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Viking Energy Wind Farm

Water Quality Monitoring Plan

Hydrochemical Quarterly report 21

Period covered: watercourses 12th May to 10th August 2025, lochs 27th April to July 2025

Prepared by:	Dr Alistair Headley	Plantecol Limited Ivybank, Half of 30 Lower Breakish, Breakish, Isle of Skye, IV42 8QA Landline: 01471 822933 Mobile: 0788 449 0494 email: plantecol.headley@gmail.com
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Waterside Ecology
Druimindarroch
Arisaig
Inverness-shire
PH39 4NR
T: 01687 450298
M: 07788 717605
E: jon@watersideecology.co.uk

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VIKING ENERGY WIND FARM:

QUARTERLY HYDROCHEMICAL MONITORING REPORT FOR JUNE TO AUGUST 2025

1. EXECUTIVE SUMMARY

Field observations and dip samples of water were collected from 14 routine watercourse sample locations on the 15th of June, 6th of July and 10th of August within the Viking Energy Wind Farm development. Additional *ad hoc* samples were taken from the following watercourses in each of the 3 months covered by this report:

- from a small watercourse (site TWE1) that drains eastwards from borrowpit KBP02 and turbine bass K51 into the Burn of Weisdale, just upstream of sample location WE4
- from the Burn of Weisdale (WE5) upstream of the confluence of the un-named watercourse (TWE) and the Burn of Weisdale
- from the Burn of Lunklet at LU2
- from the Red Burn at sample location RB2 in all 3 months

Field observations and dip samples of water were collected from 14 routine sample locations from 5 lochs within the Viking Energy Wind Farm development on the 19th and 20th of July 2025.

Control samples were collected from 2 watercourses on the 15th of June, 6th of July and 10th of August, and from 2 lochs outside the development on the 20th of July.

The results of the analysis of 29 physico-chemical determinands showed that, for the vast majority of the parameters measured in the samples, values were within the range observed during the baseline monitoring period.

Trigger threshold values for watercourses are given in Tables 7 and 8 and those for lochs in Tables 9 and 10. It should be noted that many of the threshold values equate to baseline maxima, not to formal environmental standards (ES). Exceedances based on deviation from baseline do not necessarily indicate potentially damaging conditions. Exceedances of the 'good' ES values are highlighted in bold font.

1.1.1 Watercourses

- **The annual mean pH at sample locations RB2 and RB6 on the Red Burn were below the 'good' ES threshold of 6.0 for 'clear' water rivers by 0.2 pH units.**
- The watercourse specific baseline trigger threshold of 10 mg/L for dissolved calcium was exceeded in the June samples taken from the Burn of Flamister and the Burn of Lunklet at LU1 by 3.93 and 5.19 mg/L, respectively.
- The baseline trigger threshold of 200 µg N/L for TON (nitrate) was exceeded twice over the 12 months between September 2024 and August 2025 in the control watercourse, Burn of Sandgarth, by 20 and 31 µg N/L.
- **The 'good' ES standard for the annual mean concentration of bioavailable manganese (123 µg/L) was exceeded at sample locations taken at RB2 and RB6 on the Red Burn and at LU2 on the Burn of Lunklet by 25.5, 25.1 and 16.7 µg/L, respectively (Table 2).**
- **The 'good' ES standard for the maximum allowable concentration of dissolved cadmium (0.45 µg/L) was exceeded in samples from the EF1, GO1, LU1, RB6, MA1, PW2, WE3, WF1, LB1, SA1 and SE1, on at least one occasion between September 2024 and August 2025 by at least 0.32, 0.03, 0.03, 0.23, 0.10, 0.01, 0.06, 0.09, 0.26 and 0.17 µg/L, respectively.**

- **The ‘good’ ES standard for the annual mean concentration of dissolved cadmium (0.08 μg/L) was exceeded in samples from locations EF1, GO1, RB6, MA1, PW2 and SA1 between September 2024 and August 2025 by at least 0.03, 0.02, 0.11, 0.02, 0.02 and 0.01 μg/L, respectively.**
- **The ‘good’ ES standard for maximum allowable dissolved nickel concentration (34 μg/L) was exceeded on at least one occasion at sample locations LU2, RB2 and RB6 between September 2024 and August 2025 by 4.9, 39.7 and 72.2 μg/L, respectively.**
- **The ‘good’ ES standard for the annual mean concentration of bioavailable nickel (4 μg/L) was exceeded between September 2024 and August 2025 at sample locations LU1, LU2, RB2 and RB6 by 0.3, 0.9, 6.2 and 12.5 μg/L, respectively.**
- The baseline trigger threshold of 15 μg/L for dissolved zinc was exceeded in the following samples:
    a. The Burn of Lunklet at LU1 in July and August by 1.9 and 2.8 μg/L, respectively.
    b. The Burn of Lunklet at LU2 in July and August by 4.2 and 5.0 μg/L, respectively.
    c. The Red Burn at RB2 in June, July and August by 3.4, 32.1 and 30.0 μg/L, respectively.
- **The ‘good’ ES standard for the annual mean concentration of bioavailable zinc (10.9 μg/L) was exceeded between September 2024 and August 2025 at sample locations LU1, LU2, RB2 and RB6 by 4.2, 8.7, 30.8 and 69.1 μg/L, respectively.**

