FEARNA STORAGE

Fearna Pumped Storage Hydro Scheme
EIA Report

Appendix 11.3 – Aquatic Temperature Monitoring Investigation

February 2025

Quality Information

Prepared by	Checked by	Approved by
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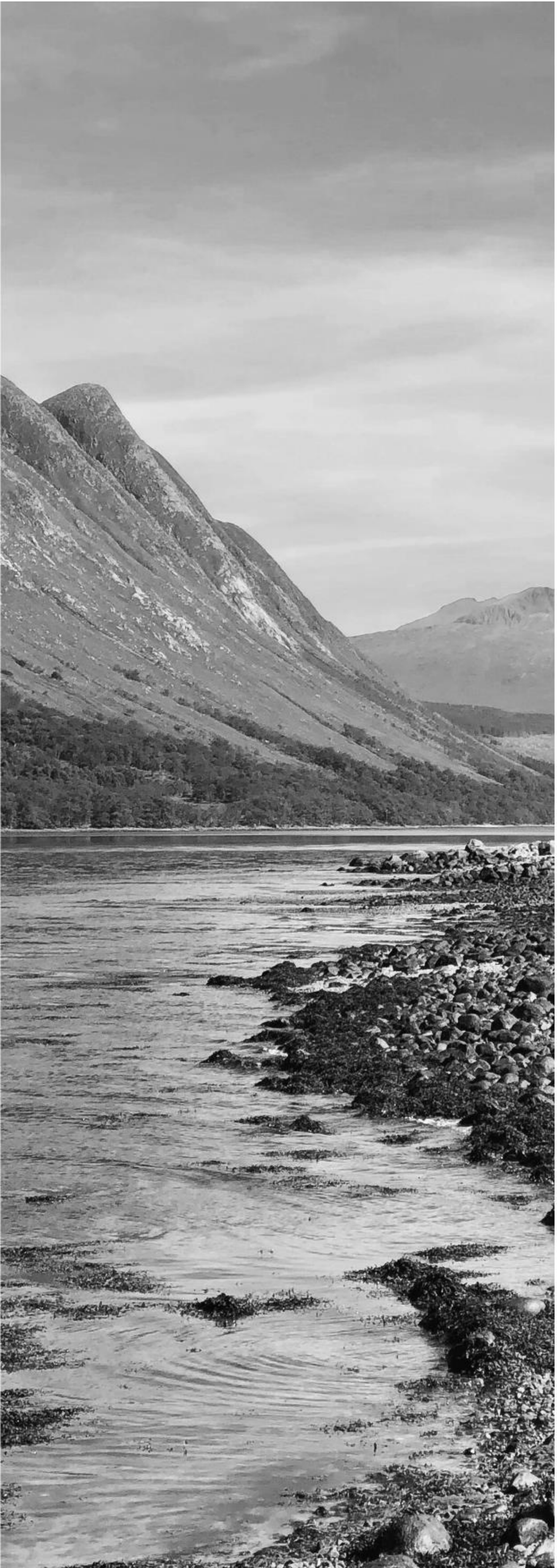
Revision History

Revision	Revision Date	Details	Authorised
01	February 2025	Issue to ECU	Fraser Allison



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APPENDIX 11.3 - LOCH QUOICH & GEARR GARRY TEMPERATURE MONITORING INVESTIGATION

FEARNA PUMPED STORAGE HYDRO SCHEME

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28/02/2025

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1	28/02/25	MA	CB	MA	Initial issue

Quality assurance

This report has been prepared according to Gavia Environmental Quality Management Process. Gavia Environmental employs consultant scientists who are members of appropriate professional institutions and adhere to professional codes of conduct.

Disclaimer

This report is presented to Fearna PSH Ltd. in respect of Appendix 11.3 - Loch Quoich & Gearr Garry Temperature monitoring investigation, and may not be used or relied on by any other person or by the client in relation to other matters not covered specifically by the scope of this report. This report was initially prepared for an EIA submission based on the results of surveys undertaken during 2023. It has been substantially reviewed and revised based on the results of further surveys undertaken during 2024 with consideration of the particular requirements of the CAR Licence application process.

Notwithstanding anything to the contrary contained in the report, Gavia Environmental Ltd is obliged to exercise reasonable skill, care, and diligence in the performance of the services required by Fearna PSH Ltd. and shall not be liable except to the extent that it has failed to exercise reasonable skill care and diligence, and this report shall be read and construed accordingly.

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Contents

Executive Summary

A detailed water temperature monitoring investigation has been undertaken across Loch Quoich and the Gearr Garry over a period of approximately six months between late-August 2024 and mid-February 2025. A total of 11No. temperature sensors were deployed across five discrete locations throughout the investigation area. The investigation was designed to provide insight into the water temperature regimes both in Loch Quoich (spatially and vertically) and in Gearr Garry (spatially only).

The water temperature regime in Loch Quoich appears to conform to a warm monomictic lake regime, whereby the lake stratifies into a warm buoyant shallow layer overlying a stable dense colder layer during Summer and Autumn. This stratification, and the corresponding thermocline collapses, leading to a well-mixed water column which persists and gradually cools during Winter and Spring. The single annual mixing event was observed to occur progressively and episodically over a four-week period between late October and mid-November. While not directly observed, the corresponding annual re-stratification is expected to occur between April and June. It is anticipated that the precise timing of these events may change slightly from year to year according to varying annual weather patterns. Notable diurnal temperature variation is evident in the uppermost surface waters, which is strongest in Summer becoming more subdued in Winter. The overall water temperature regime is observed to range between approximately 4 °C and 17 °C. The deeper hypolimnion layer, when present, is observed to be very stable with respect to water temperature, at approximately 7 °C. Prevailing ambient air temperature, coupled with seasonal and meteorological factors have been identified as the dominant driving mechanisms of the water temperature regime observed. A significant secondary driving mechanism is the warm monomictic lake regime which occurs due to the Loch's significant size and depth.

The water temperature in the Gearr Garry appears to conform to a sinusoidal wave pattern according to the prevailing season. Water temperatures are significantly more variable within the Gearr Garry than within Loch Quoich. Very significant diurnal variation is observed at all monitoring locations, with the largest temperature variation range observed in the Summer/Autumn months, with relatively modest temperature variation observed during the Winter months. Prevailing ambient air temperature, coupled with seasonal and meteorological factors have been identified as the dominant driving mechanisms of the water temperature regime observed.

There is a strong associative link between water temperatures in Loch Quoich and the Gearr Garry. Given the absence of a practical control catchment, it is not possible to quantify the magnitude of the effect of this link. Therefore, at a catchment scale, Loch Quoich acts to moderate water temperatures downstream. At a more local scale, there is evidence that under prolonged sub-zero air temperature conditions during Winter, a temporary (relative) warming and moderating effect results from Loch Quoich's outflows as a result of the existing hydro scheme present on the catchment. This effect appears to only affect short stretches of the Gearr Garry directly downstream of the outflow point. When ambient air temperatures return to typical Winter averages, a more natural air temperature-driven regime quickly re-establishes itself in the river.

The investigation included a location immediately downstream of the outflow of the existing Quoich hydro scheme, which is conveyed approximately 4km by means of an underground concrete-lined tunnel before being used to drive a turbine-generator at Quoich Power Station. On account of the short Winter episodes (referred to above) where unmodified reservoir water is transferred into the Gearr Garry, it appears that no meaningful temperature change (increase or decrease) occurs during such large scale water transfers.

While this investigation primarily sought to understand the baseline water temperature regime within the catchment, it is possible to conjecture some probable outcomes of the Proposed Development on this baseline regime based on the data gathered. It is not

considered likely that the Proposed Development will significantly alter the existing water temperature regime within the catchment. Should such changes actually occur, it is considered most likely that they would be spatially limited to the inlet/outlets of both Loch Quoich and Loch Fearna, rather than transferred down-catchment into the Gearr Garry or up-catchment into the wider Loch Quoich basin.

While this investigation is not primarily ecological in nature, it appears certain observations can be made on the ecological implications (for salmonid fish) of both the existing baseline water temperature regime and the likely future regime should the Proposed Development go ahead. It appears that Loch Quoich, and particularly the Gearr Garry, are already only marginally suitable for salmonid spawning with respect to water temperatures during the peak fish spawning season. It is considered that this situation would be even less well suited still for fish spawning were the existing Quoich hydro scheme not in place. Based on the results of this investigation, it is not considered likely that the Proposed Development will meaningfully alter this situation either positively or negatively.

Finally, it is worth noting that this investigation has considered water temperature in isolation (as it pertains to fish ecology and impacts). Several other factors (such as dissolved oxygen concentrations, nutrient levels etc.) can all also impact on the ecology of resident fish in a catchment. These factors were outwith the scope of this investigation.

1 Introduction

Gavia Environmental Ltd. was commissioned by Fearna PSH Ltd. (hereafter 'the client') to design and undertake a baseline temperature monitoring investigation at Loch Quoich and the Gearr Garry river. Loch Quoich and the Gearr Garry are located approximately 25km west of Invergarry in the Scottish Highlands. Loch Quoich and the Gearr Garry are downstream of Loch Fearna which is the upper loch of a proposed Fearna Pumped Storage Hydropower (PSH) scheme. Loch Fearna is set within a corrie at an altitude of 538m AOD (approximate grid reference: NH 05593 03126). Loch Quoich is a large reservoir (approximately 14km long) situated at an altitude of 201.38m AOD (approximate grid reference: NH 01192 02472) when at spill level, dropping to a minimum operational level of +175.38mAOD. Loch Quoich is impounded by two small dams at its western end, and one large dam at its eastern end. The Gearr Garry is a freshwater watercourse downstream of Quoich Dam and is approximately 3km length. An existing hydropower station associated with Loch Quoich is situated approximately 4km downstream of Quoich Dam, situated between the Kingie Pool and Loch Poulary.

This investigation was undertaken to provide a baseline of the current water temperature regime within the Loch Quoich/Gearr Garry system, and to inform any potential impacts of the Proposed Development on salmonid fisheries downstream of the proposed Fearna PSH.

This document has been compiled to supplement an Environmental Impact Assessment Report (EIAR) for the Proposed Development under S.36 of the Electricity Acy 1989.

1.1 Background

The client is proposing to construct an 1,800 MW pumped storage hydro scheme and associated infrastructure on Loch Fearna and Loch Quoich located approximately 5km northwest of Kingie Lodge, Invergarry (see **Appendix A, Proposed Development** for Red Line Boundary of development). The Proposed Development would function by transferring water between a lower reservoir, Loch Quoich, and an upper reservoir, Loch Fearna. The maximum water level of the upper loch would be increased by constructing dams to increase its natural water storage capacity, consequently a large area of peripheral habitat will be inundated as shown in **Appendix A, Proposed Development**. The reservoirs would be connected by an underground waterway system including two underground headrace tunnels.

1.2 Investigation objectives

During stakeholder consultation prior to the compilation of the EIAR for the Proposed Development, a query was raised related to the operation of the Proposed Development causing downstream changes in the water temperature of the Gearr Garry and other downstream waterbodies, with resulting impacts on salmonid fisheries.

As limited site-specific information on the water temperature regime in Loch Quoich and the Gearr Garry under their current conditions was available, there was a need for temperature monitoring investigation to provide a detailed understanding of the baseline water temperature regime along with insight into any interactions between the water temperature regime in Loch Quoich and the Gearr Garry, and any potential impacts of the pre-existing hydropower developments within the catchment.

The following detailed objectives for the proposed investigation were defined:

1. To characterise the baseline water temperature regime at different locations within the Loch Quoich/Gearr Garry system.
2. To characterise the baseline water temperature regime at different spatial locations within Loch Quoich relative to each other.
3. To characterise the baseline water temperature regime at different water depths within Loch Quoich relative to each other.
4. To identify and characterise the driving mechanism/s controlling water temperature variation at the different monitoring locations
5. To identify any links between the water temperature regime in the loch relative to the regime in the river.
6. To identify any current impacts of the existing hydropower schemes' operation upon the water temperature regime upon the Gearr Garry.
7. To identify any other material factors which may influence or inform how the Proposed Development may affect the Loch Quoich/Gearr Garry system in future.

2 Catchment description

2.1 Overview

The upper Glen Garry catchment in which the Proposed Development is situated includes a number of relevant hydrological features, including infrastructure and modifications associated with the existing Quoich hydro scheme. The following sections summaries the key features of relevance to this temperature monitoring investigation.

A plan of the overall catchment with key locations and features indicated is presented in **Appendix B**.

2.2 Loch Fearna

Loch Fearna is a small upland freshwater loch situated at NGR: NH056031. It is situated at an altitude of 538m AOD, and occupies an area of approximately 10.3Ha. The loch is fed by incident rainfall and a number of small tributaries draining from Coire Glas below Spidean Mialach (996m AOD). The loch drains steeply by the Allt Fearna into the northern bank of Loch Quoich approximately 1.1km to the south.

The size and capacity of Loch Fearna is envisaged to be expanded by a series of dams as part of the Proposed Development.

2.3 Loch Quoich

Loch Quoich is a very large freshwater reservoir situated at NGR: NH012025. It is situated at an altitude of 201m AOD, and occupies an area of approximately 40km^2. The loch is generally oriented from west to east, measuring approximately 14km from end to end. The loch is impounded by dams at both its western and eastern extents. The loch is fed by a very large catchment area featuring many inflowing tributaries. The largest tributaries are the Abhainn Chosaidh, Caolie Water and the River Quoich system on the northern bank, whereas much of the southern bank is typified by short, steeply flowing tributaries flowing down from a west-east trending mountain chain featuring Sgùrr Mòr (1,003m AOD). A number of larger tributaries flow into the southern side of Loch Quoich at its western end, including Allt Coire nan Gall, Allt a Choire Reidh and Allt a Choire Bhuidhe.

The level of Loch Quoich is controlled by the existing Quoich hydro scheme, with water levels varying between 175.38m AOD and the spillway level of Quoich Dam at 201.38m AOD.

2.4 Quoich hydro scheme

The existing Quoich hydro scheme was completed in 1959 by the North of Scotland Hydro Electric Board. It comprises the Quoich Dam, a connecting subterranean water transfer tunnel and the Quoich Power station which is located approximately 3.9km downstream of Quoich Dam.

Quoich Dam is a rockfill dam constructed using locally won materials. It is the largest rockfill dam in Scotland, measuring 320m across its crest, with a maximum height of 38m. The dam features a single spillway located at the dam's northern end.

Quoich Dam diverts a maximum flow of 18 $m^3 s^{-1}$ via the water transfer tunnel to Quoich power station. A further compensation release of 1 $m^3 s^{-1}$ is provided to the Gearr Garry as a compensation flow. It is understood that the compensation release can release up to a maximum of 20 $m^3 s^{-1}$.

Quoich Power Station features a single turbine generating a maximum 19Mwe electricity, which is exported to the national grid by a single above ground 132Kv overhead transmission line which runs from the power station along the northern side of Glen Garry. The outlet of the power station flows into a the river channel between the Kingie Pool to Loch Poulary.

2.5 Gearr Garry

The Gearr Garry is a stretch of river which starts at Quoich Dam before flowing in a generally south easterly direction for 3.1km. It ends upon entering the elongated lochs of Kingie Pool and Loch Poulary. The Gearr Garry is primarily fed by a 1 $m^3 s^{-1}$ compensation flow from the base of the Quoich Dam. It is supplemented by a number of small inflowing tributaries along its length, with such tributaries being more numerous on the northern side of the valley where the surrounding topography reaches significantly higher altitudes. The Gearr Garry is typically approximately15m wide and less than 0.5m deep throughout its length, however there are several braided channels and pools along its length. At its largest, the reach is approximately 35m wide. The hydrological regime is heavily modified and regulated due to the existing hydro scheme infrastructure both upstream and downstream of the Gearr Garry.

2.6 Kingie Pool and Loch Poulary

The Kingie Pool and Loch Poulary are a combined system of relatively shallow elongated lochs which form the outflow of the Gearr Garry. Both lochs are also fed by the River Kingie, which enters the southern shore of Kingie Pool shortly after the inflow of the Gearr Garry. The combined lochs are approximately 3.5km from west to east. At its narrowest point, the combined lochs are approximately 100m wide, increasing to approximately 350m wide at the largest part of Loch Poulary. A large mid-channel island is situated within the Kingie Pool immediately upstream of the existing Quoich Power Station, which is located on the lochs' northern shore. Loch Poulary transitions downstream into the River Garry through a 1km narrow stretch before expanding laterally. A mothballed salmon catch structure spans the entire width of Kingie Pool/Loch Poulary immediately downstream of the power station outflow.

3 Investigation design

3.1 Introduction

A monitoring investigation study was designed to provide the site-specific data required to address the key investigation objectives detailed in Section 1.2 above. The following sections describe key aspects of the investigation design and how it was executed.

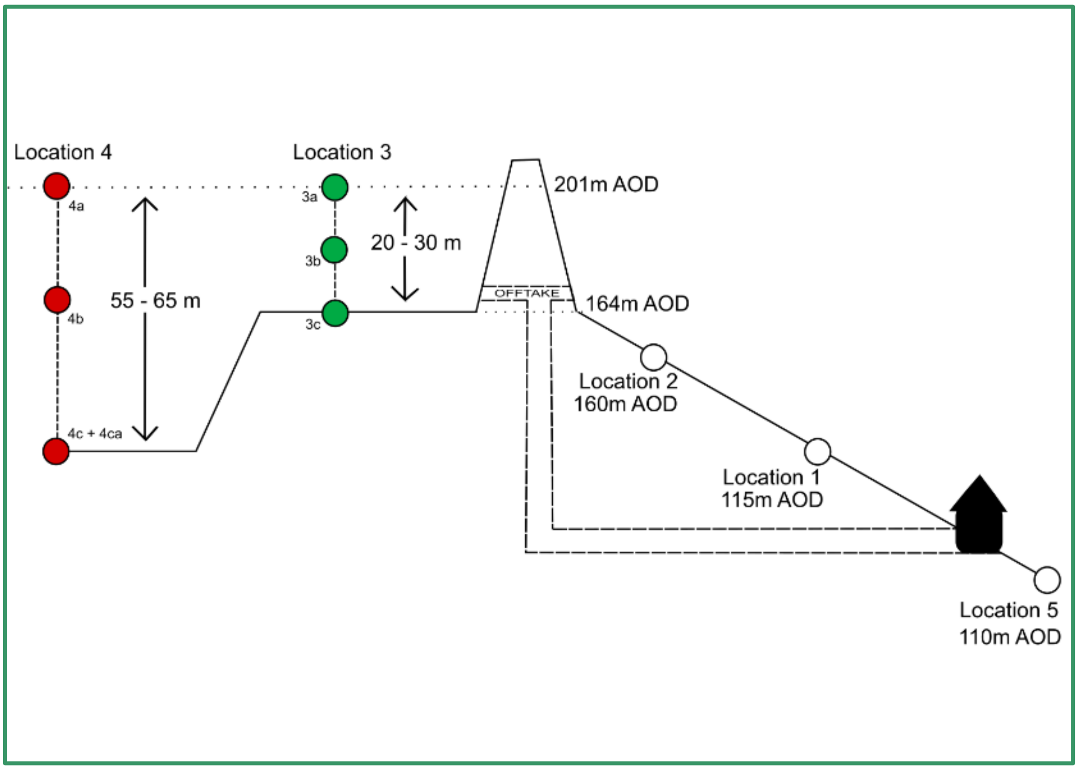
3.2 Monitoring locations

The overall investigation features temperature monitoring sensors deployed at five discrete locations across Loch Quoich, Gearr Garry and the Kingie Pool. A total of 11No. sensors were deployed across the five monitoring locations. The following sections describe the individual monitoring locations and sensor configurations in more detail.

A schematic illustrating showing the general arrangement of monitoring locations used is presented in Figure 1 below. This schematic is not to scale, it represents a vertical profile of approximately 100m and a lateral profile of approximately 10km.

A plan of the investigation area with each monitoring location indicated is presented in **Appendix C**.

Figure 1. Schematic layout of temperature monitoring sensor locations



3.2.1 River monitoring locations

Three monitoring locations are situated within riverine settings within the investigation area. These are locations 1 and 1a, 2 and 5.

Location 1 and 1a

Location 1 is situated at NGR: NH 0956 0113, approximately 2.8km downstream of Quoich Dam, in a water depth of approximately 30cm, approximately 2m into a total river width of 13m at this point. Location 1a, which was installed part way through the monitoring period, is essentially co-located with location 1. It is situated approximately 5m upstream in a similar water depth and flow setting.

Location 1a was added to the investigation to inform whether tree growth (and resulting canopy shading) at the bankside was influencing the water temperature data gathered at location 1.

Location 1 is intended to provide insight into the baseline water temperature regime of the Gearr Garry's main reach a significant distance away from Loch Quoich and Quoich Dam, which is considered likely to provide data which is representative of the Gearr Garry as a whole.

Location 2

Location 2 is situated at NGR: NH 0738 0234, approximately 0.3km downstream of Quoich Dam, in a water depth of approximately 15cm, approximately 2m out into a total river width of 9m at this point.

Location 2 is intended to provide insight into the baseline water temperature regime of the Gearr Garry immediately downstream of the Quoich Dam outflow, which is fed from the base of the dam in a water depth of 20-25m (depending on reservoir level).

Location 5

Location 5 is situated at NGR: NH 1091 0104, approximately 0.2km downstream of the outflow of Quoich Power Station, in a water depth of approximately 0.5m, midstream at a point where the river is approximately 90m wide.

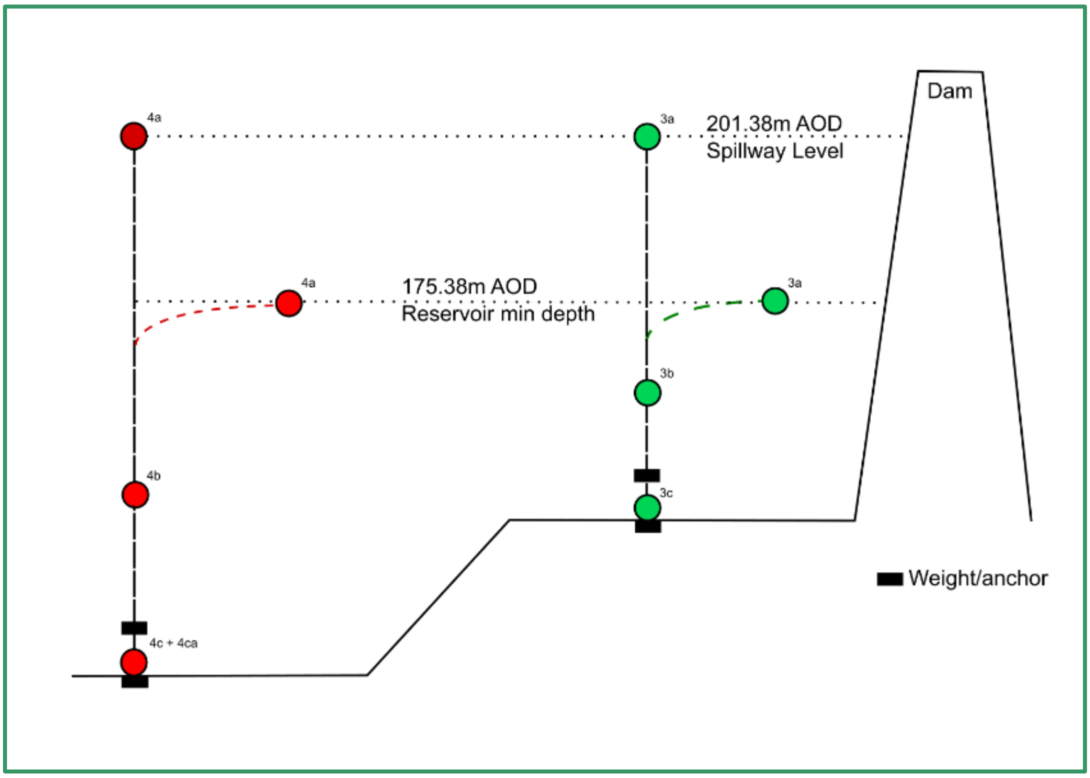
Locations 1 and 2 upon the Gearr Garry

3.2.2 Loch monitoring locations

Two monitoring locations are situated within loch (reservoir) settings within the investigation area. These are locations 3 and 4. To provide insight into any depth dependant temperature variations through the loch's water column, each loch location features multiple sensors positioned at different depths through the loch's water column.

A schematic illustration of the monitoring configuration used at locations 3 and 4 is presented in Figure 2 below. The position of the 'A' sensor at both location 3 and location 4 is dynamic to allow for changes in reservoir level. The position of the 'B' and 'C' sensors at each location remain essentially unchanged with reference to the reservoir bed throughout, albeit the absolute depth of the 'B' sensor will vary within a range of approximately 5m due to the dynamic nature of the monitoring configuration to allow for changing reservoir water levels.

Figure 2. Schematic layout of vertical temperature sensor arrangement at locations 3 and 4



Location 3

Location 3 is situated at NGR: NH 0604 0158, approximately 1.2km west of Quoich Dam. The water depth at this location varies between approximately 15 – 25m depth depending on prevailing reservoir water level. Three sensors are co-located at location 3, with one each at reservoir surface, reservoir base and at an intermediate depth.

Location 3 was selected for monitoring for two reasons. Firstly, location 3 is situated in an area where the bathymetry of the loch provides a relatively shallow shelf which prevails over large areas of the eastern end of Loch Quoich upstream of Quoich Dam. Secondly, location 3 is situated in an area in close proximity to the planned construction footprint of the proposed Fearna PSH infrastructure. As such, it was considered to provide a useful baseline location for undertaking any future monitoring which may be required to assess any future impacts from either the construction or operation of the Fearna PSH scheme.

Location 4

Location 4 is situated at NGR: NH 0604 0158, approximately 4.5km west (that is, up-loch) of Quoich Dam. The water depth at this location varies between approximately 55 – 75m depth depending on prevailing reservoir water level. Four sensors are co-located at location 4, with one each at reservoir surface, reservoir base and at an intermediate depth, plus an additional validation sensor co-located at the reservoir base.

Location 4 was selected for monitoring for two reasons. Firstly, location 4 is situated in an area where the bathymetry of the loch provides a significantly deeper water depth which is representative of large areas of the central spine of Loch Quoich (reflecting the original topography of the glen prior to its inundation in the 1950s). Secondly, location 4 is located a significant distance from the proposed construction area of the Fearna PSH infrastructure, therefore it is considered representative of the water temperature regime independent of any potential future impacts from the proposed scheme's construction or operation. It should be noted that certain areas of the central part of Loch Quoich are deeper still than those at Location 4.

Locations 3 and 4 upon Loch Quoich

3.3 Equipment specifications

Two different monitoring instruments have been used during this investigation for temperature monitoring. Primarily, Hobo Pendant instruments from Onset Computer Corporation have been used due to their waterproof and physically robust and reliable sensors. These sensors allow easy Bluetooth data download capabilities, however these sensors do need to be brought to the water's surface to enable the Bluetooth connection to work successfully. Sensors from Onset's Hobo MX2200 range have been utilised.

A second instrument from a different manufacturer was utilised at a single monitoring location (Location 4cA) to provide an independent check upon the data quality from the Onset loggers. This instrument, a Solinst Levelogger, was co-located with Location 4c, as this was judged to be the physically harshest environment (lowest temperatures, highest pressures etc.) within the investigation's scope. This location was selected as the Solinst instrument was considered to offer the most robust sensing platform for such locations and prolonged monitoring period where battery life on other instruments can be a limiting issue.

A specification for the sensors and instruments used is included within **Appendix D**.

Solinst Levellogger and Hobo MX2200 Pendant instruments as deployed (Locations 4cA and 3b respectively)

3.4 Monitoring period

Table 1 below details the instrument details and deployment periods used as part of this investigation.

Table 1. Monitoring locations, equipment details and deployment periods

Location	NGR	Waterbody	Equipment deployed	Serial number	Date deployed
1	NH 0956 0113	Gearr Garry	Hobo MX2201	21690720	29/08/2024
1a	NH 0956 0113	Gearr Garry	Hobo MX2202	21704229	22/11/2024
2	NH 0738 0234	Gearr Garry	Hobo MX2201	21690719	29/08/2024
3a	NH 0604 0158	Loch Quoich	Hobo MX2201	21690724	30/08/2024
3b	NH 0604 0158	Loch Quoich	Hobo MX2201	21690725	30/08/2024
3c	NH 0604 0158	Loch Quoich	Hobo MX2201	21690726	30/08/2024
4a	NH 0359 0219	Loch Quoich	Hobo MX2201	21690721	30/08/2024
4b	NH 0359 0219	Loch Quoich	Hobo MX2201	21690722	30/08/2024
4c	NH 0359 0219	Loch Quoich	Hobo MX2201 Solinst Levelogger	21690723 2190289	30/08/2024
5	NH 1091 0104	Gearr Garry (Kingie Pool)	Hobo MX2202	21704233	22/11/2024

While the equipment remains in-situ, the monitoring period for the purposes of this report ranges from 29/08/2024 to 13/02/2025.

3.5 Monitoring frequency

All instruments were configured to record one data point every six hours, at approximately 00:00, 06:00, 12:00 and 18:00 hours each day.

3.6 Additional data sources

A number of additional data sources were availed of in the delivery of this investigation. The following are of particular note.

SSE Generation, via Gilkes Energy Limited, have provided detailed data on the level of Loch Quoich during the investigation period, along with information on the operational regime of the existing hydro scheme. This data includes daily reservoir levels up to the end of 2024.

Meteorological data from open online sources for locations within the investigation area have been utilised to contextualise the recorded water level and water temperature data collected.

Following engagement with the Ness District Salmon Fishery Board (NDSFB), the project was granted access to and use of NDSFB's own record of water temperatures in the catchment and surrounding areas.

The contributions of each of the above is gratefully acknowledged.

4 Monitoring results

4.1 Introduction

The following sections provide factual detail and descriptions of the monitoring data gathered and trends observed during the monitoring investigation. Further consideration and interpretation of this data is provided in Section 5 below. It is suggested that Sections 4 and 5 are considered in parallel with the time series graphs included here as Figure 4, and in **Appendix E**.

4.2 Results overview

4.2.1 Factual summary

Summary statistics for all of the data collected from each location is presented in Table 2 below.

The general temperature behaviour of each location and the interrelationship between the different locations is represented by weekly average temperatures, calculated as the arithmetic mean of the 28 monitoring results in each week of the monitoring period to date. A summary of the weekly average data is presented in Table 3. A graph showing the general behaviour and interrelationship between the different monitoring locations is presented in Figure 3.

A time series graph showing the complete dataset for each monitoring location is presented in Figure 4. Additional 'month by month' time series graphs which allow greater visual resolution of the temperature results from each location are presented in **Appendix E**.

