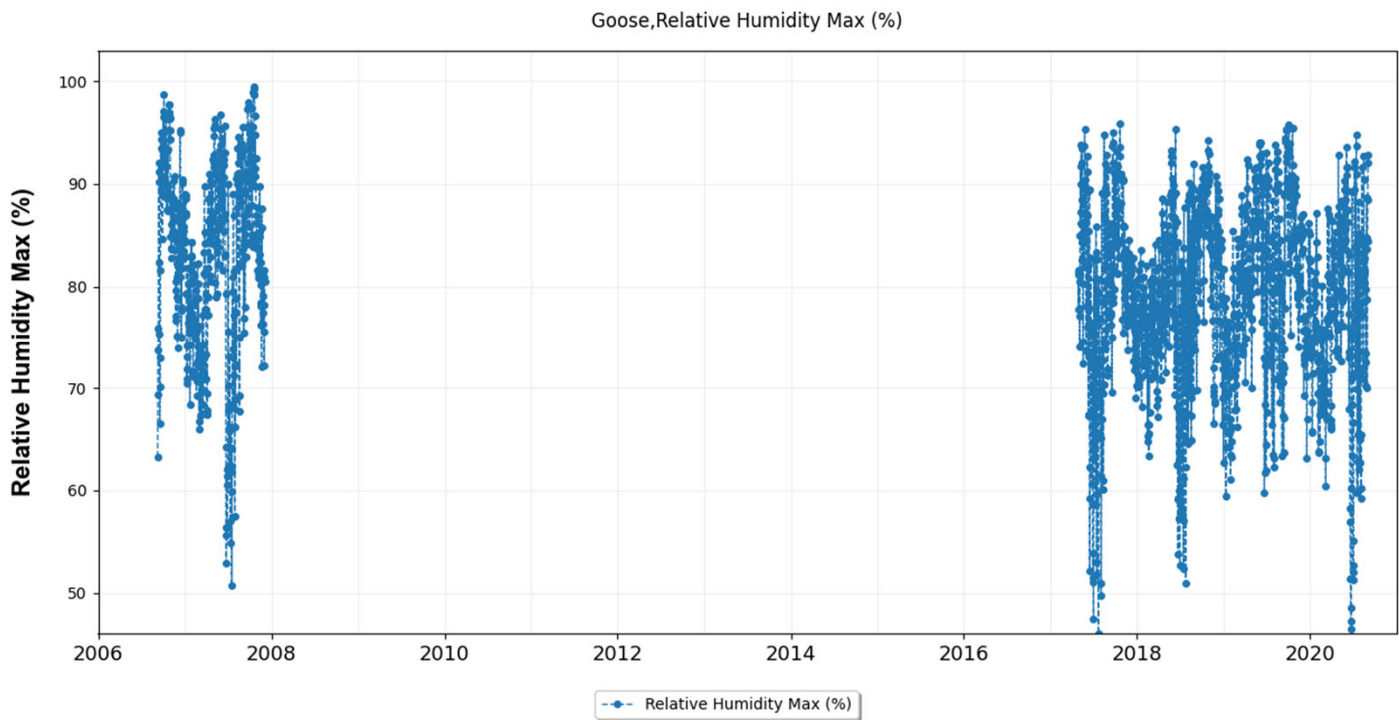
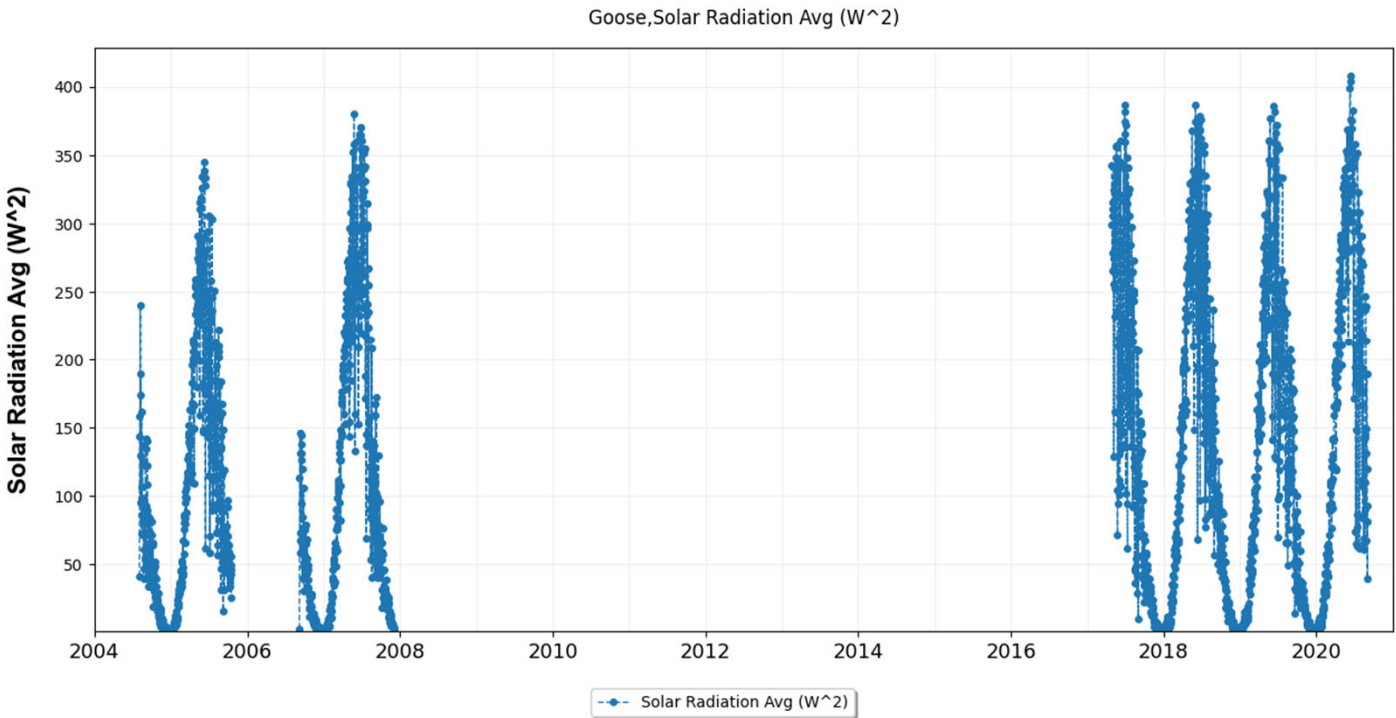