None of the other watercourse samples exceeded the trigger threshold values for any of the other determinands in this round of sampling.

1.1.2 Lochs

- The baseline trigger threshold of 100 mg/L for total suspended solids was exceeded on at least one occasion between September 2024 and August 2025 at one sample location at Petta Water by 67.1 mg/L.
- The baseline trigger threshold of 200 μg N/L for total TON (nitrate) was exceeded on at least one occasion between September 2024 and August 2025 at sample location MAA1L at Maa Water by 18 μg N/L.
- The loch specific baseline trigger threshold of 2.50 mg/L for dissolved calcium was exceeded in the July samples LB1L, LB2L, MAA1L and MAA2L by 2.11, 2.09, 2.67 and 1.41 mg/L, respectively (Table 4).
- The loch specific baseline trigger threshold of 4.00 mg/L for dissolved calcium was exceeded in the July samples TR1L and TR2L by 0.51 and 0.48 mg/L, respectively (Table 4).

None of the other loch samples exceeded the trigger threshold values for any of the other determinands in this round of sampling.

2. BACKGROUND

As part of the Viking Energy Wind Farm development by SSE on Mainland Shetland, Scotland, a series of fishery and water quality monitoring programmes have been put in place. The identified sensitive ecological receptors within the drainage system are the fish and aquatic invertebrates in the watercourses and epilithic diatoms in the lochs which are reported on separately. The suite of physico-chemical variables or determinands that are monitored are those that could potentially be affected by the proposed development and that may have direct or indirect impacts on the sensitive ecological receptors within the rivers, streams and lochs within the development area of the Viking Energy Wind Farm. The suite of determinands and sampling locations were agreed by SEPA and other consultees on 4th February 2019, as part of the Water Quality Monitoring Plan (WQMP) (Viking Energy Wind Farm 2019).

The construction phase of the Viking Energy Wind Farm for the Kergord access route and converter station was started in June 2020. Consequently, the Water Quality Monitoring Plan (WQMP) was implemented for this part of the development during that month. When construction was started in August 2020 across the whole of the Viking Energy Wind Farm, the Water Quality Monitoring Plan (WQMP) was initiated for the remaining parts of the development area. This report describes the results of the monitoring of the determinands specified in the WQMP for the period 12th of May to 10th of August 2025 for the watercourses, and the 28th of April to 20th of July 2025 for the lochs.

3. METHODS

3.1 Site Description

A full description of the Viking Energy Wind Farm development site including baseline conditions for sensitive ecological receptors and physico-chemical variables are given in the Water Quality Monitoring Plan (Viking Energy Wind Farm 2019).

3.2 Sampling

3.2.1 Routine sampling

The locations and the grid references where water samples were taken are given in the WQMP and a full description is given in the Baseline Hydrochemical Report (Headley 2020 and 2021). After consultation with Scottish Environment Protection Agency (SEPA) and Shetland Island Council (SIC) it was agreed on the 6th of May 2025 that the number of watercourse sample locations and determinands could be reduced during the post construction monitoring period, as was requested in a letter on the 24th of September 2024. Consequently, the following sample locations were not sampled on any of the dates when the other watercourse samples were collected:

- EF1, GI1, GO1, GR1, KI1, LA1, PW1, PW2 and SA1, the latter being a control watercourse

One litre whole water samples were taken from the 14 other routine ‘impacted’ watercourse sample locations, the two other control watercourses, and the 4 additional *ad hoc* sample locations within the development area, as specified in the WQMP, on the 15th of March, 6th of July and 10th of August 2025.

As with the watercourses, sampling of two of the ‘impacted’ lochs (Gossa Water and Loch of Skellister) and one control loch (Laxo Water) was stopped after the agreement with SEPA and SIC on the 6th of May 2025. Similar 1 litre samples were collected from the seven remaining lochs in the WQMP on the 19th and 20th of July 2025. When these routine watercourse and loch samples were collected field measurements were taken of the parameters specified in the WQMP. The acidity (pH), electrical conductivity (EC) and temperature were measured using a Hanna HI98194 multiparameter meter and

HI7698194 probe. Due to difficulties in successfully calibrating the dissolved oxygen (DO) probes for the field meters, the field measurements of DO concentrations were stopped after the sampling in March. The turbidity of the water in the lochs and watercourses was measured with Hanna HI93703 portable microprocessor turbidity meter.