Table 1. Summary temperature results for all monitoring locations (Aug'24 – Feb'25)

Location	Ambient air	R1	R1a*	R2	R5*	L3a	L3b	L3c	L4a	L4b	L4c	L4cA
Approximate water depth (m)	**N/a**	**0.3**	**0.3**	**0.15**	**0.5**	**1.0**	**10**	**20**	**1.0**	**20**	**55**	**55**
Total measurements	666	669	328	669	328	668	668	668	667	668	668	668
Minimum	-11	2.8	2.8	4.2	1.4	4.8	4.8	4.9	5.1	5.1	5.1	4.6
Maximum	20	16.8	9.3	17.6	9.1	15.4	13.0	13.0	15.2	12.9	10.3	9.9
Range	31	13.9	6.6	13.3	7.7	10.5	8.1	8.0	10.1	7.8	5.2	5.3
Mean	3.9	8.2	5.7	8.5	5.7	8.7	8.6	8.6	8.9	8.7	7.3	6.9
Std. Dev.	4.9	3.0	1.3	2.5	1.5	2.6	2.4	2.4	2.5	2.4	1.1	1.1

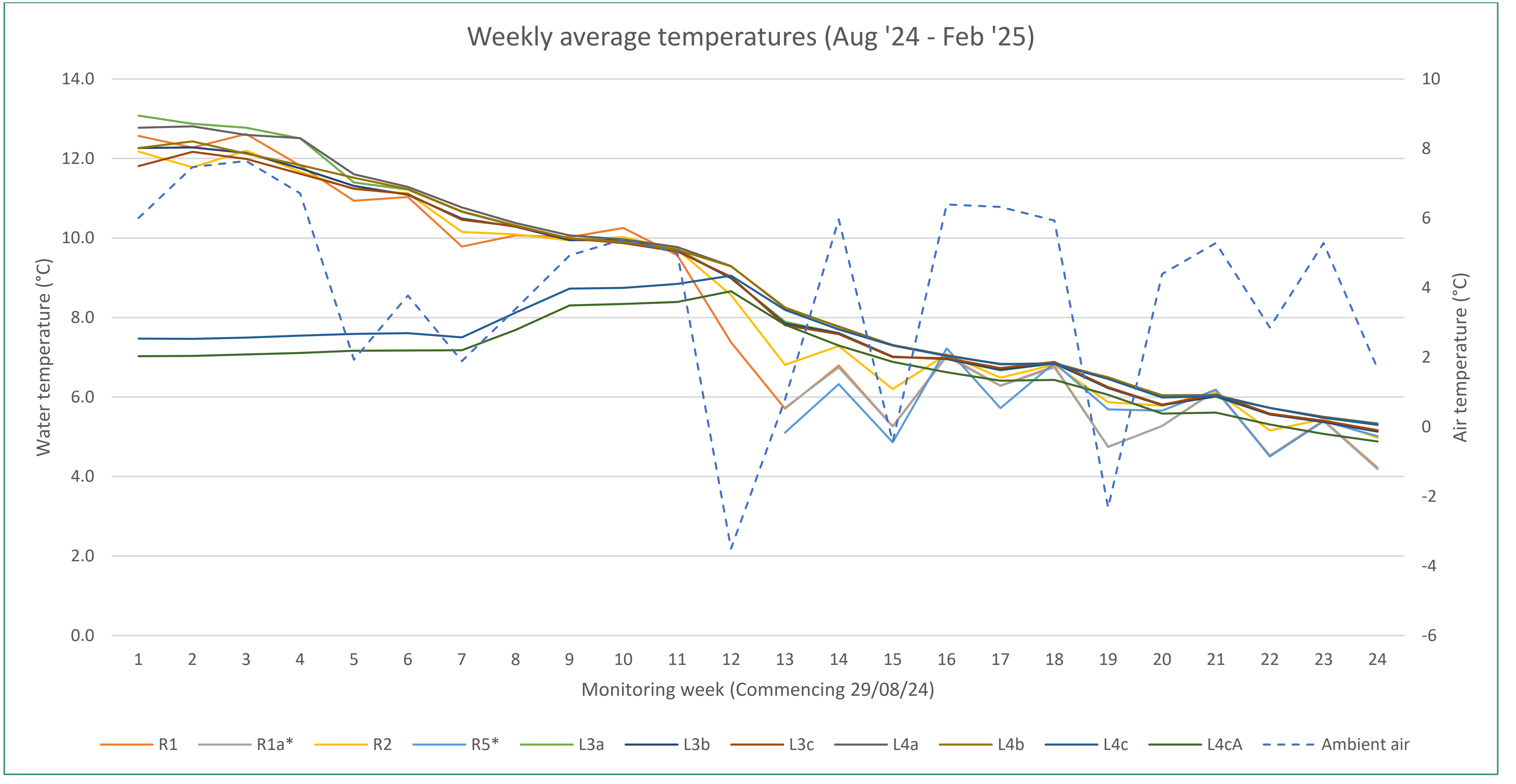
* These locations were only monitored for approximately 50% (the second half) of the monitoring period. Therefore, certain aspects of the data from these locations cannot be directly compared with the other locations (i.e. minimum temperature, temperature range etc.)

Table 3. Weekly average temperature results for all monitoring locations (Aug '24 – Feb'25)

Month	Location / Monitoring week	Ambient air	R1	R1a	R2	R5	L3a	L3b	L3c	L4a	L4b	L4c	L4cA
Aug '24	1	6	12.6	NM	12.2	NM	13.1	12.3	11.8	12.8	12.3	7.5	7.0
Sep '24	2	7	12.3	NM	11.8	NM	12.9	12.3	12.2	12.8	12.4	7.5	7.0
	3	8	12.6	NM	12.2	NM	12.8	12.1	12.0	12.6	12.1	7.5	7.1
	4	7	11.8	NM	11.7	NM	12.5	11.8	11.6	12.5	11.8	7.5	7.1
	5	2	10.9	NM	11.2	NM	11.4	11.3	11.2	11.6	11.5	7.6	7.2
Oct '24	6	4	11.0	NM	11.1	NM	11.2	11.1	11.1	11.3	11.2	7.6	7.2
	7	2	9.8	NM	10.2	NM	10.7	10.5	10.5	10.8	10.7	7.5	7.2
	8	3	10.1	NM	10.1	NM	10.3	10.3	10.3	10.4	10.3	8.1	7.7
	9	5	10.0	NM	9.9	NM	10.0	9.9	10.0	10.1	10.0	8.7	8.3
Nov '24	10	5	10.3	NM	10.0	NM	10.0	9.9	9.9	10.0	9.9	8.7	8.3
	11	5	9.6	NM	9.7	NM	9.7	9.7	9.7	9.8	9.7	8.8	8.4
	12	-4	7.4	NM	8.6	NM	9.0	9.0	9.0	9.3	9.3	9.1	8.7
	13	1	5.7	5.7	6.8	5.1	7.9	7.8	7.8	8.2	8.3	8.2	7.8
Dec '24	14	6	6.8	6.7	7.3	6.3	7.6	7.6	7.6	7.8	7.8	7.7	7.3
	15	0	5.3	5.3	6.2	4.9	7.0	7.0	7.0	7.3	7.3	7.3	6.9
	16	6	7.0	7.0	7.1	7.2	7.0	7.0	7.0	7.1	7.0	7.0	6.6
	17	6	6.3	6.3	6.5	5.7	6.7	6.7	6.7	6.8	6.8	6.8	6.4
Jan '25	18	6	6.8	6.7	6.8	6.9	6.8	6.9	6.9	6.9	6.8	6.8	6.4
	19	-2	4.7	4.7	5.9	5.7	6.2	6.2	6.2	6.5	6.5	6.5	6.1
	20	4	5.3	5.3	5.8	5.7	5.8	5.8	5.8	6.0	6.0	6.0	5.6
	21	5	6.2	6.2	6.1	6.2	6.0	6.0	6.1	6.0	6.0	6.0	5.6
	22	3	4.5	4.5	5.2	4.5	5.6	5.6	5.6	5.7	5.7	5.7	5.3
Feb '25	23	5	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.5	5.5	5.5	5.1
	24	2	4.2	4.2	5.0	5.0	5.2	5.1	5.2	5.3	5.3	5.3	4.9

NM = Not measured

Figure 3. Graph showing weekly average water and air temperatures at each monitoring location



4.3 Narrative description

A factual description of the monitoring results from each monitoring location is presented below. Further discussion of the driving mechanisms and interrelationships between different monitoring locations is presented in Section 5 below.

A plan showing the monitoring locations is presented in **Appendix C.**

4.3.1 Location 1 and 1a

Location 1 and 1a, upon the Gearr Garry approximately 2.8km downstream of Quoich Dam, recorded a maximum water temperature of 16.8 °C in the first week of the monitoring period. Thereafter, the recorded temperature gradually decreases until the end of the monitoring period, however there are several perturbations to this generally downward trend at intervals throughout the monitoring period. The temperature data from location 1 illustrates a strong diurnal variation pattern during the first half of the monitoring period, with the range of recorded temperatures between daytime maxima and nighttime minima frequently exceeding 2 °C, and occasionally exceeding 5 °C. While still evident, the diurnal pattern of temperature changes is much less stable or sustained during the second half of the monitoring period.

Location 1a, whose monitoring period commenced midway through the overall monitoring period (22/11/2024) is essentially co-located with Location 1. The monitoring data from Location 1a essentially mirrors that from Location 1. The maximum and minimum temperatures recorded are 9.3 and 2.8 °C respectively (reflecting the Winter deployment period). Similarly to Location 1, Location 1a generally displays a strong diurnal variation pattern with occasional periods of elevated temperature perturbations lasting several days during periods of relatively elevated air temperatures. A key difference between the monitoring data from location 1 and 1a respectively, is that Location 1a consistently records 'warm' periods approximately 24 hours before the equivalent temperatures are recorded at Location 1. Location 1a also appears to reach marginally colder absolute temperatures than recorded at Location 1.

4.3.2 Location 2

Location 2, upon the Gearr Garry immediately downstream of Quoich Dam, recorded a maximum water temperature of 13.6 °C in the first week of the monitoring period*. Thereafter, the recorded temperature gradually decreases week on week until the end of the monitoring period. The lowest water temperature recorded was in late January 2025 where a minimum temperature of 4.2 °C was measured. The temperature data from location 2 illustrates a modest diurnal variation pattern during the first half of the monitoring period, with the range of recorded temperatures between daytime maxima and nighttime minima generally being less than 2 °C. During the second half of the monitoring period, this diurnal variation pattern appears to break down, with largely stable temperatures persisting for several days at a time punctuated by either one off instances or short periods where a clear day/night contrast reappears. In the final weeks of the monitoring period, a very minimal diurnal variation pattern is once again evident, albeit the day/night range having reduced to less than 0.5 °C range.

Note: The first data point at Location 2 recorded an anomalously high temperature of 17.6 °C. This data point is considered to have been influenced by prevailing air temperatures as the first data point closely coincided with the sensor's initial deployment. This result is not considered generally representative of the water temperature regime at the site, and has therefore been discounted from all subsequent analysis and interpretation.

4.3.3 Location 5

Location 5, within the Kingie Pool downstream of the Quoich Power Station outflow, commenced monitoring midway through the overall monitoring period (22/11/2024). The maximum temperature recorded was 9.1 °C (18/12/24) whereas the minimum temperature recorded was 1.4 °C (13/01/2025). The pattern of temperature results recorded at Location 5 differ from the other river locations in that there is no significant downward trend across the monitoring period. This is further discussed in Section 5.7 below. Additionally, while sometimes present, this location does not appear to have a strong diurnal temperature variation pattern with several periods (lasting up to 10 days) where water temperature is essentially stable before returning to short intervening periods of erratic temperatures variation.

4.3.4 Location 3a, 3b and 3c

Location 3, which is set within approximately 20m water depth is located within a relatively shallow area at the eastern end of Loch Quoich reservoir near to the Proposed Development. Three sensors (Locations 3a, 3b and 3c) were deployed in a near-vertical arrangement through the water column.

In general, all three sensors at Location 3 record a generally very smooth, gradual decrease in water temperature from approximately 12.5 °C at the beginning of the monitoring period, to approximately 5.0 °C at the end of the monitoring period.

Location 3a, which is set within the uppermost 1m of the water column, records a notable diurnal temperature variation pattern, which is most exaggerated during periods of high ambient air temperatures, during which a day/night temperature range of up to 3 °C is evident. This diurnal patter remains evident throughout the entire monitoring period, but becomes increasingly subtle as the monitoring period progresses.

Location 3b and 3c both closely mirror the temperatures measured at Location 3a, however, no significant diurnal variation pattern is evident. That is, the temperature recorded at both Location 3b and 3c is essentially stable (albeit gradually decreasing) across the entire monitoring period. A notable feature of the temperature record from both Location 3b and 3c is that occasionally, a period of decreased temperatures which are sustained for several consecutive days is observed early in the monitoring period. During such periods, the 'deeper' waters (i.e. c.10m and c.20m) at Location are indicated as being 1-2 °C cooler than the prevailing surface water temperature at these times.

4.3.5 Location 4a, 4b and 4c/4cA

Location 4, which is set within approximately 55-60m water depth is located within a relatively deep area within the central part of Loch Quoich reservoir. Four sensors (Locations 4a, 4b and 4c/4cA) were deployed in a near-vertical arrangement through the water column.

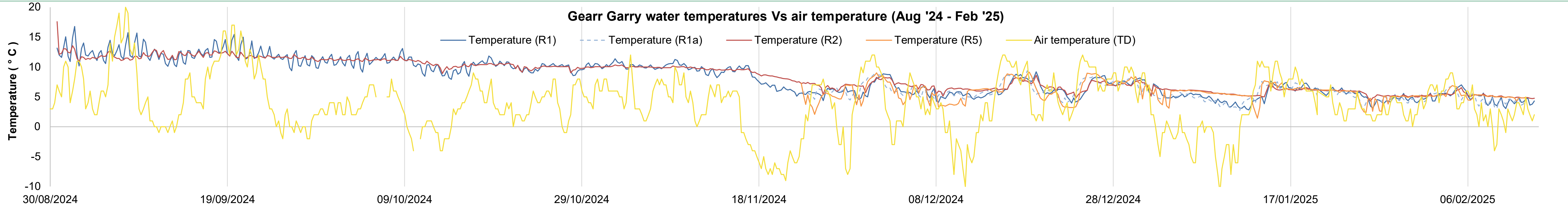
In general, the temperature data recorded at Location 4 splits into two distinctly different temperature regimes. Location 4a and 4b, which represent surface and shallow waters within the loch begin the monitoring period at approximately 12 °C and gradually and smoothly decrease towards a temperature of approximately 5 °C at the end of the monitoring period.

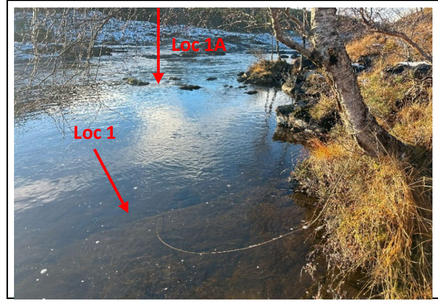
Location 4a records a similar pattern of water temperature results to Location 3a, however, the diurnal variation pattern observed at Location 4a is somewhat subdued relative to that at Location 3a.

By contrast, Location 4c and 4cA, which represent the deeper waters within the Loch begin the monitoring period at approximately 7 °C these conditions persist with very stable deep water temperatures for approximately eight weeks through late Summer/early Autumn with very little temperature variation recorded within the deep water setting. Commencing late October, a series of short term increased temperature perturbations are recorded, with water temperatures rising by up to 3 °C for 24-48 hours before returning to a lower, but now gradually increasing water temperature trend. At least nine such events are recorded within the water temperature data between October 20th and November 16th 2024. After November 16th, the water temperatures recorded at all Location 4 depths have essentially merged at a temperature of 9 °C which then continues to gradually fall towards a minima of approximately 5 °C at the end of the monitoring period.

The temperatures recorded at Locations 4c and 4cA (which are co-located sensors of different types) show very strong and consistent agreement across virtually the entire monitoring period, with a consistent variance of approximately 0.5 °C recorded across the monitoring period. This variance provides additional confidence in the data recorded from the deeper water location, and the respective accuracy of the two different sensor types used.

Figure 4. Time-series graphs showing continuous monitoring data of water temperatures at Loch Quoich and Gearr Garry

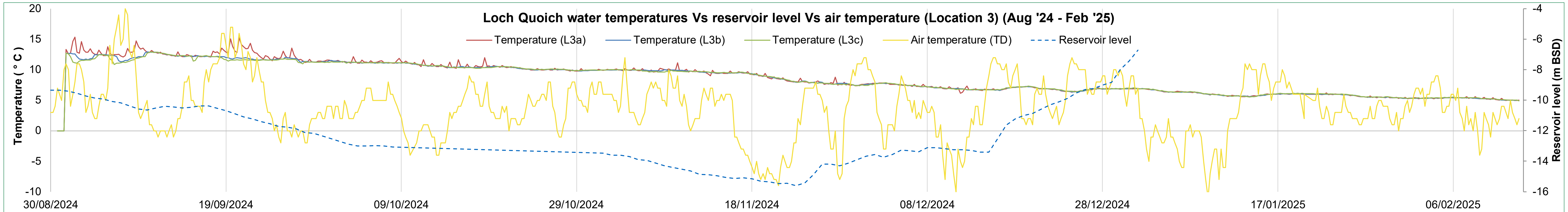




Location 1 - Situated on Gearr Garry approximately 2.8km downstream of Quoich Dam at NGR: NH095011. Location 1A has been added approximately 3m upstream in a similar water depth to Loc 1, but in a location unaffected by potential tree shading.

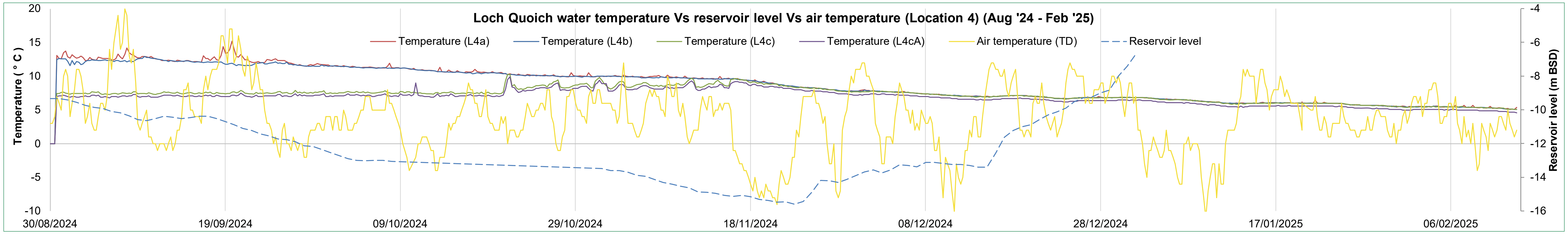
Location 5 - A further additional sensor located has been added midstream, downstream of the existing Quoich Power Station at NGR: NH109010

Location 2 - Situated on Gearr Garry approximately 0.3km downstream of Quoich Dam at NGR: NH073023.



Location 3 - Situated on Loch Quoich in approximately 20.3m depth of water (as of 10/10/24) at NGR: NH059015. Location 3 features three temperature logging sensors (L3a, L3b & L3c) at surface, intermediate depth and near loch base.

Location 4 - Situated on Loch Quoich in approximately 53.3m depth of water (as o 10/10/24) at NGR: NH035022. Location 4 features three temperature logging sensors (L4a, L4b & L4c) at surface, intermediate depth and near loch base. A fourth sensor (L4cA) is co-located at L4c for validation purposes.



5 Discussion

As described in Section 1.2 above, there were several discrete objectives in undertaking the temperature monitoring investigation on the Loch Quoich/Gearr Garry system. These are restated below to provide structure to the further analysis and interpretation of the temperature monitoring data gathered.

Investigation objectives

1. To characterise the baseline water temperature regime at different locations within the Loch Quoich/Gearr Garry system.
2. To characterise the baseline water temperature regime at different spatial locations within Loch Quoich relative to each other.
3. To characterise the baseline water temperature regime at different water depths within Loch Quoich relative to each other.
4. To identify and characterise the driving mechanism/s controlling water temperature variation at the different monitoring locations
5. To identify any links between the water temperature regime in the loch relative to the regime in the river.
6. To identify any current impacts of the existing hydropower schemes' operation upon the water temperature regime upon the Gearr Garry.

5.1 Additional background data

The Ness District Salmon Fishery Board (NDSFB), whose catchment includes the Loch Quoich/Gearr Garry system is a stakeholder in relation to any development which may impact on the water environment. As such, NDSFB have its own network of temperature monitoring sensors located throughout the wider Glen Garry catchment. NDSFB has kindly provided the raw data from their nearby temperature monitoring locations for consideration alongside the results of this investigation.

The closest and most directly comparable of NDSFB's temperature monitoring network locations is situated at NGR: NH 0814 0195. This location is situated upon the Gearr Garry approximately 1.1km downstream of Quoich Dam. As such, this location is considered analogous to Location 1 and 1a in this investigation.

The raw data provided by NDSFB is presented in **Appendix F**.

A time-series graph showing Gearr Garry water temperatures at the NDSFB monitoring location is presented in Figure 5a and 5b below.

A comparison graph which overlays NDSFB's most appropriate location data with that from Location 1 and Location 5 is presented in Figure 6a and 6b respectively below. Notwithstanding day-to-day and annual differences in weather patterns, both datasets appear broadly consistent with each other, which provides confidence that they are both accurate and representative in detailing the prevailing baseline water temperature regime in the main reach of the Gearr Garry.

Note: For Figure 5a, NDSFB's water temperature data is gathered at 15-minute intervals, between 31/08/2023 and 28/08/2024. For Figure 5b, NDSFB's water temperature data is gathered at 15-minute intervals, between 01/11/2023 and 05/10/2024. NDSFB's monitoring location use an alternative sensor type to those used during this investigation. No guarantee to the accuracy of NDSFB's data can be given, and it has been accepted in good faith.

Figure 5a. NDSFB water temperature data from Gearr Garry at approximate NGR: NH 0814 0195

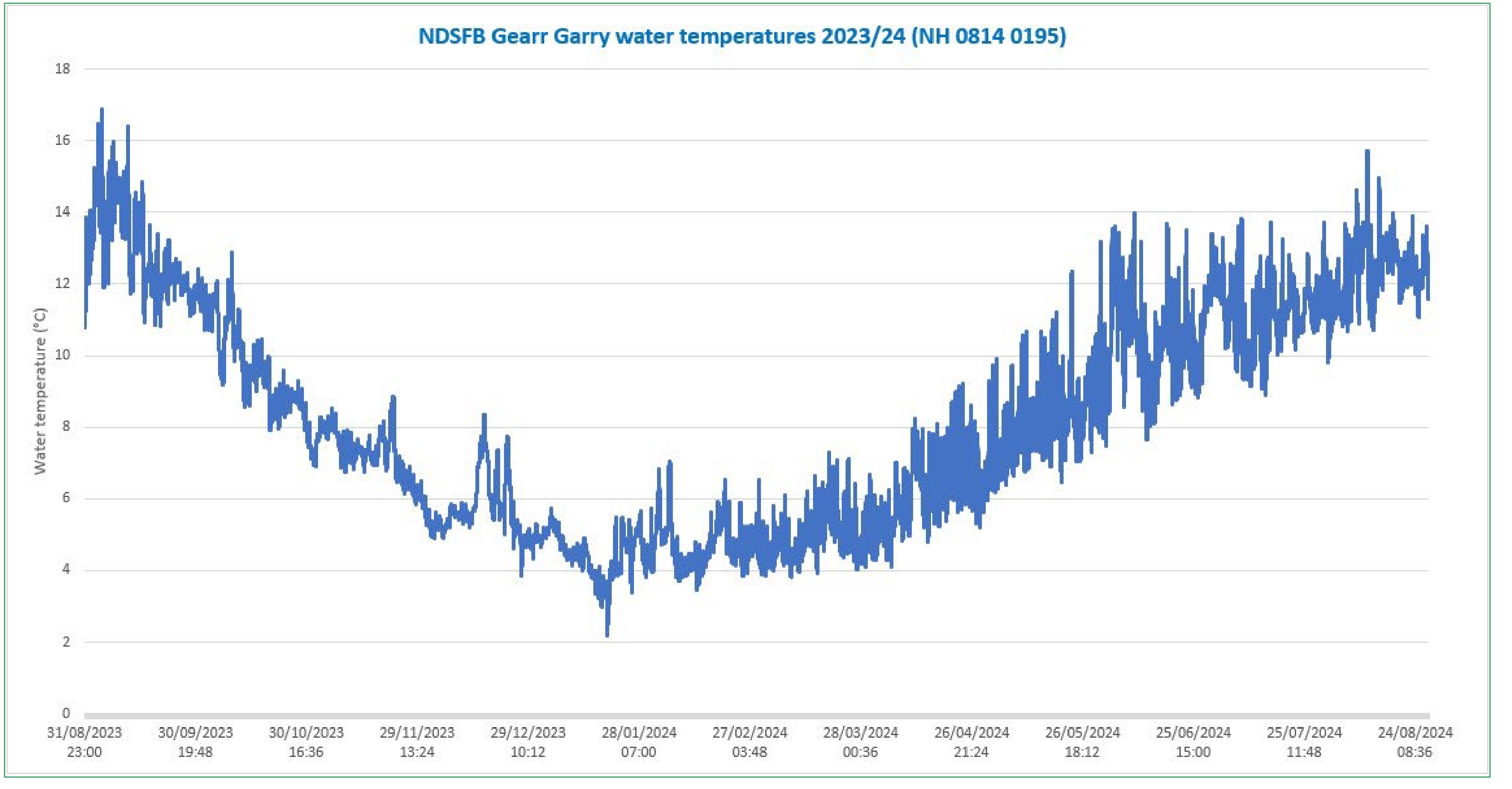
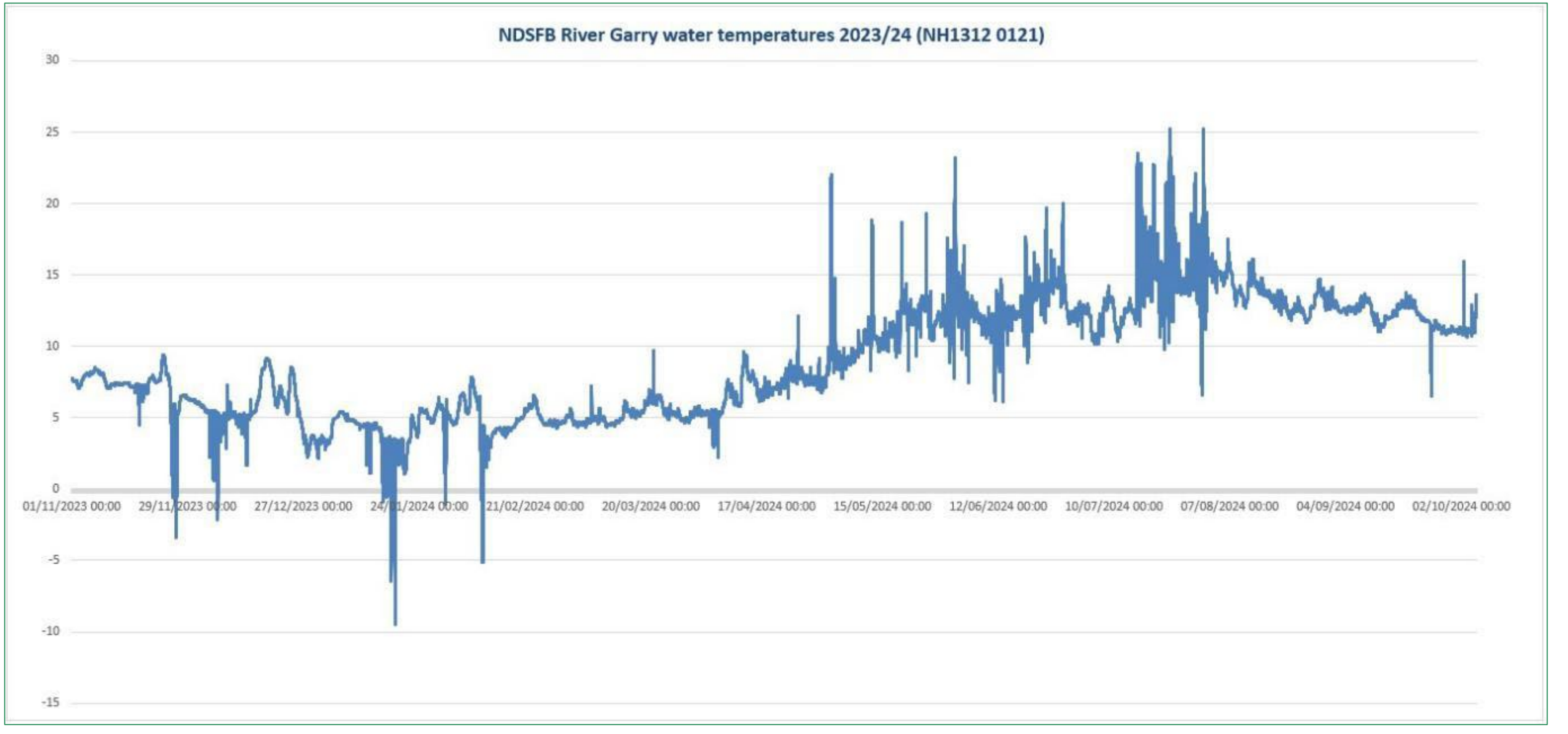


Figure 5b. NDSFB water temperature data from River Garry at approximate NGR: NH 1312 0121



Note. NDSFB have indicated that this sensor may have been exposed to air at times during its monitoring period. This may explain the occasional very low and very high temperatures recorded at this location.

Figure 6a. Comparison between Location 1 and NDSFB monitoring data across equivalent seasons in 2023/24 (NDSFB) and 2024/25 (Location 1)

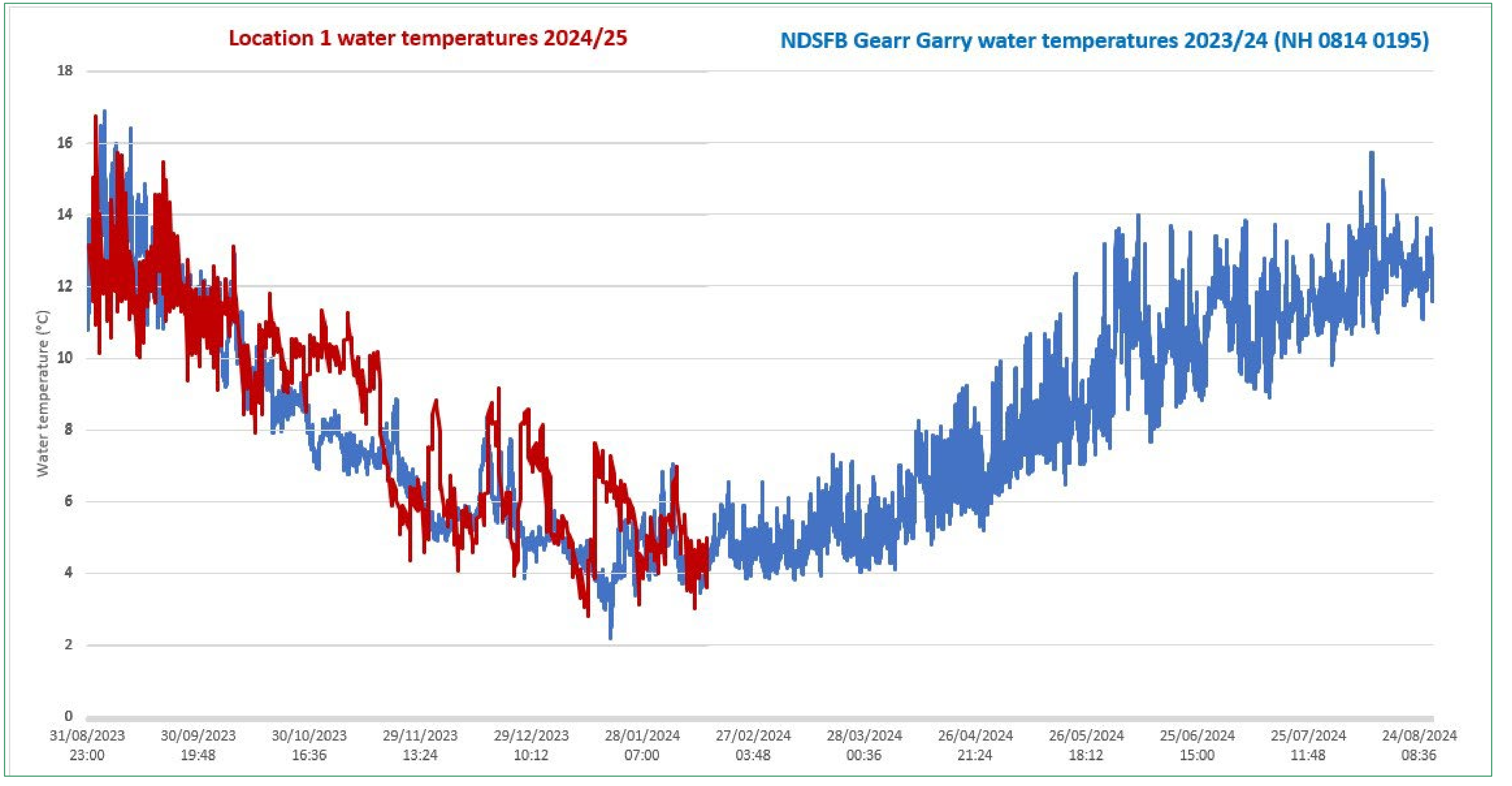
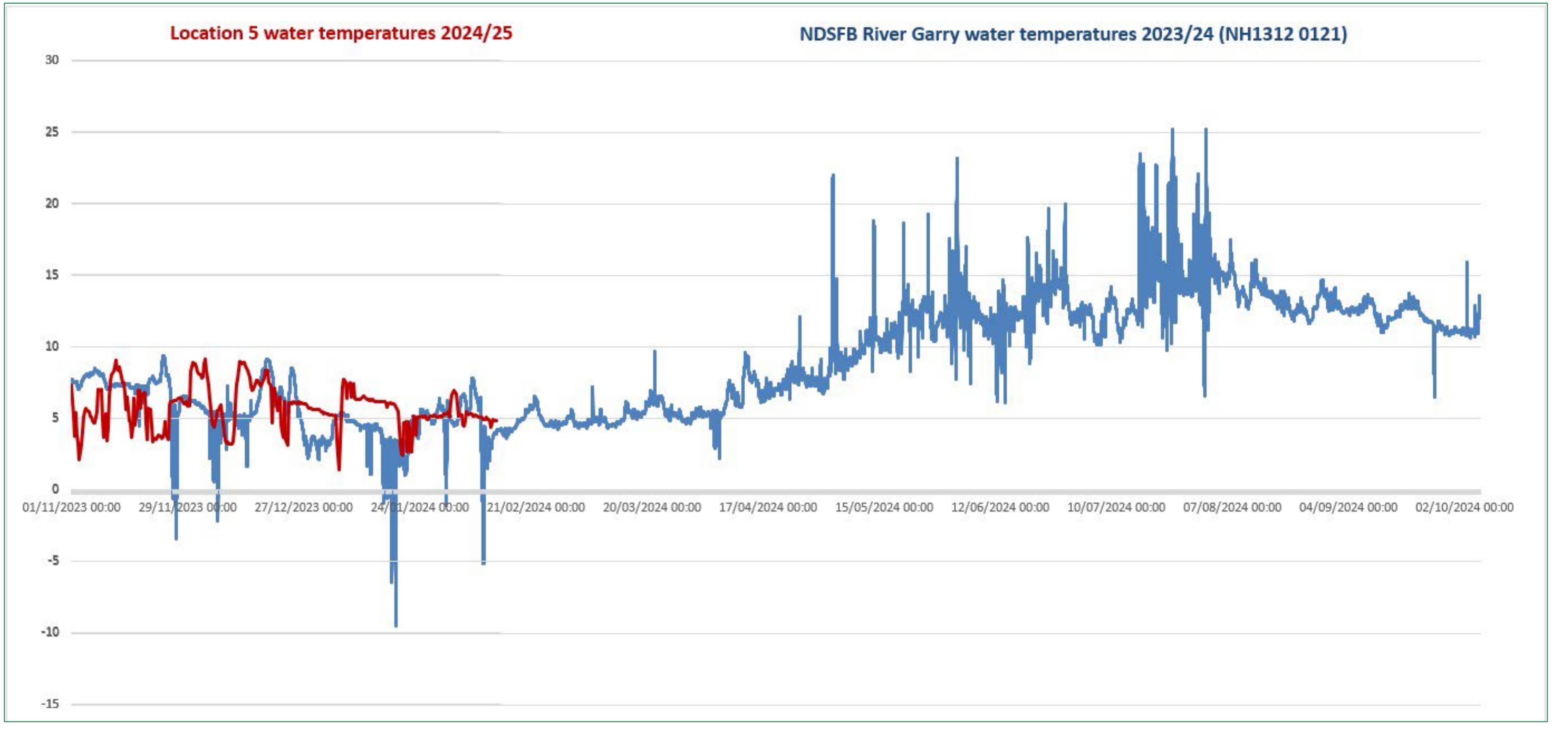


Figure 6b. Comparison between Location 5 and NDSFB monitoring data across equivalent seasons in 2023/24 (NDSFB) and 2024/25 (Location 5)



Note. NDSFB have indicated that this sensor may have been exposed to air at times during its monitoring period. This may explain the occasional very low and very high temperatures recorded at this location.