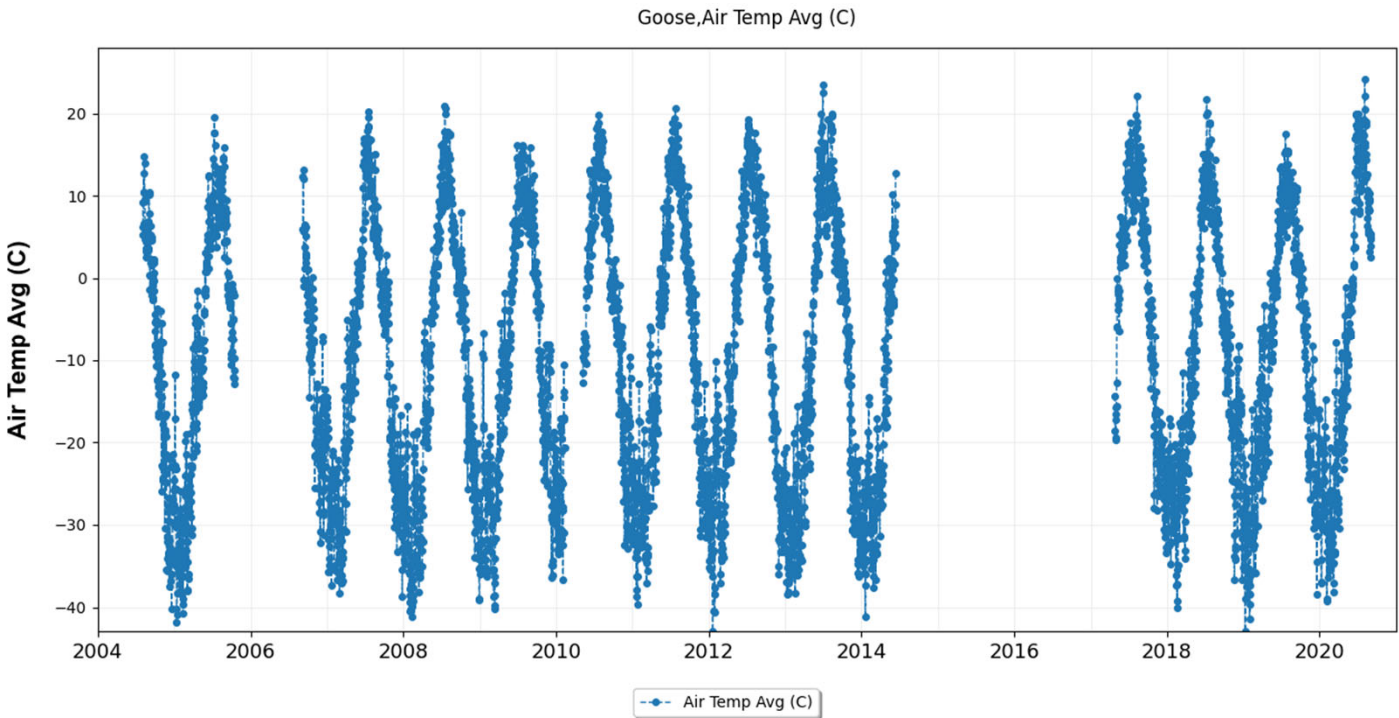