The 1 litre whole water samples (dip samples) were taken by immersing a one litre polypropylene bottle in the watercourse and filling to the rim after rinsing three times with water from the watercourse to be sampled. At the time dip samples were collected various observations were made:

- Flow (height/water-level at Weisdale Mill)/ loch height, wind direction and wave action
- Signs of suspended solids
- Signs of any oils
- Smell
- Colour

3.2.2 Additional sampling

Additional samples were collected from the following locations:

- LU2 on the Burn of Lunklet at grid reference HU 3769,5731
- RB2 on the Red Burn at grid reference HU 3809,5731
- WE5 on the Burn of Weisdale at grid reference HU 4047,5860
- TWE1 on the un-named watercourse that drains into the Burn of Weisdale at grid reference HU 4032,5795

These samples were analysed for the full suite of determinands except for SRP, TP, total calcium and aluminium in samples WE5 and TWE1.

3.3 Laboratory Analyses

The range of physico-chemical variables or determinands was also reduced after agreement with SEPA and SIC on the 6th of May to those listed below. The measurement of the determinands was carried out by the Environmental Research Institute (ERI) at the North Highland College of the University of the Highlands and Islands at Thurso for all the routine monthly samples.

- acidity (pH)
- electrical conductivity (EC)
- alkalinity by Gran titration
- dissolved organic carbon (DOC)
- total suspended solids (TSS)
- total ammoniacal-nitrogen (TAN)
- total oxidised inorganic nitrogen (TON)
- total phosphorus (TP) for only the loch samples
- dissolved (for watercourses and lochs) and total (for watercourses only) iron (Fe)
- dissolved (for watercourses and lochs) and total (for watercourses only) manganese (Mn)
- dissolved (for watercourses and lochs) and total (for watercourses only) calcium (Ca)
- dissolved (for watercourses and lochs) and total (for watercourses only) aluminium (Al)
- dissolved and total (for watercourses only) zinc (Zn)
- dissolved and total (for watercourses only) arsenic (As)
- dissolved and total (for watercourses only) cadmium (Cd)
- dissolved and total (for watercourses only) copper (Cu)
- dissolved and total (for watercourses only) nickel (Ni)
- dissolved and total (for watercourses only) lead (Pb)

In association with the reduction in the number of watercourse sample locations analysis on the 6th of May 2025, it was agreed the following determinands could be stopped for all water samples:

- turbidity, SRP, TP, dissolved sodium and dissolved chromium

It was also agreed that the analysis of watercourse samples on the east side of Pettadale (CR1, FL1, LB1, QU1, SA1 and WF1) for the following determinands could be ceased:

- total aluminium, and dissolved arsenic, cadmium, copper, nickel, lead and zinc.

The pH, electrical conductivity, TSS and alkalinity were measured on the whole water samples within one or two days of delivery to the laboratory. The whole water samples were filtered prior to analysis for DOC and those specified for dissolved concentrations. The methods used for carrying out the determinations are given in Headley (2020). Filtration and acidification of samples was carried out by ERI at the laboratory upon sample delivery.

3.4 Data analysis and Assessment

The results of the analyses of the water samples were evaluated against the baseline data and the revised trigger thresholds as presented in Headley (2020 and 2021). The concentrations of bioavailable manganese, copper, nickel, zinc and lead were calculated using the metal bioavailability assessment (m-BAT) tools[1].

3.1 Data presentation

In the tables, values outside the baseline range of values are highlighted as follows: yellow cells indicative the value is above the maximum recorded during the extended baseline monitoring period, while blue cells show the value is below the minimum recorded during the extended baseline monitoring period. Numbers in bold and red exceed the trigger threshold value for that determinand.

4. POLLUTION INCIDENTS AND POTENTIAL IMPACTS OF CONSTRUCTION WORKS

There were no reports of any pollution incidents that occurred over the period covered by this report.

5. FIELD SAMPLING AND OBSERVATIONS

5.1 Results and observations

5.1.1 Watercourses

The rainfall at Weisdale Mill for June, July and August 2025 was 107.6, 75.4 and 97.2 mm, respectively. The rainfall in June on Mainland Shetland was high with 51.8 mm of rain being recorded above the long-term average rainfall 55.8 mm. In contrast July was a dry month with the rainfall at Weisdale Mill being 31.6 mm below the long-term average. Rainfall in August was very close to the long-term average with it being only 1.8 mm below the long-term average for this month.