5.2 Objective 1 – Baseline water temperature regime

Continuous water temperature data has been gathered at six-hourly intervals at a range of locations and depths across the Loch Quoich and Gearr Garry system over a period of approximately six months from late August 2024 onwards. Data gathering continues at all locations.

The data gathered from each of the river locations (Locations 1, 1a, 2 and 5) all broadly indicate an anticipated water temperature regime, with peak temperatures recorded in late Summer before a long and gradual decrease towards the end of the monitoring period so far available (to mid-February). Several of the locations monitored indicate some form of diurnal temperature variation pattern, as would be expected in 'shallow' water settings where prevailing air temperature and sunshine hours would be expected to be the dominant drivers of water temperatures. The magnitude of the diurnal variation pattern becomes increasingly subdued as the monitoring period progresses from Summer through to Winter, which reinforces the hypothesis that seasonal and day/night ambient air temperatures are the predominant driving mechanisms on water temperature in riverine settings (alongside altitude, climate and artificial modifications (such as pre-existing hydro schemes)). Some distinct variations between the different river monitoring locations are evident, in some instances these can lead to temperature variances of up to several degrees centigrade between different riverine locations. These variances are considered further with regards to later objectives below.

When the combined results of this investigation and NDSFB's own monitoring is considered, it appears that based on the available data that water temperatures in the Gearr Garry oscillate between a late Summar maxima of approximately 17 °C and a mid-late Winter minima of between 2-4 °C. It must be recognised that significant in-year and year-to-year variation is possible based on prevailing weather patterns, however, the pattern observed appears credible and consistent with the available validation data.

The data gathered from each of the loch locations indicate a generally very stable temperature regime which prevails over at least the upper 20m of the water column within the loch environment. Both location 3 and location 4 broadly documented a maximum temperature of approximately 13 °C in late Summer before very gradually decreasing to a minima of approximately 5 °C in late Winter. Two notable exceptions to this broad regime are noteworthy. Location 3a and 4a, which monitor surface water temperatures in both locations each display a degree of responsiveness and diurnal variation which is not reflected in any of the deeper water locations (i.e. the B and C sensor positions). This daily variation is evident throughout the monitoring period, however, it is most pronounced in late Summer and Autumn before becoming increasingly subdued as the onset of Winter arrives. The magnitude of this diurnal variation in surface water temperatures is particularly elevated where successive days of elevated ambient air temperatures (i.e. 15 -20 °C). A second notable feature was detected from the intermediate and deep sensors at Location 3 (Location 3b and 3c). During two short episodes at the beginning of the monitoring period, the deeper water temperatures at Location 3 record several successive days where water temperature falls by approximately 0.5 -1.0 °C, and remains depressed for several successive days before returning to the long term stable water temperature regime. The exact mechanism controlling these events is unclear, however it is notable that on each occasion, the temperature reduction at the deep location (Location 3c) precedes the intermediate location by 24 hours. While uncertain, this suggests a potential upwelling of colder deep loch waters and/or a temporary breakdown in the distinct thermocline which is otherwise present during Summer and Autumn (see below). These events are illustrated in an extract from a time-series graph of Location 3 below.

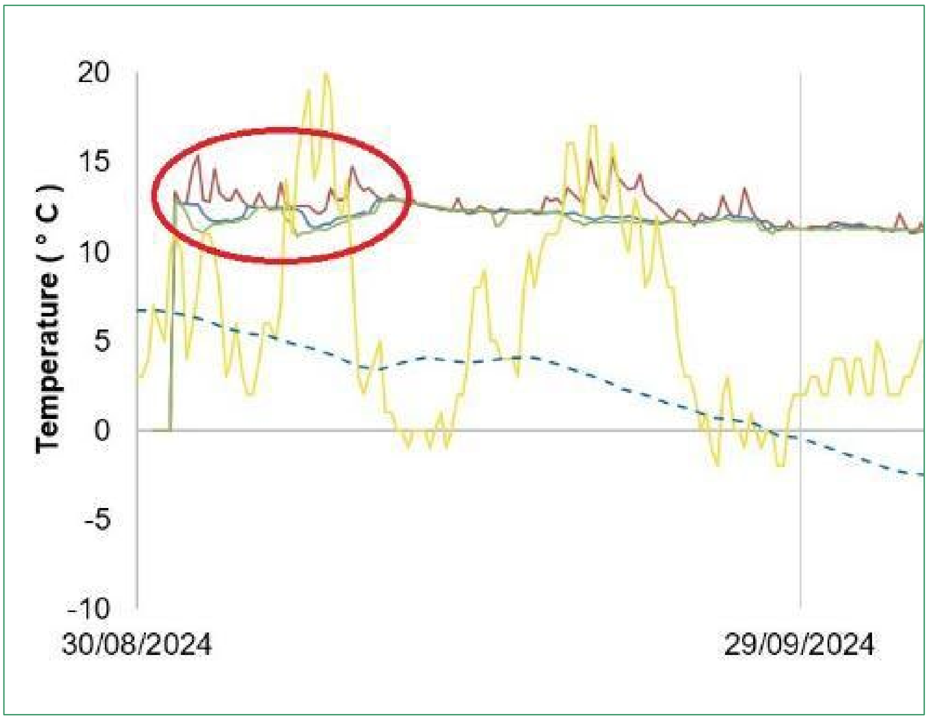


Figure 7. An extract from Figure 4 above showing Location 3's monitoring data illustrating peak period of diurnal variation of surface waters along with anomalous water cooling observed at the B and C sensor positions.

One final aspect of the loch monitoring locations worthy of mention is the distinctly different temperature regime which prevails at Location 4c (& 4cA) relative to all other loch monitoring locations. This location, which is set in 55m -60m water depths within a more central portion of the loch, records significantly colder and more stable temperature data throughout the monitoring period. These locations commence the monitoring period at temperatures of approximately 7.0 °C, and remain extremely stable (±0.5 °C) for several weeks before a sudden and marked change in the recorded temperature regime commences in the last week of October. From October onwards, a series of discrete temperature perturbation events occur, with recorded deep water temperatures reaching surface water temperatures for up to 24 hours before dropping back. Several such instances, are recorded. These events appear to be related to a mixing of the water column as part of a progressive convergence between surface water and deep water temperatures (and the distinct water bodies they represent), which occurs over a period of approximately four weeks before concluding in mid-November. Upon completion of this episodic and progressive mixing period, the deep water temperatures appear to achieve equilibrium with the shallower waters' temperatures at approximately 9.0 °C before the now-mixed water body continues its gradual temperature reduction as Winter progresses. These events are illustrated in an extract from a time-series graph of Location 4 below. Further consideration and discussion of this regime is provided below.

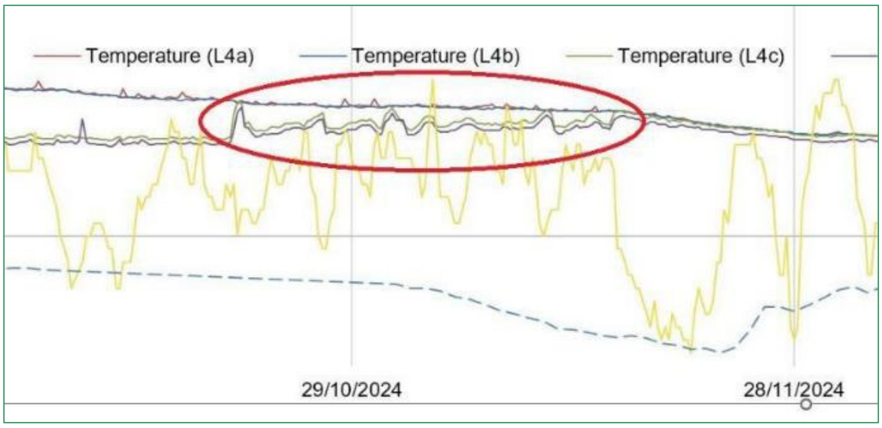


Figure 8. An extract from Figure 4 showing Location 4's monitoring data illustrating progressive thermocline collapse and water mixing occurring between late-October and mid-November.

It is highly likely that this regime, while being representative of the catchment as it currently is, is influenced by the presence of the existing hydropower scheme (i.e. it is the baseline regime, but not an entirely natural one).

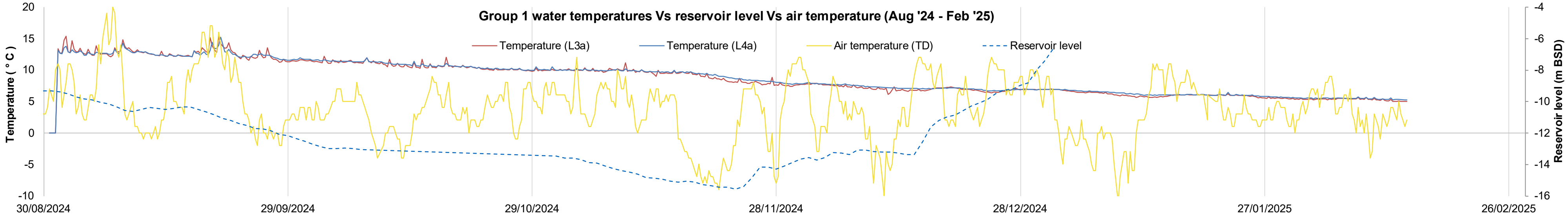
5.3 Objective 2 – Spatial variation in Loch Quoich

The design of the monitoring investigation was arranged to allow comparison between the water temperature regime in different locations on Loch Quoich. It must be noted that Loch Quoich is an extremely large body of water, and this study with only two locations can only provide limited insights into spatial variation across the entire loch. Nonetheless, the sensors deployed can be compared in groups of 'equivalent positions' to understand what, if any, spatial variation exists across the loch. Locations 3 and 4a (Group 1), both being surface water sensors, are directly equivalent in positional terms, which is to say the only significant differences between them should be driven by genuine variation across the loch regime. Similarly, Locations 3b, 3c and 4b (Group 2) are also broadly equivalent in positional terms, being deployed at approximately 10m, 20m and 25m water depth respectively. These relationships are illustrated in a number of time-series graphs presented in Figure 9 below.

Broadly speaking, the temperature record at both Location 3a and 4a is very similar, with the recorded temperature at both locations being within 0.5 °C of each other on all bar the hottest weather days (e.g. August 31st, September 1st). Whereas Location 3a generally records slightly warmer temperatures early in the monitoring period, this relationship essentially reverses partway through the monitoring period. The switchover between these two relationships appears to occur between late-October and mid-November. It appears credible that there may be a link between this relationship, and the overall water mixing described in Section 5.2 above. A further hypothesis for the subtle differences between the temperature record at Location 3a and 4a relates to the relative water depth in these locations. Location 3 is underlain by the loch bed (i.e. sediments and rock) whereas location 4 is underlain by a substantial depth of significantly colder water. Relative differences in the thermal properties and behaviours of liquids and solids may explain the observed pattern, whereby in Summer the shallower water depth and solid underlying material may cause faster and greater heating which manifests as higher peak temperatures at Location 3a relative to Location 4. In Winter, the thermal properties of the water underlying Location 4a may slow and reduce the heat loss from surface waters in the central loch relative to more marginal and/or shallow water locations (such as Location 3a).

Within the water column, as represented by locations 3b, 3c and 4a, the overall regime is very consistent between Location 3 and Location 4. With a small number of exceptions, water temperatures at all three locations are very similar (within 0.5 °C) throughout the monitoring period. As noted in Section 5.2 above, there appears to be occasions when colder water from the deeper loch upwell or spread into the shallower shelf setting typified by Location 3. The limited scope of the investigation prevents greater resolution or interpretation of this spatial variation. However, in general terms, it appears that the loch water temperature regime is largely spatially homogeneous, with occasional interruptions likely due to a combination of the bathymetry of the loch, the physical and thermal properties of the material underlying each sensor location and the apparent water mixing regime which occurs in the Loch during the Autumn season.

Figure 9. Time-series graphs showing continuous monitoring data of water temperatures at temperature-equivalent positions within Loch Quoich



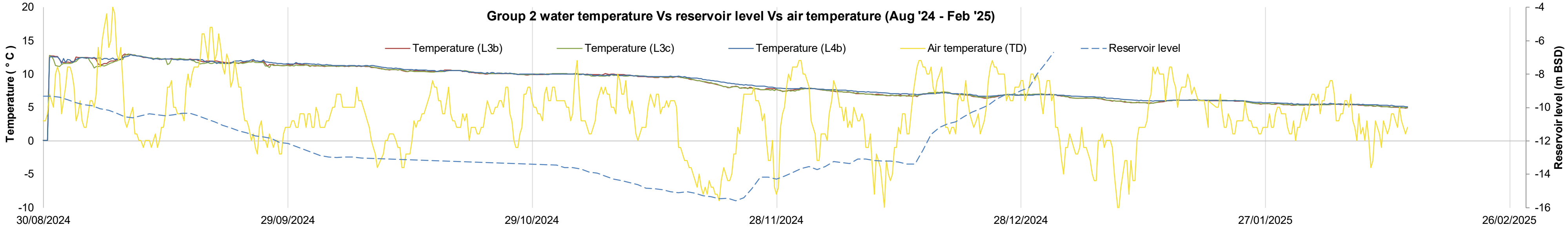
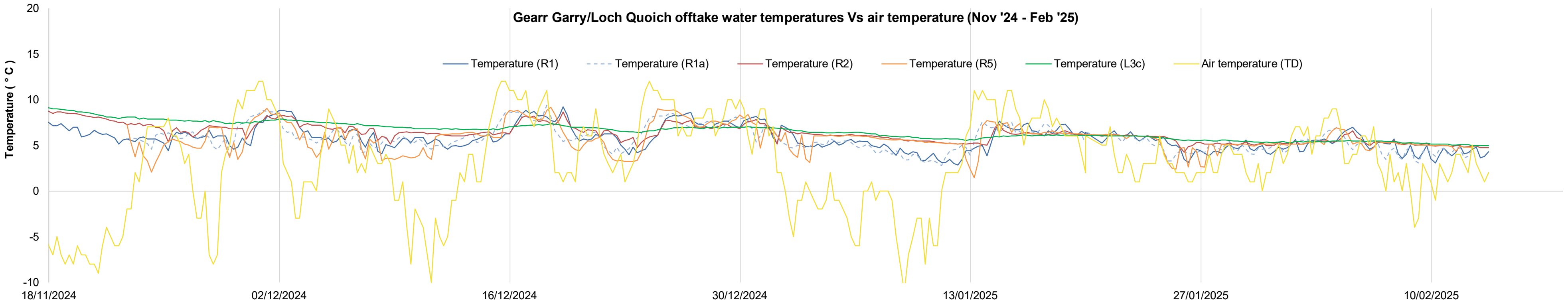


Figure 10. Time-series graphs showing continuous monitoring data of water temperatures at hydraulically linked positions within Loch Quoich and Gearr Garry



5.4 Objective 3 – Depth variation in Loch Quoich

The design of the monitoring investigation was structured to provide insight into any significant depth-driven temperature variation within the loch. As noted in Section 5.3 above, the loch is expansive, and includes water depths in excess of the maximum depth location monitored during this investigation, which is approximately 61m (at the time of the final data download). Notwithstanding this limitation, several significant aspects of the depth-driven temperature variation within the loch (and the annual regime which controls it) have been identified.

The combined monitoring data from locations 3a, 3b, 3c, 4a and 4b, which are all highly similar indicates, that at least over the monitoring period to date, a largely homogeneous strata of water of at least 25m thickness exists at Loch Quoich. As would be expected, the uppermost 1-2m of this strata are further subjected to solar gain in accordance with changing daily weather conditions (ambient air temperature, hours of sunshine, season/solar angle of incidence). However, notwithstanding surface temperature variations, the temperature of this water stratum is highly stable for most of the monitoring period with little short term variation evident. As described earlier, a gradual decreasing trend from late August to mid February whereby temperatures slowly fall from approximately 13 °C to approximately 5 °C is observed across all five sensors covering both locations.

Location 4c (and it's co-located validation (L4cA)) is the only loch monitoring location within this investigation which records a distinctly different pattern of water temperatures. As outlined in Section 5.2 above, the water temperature regime within the deeper loch waters is both significantly colder and more stable than all other monitoring locations. The consistent level of agreement between locations 4c and 4cA provides significant confidence in the accuracy of these results. Overall, the deep water temperature regime evident appears to indicate that a stable, relatively cold stratum of water exists in the deeper parts of the loch during the Summer and Autumn months. From mid-Autumn onwards, the recorded deep water temperature gradually increases until it reaches an equilibrium with the overlying shallower waters. This has been interpreted as representing the breakdown of a distinct thermocline which prevails during the Summer and Autumn months. As described in Section 5.2, this breakdown is episodic and progressive rather than sudden and short-lived. Once complete, it appears the loch's water temperature regime is homogeneous reflecting a well-mixed overall water body which has been observed to endure throughout Winter, and is anticipated to re-stratify during the late-Spring/early-Summer period, which has not yet been directly observed. Of further relevance to this discussion is a piece of anecdotal evidence provided by individuals with long-standing first hand knowledge of the loch – this indicates that with the exception of very shallow margins and sheltered locations, the loch is not known to freeze over entirely.

As such, it is considered that Loch Quoich appears to conform to a warm monomictic lake regime, whereby the loch distinctly stratifies in warmer months and becomes thoroughly mixed during colder months. Such lochs never freeze entirely (as distinct from cold monomictic lakes). In such regimes, the water column is clearly stratified for much of the year, with a warm, less-dense epilimnion (shallow, warm buoyant layer) overlying a significantly colder and denser hypolimnion (deep, colder denser layer). While the monitoring period completed to date does not allow confident definition of the start of the stratification process, it would be anticipated to commence between April and June each year. Based on the results gathered, it appears that the Loch Quoich epilimnion is at least 25m thick, whereas the hypolimnion is likely to be thicker according to the bathymetry and prevailing reservoir level during the Summer months. An estimated hypolimnion thickness of approximately 50+m thickness is suggested based on the known deeper locations within Loch Quoich beyond the depth of Location 4.

5.5 Objective 4 – Identifying driving mechanisms

It is well accepted that the largest factor controlling the water temperature in lochs and rivers is the prevailing air temperature. A range of additional factors can also influence the water temperature regime in surface water bodies. These include:

- Climatic, weather and seasonal variations,
- local conditions and habitats,
- altitude and topography,
- the dominant water source, (rainfall, snowfall, glacial melt, groundwater etc.) and;
- artificial catchment modifications, including hydropower schemes.

Based on the monitoring results collected, there is significant evidence for both air temperature and seasonal variation acting as significant driving mechanisms for the observed water temperatures. Most notably, warm Summer days coincide with peak water temperatures across all surface water locations. The effect of ambient air temperature on surface water temperature is seen to gradually decline as Summer progress into Autumn and Winter respectively. It is notable that elevated temperatures in Summer induce greater increase in water temperatures than similar ambient air temperatures in Autumn or Winter, suggesting a secondary seasonal controlling mechanism on water temperatures (e.g. contrast August 31st and September 19th with December 1st and December 15th). The upland topography of the catchment and the seasonal strength and obliquity of incident solar radiation during Winter months are considered likely explanations for these observations.

While incident solar radiation, and the resulting ambient air temperatures are considered the primary driving mechanism on water temperatures within the loch, as described in Section 5.4 above, it is considered that the thermal and density properties of water within the loch, and the relationship between them across an annual cycle is a very significant secondary mechanism within the loch. This is a behaviour observed in deep lakes, seas and oceans, and generally operates on larger scales and longer timescales than the shorter term variations seen in both loch (surface layer) and shallow riverine settings.

As described in Section 2 earlier, the Glen Garry catchment including Loch Quoich and the Gearr Garry are heavily modified, most notably due to the large scale hydropower developments of the 1950s and 1960s. While it has not been possible to include an unmodified control catchment within the scope of this investigation, it appears logical and likely that the original impoundment of Loch Quoich in the 1950s will have altered the water temperature regime both in the Gearr Garry and further down the Glen Garry catchment. Large, artificial water bodies such as Loch Quoich reservoir have the potential to substantially influence the water temperature regime lower down their catchment. Due to the thermal properties of water, such large water bodies may be expected to reduce peak Summer water temperatures and increase peak Winter water temperatures in downstream rivers. The relative thermal properties and energy exchange mechanisms of water relative to air (principally the differential in specific heat capacity) are such that Loch Quoich warms slowly through Spring, Summer and Autumn, before 'holding' that elevated water temperature as Winter becomes established. The corollary of this is that this thermal energy is lost (both back to atmosphere and downstream) slowly also. In effect, Loch Quoich reservoir can be thought of as a 'buffer' mechanism which likely holds the entire catchment at a colder temperature in Summer and warmer temperature in Winter than would be the case in an unmodified equivalent natural catchment.

These aspects, and the particular effects of the existing and proposed hydropower developments are explored further below.

5.6 Objective 5 – Temperature links between Loch Quoich and Gearr Garry

The engineering of the existing hydro scheme at Loch Quoich is such that water from Loch Quoich enters the Gearr Garry via two distinct routes. Firstly, a small compensation flow of 1 $m^3\ s^{-1}$ flows into Gearr Garry from the base of Quoich Dam. Secondly, a larger flow of up to 18 $m^3\ s^{-1}$ outflows from Quoich Power Station having first flowed through a concrete-lined tunnel of 4km length and a turbine-driven generator mechanism before emerging into Gearr Garry at Kingie Pool.

As described above, the waters of Loch Quoich are expected to act as a buffering source of thermal energy on the outflowing waters. Given the identified Loch Quoich outflows, any impact or link upon water temperature downstream would be expected to be most obvious at Location 2 (downstream of the compensation flow) and Location 5 (downstream of the power station outflow).

During the monitoring period of this study, it appears that a bimodal regime may exist whereby a subtle or reduced temperature linkage may be present during Summer and Autumn months. This is based primarily on the apparently subdued diurnal temperature variation evident at Location 2 relative to Location 1. Locations 1 and 2 are otherwise set in similar settings (altitude, water depth, river width/velocity, bankside shading etc.). The most likely explanation for the subdued diurnal variation evident at Location 2 is therefore that the reservoir outflow temporarily and partially overcomes the otherwise dominant effect of air temperature at this location (i.e the reservoir temperature is moderating the natural temperature fluctuations of the river). Location 1, located 2.5km further downstream does not display a similar 'moderated' day/night temperature profile, suggesting that the potential moderating effect of the reservoir outflow is spatially short-lived (i.e. it does not extend significantly downstream of the dam).

By contrast, during the Winter months, a significantly more complex pattern of relative temperature is evident at Locations 1 and 2. From mid-November onwards, several sustained periods are recorded where a divergence of up to 2 °C can develop and last for multiple days before the temperatures at both locations return to similar patterns. During such periods, the temperature at Location 2 (and later at Location 5) are both warmer and more thermally stable than at Location 1. That these locations are both warmer and lacking in distinct diurnal variation suggests that the reservoir outflow sustains relatively warmer and more stable water temperatures during such episodes than would otherwise be the case. For comparison, the reservoir waters are notably warmer (+0.5 – 2.0 °C) than the Gearr Garry during such episodes. These episodes also appear to coincide with periods of very cold ambient air temperatures due to sustained sub-zero air temperatures persisting for several successive days (Winter blocking atmospheric highs). The coincident occurrence of a 'winter water temperature regime' (in Loch Quoich) combined with sustained low air temperatures appears to enable a short term dominant linkage between Loch Quoich and Gearr Garry's water temperatures. It must be noted that Location 5 (and Location 1a) were not deployed across the entire monitoring period of Locations 1 and 2, and therefore these locations may behave differently during Summer/Autumn which may subsequently inform alternative interpretations of the driving mechanisms at play. This discrepancy in monitoring periods also creates an opportunity for observation bias to prejudice the interpretation of the data from these locations (particularly Location 5). This issue will resolve itself in time once a complete annual cycle at all locations is available for simultaneous review.

If a strong link does indeed exist between Loch Quoich and Gearr Garry, it would be expected to be best reflected by the respective data from Location 2 and Location 3c respectively.

A time-series graph showing the temperature relationship between the offtake from Loch Quoich and the Gearr Garry is presented in **Figure 10** above.

The interpretation of the data from Location 5 is given further consideration in Section 5.7 below.

5.7 Objective 6 – The effect of existing hydropower developments

As described above, there appears to be strong controlling influence exerted by the construction and operation of the existing hydropower scheme upon water temperatures in the Gearr Garry. It is important to recognise that this influence manifests itself in at least two distinct ways. Firstly, and least obviously, it is considered likely that the Loch Quoich reservoir (as distinct from the original, natural Loch Quoich) has a significant moderating influence on water temperatures in the Gearr Garry. In the absence of a viable control catchment, it has not been possible as part of this study to quantify this influence (i.e. how much colder should a natural Gearr Garry be in winter, and conversely how much warmer might it get in Summer absent Loch Quoich reservoir). Regardless of the precise answer to this somewhat hypothetical question, it must be acknowledged that the current conditions have been in place for many decades, and so any such influences and impacts have long since become 'normal' for this catchment. As such, it is considered likely that the resident ecology has adjusted and adapted to this configuration and the resulting water temperature regime.

Secondly, it appears that there are circumstances under which the existing Loch Quich reservoir exerts a more significant and measurable effect on downstream temperatures. As described in Section 5.6 above, there are several episodes during which the outflow of Loch Quoich elevates and moderates the temperature in the Gearr Garry downstream of the outflows. This relationship is relatively short lived (several days at a time) and appears (based on the monitoring period of this investigation) to only occur under certain specific conditions during the Winter months following the annual collapse of the Loch Quoich thermocline. Additional investigation is likely to be required to further evidence and understand these processes (e.g. multiple years, additional monitoring locations, control locations etc), and any potential impact it may have on the resident ecology.

Location 5, downstream of Quoich Power Station's outflow was added to the investigation's scope midway through the monitoring period. As such, a more limited period of data gathering is available for the water temperature regime for this location. However, several interesting observations are nonetheless possible in the available monitoring period (November 22nd -February 13th). Firstly, the water temperature regime downstream of Quoich Power Station appears to be relatively erratic when compared with the other riverine locations monitored. This manifests itself in larger day/night temperature variations (up to 3 °C), a less predictable diurnal temperature variation pattern, and as described in Section 5.6, sustained periods of extremely stable water temperatures. This pattern of data is somewhat replicated at Location 2 (also linked directly to Loch Quoich), but is distinctly absent at Location 1, 1a and in NDSFB's monitoring data from 2023/24. From this, two potential inferences can be drawn, as follows;

- Under certain circumstances at particular times of year, Loch Quoich and the operation of the existing hydropower scheme, may exert a strong controlling influence on water temperatures in the Gearr Garry for short periods of time. For clarity, this is a temporary short-lived warming effect (or rather a freezing-prevention effect).
- The spatial (i.e. downstream) extent of this link is believed to be relatively short lived. This is based on it being present 300m downstream of Quoich Dam, but entirely absent at either 1.1km or 2.8km downstream where air-temperature control appears to re-establish its primacy.

A possible interpretation for this relationship is that the relatively warmer reservoir water temporarily 'insulates' the Gearr Garry from the natural riverine temperature regime, including preventing or reducing the likelihood of complete freeze over of the Gearr Garry during sustained periods of very low air temperatures. However, this insulating effect is not so strong as to sustain all the way down the Gearr Garry (due to the differential heat loss profile of shallow moving waters relative to deep static waters). Further, during these periods, there is virtually no temperature difference between waters which flow directly through the dam (via the compensation flow) and those that are transferred several kilometres underground in a concrete-lined tunnel and thence through a turbine-generator mechanism. From this, it can be hypothesised that water transfer via underground tunnel and/or conveyance through a mechanical prime mover neither significantly increases nor decreases the water temperature in a material sense. This is considered due to the relatively slow rate of heat gain or heat loss of water over short periods of time (e.g. minutes to hours) relative the relatively fast rate of water conveyance through the dam and/or tunnel respectively. This hypothesis is tentative, but appears credible in the lack of viable alternative explanations.

5.8 Consideration of impacts of the Proposed Development

While not directly within the scope of this investigation, based on the data and information gathered, it is considered instructive to hypothesise on the potential impacts of the proposed Fearna PSH hydro scheme project upon the underlying water temperature regime in Loch Quoich and the Gearr Garry. As described in Section 1 above, the proposed Fearna PSH hydro scheme would see regular water transfers between a newly expanded upper reservoir (Loch Fearna) and the existing modified Loch Quoich reservoir acting as the lower reservoir. It is understood that the intake/outflow of this proposed scheme would be situated towards the base of the shallow shelf at the eastern end of Loch Quoich (c.20m water depths). The proposed operational regime is understood to include water transfers of up to 20 to 27 hours duration for generating and pumping respectively at regular intervals within the pre-existing operational constraints (i.e. reservoir levels) of the existing Loch Quoich regime.

From the monitoring data gathered, it can be asserted that Loch Quoich has a largely stable and predictable water temperature regime. There are surface variations, and a Summer/Autumn hypolimnion, but the main body of the epilimnion stratum is largely stable and resistant to short-term change or variation (besides seasonal patterns and winter mixing as described earlier).

The proposed Loch Fearna, being elevated at significantly higher altitude than Loch Quoich, is anticipated to experience a similar temperature regime to Loch Quoich, albeit within a narrower range (4 – 10 °C is estimated). It is considered unlikely that the current Loch Fearna is deep enough to allow a strong thermocline to develop. It is unknown, but considered credible that Loch Fearna may freeze over during winter. As such, it is conjectured that Loch Fearna as is currently, may act like the upper layer of Loch Quoich (in temperature terms) with potential freezing events during sustained colder spells (periods of -15 °C air temperature are considered entirely possible based on observations from Loch Quoich). It is understood that the proposed scheme may increase the current depth of Loch Fearna by approximately 60m. This increased depth may, over time, enable the development of a new monomictic lake regime within Fearna. However, the regular transfer of water between the two reservoirs and the attendant water mixing may preclude this.

Based on the information available, and the data gathered during this investigation, it is considered unlikely that the proposed Fearna PSH would lead to significant changes to the downstream water temperature regime at the catchment scale. It is thought likely that the proposed operation may lead to minor changes to a localised area at the eastern end of Loch Quoich, with a small net temperature increase (perhaps 1°C) in Loch Fearna in Summer/Autumn and a commensurate net temperature decrease in a small area of Loch Quoich in Winter/Spring. Overall, the thermal energy exchange between the two lochs would be expected to balance themselves out leading to little or no net change down-catchment. It is also worth noting that the relative volume balance between the proposed Loch Fearna and the current Loch Quoich is such that any thermal transfer would be anticipated to be up-catchment (i.e. Loch Fearna) rather than down-catchment (i.e. Loch Quoich or the water bodies downstream). As described earlier, large bodies of water are generally resistant to changes in their temperature, and are slow and lagging in any change that does occur. As apparently evidenced at Location 5, the large scale transfer of water does not appear to impart a significant increase or decrease in water temperature over the timescales and distances likely to be required as part of Fearna PSH. Equally, such large scale water transfers appear to create primarily a moderating effect (that is, they smooth out the natural peaks and troughs) on the receiving waterbody – this potential impact is obviously only of particular significance when the receiving water has a naturally variable temperature profile. From the monitoring undertaken, it can be seen that Loch Quoich does not have such a regime and it can be conjectured that Loch Fearna would not have one either. The Gearr Garry (in places) evidently does have a naturally variable water temperature regime, however this regime is enduring under the current conditions (except when in close proximity to an outflow under relatively infrequent weather conditions), and there is no reason to believe that the construction or operation of Fearna PSH would significantly alter that situation.