Back River

Site-wide Ground Thermal Monitoring Plan

Goose Weather Station –
Data Record

Date: March 2024	Approved: CWS	Figure: C-1
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Notes:

1. Select climate parameters measured at the Goose weather station shown.
2. Average daily measurements shown.



Site-wide Ground Thermal Monitoring Plan

Goose Weather Station –
Data Record

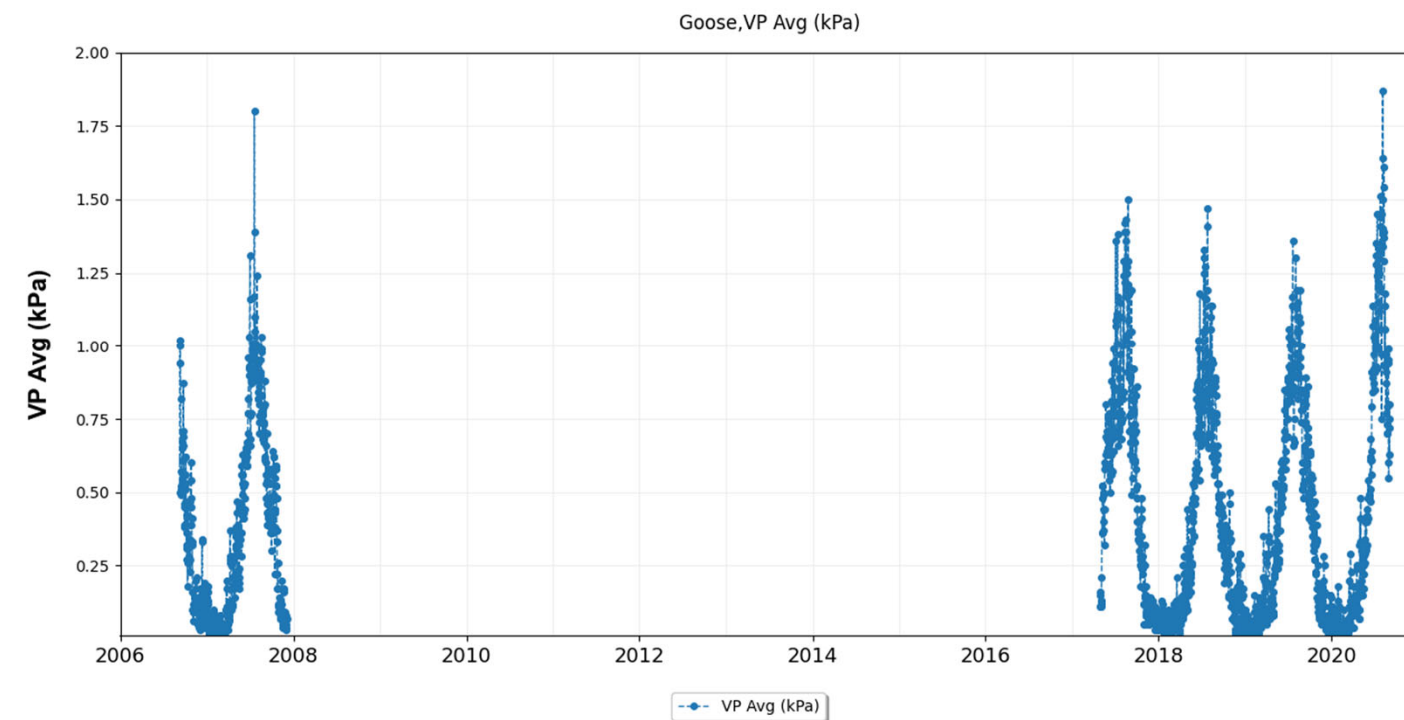
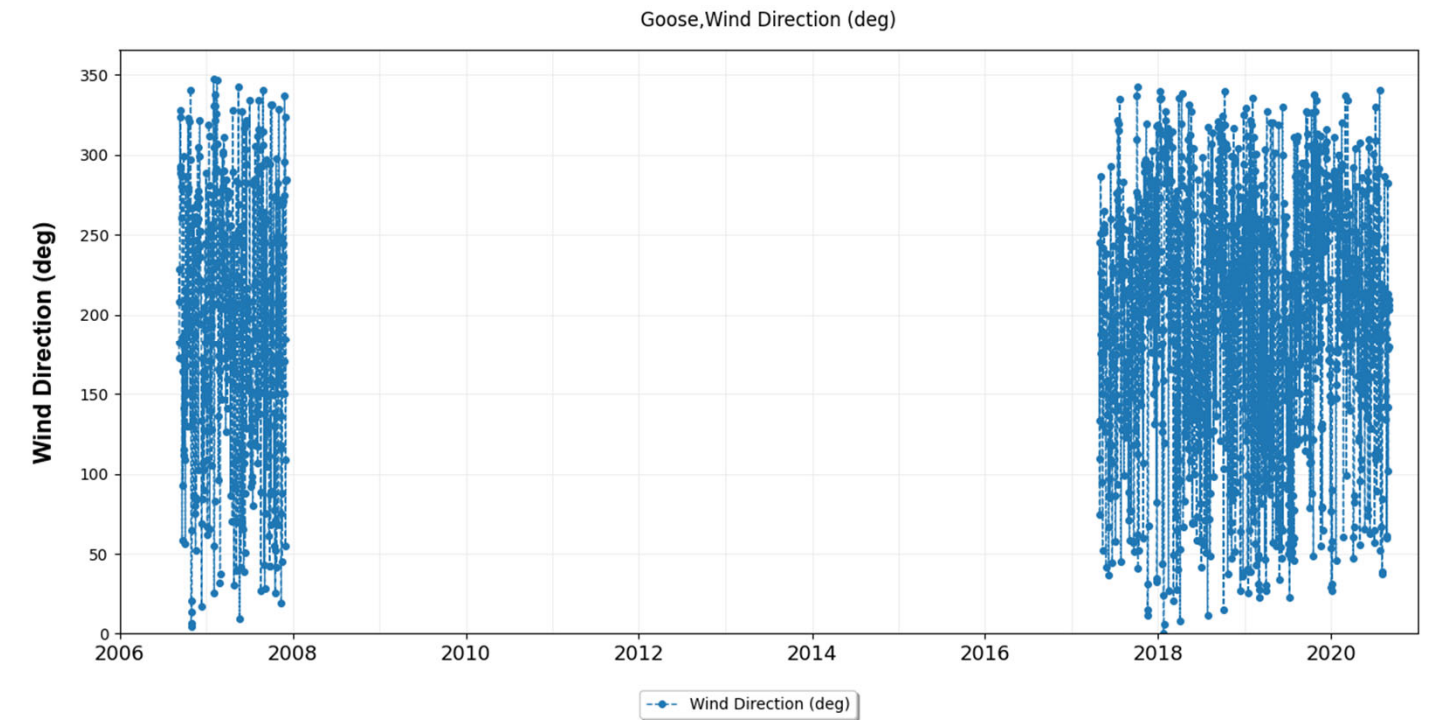
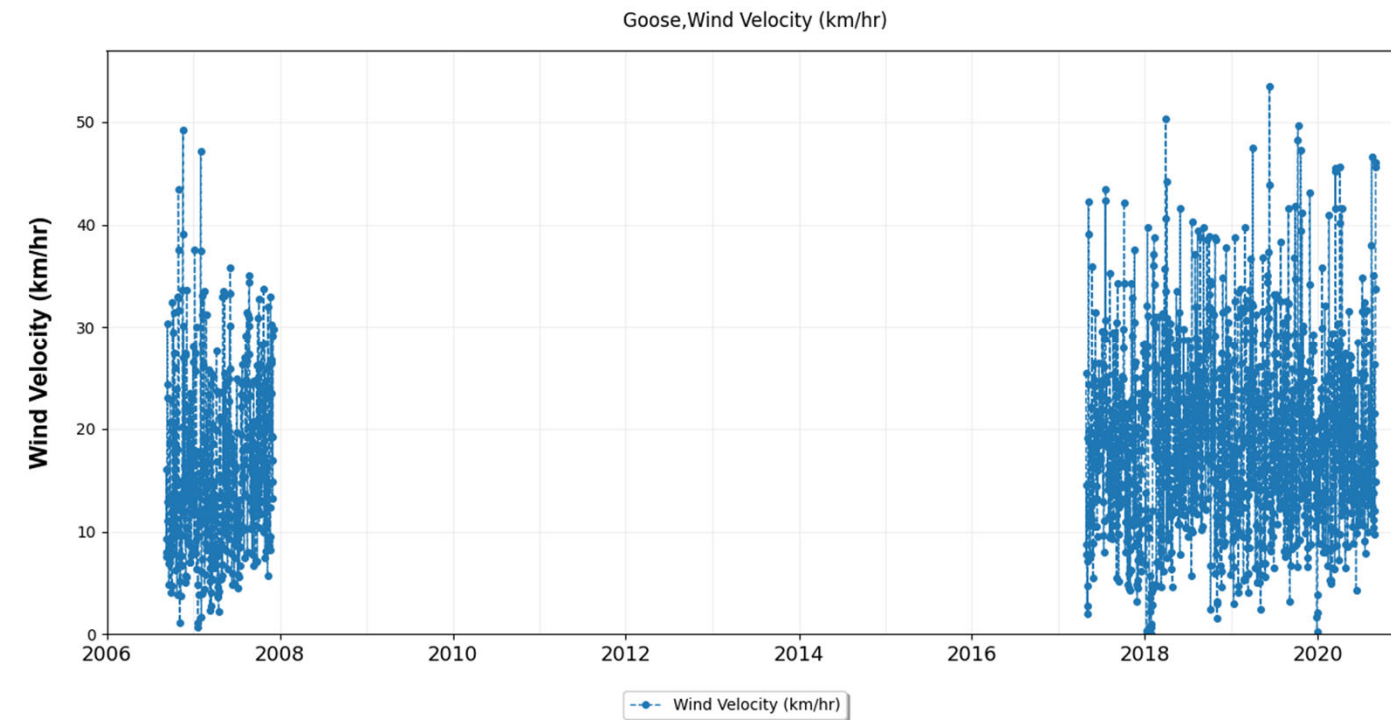
Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx

Back River

Date:
March 2024

Approved:
CWS

Figure: **C-2**



Notes:

1. Select climate parameters measured at the Goose weather station shown.
2. Average daily measurements shown.
3. Vapor pressure (VP)



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx

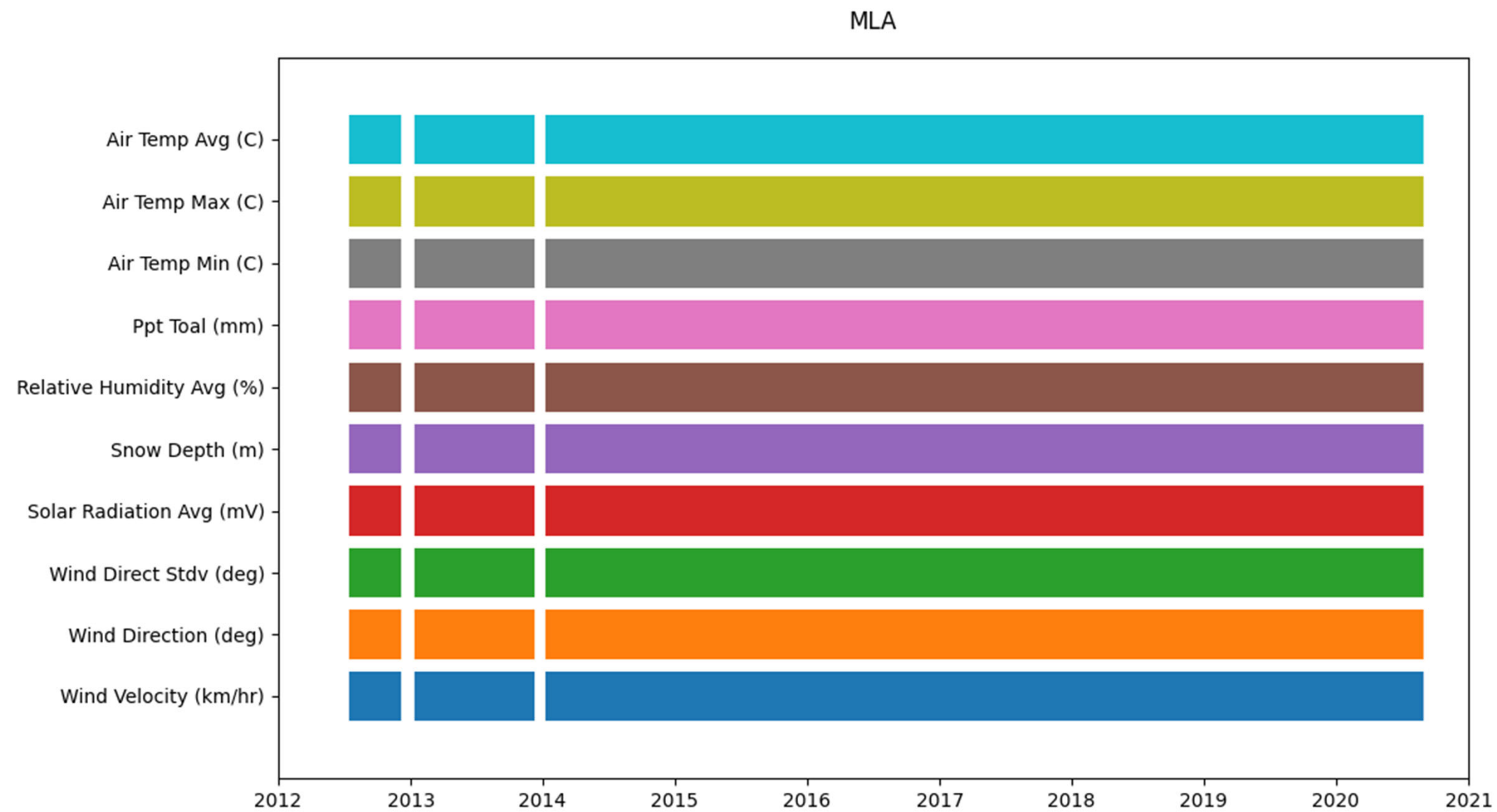


Back River

Site-wide Ground Thermal Monitoring Plan

Goose Weather Station –
Data Record

Date: March 2024	Approved: CWS	Figure: C-3
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Notes:

1. Data record for Marine Laydown Area (MLA) weather station.
2. Current measurement not shown.



Job No: CAPR003102
Filename: Appendix_GroundThermal.pptx

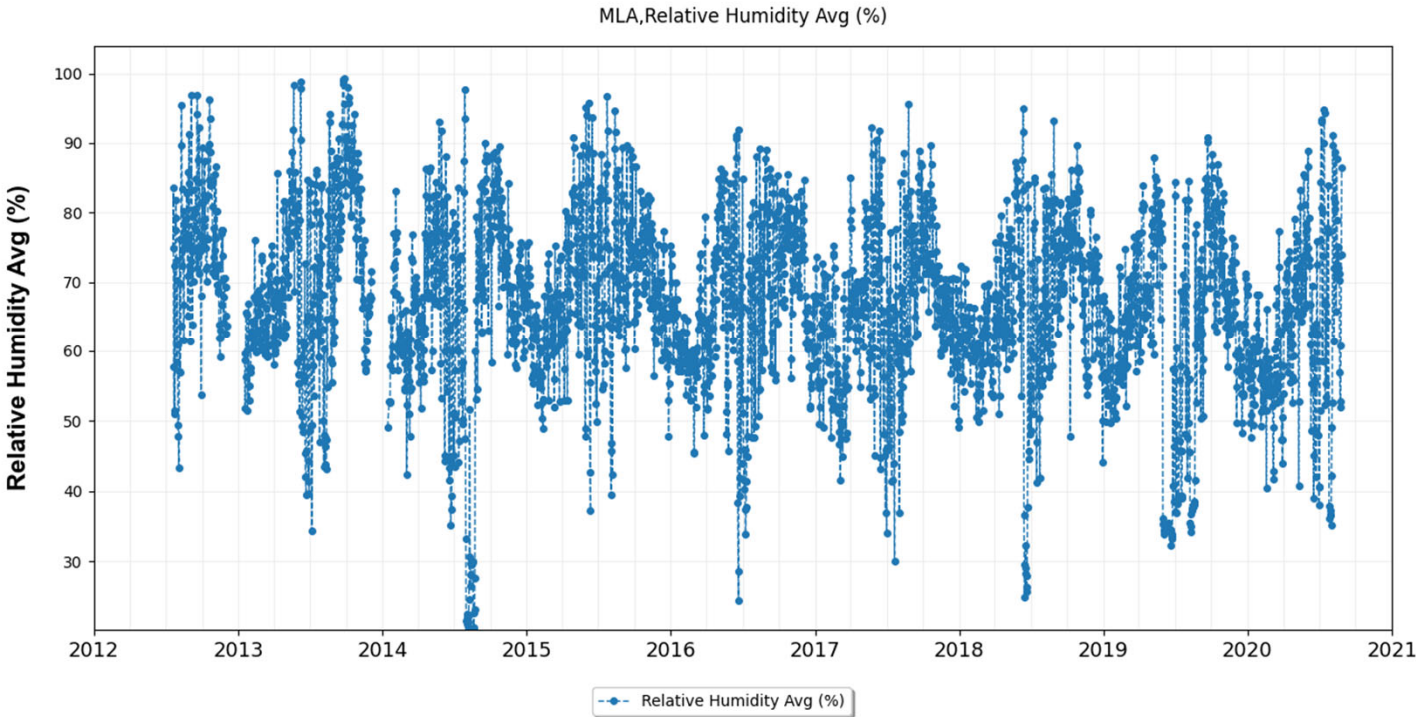
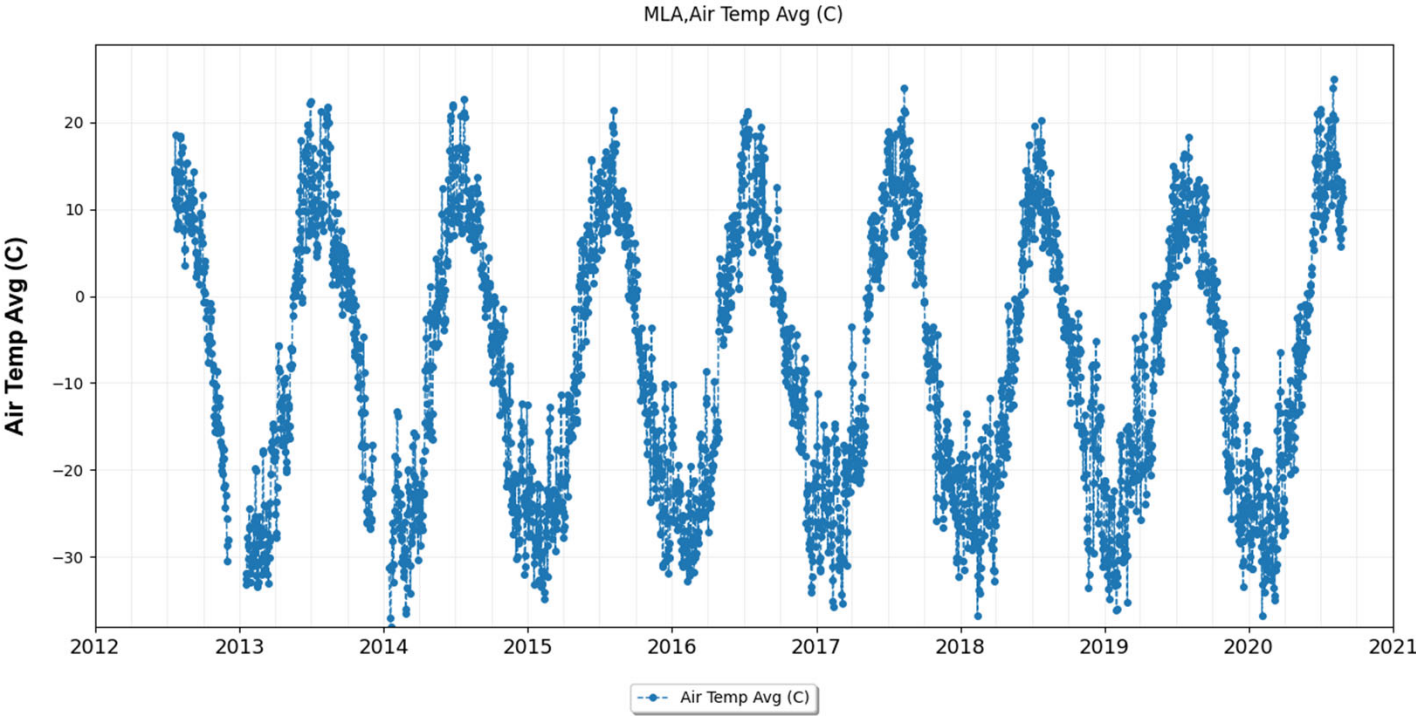