[1]https://www.wfduk.org/sites/default/files/Media/Environmental%20standards/MBAT%20UKTAG%20Method%20Statement.pdf

The level of the water in the Burn of Weisdale at Weisdale Mill was 0.35 metres on the 15th of June, 0.46 to 0.47 metres on the 6th of July and 0.46 to 0.48 metres on the 10th of August (Table 1). These levels are well within the normal range, but they are probably a little higher than normal for the Burn of Weisdale in the summer months when they are normally between 0.3 and 0.4 metres.

The temperature of the water in the watercourses ranged from 11.0 to 15.6 °C when they were sampled (Table 1). Three of the routine sample locations (BF1, MA1 and QU1) in July and 6 of the same 14 routine sample locations (BF1, FL1, LM1, LU1, MA1 and QU1) in August had temperatures above their respective extended baseline minimum values (Table 1). All of the watercourse sample locations had the 98th percentile for temperature in the 'high' class according to The Scotland River Basin District (Standards) Direction 2014 (Table 5).

The field pH values ranged from 5.2 to 7.5 across the 60 measurements that were taken this reporting period (Table 1). Field pH measurements at the Burn of Droswall in June, July and August were below its extended baseline minimum value (Table 1). The only sample location with a pH above its extended baseline maximum value was the Burn of Crookadale in June.

The EC values ranged from 101 to 300 µS/cm across all 60 field measurements (Table 1). Four of the sample locations (DR1, FL1, LU1 and WE1) in June had EC values that were above their respective extended baseline maximum values (Table 1).

The 10th percentile for DO concentrations for the year September 2024 to August 2025 were in the 'high' class for the 10 sample locations where the measurements were carried out on a regular basis (Table 5).

Field turbidity values ranged from 0 to 20.99 FTUs across all 60 measurements that were taken (Table 1). Only one sample location (LU1) in June and one in August (BF2) had a field turbidity values above their respective extended baseline maximum values (Table 1). One sample location in June (LM1) and 3 in August (BF1, LU1 and MA1) had field turbidity values below their respective extended baseline maximum values (Table 1).

5.1.2 Lochs

The temperature in the lochs when the samples were taken ranged from 18.0 to 22.0 °C (Table 3). All but one (SA2L at Sand Water) of the sample locations had a temperature that was above the extended baseline maximum value for that loch.

The pH of the lochs ranged from 6.2 to 8.9, with the highest pH values recorded in the Loch of Benston near its outflow (Table 3).

The electrical conductivity (EC) values ranged from 119 to 272 µS/cm (Table 3).

The field turbidity values ranged from 0 FTUs at sample locations in Lamba Water, Maa Water, Truggles Water and Sand Water to 5.09 FTUs at sample location MAA1L in Maa Water (Table 3). This latter sample location (close to an inflow) was the only one with a turbidity above this loch's extended baseline maximum value. The other sample location at Maa Water (MAA2L – at the outflow) and sample locations at Lamba Water (LB2L), Truggles Water (TR1L and TR2L) and Sand Water (SA3L and SA4L) had turbidity values below their respective extended baseline minimum values (Table 3).

All of the pH and EC values were within their respective extended baseline range of values.

5.2 Exceedances of Field Trigger Threshold Values

None of the field measurements in the watercourses or the lochs exceeded the relevant trigger threshold values.

6. LABORATORY RESULTS

6.1 pH, alkalinity and acid neutralising capacity (ANC)

6.1.1 Watercourses

The laboratory determinations of pH ranged from 5.4 in the Red Burn at RB2 in the August sample to 7.5 in the June samples collected from the Burn of Weisdale at WE2 and Seggie Burn at SE1 (Table 2). All of the laboratory pH values were within their respective extended baseline range of values. The annual mean pH in the Red Burn at RB2 and RB6 was below the ‘good’ ES threshold of 6.0 for ‘clear’ water rivers (Table 5). All of the other watercourses, except for the Burn of Lunklet and the Burn of Marrofield, had annual mean pH values in the ‘high’ category for either ‘clear’ or ‘humic’ rivers (Table 5).

The alkalinities of the samples ranged from 1.0 mg $CaCO_3$/L in the August sample taken from the Red Burn at RB2 to 81.1 mg $CaCO_3$/L in the sample taken from the Seggie Burn, a control watercourse, taken in June (Table 2). The alkalinities in 5 of the June (BF2, CR1, DR1, FL1 and QU1) routine samples had alkalinities above their respective extended baseline maximum values.