5.9 Consideration of impacts upon down-catchment fish ecology

Gavia Environmental understand that a query in relation to the proposed Fearna PSH scheme as it relates to altering the existing water temperature regime, and in particular transferring artificially warmed water down-catchment with resulting impacts on the spawning behaviour of salmonid fish species.

While this investigation is not intended to be a detailed study of these potential impacts, the improved understanding of water temperatures across the catchment gained, and more generally, if and how large scale water transfers affect water temperatures can now be better considered.

As described in Section 5.2 – 5.4, a significantly improved understanding of the pre-existing water temperature regime across the upper Glen Garry catchment is now available. This has shown that Loch Quoich acts according to a warm monomictic lake regime, with a temperature regime oscillating seasonally between approximately 4 – 15 °C. Further, a strong Summer/Autumn thermocline has been identified which is estimated to sit between approximately 25 - 55m water depth. This thermocline is observed to break down during late October and early November, with the resulting wintertime loch regimes being a well-mixed single water stratum with temperatures declining from approximately 9 °C at thermocline collapse to approximately 4 - 5 °C by late winter. The Gearr Garry and linked pools display a consistent diurnal temperature regime which oscillates from greater than 15 °C with significant day/night changes in late Summer to approximately 5 °C with minimal day/night changes by late Winter. A short-lived (in a spatial sense) moderating influence has been observed to be present in stretches of the Gearr Garry in close proximity (<0.5km) to hydro scheme outflows. This effect is not always apparent, and appears to only occur for short periods (several days) during Winter when notably low ambient air temperatures endure for several successive days. This leads to a temporary and spatially limited increased in water temperature (at a level of 5-6°C.) with little or no diurnal variation during such events. This temperature is approximately 1 °C higher than unimpacted stretches.

Guidance from Fisheries Management Scotland[1] on thermal discharge (from the Distillery sector) indicates that a maximum water temperature of 10 °C is considered protective of salmonid spawning. Incidentally, the same guidance notes that temperatures in excess of 23 °C is known to cause thermal stress in Atlantic salmon (*Salmo salar).*

While it is important not to overstate or over-extrapolate the results of this investigation, it appears that under current conditions, no parts of the upper Glen Garry catchment would be expected to exceed the thermal stress threshold at the present time. Salmonid spawning is understood to occur generally between September and December each year (albeit some outliers before or after this peak season have been recorded in Scotland). During this key period for species protection, the loch surface waters (upper 20m) maintains a temperature in excess of 10°C until late October. Water temperatures within the Gearr Garry range between 12 – 10 °C until later October, albeit with significant day/night variations (17 – 8 °C). Based on these data, it may be assumed that the upper Glen Garry catchment is

[1] Water temperature, Fisheries Management Scotland website (Accessed February 2025) (https://fms.scot/water-temperature/#:~:text=In%20addition%2C%20a%20maximum%2010,to%20protect%20spawning%20of%20salmonids.&text=Water%20held%20by%20impoundments%20is,depth%20of%20water%20held%20upstream.)

somewhat sub-optimal for salmonid spawning during the peak spawning season due to already pre-existing developments, however, it should also be noted that water temperatures throughout the upper catchment would in all likelihood be less suitable still were Loch Quoich not present (due to the buffering and moderating effect it has on the catchment).

A degree of expert judgement is required to predict what potential impacts the proposed Fearna PSH may have on the catchment in this respect, however, several fundamental assertions appear warranted based on the results of this investigation.

- Large bodies of static water such as Loch Quich (and in time, Loch Fearna) exist within a relatively narrow temperature range (relative to rivers) and are resistant to, and slow to experience significant temperature change.
- Where present, such large water bodies in all likelihood do have a moderating effect on the receiving rivers – that is, they cool the rivers during Summer and warm them during Winter. The magnitude of this effect is unproven by this investigation (i.e. there is no unmodified control catchment to compare against)
- Under certain circumstances (sustained very low air temperatures during Winter), the temperature profile of loch waters can be conveyed down-catchment in a manner which alters the temperature regime of the receiving water, however this effect appears to only persist over a few 100ms downstream through the receiving river).
- In the specific circumstances of Loch Quoich, the large scale water transfer through underground concrete-lined tunnels and mechanical generating equipment does not appear to significantly affect the temperature of the outflowing water.
- The long term effect of repeated water cycling between two large water bodies is unknown, but is conjectured to be marginal and localised (that is, contained around the inlet/outlet location).

Based on the above, it is considered that the proposed Fearna PSH scheme is unlikely to have a significant impact on spawning viability of salmonid species in the upper Glen Garry catchment beyond those effects which are already present due to larger-scale, longstanding catchment modifications due to hydropower developments.

It is important to note that this study has focused on temperature investigations and impacts only. It is possible that other aspects of the water environment (such as dissolved oxygen, nutrient levels etc.) may also be impacted (either positively or negatively) by both the current and proposed hydropower schemes in the catchment. Finally, one further factor worthy of mention is that ongoing climate change, and the presumed gradual warming of the entire water environment over a decadal scale, will almost certainly adversely affect the water temperature regime of the catchment with respect to salmonid spawning suitability in future years.

6 Conclusions

A detailed water temperature monitoring investigation has been undertaken across Loch Quoich and the Gearr Garry over a period of approximately six months between late-August 2024 and mid-February 2025. A total of 11No. temperature sensors were deployed across five discrete locations throughout the investigation area. The investigation was designed to provide insight into the water temperature regime/s both in Loch Quoich (spatially and vertically) and in Gearr Garry (spatially only).

The water temperature regime in Loch Quoich appears to conform to a warm monomictic lake regime, whereby the lake stratifies into a warm buoyant shallow layer overlying a stable dense colder layer during Summer and Autumn. This stratification, and the corresponding thermocline collapses, leading to a well-mixed water column which persists and gradually cools during Winter and Spring. The single annual mixing event was observed to occur progressively and episodically over a four-week period between late October and mid-November. While not directly observed, the corresponding annual re-stratification is expected to occur between April and June. It is anticipated that the precise timing of these events may change slightly from year to year according to varying annual weather patterns. Notable diurnal temperature variation is evident in the uppermost surface waters, this variation is strongest in Summer becoming more subdued in Winter. The overall water temperature regime is observed to range between approximately 4 °C and 17 °C. The deeper hypolimnion layer, when present, is observed to be very stable with respect to water temperature, at approximately 7 °C. Prevailing ambient air temperature, coupled with seasonal and meteorological factors have been identified as the dominant driving mechanisms of the water temperature regime observed. A significant secondary driving mechanism is the warm monomictic lake regime which occurs due to the Loch's significant size and depth.

The water temperature in the Gearr Garry appears to conform to a sinusoidal wave pattern according to the prevailing season. Water temperatures are significantly more variable within the Gearr Garry than within Loch Quoich. Very significant diurnal variation is observed at all monitoring locations, with the largest temperature variation range observed in the Summer/Autumn months, with relatively modest temperature variation observed during the Winter months. Prevailing ambient air temperature, coupled with seasonal and meteorological factors have been identified as the dominant driving mechanisms of the water temperature regime observed.

There is a strong associative link between water temperatures in Loch Quoich and the Gearr Garry. Given the absence of a practical control catchment, it is not possible to quantify the magnitude of the effect of this link. Therefore, at a catchment scale, Loch Quoich acts to moderate water temperatures downstream. At a more local scale, there is evidence that under prolonged sub-zero air temperature conditions during Winter, a temporary (relative) warming and moderating effect results from Loch Quoich's outflows as a result of the existing hydro scheme present on the catchment. This effect appears to only affect short stretches of the Gearr Garry directly downstream of the outflow point. When ambient air temperatures return to typical Winter averages, a more natural air temperature-driven regime quickly re-establishes itself in the river.

The investigation included a location immediately downstream of the outflow of the existing Quoich hydro scheme, which is conveyed approximately 4km by means of an underground concrete-lined tunnel before being used to drive a turbine-generator at Quoich Power Station. On account of the short Winter episodes (referred to above) where unmodified reservoir water is transferred into the Gearr Garry, it appears that no meaningful temperature change (increase or decrease) occurs during such large scale water transfers.

While this investigation primarily sought to understand the baseline water temperature regime within the catchment, it is possible to conjecture some probable outcomes of the Proposed Development on this baseline regime based on the data gathered. It is not considered likely that the Proposed Development will significantly alter the existing water temperature regime within the catchment. Should such changes actually occur, it is considered most likely that they would be spatially limited to the inlet/outlets of both Loch Quoich and Loch Fearna, rather than transferred down-catchment into the Gearr Garry or up-catchment into the wider Loch Quoich basin.

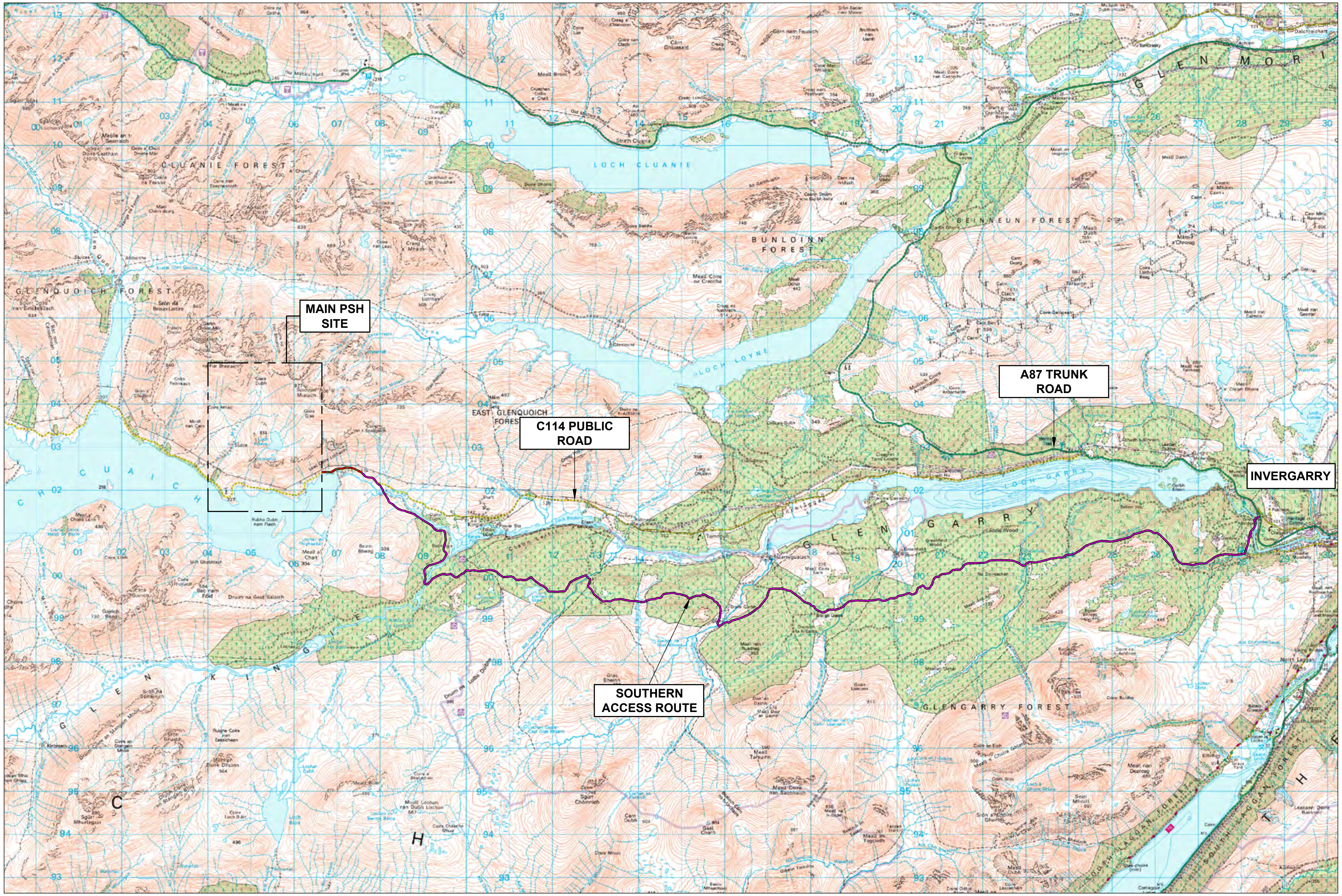
While this investigation is not primarily ecological in nature, it appears certain observations can be made on the ecological implications (for salmonid fish) of both the existing baseline water temperature regime and the likely future regime should the Proposed Development go ahead. It appears that Loch Quoich, and particularly the Gearr Garry, are already only marginal suitable for salmonid spawning with respect to water temperatures during the peak fish spawning season. It is considered that this situation would be even less well suited still for fish spawning with respect to water temperatures were the existing Quoich hydro scheme not in place. Based on the results of this investigation, it is not considered likely that the Proposed Development will meaningfully alter this situation either positively or negatively.

Finally, it is worth noting that this investigation has considered water temperature in isolation (as it pertains to fish ecology and impacts). Several other factors (such as dissolved oxygen concentrations, nutrient levels etc.) can all also impact on the ecology of resident fish in a catchment. These factors were outwith the scope of this investigation.

7 Appendices

Appendix A Proposed Development

NORTH



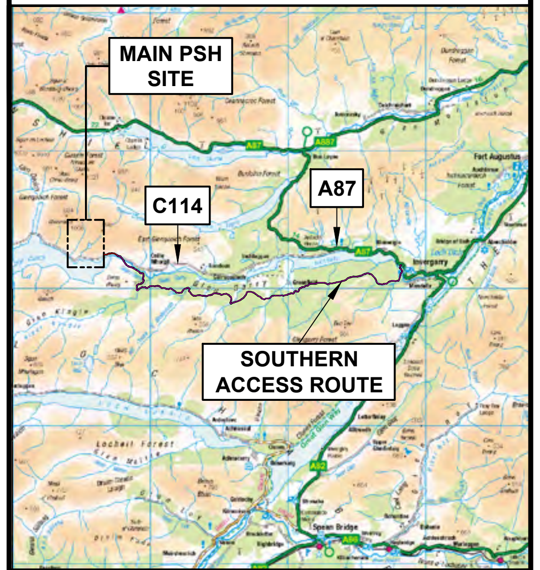
0 2.5km 5km

PLAN

1:50,000 @ A1, 1:100,000 @ A3

IF IN DOUBT - ASK

WIDER LOCATION PLAN



0 5km 10km

P1	22.01.23	MH	PRELIMINARY	FRA	FRA
REV	DATE	DRAWN	NOTES	CH'K'D	APP'D

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CLIENT

FEARNA PSH LTD.

PROJECT

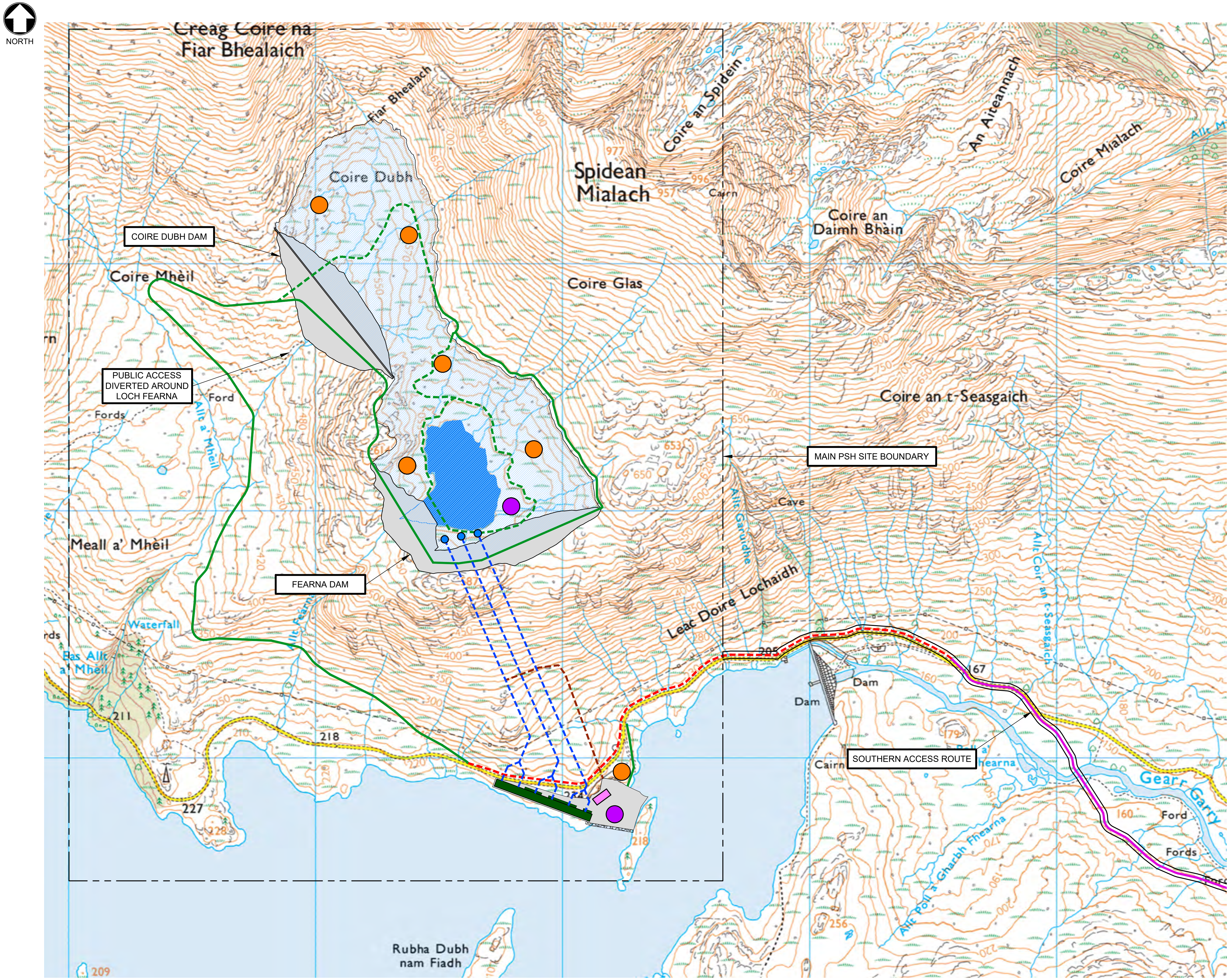
FEARNA PSH

TITLE

LOCATION PLAN

SIZE	SCALE AT A1	SCALE AT A3	STATUS
A1	1:50,000	1:100,000	PRELIMINARY

DRAWING NUMBER	REVISION
FIGURE 3.1	P1



IF IN DOUBT - ASK

NOTES

- EXISTING LOCH FEARNA SURFACE AREA
- PROPOSED INUNDATION
- POWERHOUSE
- DAM FOOTPRINT
- INTAKE
- HIGH PRESSURE TUNNEL
- ACCESS TUNNEL
- POSSIBLE ACCESS TRACK
- SAR TRACK
- TEMPORARY CONSTRUCTION ACCESS (WITHIN INUNDATED AREA)
- PUBLIC ROAD WIDENING
- BORROW PIT
- SITE COMPOUND
- SUBSTATION
- LAYDOWN AREA
- INDICATIVE SITE BOUNDARY

REV	DATE	DRAWN	NOTES	CH'K'D	APP'D
P1	22.01.23	MH	PRELIMINARY	FRA	FRA

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FEARNA PSH LTD.

PROJECT

FEARNA PSH

TITLE

SCHEME ARRANGEMENT

SIZE	SCALE AT A1	SCALE AT A3	STATUS
A1	1:7500	1:15,000	PRELIMINARY

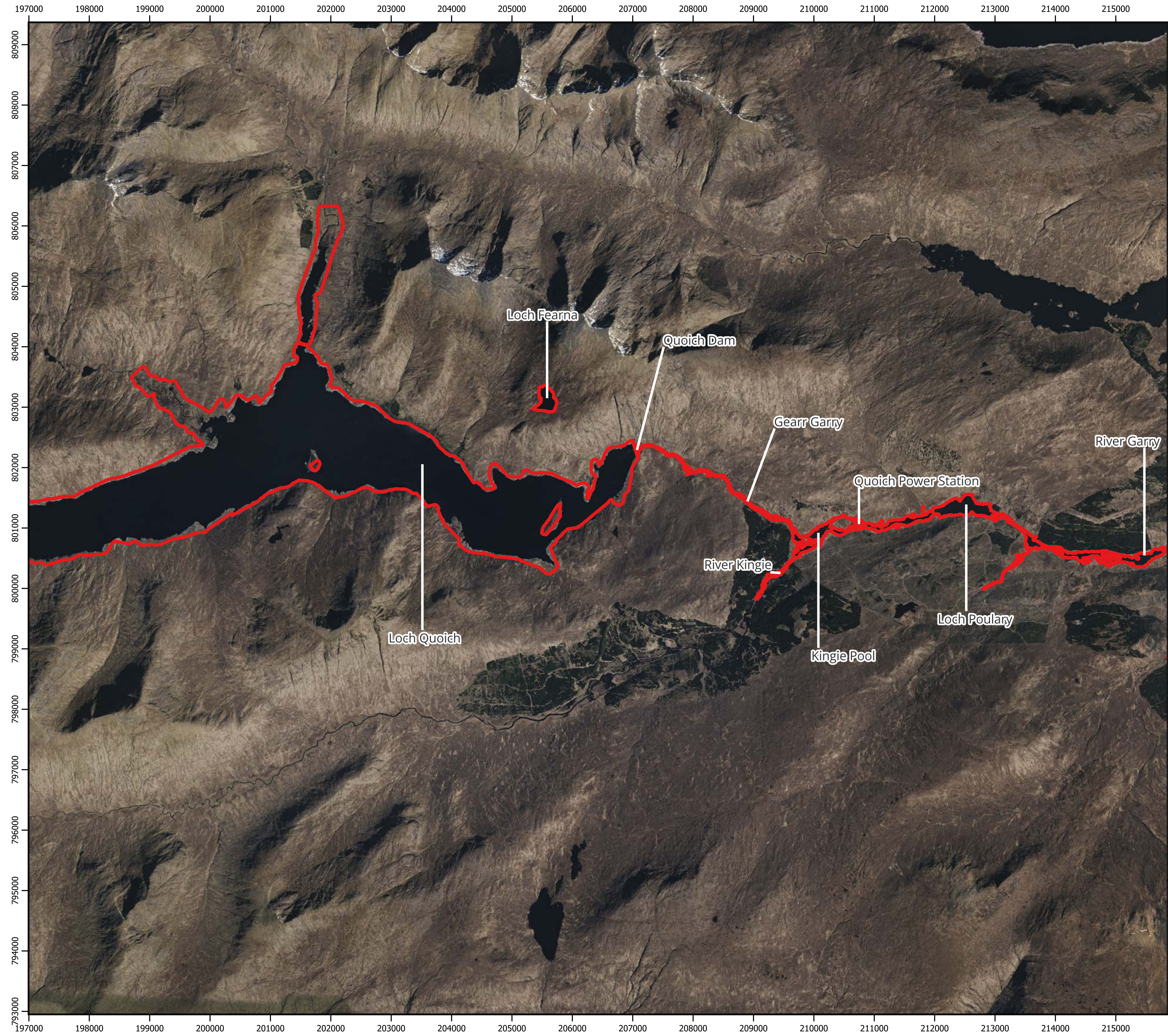
DRAWING NUMBER	REVISION
FIGURE 3.2	P1

PLAN

1:7500 @ A1, 1:15,000 @ A3

0 500m

Appendix B Catchment hydrological features layout



Loch Fearna

Figure 1
Hydrological Features Plan

Key

Features

N

Scale @ A3: 1:58,000

0 1,000 2,000 m

GAVIA environmental

Date: 07-02-2025

Prepared By: AB

Reviewed By: MA

Approved By: MA

Appendix C Monitoring location layout plan

Loch Fearna

Figure 2
Temperature Monitoring Location Plan

Key

Feature Boundaries

Locations

Scale @ A3: 1:58,000

0 1,000 2,000 m

GAVIA environmental

Date: 07-02-2025

Prepared By: AB

Reviewed By: MA

Approved By: MA

Appendix D Equipment specifications

Get Quote

Levelogger® 5

Model 3001

The Levelogger 5 records highly accurate groundwater and surface water level and temperature measurements. It combines a pressure sensor, temperature detector, 10-year lithium battery, and datalogger, sealed within a 22 mm x 160 mm (7/8" x 6.3") stainless steel housing with a corrosion-resistant coating baked-on using polymerization technology.

The Levelogger 5 measures absolute pressure using a Hastelloy® pressure sensor, offering high resolution and an accuracy of 0.05% FS. Readings are stable in extreme pressure and temperature conditions. The Hastelloy sensor can withstand 2 times over-pressure without permanent damage. Combined with the durable coating inside and out, the Levelogger 5 has high corrosion and abrasion resistance in harsh environments.

The Levelogger 5 uses a Faraday cage design, which protects against power surges or electrical spikes caused by lightning. Its durable maintenance-free design, high accuracy and stability, make the Levelogger 5 the most reliable instrument for long-term, continuous water level recording.

Fast communication and downloading speeds with a high speed Field Reader 5

Levelogger 5 Features

- Highly stable communication: single-eye optical interface—easier to clean, more scratch resistant
- Large memory: 150,000 sets of data
- Strong, robust design: double o-ring seals for increased leakage protection
- High thermistor sensitivity: accurate platinum RTD
- Superior protection in harsh environments: corrosion and abrasion resistant coating—inside and out
- Intuitive Levelogger Software: Diagnostic Utility for more proactive user "self-tests"

Single-eye optical interface

The Levelogger 5 features a smooth, single-eye optical interface, which allows for easy cleaning and more reliable, faster communication. Using a Solinst USB device, including the Field Reader 5 and Levelogger PC Software, programming and data downloading speeds are 57,600 bps.

Applications

- Aquifer characterization: pumping tests, slug tests, etc.
- Watershed, drainage basin and recharge monitoring
- Stream gauging, lake and reservoir management
- Harbour and tidal fluctuation measurement
- Wetlands and stormwater run-off monitoring
- Water supply and tank level measurement
- Mine water and landfill leachate management
- Long-term water level monitoring in wells, surface water bodies and seawater environments

Flexible Communication

Levelogger Software is streamlined, making it easy to program dataloggers, and view and compensate data in the office or the field. Data compensation is made simple; multiple data files can be barometrically compensated at once.

The Levelogger 5 App Interface on your in-field Leveloggers creates a *Bluetooth*® connection between your dataloggers and the Solinst Levelogger App on your smart device. The Solinst Readout Unit (SRU) connects to your deployed Leveloggers to display and save real-time water level readings that are automatically barometrically compensated. Also an option, the DataGrabber 5 is a field-ready USB data transfer unit.

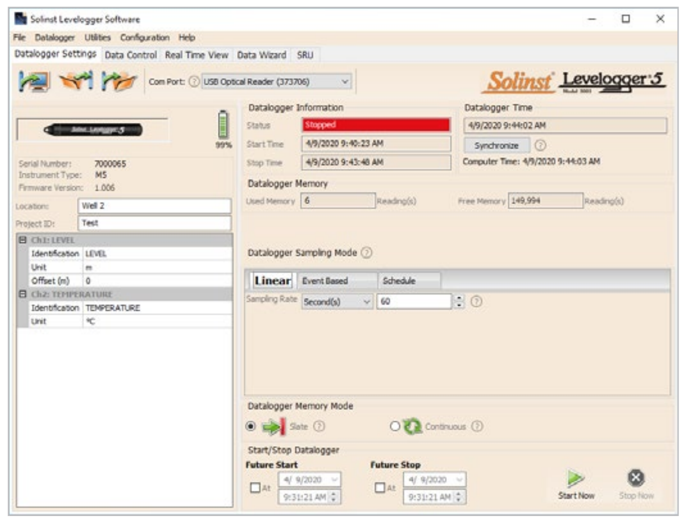
Remote monitoring options include the LevelSender 5, a simple and compact device that fits right in a 2" well, SolSat 5 Satellite Telemetry, STS Telemetry Systems, and the RRL Remote Radio Link. In addition, Levelogger 5 Series dataloggers are SDI-12 compatible.

Levelogger Setup

Programming Leveloggers is extremely intuitive. Simply connect to a PC using an Optical Reader (Desktop Reader 5 or Field Reader 5) or PC Interface Cable. Use a single screen to fill in your project information and sampling regime. Templates of settings can be saved for easy re-use.

The Levelogger time may be synchronized to the computer clock. There are options for immediate start or future start and stop times. The percentage battery life remaining and the amount of free memory are indicated on the settings screen.

Leveloggers can also be programmed with a sampling regime and start/stop times using the Solinst Levelogger App on your smart device.

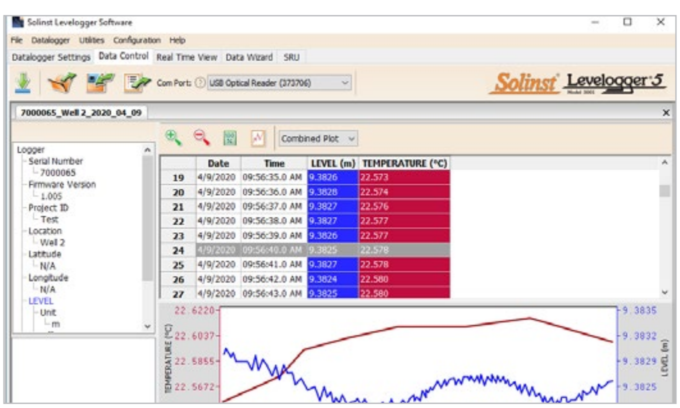


Convenient Sampling Options

Leveloggers can be programmed with linear, event-based, or a user-selectable sampling schedule. Linear sampling can be set from 1/8 second to 99 hours.

Event-based sampling can be set to record when the level changes by a selected threshold. Readings are checked at the selected time interval, but only recorded in memory if the condition has been met. A default reading is taken every 24 hours if no "event" occurs.

The Schedule option allows up to 30 schedule items, each with its own sampling rate and duration. For convenience, there is an option to automatically repeat the schedule.



Data Download, Viewing and Export

Data is downloaded to a PC with the click of a screen icon. There are multiple options for downloading data, including 'Append Data' and 'All Data'. The software also allows immediate viewing of the data in graph or table format using 'Real Time View'.

Level data is automatically compensated for temperature; the temperature data is also downloaded. Barometric compensation of Levelogger data is performed using the Data Wizard, which can also be used to input manual data adjustments, elevation, offsets, density, and adjust for Barometric efficiency. The Levelogger Software allows easy export of the data into a spreadsheet or database for further processing.

The Solinst Levelogger App also allows you to view and save real-time or logged data right on your smart device, or you can view and save the data using an SRU.

Helpful Utilities

The Diagnostic Utility can be used in case of an unexpected problem. It checks the functioning of the program, calibration, backup and logging memories, the pressure transducer, temperature sensor and battery voltage, as well as enabling a complete Memory Dump, if required. A firmware upgrade will be available from time to time, to allow upgrading of the Levelogger 5, as new features are added.

Levelogger 5 App Interface

The Levelogger 5 App Interface uses *Bluetooth*® technology to connect your Levelogger to your smart device. With the Solinst Levelogger App, you can download data, view real-time data, and program your Leveloggers. Data can be e-mailed from your smart device directly to your office (see Model 3001 Levelogger 5 App Interface data sheets).

Download on the App Store

GET IT ON Google play

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Solinst Readout Unit (SRU)

Connect an SRU to an in-field Levelogger via an L5 Direct Read Cable or L5 Threaded or Slip Fit Adaptor to display instant water level readings, Levelogger status, save a real-time logging session, and download data to the SRU memory.

DataGrabber 5

The DataGrabber 5 is a field-ready data transfer device that allows you to copy data from a Levelogger onto a USB flash key (Dual USB & USB-C key provided).The DataGrabber 5 is compact and very easy to transport. It connects to the top end of a Levelogger's Direct Read Cable, or directly to a Levelogger using an adaptor. One push-button is used to download all of the data in a Levelogger's memory to a USB device.

LevelSender 5 Telemetry

The LevelSender 5 is a simple, low cost telemetry system designed to send data from Leveloggers in the field, to your smart device and PC database via cellular communication. There is two-way communication between the LevelSender 5 and Home Station, allowing remote updates. LevelSender 5 stations are compact in design, which allows them to be discreetly installed inside a 2" (50 mm) well (see Model 9500 data sheet).