Back River

Site-wide Ground Thermal Monitoring Plan

MLA Weather Station –
Data Record

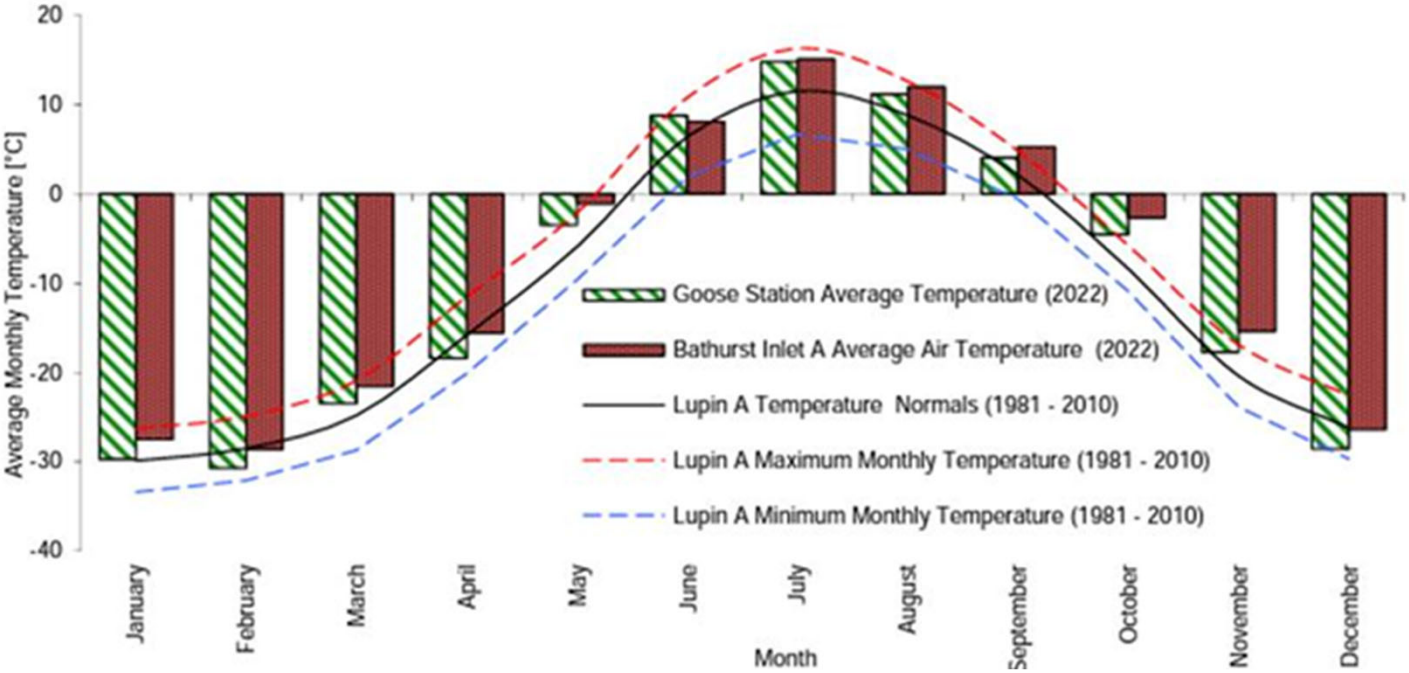
Date: March 2024	Approved: CWS	Figure: C-4
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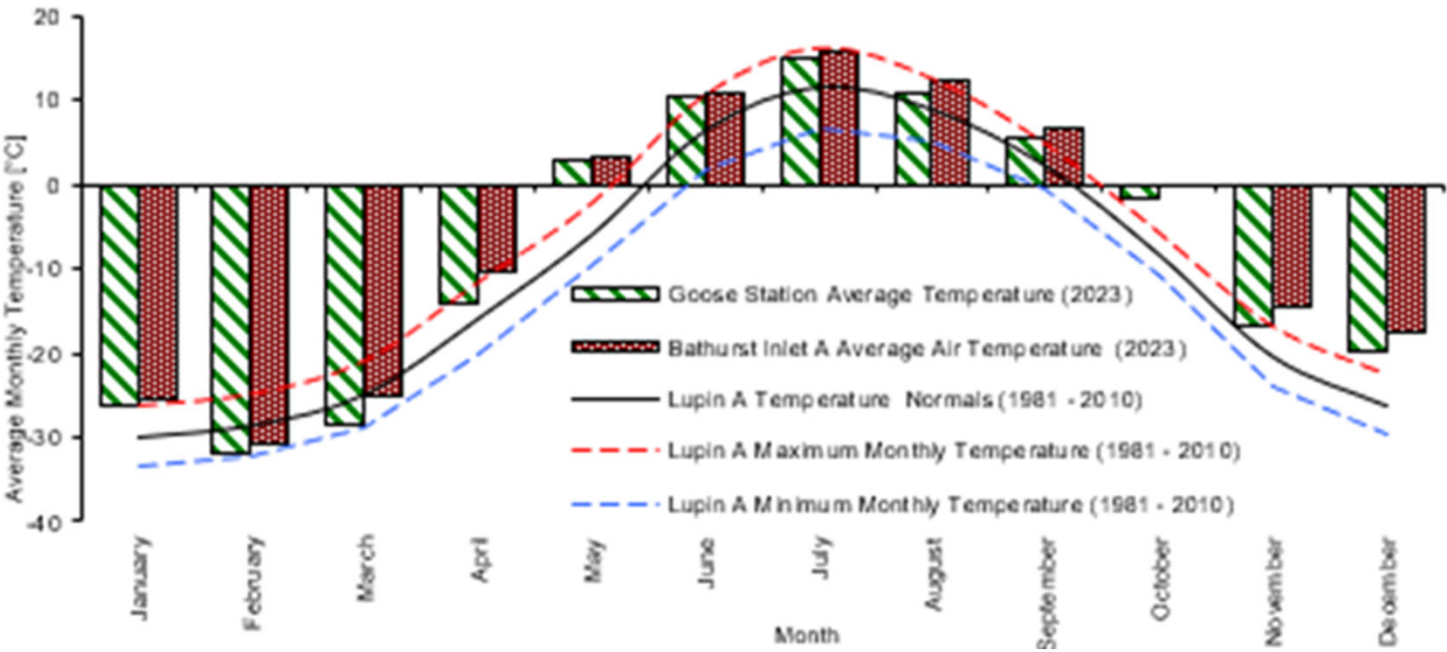
- Notes:
1. Select climate parameters measured at the Marine Laydown Area (MLA) weather station shown.
 2. Average daily measurements shown.

		Site-wide Ground Thermal Monitoring Plan		
		MLA Weather Station – Data Record		
Job No: CAPR003102 Filename: Appendix_GroundThermal.pptx	Back River	Date: March 2024	Approved: CWS	Figure: C-5

2022



2023



Notes:
1. Average monthly air temperature measured at the Goose and MLA weather stations in 2022 and 2023