The ANC concentrations ranged from 53 µequivalents/L in the August sample taken from the Red Burn at RB2 to 1.675 mequivalents/L in the June sample taken from the Seggie Burn (Table 2). The ANC values in 5 of the June (BF2, CR1, DR1, FL1 and QU1) routine samples and the July sample taken from the Burn of Flamister (FL1) had ANC values above their respective extended baseline maximum values (Table 2). The annual mean ANC concentrations for the year September 2024 to August 2025 were all in the ‘high’ category for rivers (Table 5).

6.1.2 Lochs

The pH in the loch samples ranged from 5.9 to 8.8, with the highest pH value recorded near the outflow to Loch of Benston, a control loch (Table 4). Three samples, one each from Petta Water (PE2L), Sand Water (SA4L) and Loch of Benston (BE2L) had pH values above their respective extended baseline maximum values (Table 4). The annual mean pH values for the year between September 2024 and July 2025 were within the relevant ‘Good’ ES thresholds for ‘clear’ water and ‘humic’ lochs (Table 6).

The alkalinity values ranged from 36 µequivalents/L in a sample (LB2L) from Lamba Water to 1.320 mequivalents/L in sample SA2L from Sand Water (Table 3). One sample from Maa Water (MAA1L) and both samples from Smerla Water had alkalinities that were above their respective extended baseline maximum values (Table 4).

The ANC values in the loch samples ranged from 83 µequivalents/L in a sample from Lamba Water (LB2L) to 1.388 mequivalents/L in sample SA2L from Sand Water (Table 4). The ANC concentration in both samples from Smerla Water and one sample from Maa Water (MAA1L) had ANC values that were above their respective extended baseline maximum values (Table 4).

6.2 Total suspended solids (TSS), DOC and aluminium

6.2.1 Watercourses

The concentrations of TSS ranged from 0.4 mg/L in the samples taken from the Seggie Burn in June and Burn of Weisdale at WE1 taken in August to 3.2 mg/L in the sample taken from the Red Burn at RB2 in July (Table 2). All of the routine samples had TSS concentrations within or below their respective extended baseline range of values (Table 2).

DOC concentrations ranged from 2.8 mg/L in sample WE1 taken from the Burn of Weisdale in June to 31.5 mg/L in the June sample taken from the Burn of Flamister (Table 2). This latter sample was the only one with a DOC concentration above its extended baseline maximum value (Table 2). Two of the June samples (DR1 and WE1) had DOC concentrations below their respective extended baseline minimum values (Table 2).

The concentrations of dissolved aluminium ranged from 29.1 µg/L in the June sample taken from the Seggie Burn to 323.8 µg/L in the July sample taken from the Red Burn at RB2 (Table 2). The only sample with a dissolved aluminium concentration above its extended baseline maximum value was the one taken from the Burn of Lunklet at LU1 in July (Table 2). Three of the June samples (DR1, SE1 and WE1) had dissolved aluminium concentrations below their respective extended baseline minimum values (Table 2).

Total aluminium concentrations ranged from 53.1 µg/L in the June sample taken from the Burn of Weisdale at WE1 to 784.0 µg/L in the sample taken from the Red Burn at RB2 in July (Table 2). The July and August samples from the Burn of Lunklet at LU1 had total aluminium concentrations above their respective extended baseline maximum values (Table 2). The sample taken from the Burn of Droswall in June had a total aluminium concentration below its extended baseline minimum value.

6.2.2 Lochs

The TSS concentrations ranged from 0.5 mg/L in sample SM2L from Smerla Water to 14.1 mg/L in one sample (SA4L) from Sand Water (Table 4). Sample MAA1L from Maa Water had a TSS concentration that was above its extended baseline maximum value (Table 4).

DOC concentrations ranged from 7.8 to 20.0 mg/L across the 16 loch samples covered by this report (Table 4). Both samples taken from Loch of Benston had DOC concentrations that were above its extended baseline maximum value (Table 5).

Dissolved aluminium concentrations ranged from 18.3 to 155.8 µg/L with the highest concentration in sample MAA1L from Maa Water (Table 4). This latter sample was the only one where the dissolved aluminium concentration was above its extended baseline maximum value (Table 4).

6.3 Calcium and electrical conductivity (EC)

6.3.1 Watercourses

The concentrations of dissolved calcium ranged from 2.39 to 27.93 mg/L and the total calcium concentrations ranged from 2.42 to 28.20 mg/L (Table 2). The highest dissolved and total calcium concentrations were in the sample taken from the Wester Filla Burn in June (Table 2). Ten of the June samples (BF1, BF2, CR1, DR1, FL1, LM1, LU1, QU1, WE1 and WE2) and two of the August samples (FL1 and LU1) had dissolved and total calcium concentrations above their respective extended baseline maximum values (Table 2). The July sample taken from the Burn of Flamister had just the dissolved calcium concentration above its extended baseline maximum value (Table 2).