STS Telemetry

STS Telemetry provides an efficient method to send Levelogger data from the field to your desktop. Cellular communication options give the flexibility to suit any project. STS Systems are designed to save costs by enabling the self-management of data. Alarm notification, remote firmware upgrades and diagnostic reporting make system maintenance simple (see Model 9100 data sheet).

SolSat 5 Satellite Telemetry

The SolSat 5 Satellite Telemetry uses Iridium satellite technology to provide global connectivity for your remote water monitoring projects. The SolSat 5 is simple to set up with Solinst dataloggers using an intuitive and secure Wi-Fi App on your smart device. The SolSat 5 features a built-in barometer, solar panel and a compact weatherproof enclosure for deployment almost anywhere.

RRL Remote Radio Link

The RRL Remote Radio Link is ideal for closed-loop, short range applications up to 30 km (20 miles). The RRL can be linked to an STS telemetry station to change from a closed-loop telemetry system to one which can be accessed from anywhere through internet connectivity. (see Model 9200 data sheet).

®Kevlar is a registered trademark of DuPont Corp.

Standard Cable Deployment

Leveloggers may be suspended on a stainless steel wireline or Kevlar® cord. This is a very inexpensive method of deployment, and if in a well, allows the Levelogger to be easily locked out of sight and inaccessible. Solinst offers wireline and cord assemblies in a variety of lengths.

Solinst 3001 Well Cap Assembly

The 2" Locking Well Caps are designed for both standard and Direct Read Cable deployment options.

The well cap has a convenient eyelet for suspending Leveloggers using wireline or Kevlar cord. The Well Cap insert has two openings to accommodate direct read cables for both a Levelogger and Barologger. Adaptors are available to fit 4" wells.

The cap is vented to equalize atmospheric pressure in the well. It slips over the casing, and can be secured using a lock with a 9.5 mm (3/8") shackle diameter.

Levelogger 2" Locking Well Cap Installations (see Well Caps data sheet for more details)

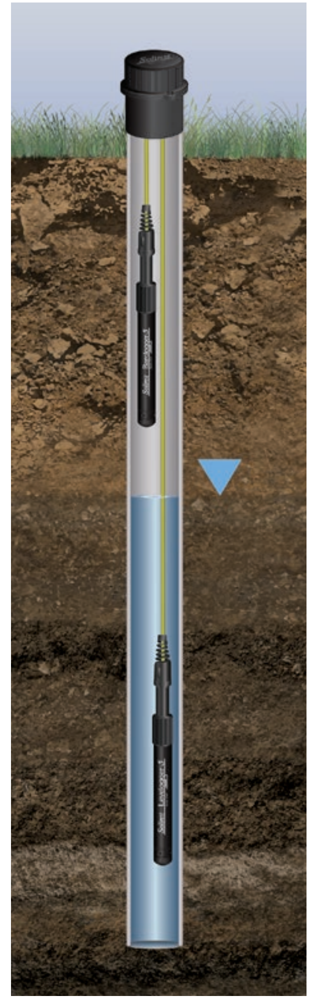
L5 Direct Read Cables

When it is desired to get real-time data and communicate with Leveloggers without removal from the water, they can be deployed using L5 Direct Read Cables. This allows viewing of data, downloading, and programming in the field using a portable PC, or Solinst Levelogger 5 App Interface. You can view and save data to an SRU, or just download data with a DataGrabber 5.

Leveloggers can be connected to an SDI-12 datalogger using the Solinst SDI-12 Interface Cable attached to a L5 Direct Read Cable.

Cable Specifications

L5 Direct Read Cables are available for attachment to any Levelogger in lengths up to 1500 ft. The 3.175 mm dia. (1/8") coaxial cable has an outer polyurethane jacket for strength and durability. The stranded stainless steel conductor gives non-stretch accuracy.



Barologger 5 and Levelogger 5 installed in Well Using L5 Direct Read Cables

Accurate Barometric Compensation

Leveloggers measure absolute pressure (water pressure + atmospheric pressure) expressed in feet, meters, centimeters, psi, kPa, or bar.

The most accurate method of obtaining changes in water level is to compensate for atmospheric pressure fluctuations using a Barologger 5, avoiding time lag in the compensation.

The Barologger 5 is set above high water level in one location on site. One Barologger can be used to compensate all Leveloggers in a 30 km (20 mile) radius and/or with every 300 m (1000 ft.) change in elevation.

The Levelogger Software Data Compensation Wizard automatically produces compensated data files using the synchronized data files from the Barologger and Leveloggers on site.

The Barologger 5 uses pressure algorithms based on air rather than water pressure, giving superior accuracy.

The recorded barometric information can also be very useful to help determine barometric lag and/or barometric efficiency of the monitored aquifer.

The Barologger 5 records atmospheric pressure in psi, kPa, or mbar. When compensating submerged Levelogger 5, Edge, Gold or Junior data, Levelogger Software can recognize the type of Levelogger and compensate using the same units found in the submerged data file (e.g. feet or meters). This makes the Barologger 5 backwards compatible.

Synchronize and Simplify Barometric Compensation Across Entire Site

Levelogger 5 Specifications

Level Sensor:	Piezoresistive Silicon with Hastelloy Sensor
Accuracy:	± 0.05% FS (Barologger 5: ± 0.05 kPa)
Stability of Readings:	Superior, low noise
Resolution:	0.002% FS to 0.0006% FS
Units of Measure:	m, cm, ft., psi, kPa, bar, ºC. ºF (Barologger 5: psi, kPa, mbar, ºC, ºF)
Normalization:	Automatic Temperature Compensation
Temp. Comp. Range:	0º to 50ºC (Barologger 5: -10 to +50ºC)
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Temp. Sensor Accuracy:	± 0.05ºC
Temp. Sensor Resolution:	0.003°C
Battery Life:	10 Years – based on 1 reading/minute
Clock Accuracy (typical):	± 1 minute/year (-20ºC to 80ºC)
Operating Temperature:	-20ºC to 80ºC
Maximum # Readings:	150,000 sets of readings
Memory Mode:	Slate and Continuous
Communication:	Optical high-speed: USB, SDI-12 57,600 bps with USB
Size:	22 mm x 160 mm (7/8" x 6.3")
Weight:	146 grams (5.2 oz)
Corrosion Resistance:	Baked-on coating using polymerization technology (inside and out)
Other Wetted Materials:	Delrin®, Viton®, 316L stainless steel, Hastelloy, PFAS-free PTFE coating
Sampling Modes:	Linear, Event & User-Selectable with Repeat Mode, Future Start, Future Stop, Real-Time View
Measurement Rates:	1/8 sec to 99 hrs
Barometric Compensation:	Software Wizard and one Barologger 5 in local area (approx. 30 km/20 miles radius)

Models	Full Scale (FS)	Accuracy	Resolution
Barologger	Air only	± 0.05 kPa	0.002% FS
M5	5 m (16.4 ft.)	± 0.3 cm (0.010 ft.)	0.001% FS
M10	10 m (32.8 ft.)	± 0.5 cm (0.016 ft.)	0.0006% FS
M20	20 m (65.6 ft.)	± 1 cm (0.032 ft.)	0.0006% FS
M30	30 m (98.4 ft.)	± 1.5 cm (0.064 ft.)	0.0006% FS
M100	100 m (328.1 ft.)	± 5 cm (0.164 ft.)	0.0006% FS
M200	200 m (656.2 ft.)	± 10 cm (0.328 ft.)	0.0006% FS

Low Cost Datalogging: See Levelogger 5 Junior data sheet.
Vented Dataloggers: See LevelVent 5 & AquaVent 5 data sheets.
Conductivity Datalogging: See Levelogger 5 LTC data sheet.

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August 21, 2023

HOBO®
Data Loggers

MX2201

HOBO Pendant MX Water Temperature Data Logger

Bluetooth-enabled logger

A waterproof logger enabled with Bluetooth wireless access to deliver accurate temperature measurements straight to your mobile device or Windows computer using our HOBOconnect app.

Important Information
Requires a compatible mobile device or Windows computer and the HOBOconnect app. System requirements for the app can be found at bottom of the HOBOconnect software page.Want cloud storage and access to the powerful tools of LI-COR Cloud™ IoT software (fka HOBOlink)? Add an MX Data Plan!

Compatible with
HOBOconnect Monitoring App

Supported Measurements

Soil Temperature, Temperature, Water Temperature

Features

- Convenient wireless setup and download via Bluetooth
- Mounting boot included
- Large memory stores 96,000 measurements
- Waterproof to 30 meters (100 feet)
- User-replaceable battery
- Mounting tabs for fast, easy deployment
- LED indicates when temperature exceeds set threshold
- Works with Onset’s free HOBOconnect app
- ±0.5°C (±0.9°F) accuracy

Contact Us

Sales (8am to 5pm ET, Monday through Friday)

- Email sales@onsetcomp.com
- Call 1-508-759-9500
- In U.S. toll free 1-800-564-4377
- Fax 1-508-759-9100

Technical Support (8am to 5pm ET, Monday through Friday)

- Contact Product Support www.onsetcomp.com/support/contact
- Call 1-508-759-9500
- In U.S. toll free 1-877-564-4377

Onset Computer Corporation
470 MacArthur Boulevard
Bourne, MA 02532

HOBO Pendant MX Water Temperature Data Logger (MX2201) Specifications

Temperature Sensor (MX2201 and MX2202)

Range	-20° to 70°C in air (-4° to 158°F in air) -20° to 50°C in water (-4° to 122°F in water)
Accuracy	±0.5°C from -20° to 70°C (±0.9°F from -4° to 158°F)
Resolution	0.04°C (0.072°F)
Drift	<0.1°C per year (<0.18°F per year)
Response Time	17 minutes typical to 90% in air moving 1 m/s, unmounted 7 minutes typical to 90% in stirred water, unmounted

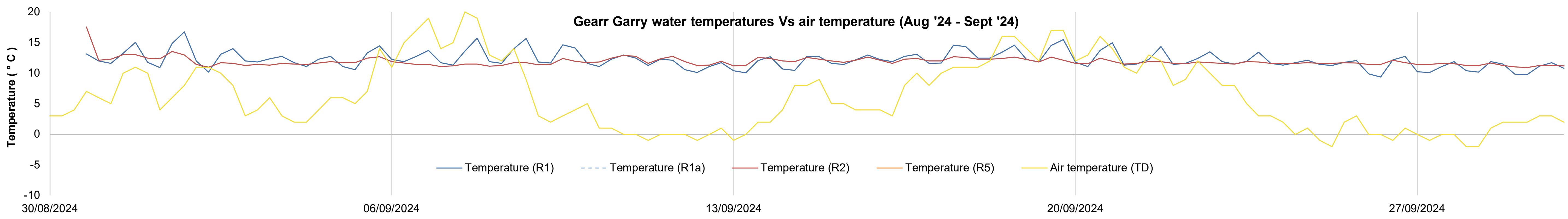
Light Sensor (MX2202)

Range	0 to 167,731 lux (0 to 15,582 lum/ft2)
Accuracy	±10% typical for direct sunlight (see Light Measurement on page 2 for more details)

Logger

Logger Operating Range	-20° to 70°C in air (-4° to 158°F in air)
Buoyancy (Fresh Water)	2 g positive (0.07 oz positive)
Waterproof	To 30.5 m (To 100 ft)
Radio Power	1 mW (0 dBm)
Transmission Range	Approximately 30.5 m line-of-sight (Approximately 100 ft line-of-sight)
Wireless Data Standard	Bluetooth Low Energy (Bluetooth Smart)
Logging Rate	1 second to 18 hours
Time Accuracy	±1 minute per month at 25°C (±1 minute per month at 77°F)
Battery	CR2032 3V lithium, user replaceable
Battery Life	1 year typical at 25°C (77°F) with logging interval of 1 minute and Bluetooth Always On enabled in software. 2 years typical at 25°C (77°F) with logging interval of 1 minute and Bluetooth Always On disabled in software. Faster logging intervals and statistics sampling intervals, burst logging, remaining connected with the app, excessive downloads, and paging may impact battery life. To ensure proper battery installation, see Battery Information for detailed instructions on replacing the battery.
Memory	96,000 measurements
Full Memory Download Time	Approximately 45 seconds; may take longer the farther the device is from the logger
Wetted Materials	Polypropylene case, EPDM O-ring
Dimensions	3.35 x 5.64 x 1.8 cm (1.32 x 2.22 x 0.69 inches)
Weight	12.75 g (0.45 oz)
Environmental Rating	IP68

Appendix E Time-series monitoring graphs (Month by month)


Gearr Garry water temperatures Vs air temperature (Aug '24 - Sept '24)
Temperature (° C)
20
15
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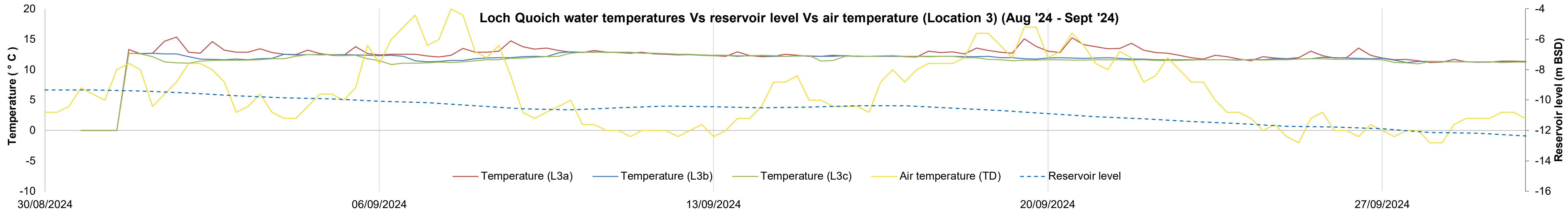
30/08/2024
06/09/2024
13/09/2024
20/09/2024
27/09/2024
Temperature (R1)
Temperature (R1a)
Temperature (R2)
Temperature (R5)
Air temperature (TD)


Loch Quoich water temperatures Vs reservoir level Vs air temperature (Location 3) (Aug '24 - Sept '24)
Temperature (° C)
Reservoir level (m BSD)
20
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-5
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-6
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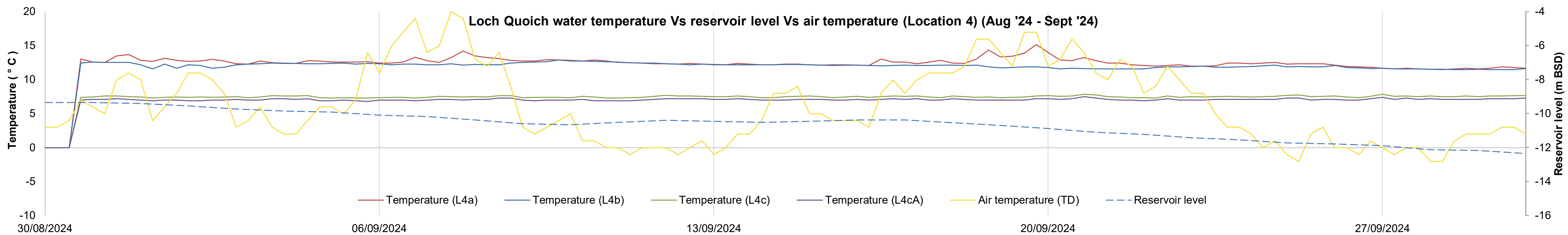
30/08/2024
06/09/2024
13/09/2024
20/09/2024
27/09/2024
Temperature (L3a)
Temperature (L3b)
Temperature (L3c)
Air temperature (TD)
Reservoir level


Loch Quoich water temperature Vs reservoir level Vs air temperature (Location 4) (Aug '24 - Sept '24)
Temperature (° C)
Reservoir level (m BSD)
20
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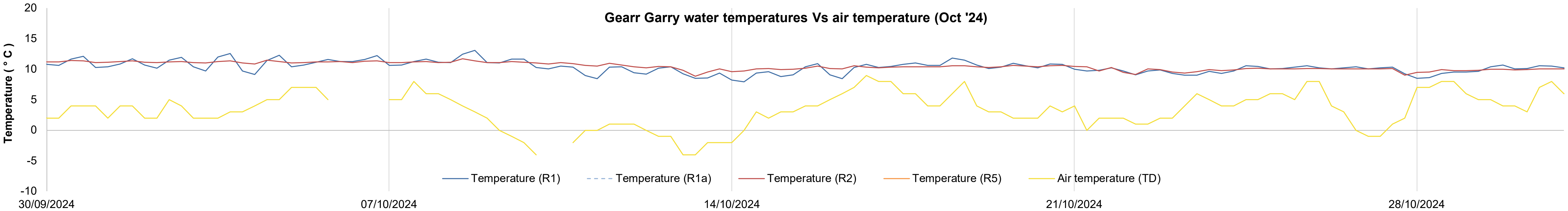
30/08/2024
06/09/2024
13/09/2024
20/09/2024
27/09/2024
Temperature (L4a)
Temperature (L4b)
Temperature (L4c)
Temperature (L4cA)
Air temperature (TD)
Reservoir level


Gearr Garry water temperatures Vs air temperature (Oct '24)
Temperature (° C)
20
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07/10/2024
14/10/2024
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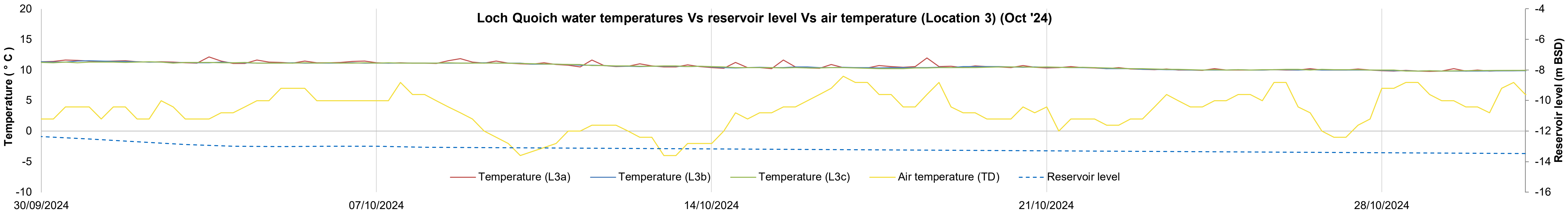
28/10/2024
Temperature (R1)
Temperature (R1a)
Temperature (R2)
Temperature (R5)
Air temperature (TD)


Loch Quoich water temperatures Vs reservoir level Vs air temperature (Location 3) (Oct '24)
Temperature (° C)
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Reservoir level (m BSD)
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30/09/2024
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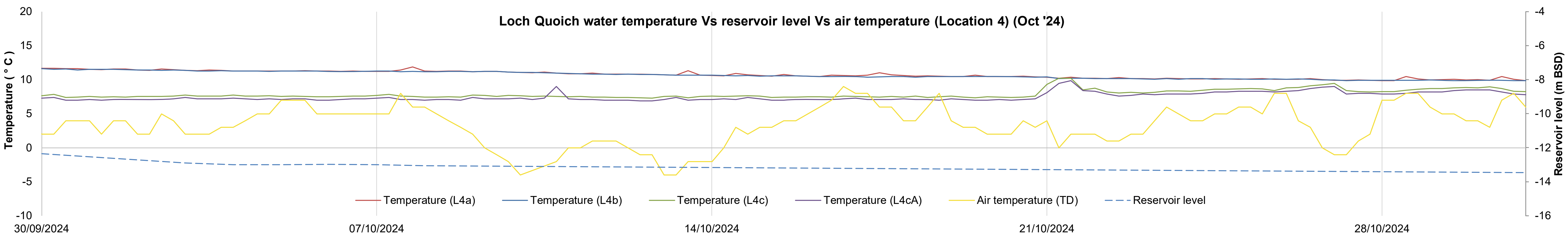
14/10/2024
21/10/2024
28/10/2024
Temperature (L3a)
Temperature (L3b)
Temperature (L3c)
Air temperature (TD)
Reservoir level


Loch Quoich water temperature Vs reservoir level Vs air temperature (Location 4) (Oct '24)
Temperature (° C)
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Reservoir level (m BSD)
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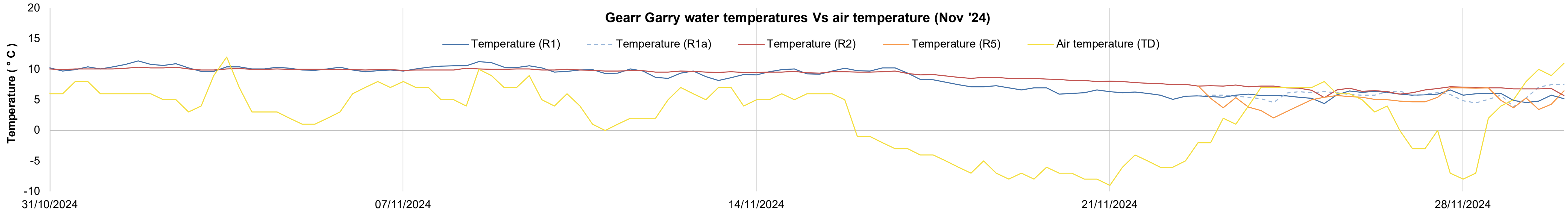
21/10/2024
28/10/2024
Temperature (L4a)
Temperature (L4b)
Temperature (L4c)
Temperature (L4cA)
Air temperature (TD)
Reservoir level


Gearr Garry water temperatures Vs air temperature (Nov '24)
Temperature (R1)
Temperature (R1a)
Temperature (R2)
Temperature (R5)
Air temperature (TD)
Temperature (° C)
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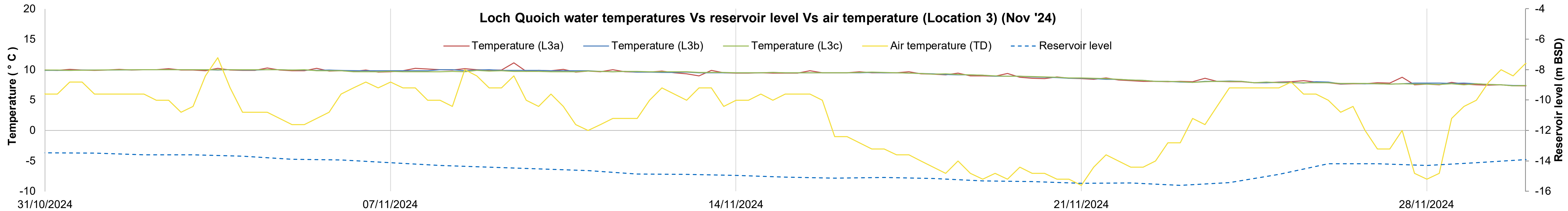
14/11/2024
21/11/2024
28/11/2024


Loch Quoich water temperatures Vs reservoir level Vs air temperature (Location 3) (Nov '24)
Temperature (L3a)
Temperature (L3b)
Temperature (L3c)
Air temperature (TD)
Reservoir level
Temperature (° C)
Reservoir level (m BSD)
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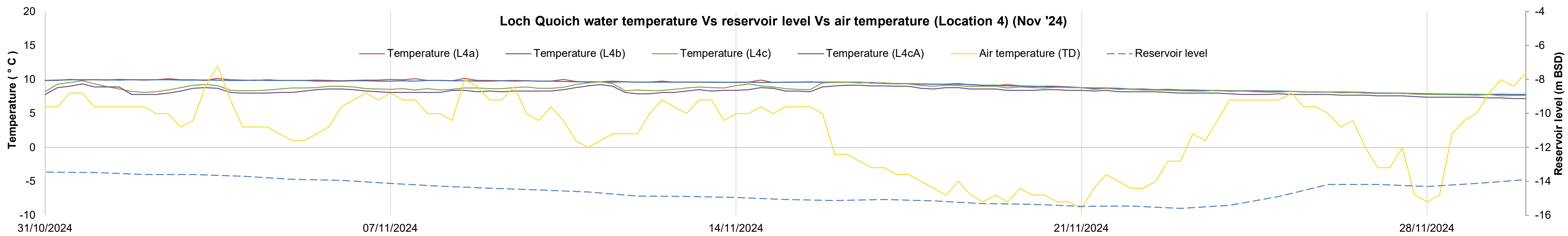
28/11/2024


Loch Quoich water temperature Vs reservoir level Vs air temperature (Location 4) (Nov '24)
Temperature (L4a)
Temperature (L4b)
Temperature (L4c)
Temperature (L4cA)
Air temperature (TD)
Reservoir level
Temperature (° C)
Reservoir level (m BSD)
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07/11/2024
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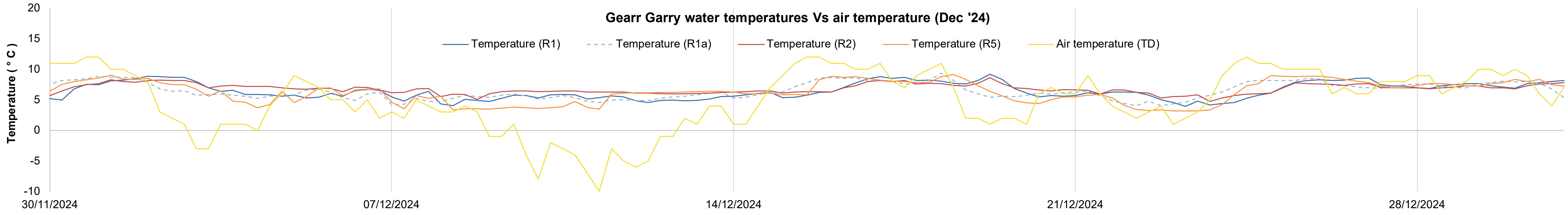
Gearr Garry water temperatures Vs air temperature (Dec '24)
Temperature (R1)
Temperature (R1a)
Temperature (R2)
Temperature (R5)
Air temperature (TD)
Temperature (° C)
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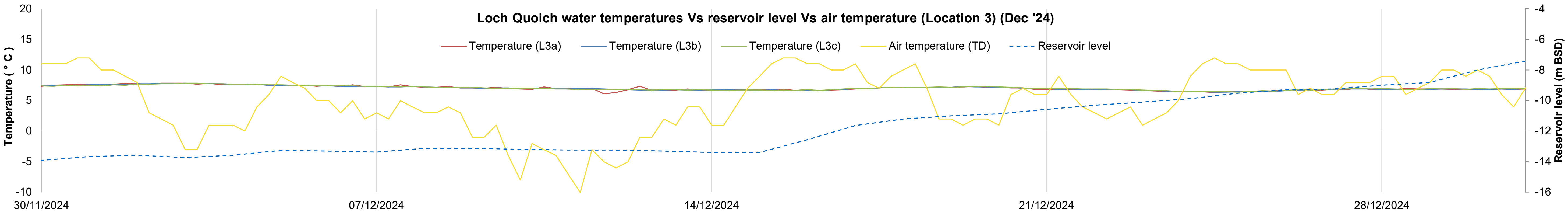
14/12/2024
21/12/2024
28/12/2024


Loch Quoich water temperatures Vs reservoir level Vs air temperature (Location 3) (Dec '24)
Temperature (L3a)
Temperature (L3b)
Temperature (L3c)
Air temperature (TD)
Reservoir level
Temperature (° C)
Reservoir level (m BSD)
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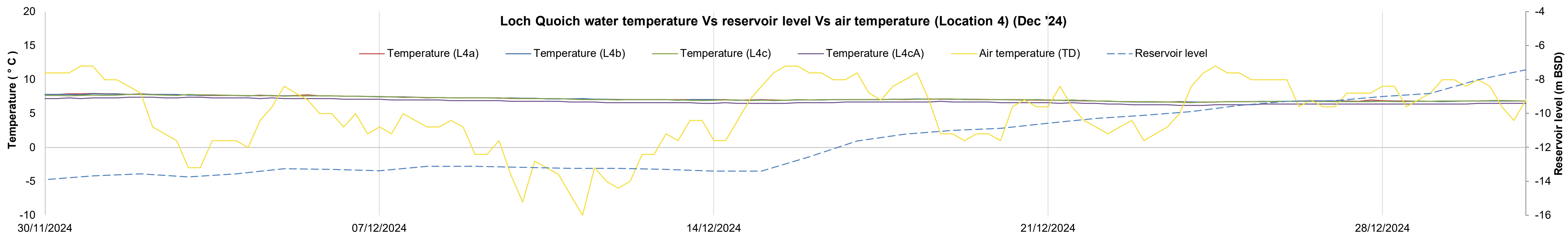
Loch Quoich water temperature Vs reservoir level Vs air temperature (Location 4) (Dec '24)
Temperature (L4a)
Temperature (L4b)
Temperature (L4c)
Temperature (L4cA)
Air temperature (TD)
Reservoir level
Temperature (° C)
Reservoir level (m BSD)
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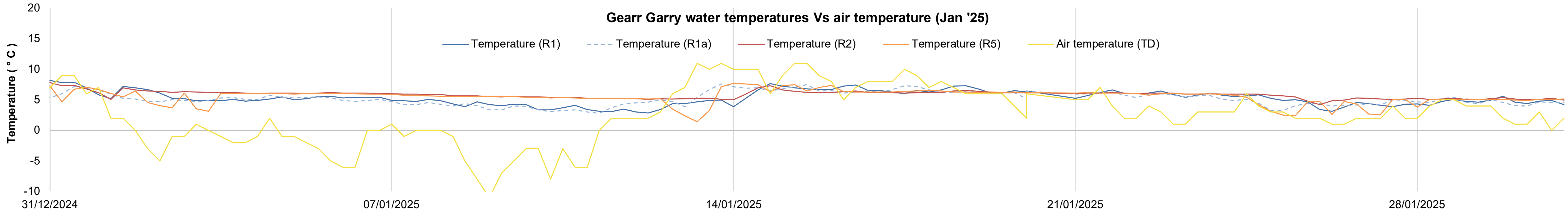

Gearr Garry water temperatures Vs air temperature (Jan '25)
Temperature (R1)
Temperature (R1a)
Temperature (R2)
Temperature (R5)
Air temperature (TD)
Temperature (° C)
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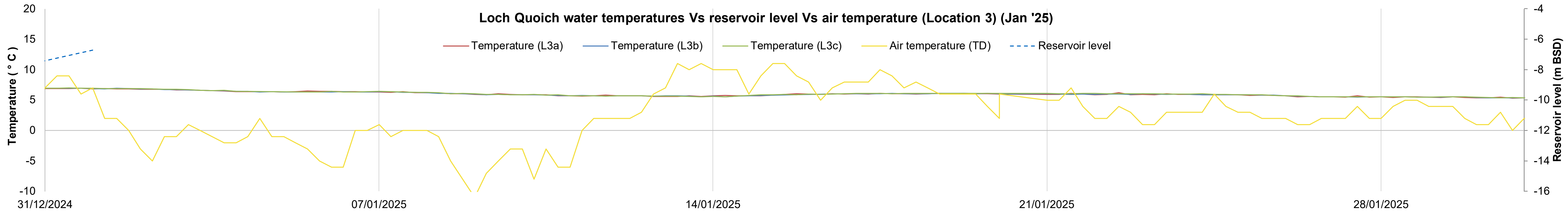

Loch Quoich water temperatures Vs reservoir level Vs air temperature (Location 3) (Jan '25)
Temperature (L3a)
Temperature (L3b)
Temperature (L3c)
Air temperature (TD)
Reservoir level
Temperature (° C)
Reservoir level (m BSD)
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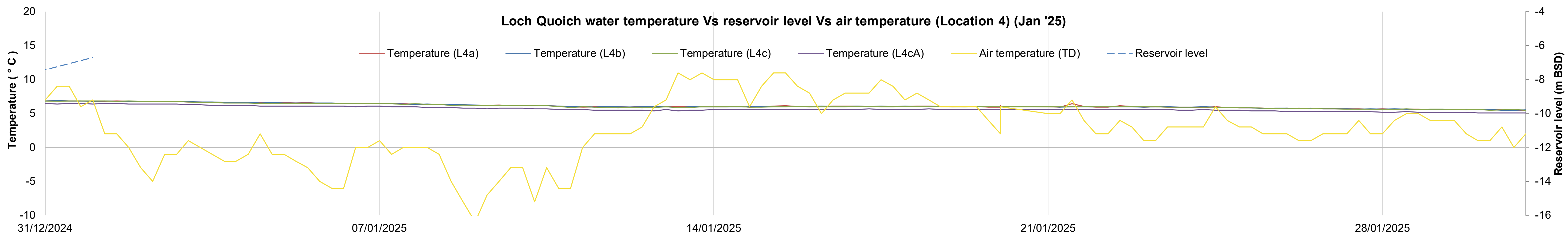
21/01/2025
28/01/2025



Loch Quoich water temperature Vs reservoir level Vs air temperature (Location 4) (Jan '25)
Temperature (L4a)
Temperature (L4b)
Temperature (L4c)
Temperature (L4cA)
Air temperature (TD)
Reservoir level
Temperature (° C)
Reservoir level (m BSD)
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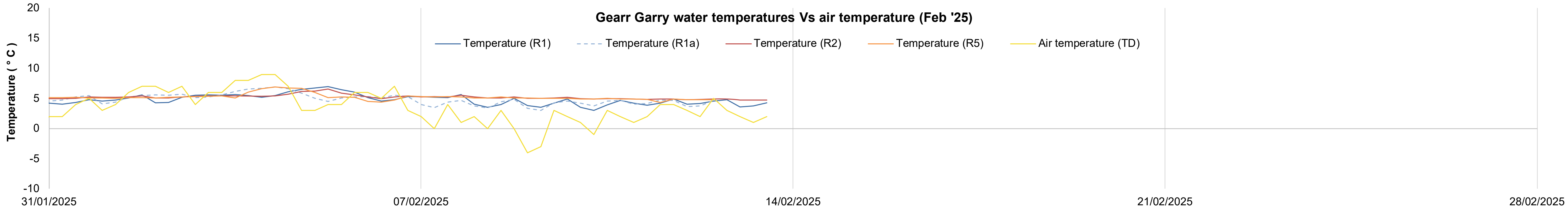
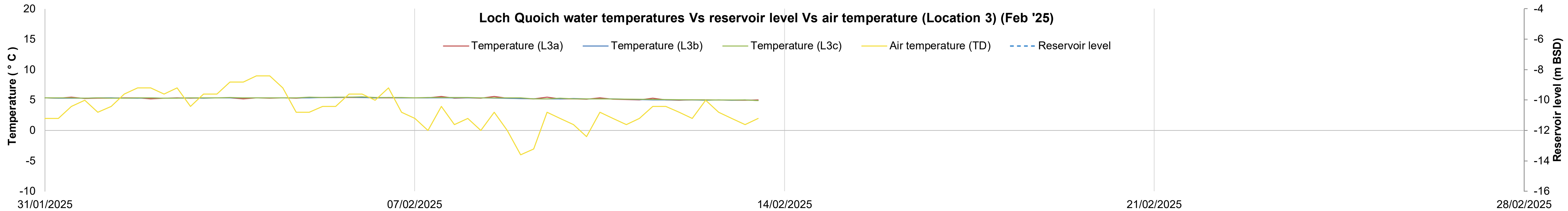
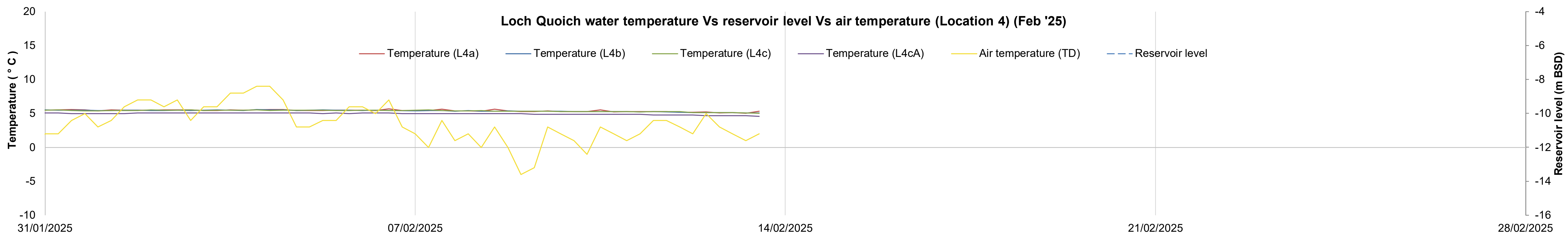
31/12/2024
07/01/2025
14/01/2025
21/01/2025
28/01/2025



Gearr Garry water temperatures Vs air temperature (Feb '25)
Temperature (R1)
Temperature (R1a)
Temperature (R2)
Temperature (R5)
Air temperature (TD)
Temperature (° C)
20
15
10
5
0
-5
-10
31/01/2025
07/02/2025
14/02/2025
21/02/2025
28/02/2025



Loch Quoich water temperatures Vs reservoir level Vs air temperature (Location 3) (Feb '25)
Temperature (L3a)
Temperature (L3b)
Temperature (L3c)
Air temperature (TD)
Reservoir level
Temperature (° C)
Reservoir level (m BSD)
20
15
10
5
0
-5
-10
-4
-6
-8
-10
-12
-14
-16
31/01/2025
07/02/2025
14/02/2025
21/02/2025
28/02/2025



Loch Quoich water temperature Vs reservoir level Vs air temperature (Location 4) (Feb '25)
Temperature (L4a)
Temperature (L4b)
Temperature (L4c)
Temperature (L4cA)
Air temperature (TD)
Reservoir level
Temperature (° C)
Reservoir level (m BSD)
20
15
10
5
0
-5
-10
-4
-6
-8
-10
-12
-14
-16
31/01/2025
07/02/2025
14/02/2025
21/02/2025
28/02/2025

Summary Table

	Reservoir level	Air temperature (TD)	Water temperature	Water temperature	Water temperature	Water temperature	Water temperature	Water temperature	Water temperature	Water temperature	Water temperature	Water temperature	Water temperature
Data source	**SSE/GEL**	**Published Met data**	**2160720**	**21704229**	**2160719**	**21704233**	**2160724**	**2160725**	**2160726**	**2160721**	**2160722**	**21690723**	**2190289**
Minimum	-15.6	-11.0	2.8	2.8	4.2	1.4	4.8	4.8	4.9	5.1	5.1	5.1	4.6
Maximum	-6.7	20.0	16.8	9.3	17.6	9.1	15.4	13.0	13.0	15.2	12.9	10.3	9.9
Range	8.9	31.0	13.9	6.6	13.3	7.7	10.5	8.1	8.0	10.1	7.8	5.2	5.3

Date and Time	Reservoir level	Air temperature (TD)	Temperature (R1)	Temperature (R1a)	Temperature (R2)	Temperature (R5)	Temperature (L3a)	Temperature (L3b)	Temperature (L3c)	Temperature (L4a)	Temperature (L4b)	Temperature (L4c)	Temperature (L4cA)
	m BSD	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
29/08/2024 18:00		3	13.2	NM	17.6	NM	NM	NM	NM	NM	NM	NM	NM
30/08/2024 00:00	-9.33	3	12.0	NM	12.1	NM	NM	NM	NM	NM	NM	NM	NM
30/08/2024 06:00		3	11.6	NM	12.3	NM	NM	NM	NM	NM	NM	NM	NM
30/08/2024 12:00		4	13.3	NM	13.0	NM	NM	NM	NM	NM	NM	NM	NM
30/08/2024 18:00		7	15.1	NM	13.0	NM	13.3	12.7	12.7	13.1	12.5	7.4	7.0
31/08/2024 00:00	-9.33	6	11.8	NM	12.4	NM	12.6	12.7	12.6	12.6	12.6	7.5	7.1
31/08/2024 06:00		5	10.9	NM	12.4	NM	12.7	12.7	12.1	12.6	12.6	7.6	7.1
31/08/2024 12:00		10	14.9	NM	13.6	NM	14.7	12.6	11.3	13.5	12.6	7.6	7.2
31/08/2024 18:00		11	16.8	NM	13.0	NM	15.4	12.6	11.2	13.7	12.6	7.5	7.1
01/09/2024 00:00	-9.40	10	12.0	NM	11.5	NM	12.9	12.1	11.1	12.9	12.2	7.5	7.0
01/09/2024 06:00		4	10.2	NM	11.0	NM	12.7	11.8	11.4	12.7	11.6	7.3	6.9
01/09/2024 12:00		6	13.1	NM	11.7	NM	14.6	11.7	11.5	13.2	12.3	7.4	7.0
01/09/2024 18:00		8	14.0	NM	11.6	NM	13.3	11.7	11.5	12.9	11.7	7.5	7.0
02/09/2024 00:00	-9.54	11	12.0	NM	11.2	NM	12.9	11.8	11.6	12.7	12.2	7.4	6.9
02/09/2024 06:00		11	11.8	NM	11.4	NM	12.9	11.7	11.6	12.8	12.1	7.5	6.9
02/09/2024 12:00		10	12.4	NM	11.3	NM	13.5	11.8	11.6	13.0	11.7	7.4	7.0
02/09/2024 18:00		8	12.8	NM	11.6	NM	12.8	11.9	11.8	12.8	11.8	7.5	7.0
03/09/2024 00:00	-9.72	3	11.7	NM	11.5	NM	12.6	12.5	11.8	12.4	12.2	7.5	7.1
03/09/2024 06:00		4	11.1	NM	11.5	NM	12.5	12.4	12.2	12.3	12.3	7.4	7.0
03/09/2024 12:00		6	12.3	NM	11.7	NM	13.3	12.5	12.5	12.8	12.4	7.5	7.0
03/09/2024 18:00		3	12.7	NM	11.9	NM	12.7	12.5	12.4	12.5	12.4	7.7	7.2
04/09/2024 00:00	-9.85	2	11.1	NM	11.8	NM	12.4	12.5	12.5	12.4	12.4	7.6	7.2
04/09/2024 06:00		2	10.6	NM	11.8	NM	12.3	12.5	12.3	12.4	12.4	7.6	7.1
04/09/2024 12:00		4	13.3	NM	12.4	NM	13.8	12.4	12.4	12.8	12.4	7.7	7.2
04/09/2024 18:00		6	14.5	NM	12.7	NM	12.7	12.4	11.8	12.7	12.4	7.4	6.9
05/09/2024 00:00	-9.91	6	12.2	NM	11.9	NM	12.4	12.3	11.5	12.6	12.4	7.3	6.9
05/09/2024 06:00		5	11.9	NM	11.7	NM	12.5	12.4	10.9	12.6	12.4	7.4	7.0
05/09/2024 12:00		7	12.7	NM	11.4	NM	12.5	12.2	11.1	12.6	12.3	7.3	6.9
05/09/2024 18:00		14	13.7	NM	11.5	NM	12.6	11.5	11.1	12.7	12.4	7.3	6.8
06/09/2024 00:00	-10.08	11	11.8	NM	11.1	NM	12.3	11.3	11.2	12.4	12.4	7.4	7.0
06/09/2024 06:00		15	11.3	NM	11.2	NM	12.1	11.4	11.2	12.4	12.2	7.4	7.0
06/09/2024 12:00		17	13.6	NM	11.5	NM	12.4	11.5	11.2	12.6	12.3	7.4	7.0
06/09/2024 18:00		19	15.7	NM	11.5	NM	13.5	11.5	11.3	13.3	12.3	7.3	6.9
07/09/2024 00:00	-10.17	14	11.9	NM	11.2	NM	12.9	11.8	11.5	12.8	12.2	7.4	7.0
07/09/2024 06:00		15	11.6	NM	11.2	NM	12.9	11.9	11.6	12.6	12.2	7.6	7.1
07/09/2024 12:00		20	14.0	NM	11.8	NM	13.0	12.0	11.7	13.3	12.4	7.5	7.1
07/09/2024 18:00		19	15.7	NM	11.8	NM	14.8	12.0	11.9	14.2	12.1	7.5	7.0
08/09/2024 00:00	-10.36	13	11.8	NM	11.4	NM	13.8	12.1	11.9	13.5	12.3	7.5	7.1
08/09/2024 06:00		12	11.7	NM	11.5	NM	13.4	12.2	12.1	13.3	12.2	7.5	7.1
08/09/2024 12:00		14	14.6	NM	12.4	NM	13.6	12.1	12.1	13.1	12.2	7.7	7.3
08/09/2024 18:00		9	14.2	NM	12.0	NM	13.2	12.8	12.2	12.9	12.4	7.7	7.3
09/09/2024 00:00	-10.58	3	11.6	NM	11.8	NM	12.9	13.0	12.7	12.7	12.6	7.4	7.0
09/09/2024 06:00		2	11.1	NM	11.8	NM	12.8	12.9	12.9	12.7	12.6	7.4	6.9
09/09/2024 12:00		3	12.3	NM	12.4	NM	13.2	12.9	13.0	13.0	12.7	7.4	7.0
09/09/2024 18:00		4	13.0	NM	13.0	NM	12.9	12.9	12.8	12.9	12.9	7.4	7.0
10/09/2024 00:00	-10.64	5	12.4	NM	12.8	NM	12.8	12.9	12.9	12.9	12.8	7.4	7.0
10/09/2024 06:00		1	11.3	NM	11.6	NM	12.7	12.8	12.9	12.8	12.8	7.6	7.1
10/09/2024 12:00		1	12.3	NM	12.4	NM	12.9	12.7	12.7	12.9	12.7	7.5	6.9
10/09/2024 18:00		0	12.1	NM	12.8	NM	12.6	12.7	12.7	12.7	12.7	7.3	6.9
11/09/2024 00:00	-10.51	0	10.6	NM	11.9	NM	12.6	12.6	12.7	12.6	12.6	7.3	6.9
11/09/2024 06:00		-1	10.1	NM	11.3	NM	12.4	12.5	12.6	12.5	12.5	7.4	6.9
11/09/2024 12:00		0	11.1	NM	11.3	NM	12.5	12.5	12.5	12.5	12.5	7.4	7.0
11/09/2024 18:00		0	11.8	NM	12.0	NM	12.4	12.4	12.4	12.4	12.4	7.6	7.1
12/09/2024 00:00	-10.38	0	10.4	NM	11.2	NM	12.3	12.4	12.4	12.4	12.4	7.7	7.2
12/09/2024 06:00		-1	10.0	NM	11.2	NM	12.2	12.4	12.4	12.3	12.3	7.6	7.2
12/09/2024 12:00		0	12.1	NM	12.6	NM	13.0	12.2	12.3	12.4	12.2	7.6	7.2
12/09/2024 18:00		1	12.7	NM	12.4	NM	12.3	12.3	12.3	12.3	12.3	7.6	7.2
13/09/2024 00:00	-10.44	-1	10.7	NM	12.0	NM	12.1	12.3	12.4	12.2	12.3	7.5	7.1
13/09/2024 06:00		0	10.5	NM	11.9	NM	12.2	12.2	12.3	12.2	12.2	7.5	7.1
13/09/2024 12:00		2	12.7	NM	12.6	NM	12.5	12.2	12.2	12.4	12.2	7.6	7.2
13/09/2024 18:00		2	12.7	NM	12.3	NM	12.4	12.3	12.3	12.3	12.2	7.5	7.1
14/09/2024 00:00	-10.51	4	11.6	NM	12.0	NM	12.2	12.3	12.3	12.2	12.2	7.4	7.0
14/09/2024 06:00		8	11.5	NM	11.8	NM	12.2	12.2	11.4	12.2	12.2	7.4	7.0
14/09/2024 12:00		8	12.2	NM	12.1	NM	12.4	12.2	11.5	12.3	12.3	7.5	7.0
14/09/2024 18:00		9	13.0	NM	12.6	NM	12.3	12.3	12.2	12.3	12.3	7.6	7.1
15/09/2024 00:00	-10.45	5	12.2	NM	12.1	NM	12.2	12.2	12.3	12.2	12.2	7.6	7.1
15/09/2024 06:00		5	11.9	NM	11.6	NM	12.2	12.2	12.2	12.1	12.1	7.5	7.1
15/09/2024 12:00		4	12.7	NM	12.3	NM	12.3	12.2	12.3	12.2	12.1	7.4	7.0
15/09/2024 18:00		4	13.1	NM	12.4	NM	12.3	12.2	12.3	12.2	12.1	7.5	7.0
16/09/2024 00:00	-10.37	4	11.6	NM	12.0	NM	12.1	12.2	12.2	12.1	12.1	7.6	7.1
16/09/2024 06:00		3	11.7	NM	12.0	NM	12.1	12.2	12.2	12.1	12.1	7.4	7.0
16/09/2024 12:00		8	14.6	NM	12.7	NM	13.0	12.1	12.2	13.0	12.1	7.5	7.1
16/09/2024 18:00		10	14.3	NM	12.6	NM	12.8	12.2	12.2	12.6	12.1	7.6	7.2
17/09/2024 00:00	-10.37	8	12.5	NM	12.3	NM	13.0	12.2	12.2	12.6	12.1	7.6	7.1
17/09/2024 06:00		10	12.4	NM	12.3	NM	12.6	12.1	12.0	12.4	12.1	7.6	7.2
17/09/2024 12:00		11	13.4	NM	12.4	NM	13.6	12.1	12.0	12.6	12.1	7.5	7.0
17/09/2024 18:00		11	14.6	NM	12.6	NM	13.2	12.2	11.7	12.9	12.1	7.4	7.0
18/09/2024 00:00	-10.52	11	12.2	NM	12.2	NM	12.9	12.0	11.7	12.4	12.1	7.6	7.2
18/09/2024 06:00		12	11.8	NM	11.8	NM	12.7	12.0	11.5	12.4	12.1	7.5	7.1
18/09/2024 12:00		16	14.5	NM	12.7	NM	15.1	11.8	11.6	13.1	12.1	7.4	7.0
18/09/2024 18:00		16	15.5	NM	12.1	NM	13.9	11.8	11.6	14.4	11.9	7.5	7.0
19/09/2024 00:00	-10.69	14	11.8	NM	11.6	NM	13.1	11.9	11.6	13.4	11.8	7.4	7.0
19/09/2024 06:00		12	11.1	NM	11.5	NM	12.8	12.0	11.7	13.5	11.8	7.4	7.0
19/09/2024 12:00		17	13.7	NM	12.5	NM	15.3	11.9	11.6	13.9	11.9	7.5	7.0
19/09/2024 18:00		17	15.0	NM	12.0	NM	14.1	11.9	11.6	15.2	11.9	7.6	7.2
20/09/2024 00:00	-10.88	12	11.3	NM	11.5	NM	13.8	11.9	11.7	14.0	11.8	7.7	7.2
20/09/2024 06:00		13	11.5	NM	11.6	NM	13.4	12.0	11.7	12.9	11.6	7.6	7.1
20/09/2024 12:00		16	12.2	NM	11.9	NM	13.5	11.9	11.6	12.8	11.7	7.6	7.2
20/09/2024 18:00		14	14.4	NM	11.9	NM	14.3	11.8	11.6	13.3	11.7	7.9	7.5
21/09/2024 00:00	-11.09	11	11.4	NM	11.6	NM	13.2	11.8	11.6	12.8	11.6	7.8	7.3
21/09/2024 06:00		10	11.6	NM	11.5	NM	12.8	11.7	11.5	12.4	11.6	7.5	7.1
21/09/2024 12:00		13	12.4	NM	11.8	NM	12.7	11.7	11.5	12.5	11.6	7.5	7.0
21/09/2024 18:00		12	13.5	NM	11.8	NM	12.4	11.6	11.5	12.2	11.6	7.4	7.0
22/09/2024 00:00	-11.22	8	11.9	NM	11.6	NM	12.0	11.7	11.6	12.1	11.6	7.4	6.9
22/09/2024 06:00		9	11.5	NM	11.5	NM	11.8	11.7	11.7	12.0	11.8	7.3	7.0
22/09/2024 12:00		12	12.0	NM	11.9	NM	12.4	11.7	11.6	12.1	11.9	7.6	7.2
22/09/2024 18:00		10	13.4	NM	11.8	NM	12.1	11.6	11.6	12.2	11.9	7.4	7.0
23/09/2024 00:00	-11.41	8	11.6	NM	11.6	NM	11.8	11.6	11.6	12.0	12.0	7.5	7.0
23/09/2024 06:00		8	11.3	NM	11.6	NM	11.5	11.7	11.6	12.0	12.0	7.5	7.0
23/09/2024 12:00		5	11.7	NM	11.6	NM	12.1	11.7	11.6	12.1	11.8	7.5	7.1
23/09/2024 18:00		3	12.1	NM	11.7	NM	11.9	11.8	11.6	12.5	11.8	7.6	7.1
24/09/2024 00:00	-11.53	3	11.5	NM	11.6	NM	11.8	11.8	11.7	12.4	11.9	7.5	7.1
24/09/2024 06:00		2	11.2	NM	11.6	NM	12.0	11.8	11.8	12.4	12.0	7.5	7.1
24/09/2024 12:00		0	11.8	NM	11.7	NM	13.1	11.8	11.8	12.5	12.1	7.5	7.1
24/09/2024 18:00		1	12.1	NM	11.7	NM	12.3	12.1	11.8	12.6	12.1	7.6	7.1
25/09/2024 00:00	-11.72	-1	9.9	NM	11.4	NM	11.9	12.0	11.7	12.3	11.9	7.7	7.3
25/09/2024 06:00		-2	9.4	NM	11.5	NM	12.0	11.9	11.7	12.4	12.0	7.8	7.3
25/09/2024 12:00		2	12.2	NM	12.1	NM	13.6	11.9	11.7	12.4	11.9	7.5	7.0
25/09/2024 18:00		3	12.8	NM	11.7	NM	12.4	11.8	11.7	12.4	11.9	7.6	7.1
26/09/2024 00:00	-11.77	0	10.3	NM	11.5	NM	11.9	11.9	11.7	12.1	12.1	7.6	7.1
26/09/2024 06:00		0	10.1	NM	11.4	NM	11.7	11.6	11.2	12.0	11.8	7.5	7.0
26/09/2024 12:00		-1	11.1	NM	11.6	NM	11.7	11.2	11.2	11.9	11.8	7.4	7.0
26/09/2024 18:00		1	11.9	NM	11.5	NM	11.5	11.4	11.0	11.8	11.7	7.6	7.2
27/09/2024 00:00	-11.88	0	10.4	NM	11.3	NM	11.2	11.4	11.4	11.7	11.7	7.9	7.4
27/09/2024 06:00		-1	10.2	NM	11.2	NM	11.2	11.4	11.3	11.6	11.6	7.6	7.1
27/09/2024 12:00		0	11.9	NM	11.7	NM	11.7	11.3	11.3	11.7	11.6	7.6	7.3
27/09/2024 18:00		0	11.5	NM	11.3	NM	11.3	11.3	11.3	11.6	11.6	7.5	7.1
28/09/2024 00:00	-12.12	-2	9.9	NM	11.0	NM	11.2	11.2	11.3	11.5	11.5	7.6	7.2
28/09/2024 06:00		-2	9.8	NM	10.9	NM	11.2	11.3	11.3	11.5	11.5	7.5	7.1
28/09/2024 12:00		1	11.2	NM	11.3	NM	11.4	11.2	11.2	11.6	11.5	7.5	7.1
28/09/2024 18:00		2	11.7	NM	11.3	NM	11.4	11.3	11.2	11.7	11.5	7.6	7.1
29/09/2024 00:00	-12.17	2	10.8	NM	11.2	NM	11.4	11.4	11.2	11.6	11.5	7.5	7.1
29/09/2024 06:00		2	10.6	NM	11.2	NM	11.4	11.3	11.2	11.7	11.5	7.6	7.2
29/09/2024 12:00		3	11.7	NM	11.4	NM	11.6	11.3	11.3	11.9	11.5	7.6	7.2
29/09/2024 18:00		3	12.1	NM	11.4	NM	11.6	11.5	11.2	11.8	11.5	7.7	7.2
30/09/2024 00:00	-12.35	2	10.3	NM	11.1	NM	11.5	11.5	11.3	11.7	11.7	7.7	7.3
30/09/2024 06:00		2	10.4	NM	11.2	NM	11.4	11.5	11.3	11.7	11.5	7.9	7.4
30/09/2024 12:00		4	10.9	NM	11.3	NM	11.5	11.4	11.3	11.7	11.6	7.4	7.0
30/09/2024 18:00		4	11.7	NM	11.4	NM	11.5	11.4	11.2	11.7	11.5	7.5	7.0
01/10/2024 00:00	-12.52	4	10.7	NM	11.2	NM	11.4	11.4	11.3	11.5	11.5	7.6	7.1
01/10/2024 06:00		2	10.2	NM	11.1	NM	11.3	11.3	11.4	11.5	11.5	7.5	7.0
01/10/2024 12:00		4	11.5	NM	11.2	NM	11.4	11.3	11.3	11.6	11.5	7.5	7.1
01/10/2024 18:00		4	12.0	NM	11.3	NM	11.3	11.2	11.1	11.6	11.5	7.5	7.1
02/10/2024 00:00	-12.70	2	10.4	NM	11.1	NM	11.2	11.2	11.2	11.5	11.5	7.6	7.1
02/10/2024 06:00		2	9.7	NM	11.0	NM	11.1	11.2	11.2	11.4	11.5	7.6	7.1
02/10/2024 12:00		5	12.0	NM	11.3	NM	12.1	11.2	11.2	11.6	11.4	7.6	7.1