EC values ranged from 115 to 299 µS/cm, with the highest EC value in the sample taken from the Burn of Lunklet at LU2 in June (Table 2). The only sample with an EC value above its extended baseline maximum value was the June sample taken from the Burn of Flamister (Table 2). The annual mean EC values for this last year were all in the ‘high’ category for rivers (Table 5).

6.3.2 Lochs

The concentrations of dissolved calcium ranged from 1.47 to 25.27 mg/L with the highest concentration in sample SA2L from Sand Water (Table 4). All of the samples from Lamba Water, Maa Water and Truggles Water and two samples from Sand Water (SA1L and SA2L) had dissolved calcium concentrations above their respective extended baseline maximum values (Table 4).

Laboratory EC values ranged from 120 to 309 µS/cm (Table 4). Only one sample, LB1L from Lamba Water, had an EC value above its extended baseline maximum value (Table 4).

6.4 Nitrogen (ammoniacal and total oxidised nitrogen)

6.4.1 Watercourses

The concentrations of total ammoniacal-nitrogen (TAN) ranged from below the limits of detection (3 to 8 µg N/L) in 39 of the 60 samples analysed for this determinand to a maximum of 66 µg N/L in the June sample taken from the Red Burn t at RB2 (Table 2). One of the June samples (CR1) and one of the August samples (MA1) had TAN concentrations above their respective extended baseline maximum values (Table 2). The 90th percentile for TAN concentrations for the year September 2024 to August 2025 were all in the 'high' ES category (Table 5).

The concentrations of total oxidised inorganic nitrogen (TON), principally nitrate, ranged from below the limits of detection (3 to 5 µg N/L) in 36 samples to a maximum of 40 µg N/L in the sample taken from the Red Burn at RB2 in June (Table 2). All of the routine samples had TON concentrations within their respective extended baseline range of values (Table 2).

The annual mean concentrations of SRP for this last year were all very low and within the 'high' ES category (Table 5).

6.4.2 Lochs

The concentrations of total ammoniacal-nitrogen (TAN) ranged from below the limit of detection (4 µg N/L) in 4 samples to a maximum of 43 µg N/L in sample SA4L taken from Sand Water (Table 4). This latter sample, and sample SA1L from Sand Water, had TAN concentrations above this loch's extended baseline maximum concentration.

TON concentrations were below the limit of detection (5 µg N/L) in all but the two samples taken from Smerla Water where the concentrations were 30 and 39 µg N/L (Table 4). In one of these samples (SM2L) the TON concentration was below this loch's extended baseline minimum value.

TP concentrations were below the limit of detection (9 µg P/L) in all but two samples, which were those taken from Loch of Benston where the concentrations were 10 and 19 µg P/L (Table 4). All 16 of the loch samples covered by this report had TP concentrations within their respective extended baseline range of values (Table 4). The ranges in annual mean concentration of TP were within the 'high' ES standard for seven of the lochs, with the three other lochs having ranges in annual mean TP concentration within the 'good' ES threshold relevant to that loch (Table 6).

6.5 Heavy Metals (iron, manganese, arsenic, cadmium, chromium, copper, lead, nickel and zinc)

6.5.1 Watercourses

The concentrations of dissolved iron ranged from 0.32 mg/L in the sample taken from the Burn of Lambawater in June to 2.23 mg/L in the sample taken from the Burn of Quoys in June (Table 2). The

June and July samples taken from the Burn of Lambawater (LM1) had dissolved iron concentrations below this sample location's extended baseline minimum value (Table 2). Ten sample locations (DR1, GR1, KI1, RB6, QU1, WE1, WE3, WE4, WE5 and TWE1) had annual mean concentrations of dissolved iron above the 'good' ES threshold of 1.0 mg/L (Table 5).

The concentrations of dissolved manganese ranged from 2.4 µg/L in the sample taken from the Seggie Burn in July to 641.1 mg/L in the sample taken from the Red Burn at RB2 in August (Table 2). One of the June samples (LU1), two of the July samples (BF1 and LU1) and five of the August samples (BF1, BF2, LM1, LU1 and MA1) had dissolved manganese concentrations above their respective extended baseline maximum values (Table 2). Two of the June samples (FL1 and MA1) and two of the July samples (FL1 and SE1) had dissolved manganese concentrations below their respective extended baseline minimum values (Table 2). The bioavailable manganese concentrations were in the range of 1.3 to 142.8 µg/L, with the highest concentration in the August sample taken from the Red Burn at RB2 (Table 2). Four of the August samples (BF1, BF2, LM1 and MA1) had bioavailable manganese concentrations above their respective extended baseline maximum values, whilst three of the June samples (BF2, FL1 and MA1) and one of the July samples (SE1) had bioavailable manganese concentrations below their respective extended baseline minimum values (Table 2). Three sample locations (LU2, RB2 and RB6) had bioavailable manganese concentrations above the 'good' ES threshold of 123 µg/L (Table 5).