Date and Time	Reservoir level	Air temperature (TD)	Temperature (R1)	Temperature (R1a)	Temperature (R2)	Temperature (R5)	Temperature (L3a)	Temperature (L3b)	Temperature (L3c)	Temperature (L4a)	Temperature (L4b)	Temperature (L4c)	Temperature (L4cA)
	m BSD	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
02/10/2024 18:00		4	12.6	NM	11.4	NM	11.5	11.3	11.2	11.5	11.5	7.6	7.2
03/10/2024 00:00	-12.88	2	9.7	NM	11.0	NM	11.1	11.2	11.2	11.4	11.4	7.8	7.4
03/10/2024 06:00		2	9.1	NM	10.9	NM	11.1	11.2	11.2	11.4	11.3	7.6	7.2
03/10/2024 12:00		2	11.4	NM	11.5	NM	11.6	11.1	11.2	11.5	11.3	7.6	7.2
03/10/2024 18:00		3	12.3	NM	11.2	NM	11.3	11.2	11.2	11.4	11.4	7.6	7.2
04/10/2024 00:00	-12.99	3	10.4	NM	11.0	NM	11.2	11.2	11.2	11.3	11.3	7.8	7.3
04/10/2024 06:00		4	10.7	NM	11.1	NM	11.2	11.2	11.2	11.3	11.3	7.6	7.2
04/10/2024 12:00		5	11.2	NM	11.2	NM	11.5	11.2	11.2	11.3	11.3	7.6	7.1
04/10/2024 18:00		5	11.6	NM	11.2	NM	11.2	11.2	11.2	11.3	11.2	7.7	7.2
05/10/2024 00:00	-13.00	7	11.2	NM	11.2	NM	11.2	11.1	11.2	11.3	11.3	7.6	7.1
05/10/2024 06:00		7	11.2	NM	11.1	NM	11.2	11.2	11.1	11.3	11.3	7.6	7.2
05/10/2024 12:00		7	11.6	NM	11.3	NM	11.4	11.2	11.2	11.4	11.3	7.6	7.2
05/10/2024 18:00		5	12.2	NM	11.4	NM	11.5	11.2	11.2	11.3	11.3	7.5	7.0
06/10/2024 00:00	-12.98		10.6	NM	11.1	NM	11.2	11.1	11.2	11.3	11.2	7.5	7.0
06/10/2024 06:00			10.7	NM	11.1	NM	11.2	11.2	11.2	11.2	11.2	7.6	7.1
06/10/2024 12:00			11.2	NM	11.2	NM	11.2	11.1	11.2	11.3	11.2	7.6	7.2
06/10/2024 18:00			11.7	NM	11.3	NM	11.2	11.2	11.2	11.2	11.2	7.6	7.2
07/10/2024 00:00	-12.99	5	11.2	NM	11.1	NM	11.1	11.2	11.2	11.2	11.3	7.7	7.3
07/10/2024 06:00		5	11.1	NM	11.2	NM	11.1	11.2	11.2	11.2	11.3	7.9	7.4
07/10/2024 12:00		8	12.4	NM	11.8	NM	11.5	11.1	11.2	11.5	11.2	7.6	7.1
07/10/2024 18:00		6	13.1	NM	11.4	NM	11.9	11.2	11.2	11.9	11.2	7.6	7.1
08/10/2024 00:00	-13.05	6	11.1	NM	11.1	NM	11.3	11.1	11.2	11.3	11.2	7.5	7.0
08/10/2024 06:00		5	11.0	NM	11.1	NM	11.2	11.2	11.2	11.2	11.2	7.5	7.1
08/10/2024 12:00		4	11.7	NM	11.3	NM	11.5	11.1	11.2	11.3	11.2	7.5	7.1
08/10/2024 18:00		3	11.7	NM	11.2	NM	11.2	11.1	11.2	11.3	11.2	7.5	7.0
09/10/2024 00:00		2	10.3	NM	11.0	NM	11.0	11.1	11.1	11.2	11.2	7.8	7.4
09/10/2024 06:00		0	10.1	NM	10.9	NM	10.9	11.0	11.0	11.2	11.2	7.7	7.2
09/10/2024 12:00		-1	10.5	NM	11.1	NM	11.2	10.9	11.0	11.2	11.2	7.6	7.2
09/10/2024 18:00		-2	10.3	NM	10.9	NM	10.9	10.9	11.0	11.2	11.2	7.7	7.2
10/10/2024 00:00		-4	9.0	NM	10.6	NM	10.8	10.9	10.9	11.1	11.1	7.7	7.3
10/10/2024 06:00			8.5	NM	10.5	NM	10.5	10.8	10.9	11.0	11.1	7.6	7.1
10/10/2024 12:00			10.3	NM	11.0	NM	11.7	10.8	10.7	11.2	11.0	7.6	7.3
10/10/2024 18:00		-2	10.4	NM	10.7	NM	10.8	10.7	10.8	11.0	11.0	7.5	9.0
11/10/2024 00:00		0	9.4	NM	10.4	NM	10.6	10.6	10.7	10.9	10.9	7.5	7.2
11/10/2024 06:00		0	9.2	NM	10.2	NM	10.6	10.6	10.7	10.9	10.9	7.5	7.1
11/10/2024 12:00		1	10.2	NM	10.5	NM	11.0	10.6	10.6	11.0	10.9	7.5	7.1
11/10/2024 18:00		1	10.4	NM	10.4	NM	10.7	10.6	10.6	10.9	10.9	7.5	7.0
12/10/2024 00:00		1	9.3	NM	9.8	NM	10.5	10.6	10.7	10.9	10.8	7.4	7.0
12/10/2024 06:00		0	8.5	NM	8.9	NM	10.5	10.6	10.7	10.9	10.9	7.4	7.0
12/10/2024 12:00		-1	8.6	NM	9.5	NM	10.9	10.6	10.6	10.9	10.8	7.4	6.9
12/10/2024 18:00		-1	9.3	NM	10.0	NM	10.6	10.6	10.6	10.8	10.8	7.3	6.9
13/10/2024 00:00		-4	8.2	NM	9.6	NM	10.4	10.5	10.6	10.8	10.8	7.5	7.1
13/10/2024 06:00		-4	7.9	NM	9.7	NM	10.3	10.4	10.5	10.7	10.7	7.6	7.4
13/10/2024 12:00		-2	9.3	NM	10.1	NM	11.2	10.3	10.4	11.3	10.7	7.4	7.0
13/10/2024 18:00		-2	9.6	NM	10.1	NM	10.4	10.4	10.4	10.7	10.7	7.5	7.1
14/10/2024 00:00		-2	8.8	NM	10.0	NM	10.4	10.5	10.4	10.6	10.7	7.6	7.1
14/10/2024 06:00		0	9.1	NM	10.0	NM	10.3	10.4	10.4	10.6	10.6	7.5	7.2
14/10/2024 12:00		3	10.4	NM	10.2	NM	11.7	10.4	10.3	10.9	10.6	7.6	7.1
14/10/2024 18:00		2	10.9	NM	10.5	NM	10.5	10.5	10.4	10.7	10.6	7.7	7.4
15/10/2024 00:00		3	9.1	NM	10.1	NM	10.3	10.5	10.3	10.6	10.6	7.6	7.2
15/10/2024 06:00		3	8.4	NM	10.0	NM	10.3	10.4	10.3	10.6	10.6	7.4	7.0
15/10/2024 12:00		4	10.3	NM	10.6	NM	10.9	10.4	10.4	10.8	10.6	7.5	7.0
15/10/2024 18:00		4	10.8	NM	10.3	NM	10.4	10.5	10.4	10.6	10.6	7.5	7.1
16/10/2024 00:00		5	10.3	NM	10.2	NM	10.4	10.4	10.3	10.6	10.6	7.5	7.1
16/10/2024 06:00		6	10.5	NM	10.3	NM	10.3	10.4	10.3	10.5	10.5	7.5	7.1
16/10/2024 12:00		7	10.8	NM	10.4	NM	10.7	10.3	10.3	10.7	10.5	7.5	7.1
16/10/2024 18:00		9	11.0	NM	10.4	NM	10.6	10.4	10.3	10.6	10.5	7.6	7.2
17/10/2024 00:00		8	10.6	NM	10.4	NM	10.5	10.4	10.3	10.6	10.5	7.5	7.3
17/10/2024 06:00		8	10.6	NM	10.4	NM	10.6	10.4	10.3	10.7	10.4	7.5	7.1
17/10/2024 12:00		6	11.8	NM	10.6	NM	12.0	10.4	10.3	11.0	10.4	7.5	7.1
17/10/2024 18:00		6	11.5	NM	10.6	NM	10.6	10.5	10.4	10.7	10.5	7.5	7.1
18/10/2024 00:00		4	10.7	NM	10.4	NM	10.6	10.4	10.4	10.6	10.5	7.5	7.2
18/10/2024 06:00		4	10.1	NM	10.3	NM	10.4	10.6	10.4	10.6	10.4	7.6	7.1
18/10/2024 12:00		6	10.3	NM	10.4	NM	10.7	10.6	10.4	10.6	10.5	7.4	7.1
18/10/2024 18:00		8	11.0	NM	10.6	NM	10.6	10.6	10.5	10.6	10.5	7.5	7.0
19/10/2024 00:00		4	10.6	NM	10.5	NM	10.5	10.6	10.5	10.5	10.5	7.6	7.2
19/10/2024 06:00		3	10.2	NM	10.4	NM	10.4	10.5	10.5	10.5	10.5	7.5	7.1
19/10/2024 12:00		3	10.9	NM	10.6	NM	10.7	10.5	10.5	10.7	10.5	7.4	7.0
19/10/2024 18:00		2	10.8	NM	10.6	NM	10.5	10.5	10.5	10.5	10.5	7.5	7.0
20/10/2024 00:00		2	10.0	NM	10.5	NM	10.3	10.5	10.5	10.5	10.5	7.5	7.1
20/10/2024 06:00		2	9.7	NM	10.4	NM	10.4	10.5	10.5	10.5	10.5	7.4	7.0
20/10/2024 12:00		4	9.8	NM	9.7	NM	10.6	10.4	10.4	10.6	10.4	7.5	7.1
20/10/2024 18:00		3	10.3	NM	10.3	NM	10.4	10.4	10.5	10.4	10.4	7.6	7.2
21/10/2024 00:00		4	9.7	NM	9.5	NM	10.3	10.4	10.4	10.4	10.4	9.3	8.1
21/10/2024 06:00		0	9.1	NM	9.1	NM	10.3	10.3	10.3	10.3	10.2	10.3	9.5
21/10/2024 12:00		2	9.7	NM	10.0	NM	10.4	10.2	10.3	10.4	10.3	10.3	9.9
21/10/2024 18:00		2	9.9	NM	10.0	NM	10.2	10.2	10.3	10.3	10.3	8.5	8.4
22/10/2024 00:00		2	9.3	NM	9.6	NM	10.1	10.1	10.2	10.3	10.2	8.7	8.3
22/10/2024 06:00		1	9.0	NM	9.4	NM	10.1	10.1	10.2	10.2	10.2	8.2	7.9
22/10/2024 12:00		1	9.0	NM	9.6	NM	10.2	10.1	10.1	10.3	10.2	8.1	7.6
22/10/2024 18:00		2	9.6	NM	10.0	NM	10.0	10.1	10.1	10.2	10.2	8.1	7.7
23/10/2024 00:00		2	9.3	NM	9.8	NM	10.0	10.0	10.1	10.2	10.1	8.1	7.9
23/10/2024 06:00		4	9.7	NM	9.9	NM	10.0	10.0	10.0	10.1	10.1	8.1	7.8
23/10/2024 12:00		6	10.6	NM	10.1	NM	10.2	10.0	10.1	10.3	10.2	8.4	7.9
23/10/2024 18:00		5	10.5	NM	10.2	NM	10.0	10.0	10.0	10.2	10.1	8.4	7.9
24/10/2024 00:00		4	10.0	NM	10.0	NM	10.0	10.1	10.1	10.1	10.2	8.3	7.9
24/10/2024 06:00		4	10.1	NM	10.0	NM	10.0	10.0	10.0	10.1	10.2	8.4	8.0
24/10/2024 12:00		5	10.3	NM	10.0	NM	10.0	10.0	10.1	10.2	10.1	8.6	8.2
24/10/2024 18:00		5	10.6	NM	10.1	NM	10.1	10.1	10.1	10.1	10.1	8.6	8.2
25/10/2024 00:00		6	10.2	NM	10.1	NM	10.0	10.1	10.1	10.1	10.1	8.7	8.3
25/10/2024 06:00		6	10.1	NM	10.0	NM	10.0	10.0	10.1	10.1	10.1	8.7	8.3
25/10/2024 12:00		5	10.2	NM	10.1	NM	10.3	10.1	10.0	10.2	10.1	8.7	8.3
25/10/2024 18:00		8	10.4	NM	10.1	NM	10.0	10.0	10.1	10.1	10.1	8.4	8.2
26/10/2024 00:00		8	10.1	NM	10.1	NM	10.0	10.0	10.1	10.1	10.1	8.8	8.3
26/10/2024 06:00		4	10.3	NM	10.0	NM	10.0	10.0	10.1	10.1	10.1	8.9	8.4
26/10/2024 12:00		3	10.3	NM	10.1	NM	10.2	10.0	10.1	10.2	10.1	9.1	8.7
26/10/2024 18:00		0	9.3	NM	9.0	NM	10.0	10.0	10.0	10.0	10.0	9.3	8.9
27/10/2024 00:00		-1	8.5	NM	9.5	NM	9.9	10.0	10.0	10.0	10.0	9.5	9.0
27/10/2024 06:00		-1	8.6	NM	9.5	NM	9.8	9.9	10.0	10.0	9.9	8.4	7.9
27/10/2024 12:00		1	9.3	NM	10.0	NM	10.0	9.9	9.9	10.0	10.0	8.3	8.0
27/10/2024 18:00		2	9.5	NM	9.8	NM	9.8	9.9	9.9	10.0	10.0	8.2	8.0
28/10/2024 00:00		7	9.6	NM	9.8	NM	9.8	9.9	9.9	9.9	10.0	8.3	7.9
28/10/2024 06:00		7	9.6	NM	9.8	NM	9.8	9.8	9.9	9.9	10.0	8.3	7.9
28/10/2024 12:00		8	10.4	NM	10.0	NM	10.2	9.8	9.9	10.5	10.0	8.4	8.0
28/10/2024 18:00		8	10.7	NM	10.0	NM	9.9	9.9	9.9	10.1	10.0	8.6	8.2
29/10/2024 00:00		6	10.1	NM	9.9	NM	10.0	9.9	9.9	10.0	10.0	8.7	8.2
29/10/2024 06:00		5	10.1	NM	10.0	NM	9.9	9.9	10.0	10.0	10.0	8.7	8.2
29/10/2024 12:00		5	10.6	NM	10.1	NM	9.9	9.9	10.0	10.1	9.9	8.8	8.4
29/10/2024 18:00		4	10.5	NM	10.1	NM	9.9	9.9	10.0	10.0	9.9	8.9	8.5
30/10/2024 00:00		4	10.3	NM	10.0	NM	10.0	9.9	10.0	10.0	10.0	8.8	8.5
30/10/2024 06:00		3	9.7	NM	10.0	NM	9.9	9.9	10.0	10.0	10.0	9.0	8.5
30/10/2024 12:00		7	10.0	NM	10.0	NM	10.1	9.9	9.9	10.5	10.0	8.7	8.2
30/10/2024 18:00		8	10.4	NM	10.0	NM	10.0	10.0	10.0	10.1	9.9	8.3	7.9
31/10/2024 00:00		6	10.0	NM	10.0	NM	9.9	10.0	10.0	9.9	9.9	8.3	7.8
31/10/2024 06:00		6	10.4	NM	10.1	NM	10.0	10.0	10.0	9.9	10.0	9.3	8.8
31/10/2024 12:00		8	10.8	NM	10.2	NM	10.1	10.0	10.0	10.0	10.0	9.6	9.0
31/10/2024 18:00		8	11.4	NM	10.3	NM	10.0	10.0	10.0	10.0	10.0	9.8	9.4
01/11/2024 00:00	-13.47	6	10.8	NM	10.3	NM	10.0	10.0	10.0	10.0	10.0	9.4	8.9
01/11/2024 06:00		6	10.6	NM	10.3	NM	10.0	10.0	10.0	10.0	10.0	9.0	8.9
01/11/2024 12:00		6	10.9	NM	10.3	NM	10.2	10.0	10.0	10.0	10.0	8.6	8.9
01/11/2024 18:00		6	10.3	NM	10.1	NM	10.0	10.0	10.0	10.0	10.0	8.3	7.8
02/11/2024 00:00	-13.60	6	9.6	NM	9.9	NM	10.0	10.0	10.0	10.0	10.0	8.1	7.8
02/11/2024 06:00		5	9.6	NM	9.9	NM	9.9	10.0	10.0	10.0	10.0	8.2	7.8
02/11/2024 12:00		5	10.4	NM	10.0	NM	10.2	10.0	10.0	10.1	10.0	8.5	8.0
02/11/2024 18:00		3	10.4	NM	10.1	NM	10.0	10.0	10.0	10.0	10.0	8.8	8.3
03/11/2024 00:00	-13.60	4	10.1	NM	10.0	NM	9.9	10.0	10.0	10.0	10.0	9.2	8.7
03/11/2024 06:00		9	10.1	NM	10.0	NM	9.9	10.0	10.0	9.9	10.0	9.3	8.8
03/11/2024 12:00		12	10.3	NM	10.1	NM	10.3	10.0	10.0	10.2	10.0	9.1	8.7
03/11/2024 18:00		7	10.2	NM	10.0	NM	10.0	10.0	10.0	10.0	9.9	8.4	8.1
04/11/2024 00:00	-13.69	3	9.9	NM	10.0	NM	9.9	10.0	10.0	10.0	9.9	8.4	8.0
04/11/2024 06:00		3	9.8	NM	10.0	NM	9.9	10.0	10.0	9.9	10.0	8.4	8.0
04/11/2024 12:00		3	10.1	NM	10.0	NM	10.2	9.9	9.8	10.0	9.9	8.4	8.0
04/11/2024 18:00		2	10.3	NM	10.0	NM	9.8	10.0	9.8	9.9	9.9	8.6	8.1
05/11/2024 00:00	-13.88	1	9.9	NM	10.0	NM	9.8	9.9	9.8	9.9	9.9	8.7	8.1
05/11/2024 06:00		1	9.6	NM	9.9	NM	9.7	9.9	9.6	9.9	9.9	8.8	8.3
05/11/2024 12:00		2	9.8	NM	10.0	NM	10.0	9.9	9.7	10.0	9.8	8.8	8.5
05/11/2024 18:00		3	9.9	NM	10.0	NM	9.6	9.9	9.7	9.9	9.8	9.0	8.6
06/11/2024 00:00	-13.94	6	9.7	NM	9.8	NM	9.7	9.9	9.7	9.8	9.8	9.0	8.6
06/11/2024 06:00		7	10.0	NM	9.9	NM	9.8	9.9	9.6	9.9	9.8	8.9	8.5
06/11/2024 12:00		8	10.3	NM	9.9	NM	10.3	9.8	9.6	10.0	9.8	8.7	8.3
06/11/2024 18:00		7	10.5	NM	9.9	NM	10.1	9.9	9.6	10.0	9.8	8.6	8.2
07/11/2024 00:00	-14.11	8	10.6	NM	9.9	NM	10.0	10.0	9.6	10.0	9.8	8.6	8.1
07/11/2024 06:00		7	10.6	NM	10.2	NM	10.0	10.0	9.7	10.0	9.8	8.7	8.1
07/11/2024 12:00		7	11.3	NM	10.1	NM	10.2	9.9	9.7	10.1	9.8	8.5	8.1
07/11/2024 18:00		5	11.1	NM	10.0	NM	10.0	10.0	9.9	9.9	9.9	8.7	8.1
08/11/2024 00:00	-14.29	5	10.3	NM	10.0	NM	10.0	10.0	9.8	9.9	9.9	8.5	8.1
08/11/2024 06:00		4	10.3	NM	10.1	NM	10.0	9.9	9.8	9.8	9.8	8.6	8.4
08/11/2024 12:00		10	10.6	NM	10.1	NM	11.2	9.9	9.7	10.2	9.8	8.7	8.4
08/11/2024 18:00		9	10.2	NM	9.9	NM	9.7	9.9	9.7	9.9	9.8	8.7	8.2

Date and Time	Reservoir level	Air temperature (TD)	Temperature (R1)	Temperature (R1a)	Temperature (R2)	Temperature (R5)	Temperature (L3a)	Temperature (L3b)	Temperature (L3c)	Temperature (L4a)	Temperature (L4b)	Temperature (L4c)	Temperature (L4cA)
	m BSD	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
09/11/2024 00:00	-14.40	7	9.5	NM	9.9	NM	9.9	9.9	9.7	9.9	9.8	8.7	8.3
09/11/2024 06:00		7	9.6	NM	10.0	NM	9.9	9.9	9.7	9.8	9.8	8.7	8.2
09/11/2024 12:00		9	9.9	NM	9.9	NM	10.1	9.8	9.7	9.9	9.8	8.8	8.3
09/11/2024 18:00		5	10.0	NM	9.8	NM	9.6	9.8	9.7	9.8	9.8	8.9	8.3
10/11/2024 00:00	-14.51	4	9.3	NM	9.7	NM	9.8	9.8	9.8	9.8	9.8	8.7	8.3
10/11/2024 06:00		6	9.4	NM	9.7	NM	9.7	9.7	9.7	9.8	9.8	8.7	8.3
10/11/2024 12:00		4	10.0	NM	9.8	NM	10.0	9.7	9.7	10.0	9.7	8.9	8.5
10/11/2024 18:00		1	9.7	NM	9.8	NM	9.7	9.7	9.7	9.7	9.7	9.3	8.8
11/11/2024 00:00	-14.63	0	8.7	NM	9.5	NM	9.6	9.6	9.7	9.6	9.7	9.5	9.1
11/11/2024 06:00		1	8.5	NM	9.6	NM	9.6	9.6	9.7	9.7	9.7	9.7	9.3
11/11/2024 12:00		2	9.3	NM	9.7	NM	9.8	9.6	9.7	9.8	9.6	9.4	9.0
11/11/2024 18:00		2	9.7	NM	9.6	NM	9.5	9.6	9.7	9.7	9.7	8.4	8.1
12/11/2024 00:00	-14.86	2	8.8	NM	9.5	NM	9.3	9.6	9.6	9.6	9.6	8.4	7.9
12/11/2024 06:00		5	8.2	NM	9.5	NM	9.0	9.5	9.6	9.6	9.6	8.4	7.9
12/11/2024 12:00		7	8.6	NM	9.6	NM	9.9	9.5	9.6	9.8	9.6	8.4	8.1
12/11/2024 18:00		6	9.1	NM	9.5	NM	9.5	9.5	9.6	9.6	9.6	8.6	8.1
13/11/2024 00:00	-14.88	5	9.1	NM	9.5	NM	9.4	9.5	9.5	9.6	9.6	8.7	8.3
13/11/2024 06:00		7	9.6	NM	9.5	NM	9.4	9.5	9.5	9.6	9.6	8.9	8.5
13/11/2024 12:00		7	10.0	NM	9.6	NM	9.5	9.5	9.5	9.6	9.6	8.8	8.3
13/11/2024 18:00		4	10.1	NM	9.6	NM	9.4	9.6	9.6	9.6	9.6	8.8	8.4
14/11/2024 00:00	-14.95	5	9.3	NM	9.4	NM	9.4	9.5	9.5	9.6	9.6	9.1	8.4
14/11/2024 06:00		5	9.2	NM	9.4	NM	9.4	9.5	9.5	9.6	9.6	9.4	8.5
14/11/2024 12:00		6	9.7	NM	9.6	NM	9.8	9.5	9.5	10.0	9.6	9.1	8.8
14/11/2024 18:00		5	10.2	NM	9.6	NM	9.5	9.5	9.5	9.6	9.6	8.9	8.7
15/11/2024 00:00	-15.06	6	9.8	NM	9.6	NM	9.5	9.5	9.5	9.6	9.6	8.7	8.3
15/11/2024 06:00		6	9.7	NM	9.5	NM	9.5	9.5	9.5	9.6	9.6	8.6	8.3
15/11/2024 12:00		6	10.2	NM	9.6	NM	9.7	9.5	9.6	9.7	9.6	8.5	8.2
15/11/2024 18:00		5	10.2	NM	9.7	NM	9.5	9.6	9.6	9.6	9.6	9.5	8.9
16/11/2024 00:00	-15.13	-1	9.3	NM	9.3	NM	9.5	9.5	9.6	9.6	9.6	9.6	9.1
16/11/2024 06:00		-1	8.3	NM	9.1	NM	9.5	9.5	9.5	9.6	9.6	9.6	9.2
16/11/2024 12:00		-2	8.3	NM	9.1	NM	9.7	9.4	9.4	9.6	9.5	9.6	9.2
16/11/2024 18:00		-3	7.9	NM	8.9	NM	9.3	9.4	9.4	9.5	9.6	9.5	9.1
17/11/2024 00:00	-15.07	-3	7.5	NM	8.7	NM	9.3	9.3	9.3	9.4	9.5	9.5	9.1
17/11/2024 06:00		-4	7.1	NM	8.5	NM	9.2	9.2	9.3	9.4	9.4	9.4	9.0
17/11/2024 12:00		-4	7.2	NM	8.7	NM	9.4	9.2	9.2	9.4	9.4	9.4	9.0
17/11/2024 18:00		-5	7.3	NM	8.7	NM	9.0	9.1	9.1	9.3	9.4	9.1	8.7
18/11/2024 00:00	-15.14	-6	6.9	NM	8.5	NM	9.0	9.1	9.1	9.3	9.3	9.0	8.6
18/11/2024 06:00		-7	6.6	NM	8.5	NM	8.9	9.0	9.0	9.3	9.3	9.2	8.8
18/11/2024 12:00		-5	6.9	NM	8.5	NM	9.4	9.0	9.0	9.4	9.3	9.1	8.8
18/11/2024 18:00		-7	6.9	NM	8.4	NM	8.7	8.9	8.9	9.2	9.3	9.0	8.6
19/11/2024 00:00	-15.31	-8	5.9	NM	8.3	NM	8.6	8.8	8.9	9.2	9.2	9.0	8.6
19/11/2024 06:00		-7	6.0	NM	8.2	NM	8.5	8.7	8.8	9.1	9.2	9.0	8.6
19/11/2024 12:00		-8	6.2	NM	8.1	NM	8.8	8.7	8.8	9.3	9.1	8.8	8.4
19/11/2024 18:00		-6	6.6	NM	8.0	NM	8.6	8.6	8.7	9.1	9.1	8.9	8.4
20/11/2024 00:00	-15.36	-7	6.3	NM	8.1	NM	8.5	8.6	8.7	9.0	9.0	8.8	8.4
20/11/2024 06:00		-7	6.2	NM	8.0	NM	8.4	8.5	8.6	9.0	9.0	8.8	8.5
20/11/2024 12:00		-8	6.3	NM	7.8	NM	8.7	8.4	8.5	9.0	8.9	8.9	8.5
20/11/2024 18:00		-8	6.0	NM	7.7	NM	8.3	8.4	8.4	8.9	8.9	8.8	8.4
21/11/2024 00:00	-15.47	-9	5.8	NM	7.6	NM	8.2	8.3	8.3	8.8	8.8	8.8	8.4
21/11/2024 06:00		-6	5.1	NM	7.5	NM	8.1	8.2	8.3	8.7	8.7	8.6	8.3
21/11/2024 12:00		-4	5.6	NM	7.5	NM	8.1	8.1	8.1	8.7	8.7	8.7	8.4
21/11/2024 18:00		-5	5.7	NM	7.2	NM	8.0	8.1	8.1	8.7	8.7	8.6	8.2
22/11/2024 00:00	-15.45	-6	5.5	NM	7.3	NM	8.1	8.0	8.0	8.6	8.6	8.6	8.2
22/11/2024 06:00		-6	5.4	NM	7.2	NM	8.0	7.9	7.9	8.5	8.6	8.4	8.2
22/11/2024 12:00		-5	5.8	NM	7.4	NM	8.6	8.1	8.0		8.5	8.5	8.2
22/11/2024 18:00		-2	5.9	5.7	7.2	7.3	8.1	8.1	8.1	8.5	8.6	8.4	8.1
23/11/2024 00:00	-15.59	-2	5.7	5.8	7.2	5.2	8.0	8.1	8.1	8.4	8.5	8.4	8.0
23/11/2024 06:00		2	5.7	5.7	7.2	3.7	8.0	8.1	8.1	8.4	8.4	8.3	8.0
23/11/2024 12:00		1	5.7	5.6	6.9	5.4	7.8	7.9	7.9	8.4	8.4	8.3	8.0
23/11/2024 18:00		4	5.4	5.4	6.9	3.8	7.9	7.9	8.0	8.4	8.4	8.4	8.0
24/11/2024 00:00	-15.42	7	5.2	5.2	6.6	3.3	8.0	7.9	7.9	8.4	8.3	8.3	7.9
24/11/2024 06:00		7	4.4	4.6	5.4	2.1	8.0	7.9	7.8	8.3	8.4	8.3	7.8
24/11/2024 12:00		7	5.8	6.1	6.6	3.1	8.2	7.8	7.8	8.4	8.3	8.2	7.8
24/11/2024 18:00		7	6.4	6.3	6.9	4.0	8.0	8.0	7.8	8.3	8.3	8.2	7.8
25/11/2024 00:00	-14.88	7	6.2	6.2	6.4	5.0	7.9	8.0	7.8	8.2	8.3	8.2	7.9
25/11/2024 06:00		8	6.4	6.3	6.5	5.4	7.6	7.7	7.8	8.3	8.3	8.3	7.8
25/11/2024 12:00		6	6.2	6.2	6.3	5.7	7.7	7.8	7.8	8.2	8.2	8.1	7.8
25/11/2024 18:00		6	5.9	5.9	5.9	5.5	7.7	7.7	7.8	8.2	8.1	8.2	7.8
26/11/2024 00:00	-14.18	5	5.7	5.7	6.2	5.4	7.9	7.7	7.7	8.2	8.2	8.2	7.8
26/11/2024 06:00		3	5.8	5.8	6.6	5.1	7.8	7.6	7.6	8.1	8.1	8.1	7.7
26/11/2024 12:00		4	6.0	6.3	6.9	5.0	8.8	7.7	7.7	8.1	8.1	8.1	7.7
26/11/2024 18:00		0	6.6	6.5	7.1	4.8	7.5	7.8	7.6	8.1	8.1	8.0	7.7
27/11/2024 00:00	-14.19	-3	5.8	5.7	7.1	4.7	7.6	7.8	7.6	8.0	8.0	8.0	7.6
27/11/2024 06:00		-3	6.0	5.9	7.0	4.7	7.5	7.8	7.6	8.0	8.0	8.0	7.6
27/11/2024 12:00		0	6.0	6.2	7.0	5.4	7.9	7.8	7.7	8.0	8.0	8.0	7.6
27/11/2024 18:00		-7	6.0	5.9	7.0	7.0	7.6	7.8	7.5	7.9	8.0	7.8	7.5
28/11/2024 00:00	-14.30	-8	4.9	4.8	6.8	6.9	7.5	7.7	7.7	7.9	7.9	7.8	7.4
28/11/2024 06:00		-7	4.6	4.5	6.8	6.9	7.5	7.6	7.6	7.8	7.8	7.8	7.4
28/11/2024 12:00		2	4.8	5.1	6.8	7.0	7.5	7.5	7.5	7.8	7.8	7.8	7.4
28/11/2024 18:00		4	5.8	5.8	6.9	4.9	7.4	7.4	7.4	7.8	7.8	7.8	7.4
29/11/2024 00:00	-14.12	5	5.2	3.9	5.7	3.7	7.4	7.4	7.4	7.7	7.8	7.7	7.4
29/11/2024 06:00		8	5.0	5.3	6.5	5.3	7.5	7.5	7.4	7.8	7.8	7.8	7.3
29/11/2024 12:00		10	6.8	7.1	7.2	3.4	7.6	7.5	7.5	7.8	7.8	7.6	7.3
29/11/2024 18:00		9	7.5	7.5	7.5	4.3	7.6	7.5	7.4	7.8	7.8	7.7	7.2
30/11/2024 00:00	-13.90	11	7.5	7.5	7.7	6.4	7.7	7.6	7.5	7.8	7.8	7.7	7.2
30/11/2024 06:00		11	8.1	8.1	8.3	7.5	7.7	7.6	7.4	7.8	7.8	7.7	7.2
30/11/2024 12:00		11	8.2	8.3	8.0	8.0	7.7	7.7	7.6	7.9	7.8	7.6	7.3
30/11/2024 18:00		12	8.4	8.4	7.9	8.3	7.8	7.6	7.5	7.9	7.8	7.7	7.2
01/12/2024 00:00	-13.67	12	8.8	8.8	8.2	8.6	7.8	7.8	7.7	8.0	7.9	7.7	7.3
01/12/2024 06:00		10	8.8	8.7	8.2	9.0	7.7	7.8	7.7	7.9	7.8	7.7	7.3
01/12/2024 12:00		10	8.7	8.7	8.1	8.4	7.8	7.8	7.8	7.9	7.8	7.7	7.3
01/12/2024 18:00		9	8.7	8.6	8.2	8.4	7.8	7.8	7.8	7.8	7.8	7.8	7.4
02/12/2024 00:00	-13.56	8	8.0	7.9	7.8	8.5	7.8	7.8	7.8	7.9	7.8	7.8	7.4
02/12/2024 06:00		3	6.9	6.8	7.0	7.8	7.7	7.8	7.9	7.8	7.8	7.8	7.4
02/12/2024 12:00		2	6.4	6.4	7.2	7.5	7.8	7.8	7.8	7.8	7.8	7.7	7.3
02/12/2024 18:00		1	6.6	6.5	7.4	7.5	7.6	7.8	7.8	7.8	7.8	7.7	7.3
03/12/2024 00:00	-13.73	-3	5.9	5.7	7.2	6.7	7.6	7.7	7.7	7.8	7.7	7.8	7.4
03/12/2024 06:00		-3	5.9	5.9	7.2	5.6	7.6	7.7	7.7	7.7	7.7	7.8	7.4
03/12/2024 12:00		1	5.8	5.9	7.2	6.5	7.6	7.6	7.6	7.7	7.7	7.8	7.3
03/12/2024 18:00		1	5.6	5.7	6.9	4.8	7.5	7.5	7.6	7.7	7.7	7.7	7.3
04/12/2024 00:00	-13.56	1	5.7	5.6	6.8	4.6	7.5	7.5	7.6	7.7	7.7	7.7	7.3
04/12/2024 06:00		0	5.3	5.2	6.7	3.7	7.4	7.5	7.5	7.6	7.6	7.7	7.3
04/12/2024 12:00		4	5.4	5.6	6.9	4.2	7.5	7.5	7.5	7.7	7.7	7.6	7.2
04/12/2024 18:00		6	6.0	5.8	6.9	6.4	7.4	7.4	7.5	7.6	7.7	7.7	7.3
05/12/2024 00:00	-13.26	9	5.6	5.8	6.3	4.5	7.5	7.4	7.5	7.6	7.6	7.5	7.2
05/12/2024 06:00		8	6.6	6.6	7.1	5.5	7.3	7.4	7.4	7.7	7.6	7.6	7.2
05/12/2024 12:00		7	6.7	6.7	7.0	6.9	7.6	7.4	7.4	7.8	7.6	7.6	7.2
05/12/2024 18:00		5	6.6	6.3	6.6	6.9	7.3	7.4	7.4	7.6	7.6	7.6	7.2
06/12/2024 00:00	-13.30	5	5.5	5.4	6.2	5.7	7.3	7.3	7.3	7.6	7.6	7.6	7.2
06/12/2024 06:00		3	4.8	4.9	6.2	6.5	7.2	7.2	7.3	7.5	7.5	7.5	7.1
06/12/2024 12:00		5	5.8	6.0	6.8	6.7	7.6	7.2	7.2	7.5	7.5	7.5	7.1
06/12/2024 18:00		2	6.4	6.3	6.9	6.8	7.3	7.3	7.3	7.5	7.5	7.5	7.1
07/12/2024 00:00	-13.37	3	4.3	4.2	5.5	4.6	7.2	7.2	7.2	7.5	7.5	7.5	7.1
07/12/2024 06:00		2	4.1	4.3	6.0	3.5	7.2	7.2	7.2	7.5	7.5	7.5	7.0
07/12/2024 12:00		5	5.1	5.2	5.9	5.7	7.3	7.2	7.1	7.5	7.4	7.4	7.0
07/12/2024 18:00		4	4.9	4.8	5.1	5.2	7.1	7.1	7.1	7.4	7.4	7.4	7.0
08/12/2024 00:00	-13.11	3	4.7	4.8	6.0	5.6	7.1	7.1	7.2	7.3	7.4	7.4	7.0
08/12/2024 06:00		3	5.2	5.2	6.3	3.3	7.0	7.0	7.1	7.4	7.4	7.4	7.0
08/12/2024 12:00		4	5.7	5.8	6.4	3.6	7.2	7.1	7.0	7.3	7.3	7.3	6.9
08/12/2024 18:00		3	5.7	5.5	6.5	3.6	6.9	7.1	7.0	7.3	7.3	7.3	6.9
09/12/2024 00:00	-13.11	-1	5.3	5.4	6.3	3.5	6.9	6.9	7.0	7.3	7.3	7.3	6.9
09/12/2024 06:00		-1	5.8	5.8	6.4	3.6	6.9	6.9	6.9	7.3	7.3	7.3	6.9
09/12/2024 12:00		1	5.9	6.0	6.4	3.8	7.2	6.9	6.9	7.3	7.2	7.2	6.9
09/12/2024 18:00		-4	5.8	5.7	6.4	3.7	6.9	6.9	6.9	7.2	7.3	7.2	6.8
10/12/2024 00:00	-13.18	-8	5.1	5.1	6.3	3.6	6.9	6.9	6.9	7.2	7.2	7.2	6.8
10/12/2024 06:00		-2	5.4	5.4	6.3	3.7	6.9	6.9	6.8	7.2	7.2	7.2	6.8
10/12/2024 12:00		-3	5.7	5.7	6.3	3.9	7.0	6.9	6.8	7.2	7.2	7.2	6.8
10/12/2024 18:00		-4	5.5	5.4	6.3	4.8	6.1	6.9	6.8	7.2	7.2	7.2	6.8
11/12/2024 00:00	-13.23	-7	4.8	4.7	6.1	3.8	6.3	6.9	6.8	7.2	7.2	7.1	6.7
11/12/2024 06:00		-10	4.6	4.6	6.1	3.5	6.8	6.8	6.8	7.1	7.2	7.1	6.7
11/12/2024 12:00		-3	4.9	5.0	6.0	5.9	7.3	6.7	6.8	7.1	7.1	7.1	6.7
11/12/2024 18:00		-5	5.0	5.0	6.0	6.1	6.7	6.7	6.7	7.1	7.1	7.0	6.6
12/12/2024 00:00	-13.23	-6	4.8	4.8	6.0	6.2	6.7	6.7	6.8	7.1	7.1	7.0	6.6
12/12/2024 06:00		-5	4.9	4.9	6.0	6.2	6.7	6.8	6.8	7.0	7.0	7.0	6.6
12/12/2024 12:00		-1	5.1	5.3	6.1	6.2	6.9	6.7	6.7	7.0	7.0	7.1	6.6
12/12/2024 18:00		-1	5.5	5.5	6.2	6.2	6.7	6.7	6.8	7.0	7.0	7.0	6.6
13/12/2024 00:00	-13.29	2	5.6	5.6	6.3	6.3	6.6	6.8	6.7	7.0	7.0	7.0	6.6
13/12/2024 06:00		1	5.8	5.8	6.3	6.3	6.6	6.8	6.7	7.0	6.9	7.0	6.6
13/12/2024 12:00		4	6.0	6.1	6.4	6.4	6.8	6.7	6.7	7.0	7.0	6.9	6.6
13/12/2024 18:00		4	6.2	6.2	6.5	6.4	6.8	6.7	6.7	7.1	7.0	6.9	6.5
14/12/2024 00:00	-13.40	1	5.4	5.3	6.1	6.3	6.8	6.7	6.7	7.0	7.0	6.9	6.5
14/12/2024 06:00		1	5.4	5.4	6.3	6.0	6.7	6.8	6.7	7.0	7.0	7.0	6.6
14/12/2024 12:00		4	5.8	5.9	6.3	6.0	6.9	6.7	6.7	6.9	6.9	7.0	6.5
14/12/2024 18:00		7	6.2	6.2	6.3	6.1	6.7	6.6	6.7	7.0	6.9	6.9	6.5
15/12/2024 00:00	-13.40	9	6.3	6.3	6.3	5.8	6.8	6.7	6.8	7.0	7.0	6.9	6.5
15/12/2024 06:00		11	7.0	7.1	7.0	5.9	6.6	6.6	6.7	7.0	6.9	6.9	6.5
15/12/2024 12:00		12	7.8	7.8	7.3	5.8	6.7	6.8	6.8	6.9	6.9	6.9	6.5
15/12/2024 18:00		12	8.4	8.6	8.0	8.3	6.8	6.9	6.9	7.0	7.0	7.0	6.6
16/12/2024 00:00	-12.55	11	8.8	8.6	8.2	8.8	6.9	7.0	7.0	7.0	7.0	7.0	6.6