Out of the 42 samples analysed for dissolved arsenic 37 of them had concentrations below the limits of detection (2.6 to 9.6 µg/L). The five samples with detectable dissolved arsenic concentrations were all taken in August and they ranged from 3.0 µg/L to a maximum of 5.0 µg/L in the sample taken from the Burn of Lunklet at LU1 (Table 2). All 30 sample locations had annual mean concentrations for this last year within the 'good' ES threshold of 50 µg/L (Table 5).

All 42 of the samples analysed for dissolved cadmium had concentrations below the limits of detection, which ranged from 0.38 to 0.69 µg/L over this reporting period (Table 2). However, for this last year one or more samples at six sample locations (EF1, GO1, RB6, MA1, PW2 and SA1) had a dissolved cadmium concentration above the maximum allowable concentration of 0.45 µg/L (Table 5). These same sample locations, plus sample locations LU1, WF1, LB1 and SE1, had annual mean concentrations of dissolved cadmium above the 'good' ES threshold of 0.08 µg/L (Table 5).

The concentrations of dissolved copper ranged from below the limits of detection (0.6 to 2.9 µg/L) in 28 samples to a maximum of 4.7 µg/L in the sample taken from the Red Burn at RB2 in July (Table 2). The concentrations of bioavailable copper ranged from less than 0.02 µg/L to a maximum of 0.61 µg/L in the sample taken from the Red Burn at RB2 in July (Table 2). The annual mean concentrations of bioavailable copper were within the 'good' ES threshold of 1.0 µg/L at all 30 sample locations (Table 5).

The concentrations of dissolved nickel ranged from below the limits of detection (1.2 to 1.5 µg/L) in 20 of the 42 samples analysed for this determinand to a maximum of 31.3 µg/L in the sample taken from the Red Burn at RB2 in July (Table 2). The concentrations of bioavailable nickel ranged from less than 0.2 µg/L to a maximum of 7.0 µg/L in the sample taken from the Red Burn at RB2 in August (Table 2). One or more samples at both sample locations on the Red Burn (RB2 and RB6) and at LU2 on the Burn of Lunklet over this last year had a dissolved nickel concentration above the maximum allowable concentration of 34 µg/L (Table 5). Also, these same sample locations and sample location LU1 on the Burn of Lunklet had annual mean concentrations of bioavailable nickel above the 'good' ES threshold of 4 µg/L (Table 5).

The concentrations of dissolved lead ranged from below the limits of detection (3.2 to 6.1 µg/L) in 40 of the 42 samples analysed for this determinand. The only samples with a detectable dissolved lead concentration were the June sample from the Burn of Burrafirth at BF1 (7.2 µg/L) and the August sample from the Burn of Lunklet at LU1, where the concentration was 6.2 µg/L (Table 2). The concentrations of available lead ranged from less than 0.2 µg/L to a possible maximum of 2.2 µg/L in the June sample taken from the Burn of Weisdale at WE1 (Table 2). The annual mean concentrations of available lead were within the 'good' ES threshold of 1.2 µg/L at 29 of the sample locations (Table 5). The range in annual mean concentration of bioavailable lead at sample location BF2 on the Burn of Burrafirth straddled this threshold value (Table 5).

The concentrations of dissolved zinc ranged from below the limit of detection (1.6 µg/L) in 4 of the June samples to a maximum of 47.1 µg/L in the July sample taken from the Red Burn at RB2 (Table 2). The dissolved zinc concentrations were above the extended baseline maximum value in both the July and August samples taken from the Burn of Lunklet at LU1 (Table 2). Bioavailable zinc concentrations ranged from less than 0.4 µg/L to 25.5 µg/L, with the highest concentration in the sample taken from the Red Burn at RB2 in July (Table 2). The possible ranges in annual mean concentrations of bioavailable zinc at all of the sample locations on the Burn of Lunklet and the Red Burn were above the 'good' ES threshold of 10.9 µg/L (Table 5).

6.5.2 Lochs

Dissolved iron concentrations ranged from 0.01 to 1.02 mg/L (Table 4). Both samples from Lamba Water and one sample from Maa Water (MAA2L) had dissolved iron concentrations below their respective extended baseline minimum values (Table 4).