Date and Time	Reservoir level	Air temperature (TD)	Temperature (R1)	Temperature (R1a)	Temperature (R2)	Temperature (R5)	Temperature (L3a)	Temperature (L3b)	Temperature (L3c)	Temperature (L4a)	Temperature (L4b)	Temperature (L4c)	Temperature (L4cA)
	m BSD	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
16/12/2024 06:00		11	8.5	8.5	8.0	8.7	7.0	7.0	7.0	7.0	7.0	7.0	6.6
16/12/2024 12:00		10	8.7	8.6	8.2	8.8	7.1	7.1	7.1	7.1	7.0	7.0	6.6
16/12/2024 18:00		10	8.2	8.1	7.6	8.5	7.1	7.2	7.2	7.0	7.0	7.1	6.7
17/12/2024 00:00	-11.62	11	8.2	8.1	7.7	8.2	7.1	7.1	7.2	7.1	7.1	7.1	6.7
17/12/2024 06:00		8	8.1	8.0	7.6	8.1	7.2	7.2	7.2	7.1	7.1	7.1	6.7
17/12/2024 12:00		7	7.7	7.7	7.4	8.0	7.2	7.2	7.2	7.1	7.1	7.1	6.7
17/12/2024 18:00		9	7.6	7.6	7.2	7.8	7.2	7.2	7.2	7.1	7.1	7.1	6.7
18/12/2024 00:00	-11.21	10	8.1	8.2	7.7	7.8	7.2	7.2	7.2	7.1	7.1	7.1	6.7
18/12/2024 06:00		11	9.2	9.3	8.6	8.8	7.2	7.3	7.2	7.1	7.2	7.1	6.7
18/12/2024 12:00		7	8.3	8.1	7.7	9.1	7.3	7.2	7.3	7.2	7.1	7.1	6.7
18/12/2024 18:00		2	6.9	6.6	7.0	8.4	7.2	7.2	7.3	7.1	7.2	7.2	6.8
19/12/2024 00:00	-10.99	2	6.1	6.0	6.9	7.3	7.2	7.2	7.2	7.1	7.1	7.2	6.7
19/12/2024 06:00		1	5.5	5.4	6.6	6.4	7.1	7.2	7.2	7.1	7.1	7.0	6.7
19/12/2024 12:00		2	5.7	5.6	6.4	5.7	7.1	7.0	7.1	7.1	7.1	7.1	6.7
19/12/2024 18:00		2	5.6	5.5	6.7	4.8	6.9	6.9	6.9	7.0	7.0	7.0	6.7
20/12/2024 00:00	-10.87	1	5.7	5.7	6.6	4.5	6.9	6.9	6.9	7.0	7.0	7.1	6.6
20/12/2024 06:00		6	6.2	6.2	6.6	4.4	6.9	6.9	6.9	7.0	7.0	7.0	6.6
20/12/2024 12:00		7	5.9	5.9	5.9	5.0	6.9	6.9	6.9	7.0	7.0	7.0	6.6
20/12/2024 18:00		6	6.3	6.2	6.6	5.5	6.9	6.9	6.9	6.9	7.0	7.0	6.6
21/12/2024 00:00	-10.57	6	6.3	6.3	6.6	5.5	6.8	6.9	6.9	6.9	7.0	7.0	6.6
21/12/2024 06:00		9	6.2	6.5	6.2	5.7	6.8	6.8	6.9	6.9	6.9	6.9	6.5
21/12/2024 12:00		6	5.8	5.7	6.1	5.9	6.8	6.8	6.9	6.9	6.9	7.0	6.6
21/12/2024 18:00		4	5.0	4.8	5.3	5.3	6.7	6.8	6.8	6.9	6.9	6.9	6.5
22/12/2024 00:00	-10.29	3	4.6	4.4	5.5	4.1	6.7	6.7	6.7	6.9	6.9	6.9	6.5
22/12/2024 06:00		2	3.9	4.0	5.6	3.4	6.6	6.6	6.7	6.9	6.8	6.9	6.4
22/12/2024 12:00		3	4.8	4.8	5.8	3.3	6.5	6.6	6.6	6.8	6.8	6.8	6.4
22/12/2024 18:00		4	4.2	4.1	4.8	3.3	6.4	6.5	6.5	6.7	6.7	6.7	6.3
23/12/2024 00:00	-10.10	1	4.4	4.3	5.3	3.2	6.5	6.5	6.5	6.7	6.7	6.7	6.3
23/12/2024 06:00		2	4.6	4.6	5.7	3.2	6.4	6.4	6.5	6.7	6.7	6.7	6.3
23/12/2024 12:00		3	5.2	5.3	5.9	3.2	6.3	6.4	6.5	6.7	6.7	6.7	6.3
23/12/2024 18:00		5	5.7	5.8	6.0	3.3	6.5	6.4	6.4	6.7	6.7	6.6	6.2
24/12/2024 00:00	-9.88	9	6.1	6.3	6.1	4.2	6.4	6.4	6.4	6.7	6.7	6.6	6.2
24/12/2024 06:00		11	7.1	7.2	7.0	5.9	6.4	6.4	6.5	6.6	6.7	6.7	6.2
24/12/2024 12:00		12	7.9	8.0	7.8	7.3	6.5	6.5	6.6	6.7	6.7	6.7	6.3
24/12/2024 18:00		11	8.1	8.1	7.7	7.7	6.6	6.5	6.6	6.7	6.7	6.7	6.3
25/12/2024 00:00	-9.51	11	8.3	8.2	7.6	9.0	6.6	6.6	6.7	6.7	6.7	6.8	6.3
25/12/2024 06:00		10	8.2	8.2	7.5	8.9	6.6	6.7	6.8	6.7	6.7	6.8	6.3
25/12/2024 12:00		10	8.2	8.2	7.4	8.8	6.7	6.7	6.7	6.8	6.8	6.7	6.4
25/12/2024 18:00		10	8.5	8.5	7.6	8.8	6.7	6.8	6.8	6.8	6.8	6.8	6.4
26/12/2024 00:00	-9.28	10	8.6	8.4	7.7	8.9	6.9	6.9	6.9	6.8	6.8	6.8	6.4
26/12/2024 06:00		6	7.5	7.4	7.0	8.7	6.8	6.9	6.9	6.8	6.9	6.8	6.4
26/12/2024 12:00		7	7.2	7.3	6.9	8.3	7.1	6.9	6.9	6.9	6.9	6.8	6.4
26/12/2024 18:00		6	7.2	7.1	6.9	8.1	6.9	6.9	6.9	6.9	6.9	6.8	6.4
27/12/2024 00:00	-9.23	6	7.0	6.9	6.9	7.8	6.8	6.9	6.9	6.9	6.8	6.8	6.4
27/12/2024 06:00		8	6.9	6.9	6.8	7.2	6.9	6.8	6.9	6.9	6.8	6.8	6.4
27/12/2024 12:00		8	7.3	7.3	7.0	6.9	7.0	6.8	6.9	6.8	6.8	6.8	6.4
27/12/2024 18:00		8	7.5	7.4	7.1	7.0	6.9	6.8	6.8	7.0	6.8	6.8	6.4
28/12/2024 00:00	-8.99	9	7.6	7.6	7.3	7.4	6.9	6.9	6.9	6.9	6.8	6.8	6.4
28/12/2024 06:00		9	7.6	7.6	7.2	7.6	6.9	6.9	6.9	6.9	6.8	6.8	6.4
28/12/2024 12:00		6	7.3	7.2	6.9	7.6	6.9	6.9	6.9	6.9	6.8	6.8	6.4
28/12/2024 18:00		7	7.1	7.0	6.9	7.5	6.9	6.9	6.9	6.8	6.8	6.9	6.4
29/12/2024 00:00	-8.82	8	6.9	6.9	6.8	7.3	6.8	6.9	6.9	6.8	6.8	6.8	6.4
29/12/2024 06:00		10	7.7	7.6	7.3	7.2	6.9	6.9	6.9	6.9	6.8	6.9	6.4
29/12/2024 12:00		10	7.8	7.8	7.6	7.6	6.9	6.9	6.9	6.9	6.8	6.9	6.4
29/12/2024 18:00		9	8.0	8.1	7.6	7.8	6.9	6.9	7.0	6.9	6.9	6.9	6.4
30/12/2024 00:00	-8.00	10	8.1	7.9	7.8	8.3	6.9	6.9	7.0	6.9	6.9	6.9	6.5
30/12/2024 06:00		9	7.8	8.0	7.3	8.0	6.9	6.9	6.9	6.9	6.9	6.9	6.5
30/12/2024 12:00		6	7.9	7.7	7.4	8.4	6.9	7.0	7.0	6.9	6.9	6.9	6.5
30/12/2024 18:00		4	6.9	6.8	6.8	7.5	6.9	6.9	7.0	6.9	6.9	6.9	6.5
31/12/2024 00:00	-7.42	7	5.8	5.4	6.2	7.2	6.9	6.9	6.9	6.9	6.9	6.9	6.5
31/12/2024 06:00		9	5.2	6.0	5.1	4.7	6.9	6.9	6.9	6.9	6.9	6.8	6.4
31/12/2024 12:00		9	7.2	7.2	7.0	6.7	6.9	6.9	6.9	6.9	6.9	6.9	6.5
31/12/2024 18:00		6	6.9	6.8	6.6	7.1	6.9	6.9	6.9	6.9	6.9	6.9	6.5
01/01/2025 00:00	-6.70	7	6.7	6.6	6.4	6.7	6.8	6.9	6.9	6.8	6.8	6.9	6.4
01/01/2025 06:00		2	6.1	6.0	6.4	6.0	6.8	6.9	6.9	6.8	6.9	6.9	6.5
01/01/2025 12:00		2	5.2	5.3	6.2	5.5	6.8	6.7	6.8	6.9	6.8	6.8	6.5
01/01/2025 18:00		0	5.2	5.1	6.3	6.4	6.7	6.7	6.8	6.8	6.8	6.9	6.4
02/01/2025 00:00		-3	4.8	4.8	6.3	4.5	6.7	6.7	6.7	6.8	6.8	6.8	6.4
02/01/2025 06:00		-5	4.8	4.7	6.2	4.0	6.6	6.6	6.6	6.8	6.8	6.8	6.4
02/01/2025 12:00		-1	4.8	5.0	6.2	3.7	6.6	6.6	6.6	6.8	6.7	6.7	6.4
02/01/2025 18:00		-1	5.1	4.9	6.2	6.1	6.5	6.6	6.6	6.7	6.7	6.8	6.4
03/01/2025 00:00		1	4.8	4.8	6.1	3.5	6.4	6.4	6.5	6.7	6.7	6.7	6.3
03/01/2025 06:00		0	4.9	4.8	6.0	3.1	6.4	6.4	6.4	6.7	6.7	6.6	6.3
03/01/2025 12:00		-1	5.1	5.3	6.1	6.0	6.4	6.3	6.4	6.6	6.7	6.6	6.2
03/01/2025 18:00		-2	5.5	5.4	6.1	6.0	6.4	6.4	6.4	6.6	6.6	6.6	6.2
04/01/2025 00:00		-2	5.0	5.1	6.1	6.0	6.3	6.3	6.4	6.6	6.6	6.6	6.2
04/01/2025 06:00		-1	5.2	5.1	6.0	6.0	6.4	6.3	6.3	6.6	6.6	6.6	6.2
04/01/2025 12:00		2	5.5	5.7	6.1	6.1	6.5	6.3	6.3	6.6	6.6	6.5	6.1
04/01/2025 18:00		-1	5.6	5.4	6.2	6.0	6.4	6.3	6.3	6.6	6.6	6.5	6.1
05/01/2025 00:00		-1	5.3	5.3	6.1	6.0	6.4	6.3	6.4	6.6	6.6	6.5	6.1
05/01/2025 06:00		-2	5.4	5.4	6.1	6.0	6.4	6.4	6.3	6.6	6.6	6.5	6.1
05/01/2025 12:00		-3	5.4	5.5	6.1	6.1	6.4	6.3	6.3	6.6	6.6	6.5	6.1
05/01/2025 18:00		-5	5.4	5.3	6.0	6.0	6.3	6.3	6.4	6.5	6.6	6.5	6.1
06/01/2025 00:00		-6	4.9	4.9	6.0	6.0	6.3	6.4	6.4	6.5	6.6	6.5	6.1
06/01/2025 06:00		-6	4.8	4.8	6.0	6.0	6.3	6.4	6.4	6.5	6.5	6.5	6.1
06/01/2025 12:00		0	4.8	4.9	5.9	6.0	6.4	6.3	6.3	6.5	6.5	6.5	6.0
06/01/2025 18:00		0	5.1	5.1	5.9	6.0	6.2	6.3	6.3	6.5	6.5	6.5	6.1
07/01/2025 00:00		1	4.8	4.8	5.9	5.9	6.2	6.2	6.3	6.4	6.4	6.4	6.1
07/01/2025 06:00		-1	4.3	4.2	5.7	5.8	6.2	6.1	6.2	6.4	6.5	6.5	6.0
07/01/2025 12:00		0	3.9	4.2	5.7	5.7	6.0	6.1	6.0	6.4	6.4	6.3	6.0
07/01/2025 18:00		0	4.7	4.5	5.7	5.7	6.0	6.0	6.1	6.3	6.3	6.4	6.0
08/01/2025 00:00		0	4.2	4.3	5.5	5.6	6.0	6.0	6.0	6.3	6.4	6.3	5.9
08/01/2025 06:00		-1	4.0	4.0	5.5	5.6	5.9	5.9	6.0	6.3	6.3	6.3	5.9
08/01/2025 12:00		-5	4.3	4.4	5.6	5.6	6.0	6.0	6.0	6.3	6.3	6.2	5.9
08/01/2025 18:00		-8	4.2	4.0	5.5	5.6	6.0	5.9	5.9	6.3	6.3	6.3	5.8
09/01/2025 00:00		-11	3.3	3.4	5.5	5.6	5.9	5.9	5.9	6.2	6.3	6.2	5.8
09/01/2025 06:00		-7	3.3	3.4	5.4	5.6	5.9	5.9	6.0	6.2	6.2	6.1	5.7
09/01/2025 12:00		-5	3.7	4.0	5.4	5.5	5.9	5.8	5.8	6.3	6.2	6.2	5.8

Date and Time	Reservoir level	Air temperature (TD)	Temperature (R1)	Temperature (R1a)	Temperature (R2)	Temperature (R5)	Temperature (L3a)	Temperature (L3b)	Temperature (L3c)	Temperature (L4a)	Temperature (L4b)	Temperature (L4c)	Temperature (L4cA)
	m BSD	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
09/01/2025 18:00		-3	4.1	3.9	5.4	5.4	5.7	5.8	5.9	6.2	6.1	6.2	5.8
10/01/2025 00:00		-3	3.4	3.3	5.3	5.4	5.7	5.7	5.7	6.1	6.1	6.2	5.8
10/01/2025 06:00		-8	3.1	3.1	5.3	5.3	5.7	5.8	5.7	6.2	6.1	6.1	5.7
10/01/2025 12:00		-3	3.1	3.3	5.2	5.4	5.7	5.7	5.7	6.2	6.1	6.2	5.7
10/01/2025 18:00		-6	3.5	3.3	5.2	5.3	5.8	5.7	5.7	6.1	6.1	6.0	5.6
11/01/2025 00:00		-6	3.0	3.0	5.2	5.3	5.7	5.7	5.7	6.0	6.0	5.9	5.6
11/01/2025 06:00		0	2.8	2.8	5.1	5.2	5.7	5.7	5.7	6.0	6.0	6.0	5.6
11/01/2025 12:00		2	3.4	3.7	5.2	5.2	5.7	5.7	5.7	6.0	6.0	6.0	5.5
11/01/2025 18:00		2	4.4	4.3	5.1	5.2	5.6	5.7	5.7	6.0	6.0	5.9	5.5
12/01/2025 00:00		2	4.4	4.5	5.2	5.2	5.6	5.7	5.7	6.0	6.0	5.8	5.5
12/01/2025 06:00		2	4.7	4.6	5.2	5.1	5.6	5.7	5.7	6.0	6.0	5.9	5.5
12/01/2025 12:00		3	4.9	5.0	5.2	5.2	5.7	5.7	5.6	6.0	6.0	5.8	5.5
12/01/2025 18:00		6	5.0	4.7	5.1	3.5	5.6	5.6	5.5	6.0	6.0	5.9	5.4
13/01/2025 00:00		7	3.9	3.9	5.0	2.4	5.7	5.7	5.6	6.0	6.0	6.0	5.6
13/01/2025 06:00		11	5.2	5.4	5.9	1.4	5.8	5.6	5.6	6.0	5.9	5.9	5.4
13/01/2025 12:00		10	6.6	6.7	6.9	3.3	5.7	5.7	5.7	6.0	6.0	5.9	5.5
13/01/2025 18:00		11	7.6	7.6	7.3	7.1	5.7	5.7	5.8	6.0	6.0	6.0	5.5
14/01/2025 00:00		10	7.2	7.1	6.6	7.7	5.7	5.8	5.9	6.0	6.0	6.0	5.6
14/01/2025 06:00		10	6.9	6.9	6.4	7.6	5.8	5.8	5.9	6.0	6.0	6.0	5.6
14/01/2025 12:00		10	6.8	7.0	6.2	7.5	6.0	5.8	6.0	6.0	6.0	6.0	5.6
14/01/2025 18:00		6	6.7	6.4	6.2	6.3	6.0	5.9	5.9	6.0	6.0	6.0	5.6
15/01/2025 00:00		9	6.7	6.8	6.2	7.3	6.0	6.0	6.0	6.0	6.0	6.0	5.6
15/01/2025 06:00		11	7.2	7.2	6.3	7.5	6.0	6.0	6.0	6.1	6.0	6.0	5.6
15/01/2025 12:00		11	7.4	7.5	6.4	6.4	6.0	6.0	6.0	6.1	6.0	6.0	5.6
15/01/2025 18:00		9	6.6	6.4	6.2	7.0	6.0	6.0	6.0	6.0	6.0	6.0	5.6
16/01/2025 00:00		8	6.5	6.5	6.2	7.4	6.0	6.0	6.1	6.0	6.0	6.0	5.6
16/01/2025 06:00		5	6.3	6.1	6.2	6.3	6.0	6.0	6.1	6.0	6.1	6.0	5.6
16/01/2025 12:00		7	6.0	6.3	6.1	6.3	6.1	6.0	6.1	6.1	6.0	6.0	5.6
16/01/2025 18:00		8	6.6	6.5	6.2	6.3	6.0	6.1	6.0	6.1	6.0	6.0	5.6
17/01/2025 00:00		8	6.3	6.3	6.2	6.3	6.0	6.0	6.1	6.1	6.1	6.0	5.6
17/01/2025 06:00		8	6.6	6.7	6.2	6.3	6.0	6.0	6.1	6.0	6.0	6.0	5.7
17/01/2025 12:00		10	7.2	7.3	6.5	6.4	6.0	6.0	6.1	6.0	6.1	6.0	5.6
17/01/2025 18:00		9	7.3	7.2	6.6	6.4	6.1	6.1	6.1	6.0	6.0	6.0	5.6
18/01/2025 00:00		7	6.8	6.6	6.4	6.6	6.0	6.1	6.1	6.0	6.1	6.0	5.6
18/01/2025 06:00		8	6.2	6.2	6.3	6.4	6.1	6.1	6.1	6.1	6.0	6.0	5.6
18/01/2025 12:00		7	6.1	6.3	6.2	6.3	6.0	6.0	6.1	6.1	6.0	6.0	5.7
18/01/2025 18:00		6	6.5	6.4	6.2	6.3	6.0	6.1	6.1	6.0	6.0	6.0	5.6
19/01/2025 00:00		6	6.3	6.2	6.2	6.2	6.0	6.0	6.1	6.0	6.0	6.0	5.6
19/01/2025 06:00		6	6.1	6.1	6.1	6.3	6.0	6.0	6.1	6.0	6.0	6.0	5.6
19/01/2025 12:00		6	5.9	6.2	6.1	6.2	6.0	6.0	6.1	6.0	6.0	6.0	5.6
19/01/2025 18:00		4	6.4	6.2	6.2	6.3	6.0	6.0	6.1	6.0	6.0	6.0	5.6
20/01/2025 00:00		2	5.2	5.2	6.0	6.1	6.0	6.0	6.1	6.0	6.0	6.0	5.6
20/01/2025 00:00		5	5.7	5.7	6.1	6.1	6.0	6.0	6.0	6.0	6.0	6.0	5.6
20/01/2025 00:00		5	6.2	6.5	6.1	6.2	6.1	6.0	6.0	6.2	6.0	6.0	5.6
20/01/2025 00:00		6	6.6	6.4	6.2	6.2	6.0	6.0	6.1	6.0	6.0	6.0	5.6
21/01/2025 00:00		5	6.0	6.0	6.1	6.1	5.9	6.0	6.1	6.0	6.0	6.0	5.6
21/01/2025 06:00		5	6.0	6.0	6.0	6.2	6.0	6.0	6.0	6.0	6.0	6.0	5.6
21/01/2025 12:00		7	6.1	6.3	6.1	6.1	6.2	6.0	6.0	6.4	6.0	6.0	5.6
21/01/2025 18:00		4	6.5	6.3	6.1	6.1	5.9	6.0	6.0	6.0	6.0	6.0	5.6
22/01/2025 00:00		2	5.9	5.8	6.1	6.1	6.0	6.0	6.0	6.0	6.0	6.0	5.6
22/01/2025 06:00		2	5.4	5.4	6.0	6.0	5.9	6.0	6.0	6.0	6.0	6.0	5.6
22/01/2025 12:00		4	5.7	6.0	6.0	5.7	6.0	6.0	6.0	6.1	6.0	6.0	5.6
22/01/2025 18:00		3	6.1	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.6
23/01/2025 00:00		1	5.8	5.7	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.6
23/01/2025 06:00		1	5.5	5.5	6.0	6.0	5.9	5.9	6.0	6.0	6.0	6.0	5.6
23/01/2025 12:00		3	5.7	5.7	5.9	6.0	5.9	5.9	6.0	6.0	6.0	6.0	5.6
23/01/2025 18:00		3	5.8	5.7	6.0	6.0	5.9	5.9	6.0	6.0	6.0	6.0	5.5
24/01/2025 00:00		3	5.2	5.1	5.8	5.9	5.9	5.9	5.9	6.0	6.0	6.0	5.5
24/01/2025 06:00		3	4.9	4.9	5.7	5.7	5.8	5.9	5.9	5.9	6.0	6.0	5.6
24/01/2025 12:00		6	5.0	5.1	5.5	5.4	5.8	5.8	5.9	6.0	6.0	6.0	5.5
24/01/2025 18:00		4	4.7	4.5	4.8	4.2	5.8	5.8	5.8	5.9	5.9	5.9	5.5
25/01/2025 00:00		3	3.4	3.3	4.2	3.1	5.7	5.7	5.7	5.8	5.8	5.9	5.5
25/01/2025 06:00		3	3.1	3.3	4.8	2.5	5.6	5.7	5.7	5.8	5.8	5.8	5.4
25/01/2025 12:00		2	3.8	4.0	5.0	2.4	5.6	5.6	5.6	5.8	5.7	5.8	5.4
25/01/2025 18:00		2	4.5	4.4	5.3	4.7	5.6	5.6	5.6	5.7	5.8	5.7	5.4
26/01/2025 00:00		2	4.4	4.4	5.3	4.8	5.5	5.5	5.5	5.7	5.8	5.8	5.3
26/01/2025 06:00		1	4.1	4.0	5.1	2.6	5.5	5.5	5.6	5.8	5.7	5.7	5.3
26/01/2025 12:00		1	3.9	4.1	5.1	4.7	5.7	5.5	5.5	5.7	5.7	5.8	5.3
26/01/2025 18:00		2	4.3	4.2	5.1	4.3	5.5	5.5	5.5	5.7	5.7	5.7	5.3
27/01/2025 00:00		2	4.3	4.4	5.2	2.7	5.5	5.5	5.5	5.7	5.7	5.7	5.3
27/01/2025 06:00		2	4.1	4.2	5.1	2.6	5.4	5.5	5.6	5.7	5.7	5.7	5.3
27/01/2025 12:00		4	4.7	5.0	5.1	5.1	5.5	5.5	5.5	5.7	5.7	5.7	5.3
27/01/2025 18:00		2	5.1	4.9	5.2	5.1	5.5	5.5	5.5	5.7	5.7	5.7	5.3
28/01/2025 00:00		2	4.7	4.7	5.1	3.8	5.5	5.5	5.5	5.7	5.7	5.6	5.2
28/01/2025 06:00		4	4.6	4.5	5.0	5.1	5.4	5.5	5.6	5.7	5.7	5.6	5.2
28/01/2025 12:00		5	5.0	5.2	5.2	5.1	5.6	5.5	5.6	5.7	5.7	5.7	5.3
28/01/2025 18:00		5	5.6	5.4	5.4	5.0	5.4	5.5	5.5	5.7	5.6	5.6	5.2
29/01/2025 00:00		4	4.6	4.6	5.1	5.1	5.4	5.4	5.5	5.6	5.6	5.7	5.2
29/01/2025 06:00		4	4.4	4.4	5.0	5.1	5.4	5.4	5.4	5.6	5.6	5.7	5.2
29/01/2025 12:00		4	4.8	5.1	5.1	5.1	5.5	5.4	5.4	5.6	5.6	5.6	5.2
29/01/2025 18:00		2	4.9	4.6	5.2	5.1	5.3	5.4	5.4	5.6	5.6	5.5	5.2
30/01/2025 00:00		1	4.2	4.1	5.0	5.0	5.4	5.4	5.4	5.6	5.5	5.6	5.1
30/01/2025 06:00		1	4.0	4.0	5.0	4.9	5.3	5.3	5.4	5.5	5.6	5.5	5.1
30/01/2025 12:00		3	4.3	4.7	5.0	5.1	5.5	5.3	5.4	5.6	5.5	5.5	5.1
30/01/2025 18:00		0	4.8	4.6	5.3	5.1	5.3	5.3	5.3	5.4	5.5	5.6	5.1
31/01/2025 00:00		2	4.6	4.6	5.2	5.1	5.3	5.4	5.4	5.5	5.5	5.5	5.1
31/01/2025 06:00		2	4.8	4.8	5.2	5.1	5.3	5.4	5.3	5.5	5.5	5.5	5.1
31/01/2025 12:00		4	5.1	5.2	5.2	5.2	5.4	5.3	5.3	5.6	5.5	5.4	5.0
31/01/2025 18:00		5	5.6	5.5	5.4	5.1	5.4	5.3	5.4	5.5	5.5	5.4	5.0
01/02/2025 00:00		3	4.3	4.1	5.1	5.1	5.2	5.4	5.4	5.4	5.4	5.4	5.0
01/02/2025 06:00		4	4.3	4.4	5.1	5.0	5.3	5.3	5.3	5.5	5.4	5.4	5.0
01/02/2025 12:00		6	5.2	5.3	5.3	5.1	5.4	5.3	5.3	5.5	5.5	5.4	5.0
01/02/2025 18:00		7	5.5	5.5	5.4	5.1	5.3	5.4	5.4	5.5	5.5	5.4	5.1
02/02/2025 00:00		7	5.6	5.6	5.4	5.1	5.4	5.3	5.4	5.5	5.4	5.5	5.1
02/02/2025 06:00		6	5.5	5.5	5.4	5.2	5.4	5.4	5.4	5.5	5.4	5.5	5.1
02/02/2025 12:00		7	5.7	5.7	5.4	5.3	5.4	5.4	5.4	5.5	5.5	5.5	5.1
02/02/2025 18:00		4	5.5	5.1	5.4	5.3	5.2	5.4	5.4	5.5	5.4	5.5	5.1
03/02/2025 00:00		6	5.2	5.2	5.4	5.4	5.4	5.4	5.4	5.4	5.5	5.4	5.1
03/02/2025 06:00		6	5.5	5.6	5.4	5.4	5.3	5.4	5.4	5.4	5.5	5.5	5.1
03/02/2025 12:00		8	6.1	6.2	5.7	5.1	5.4	5.4	5.4	5.5	5.5	5.5	5.1
03/02/2025 18:00		8	6.5	6.6	6.2	6.0	5.3	5.4	5.4	5.5	5.4	5.5	5.1
04/02/2025 00:00		9	6.7	6.7	6.2	6.6	5.4	5.4	5.5	5.5	5.6	5.5	5.1
04/02/2025 06:00		9	7.0	6.9	6.6	6.9	5.4	5.4	5.4	5.6	5.5	5.4	5.1
04/02/2025 12:00		7	6.5	6.6	5.9	6.7	5.4	5.4	5.5	5.6	5.5	5.5	5.1
04/02/2025 18:00		3	6.0	5.9	5.6	6.7	5.4	5.5	5.5	5.4	5.4	5.5	5.1
05/02/2025 00:00		3	5.1	5.0	5.2	6.0	5.4	5.4	5.5	5.4	5.5	5.5	5.1
05/02/2025 06:00		4	4.5	4.5	5.0	5.1	5.4	5.4	5.4	5.4	5.5	5.5	5.0
05/02/2025 12:00		4	4.8	5.1	5.3	5.3	5.4	5.4	5.4	5.5	5.5	5.4	5.1
05/02/2025 18:00		6	5.3	5.2	5.4	5.2	5.4	5.4	5.4	5.5	5.5	5.4	5.0
06/02/2025 00:00		6	5.3	5.3	5.3	4.5	5.4	5.4	5.4	5.5	5.4	5.5	5.1
06/02/2025 06:00		5	5.2	5.1	5.3	4.4	5.4	5.4	5.4	5.4	5.5	5.5	5.1
06/02/2025 12:00		7	5.1	5.5	5.2	4.7	5.6	5.4	5.4	5.7	5.4	5.4	5.1
06/02/2025 18:00		3	5.7	5.3	5.5	5.4	5.3	5.4	5.4	5.4	5.4	5.4	5.0
07/02/2025 00:00		2	4.1	4.0	5.2	5.3	5.4	5.4	5.4	5.4	5.4	5.5	5.0
07/02/2025 06:00		0	3.6	3.5	5.1	5.3	5.3	5.4	5.4	5.4	5.4	5.5	5.0
07/02/2025 12:00		4	4.0	4.4	5.1	5.3	5.6	5.3	5.4	5.7	5.4	5.4	5.0
07/02/2025 18:00		1	5.0	4.7	5.2	5.3	5.3	5.3	5.4	5.4	5.4	5.4	5.0
08/02/2025 00:00		2	3.8	3.8	5.0	5.1	5.3	5.3	5.4	5.4	5.4	5.4	5.0
08/02/2025 06:00		0	3.5	3.4	5.0	5.1	5.2	5.2	5.2	5.4	5.4	5.4	5.0
08/02/2025 12:00		3	4.2	4.5	5.1	5.2	5.5	5.2	5.2	5.7	5.4	5.4	5.0
08/02/2025 18:00		0	4.9	4.8	5.2	5.1	5.2	5.2	5.3	5.4	5.4	5.4	5.0
09/02/2025 00:00		-4	3.5	3.3	5.0	5.1	5.2	5.3	5.2	5.3	5.4	5.4	5.0
09/02/2025 06:00		-3	3.0	3.0	4.9	5.0	5.1	5.2	5.2	5.3	5.4	5.4	4.9
09/02/2025 12:00		3	3.9	4.3	5.0	5.0	5.4	5.2	5.2	5.4	5.4	5.4	4.9
09/02/2025 18:00		2	4.7	4.5	5.0	5.0	5.1	5.2	5.2	5.3	5.4	5.3	4.9
10/02/2025 00:00		1	4.2	4.2	4.9	4.9	5.1	5.1	5.1	5.3	5.3	5.3	4.9
10/02/2025 06:00		-1	3.9	3.8	4.8	4.9	5.1	5.1	5.1	5.3	5.3	5.3	4.9
10/02/2025 12:00		3	4.2	4.5	4.9	5.0	5.3	5.1	5.1	5.5	5.3	5.3	4.9
10/02/2025 18:00		2	4.9	4.7	4.9	4.9	5.0	5.1	5.1	5.2	5.3	5.3	4.9
11/02/2025 00:00		1	4.1	4.1	4.8	4.9	5.0	5.1	5.1	5.3	5.3	5.3	4.9
11/02/2025 06:00		2	4.2	4.2	4.8	4.8	5.0	5.1	5.0	5.3	5.2	5.2	4.9
11/02/2025 12:00		4	4.6	4.7	4.9	4.3	5.1	5.0	5.0	5.3	5.3	5.3	4.8
11/02/2025 18:00		4	4.8	4.7	4.9	4.9	5.0	5.0	5.1	5.3	5.2	5.3	4.8
12/02/2025 00:00		3	3.6	3.6	4.8	4.8	5.0	5.0	5.1	5.2	5.2	5.3	4.8
12/02/2025 06:00		2	3.8	3.8	4.7	4.8	5.0	5.0	5.1	5.2	5.1	5.1	4.8
12/02/2025 12:00		5	4.3	4.7	4.8	4.8	5.0	4.9	4.9	5.2	5.1	5.1	4.7
12/02/2025 18:00		3	5.0	NM	4.8	NM	5.0	4.9	5.0	5.1	5.1	5.1	4.7
13/02/2025 00:00		2	NM	NM	NM	NM	4.9	4.9	4.9	5.1	5.1	5.1	4.7
13/02/2025 06:00		1	NM	NM	NM	NM	4.8	4.8	4.9	5.1	5.1	5.1	4.7
13/02/2025 12:00		2	NM	NM	NM	NM	5.2	4.9	5.0	5.4	5.1	5.1	4.6

Appendix F NDSFB water temperature data

Appendix F comprises approximately 200 A4 pages of 15-minute water temperature data collected at two locations upon the Gearr Garry and River Garry respectively by NDSFB. This appendix can be provided in full upon request.