Dissolved manganese concentrations ranged from 0.9 to 477.5 µg/L, with the highest concentration in sample MAA1L from Maa Water (Table 4). Sample LB1L from Lamba Water and sample MAA1L from Maa Water had dissolved manganese concentrations above their respective extended baseline maximum values (Table 4). The other sample from Maa Water (MAA2L) had a dissolved manganese concentration below its extended baseline minimum value. Bioavailable manganese concentrations ranged from 0.8 to 311.7 µg/L, with the highest concentration in sample MAA1L from Maa Water (Table 4). This latter sample and sample BE2L from Loch of Benston had bioavailable manganese concentrations above their respective extended baseline maximum values, whilst samples MAA2L from Maa Water had a bioavailable manganese concentration below its extended baseline minimum value (Table 4). All of the lochs had annual mean concentrations for bioavailable manganese within the 'good' ES threshold of 123 µg/L (Table 6).

All of the lochs had annual mean concentrations for dissolved arsenic and chromium, and bioavailable concentrations of copper, nickel and zinc within the relevant 'good' ES thresholds (Table 6). The annual mean and maximum concentrations of available lead were also within the relevant 'good' ES thresholds of 1.2 and 14 µg/L (Table 6). However, the ranges in annual mean and potential maximum concentrations of dissolved cadmium straddled the 'good' ES thresholds of 0.08 and 0.45 µg/L, respectively for all of the lochs, including all three control lochs (Table 6).

6.6 Exceedances of Trigger Threshold Values

It should be noted that many of the threshold values equate to baseline maxima, not to formal environmental standards (ES) given in The Scotland River Basin District (Standards) Direction 2014 and amended in 2015. Exceedances based on deviation from baseline do not necessarily indicate potentially damaging conditions. Exceedances of the 'good' ES value are highlighted in bold. Trigger threshold values for watercourses and lochs are given in Tables 5, 6, 7 and 8. Individual samples are only compared to trigger thresholds or 'good' ES values for maximum allowable concentrations.

6.6.1 Watercourses

- The annual mean pH at sample locations RB2 and RB6 on the Red Burn were below the 'good' ES threshold of 6.0 for 'clear' water rivers by 0.2 pH units.

- The watercourse specific baseline trigger threshold of 10 mg/L for dissolved calcium was exceeded in the June samples taken from the Burn of Flamister and the Burn of Lunklet at LU1 by 3.93 and 5.19 mg/L, respectively.
- The baseline trigger threshold of 200 µg N/L for TON (nitrate) was exceeded twice over the 12 months between September 2024 and August 2025 in the control watercourse, Burn of Sandgarth, by 20 and 31 µg N/L.
- The 'good' ES standard for the annual mean concentration of bioavailable manganese (123 µg/L) was exceeded at sample locations taken at RB2 and RB6 on the Red Burn and at LU2 on the Burn of Lunklet by 25.5, 25.1 and 16.7 µg/L, respectively (Table 2).
- The 'good' ES standard for the maximum allowable concentration of dissolved cadmium (0.45 µg/L) was exceeded in samples from the EF1, GO1, LU1, RB6, MA1, PW2, WE3, WF1, LB1, SA1 and SE1, on at least one occasion between September 2024 and August 2025 by at least 0.32, 0.03, 0.03, 0.23, 0.10, 0.01, 0.06, 0.09, 0.26 and 0.17 µg/L, respectively.
- The 'good' ES standard for the annual mean concentration of dissolved cadmium (0.08 µg/L) was exceeded in samples from locations EF1, GO1, RB6, MA1, PW2 and SA1 between September 2024 and August 2025 by at least 0.03, 0.02, 0.11, 0.02, 0.02 and 0.01 µg/L, respectively.
- The 'good' ES standard for maximum allowable dissolved nickel concentration (34 µg/L) was exceeded on at least one occasion at sample locations LU2, RB2 and RB6 between September 2024 and August 2025 by 4.9, 39.7 and 72.2 µg/L, respectively.
- The 'good' ES standard for the annual mean concentration of bioavailable nickel (4 µg/L) was exceeded between September 2024 and August 2025 at sample locations LU1, LU2, RB2 and RB6 by 0.3, 0.9, 6.2 and 12.5 µg/L, respectively.
- The baseline trigger threshold of 15 µg/L for dissolved zinc was exceeded in the following samples:
    d. The Burn of Lunklet at LU1 in July and August by 1.9 and 2.8 µg/L, respectively.
    e. The Burn of Lunklet at LU2 in July and August by 4.2 and 5.0 µg/L, respectively.
    f. The Red Burn at RB2 in June, July and August by 3.4, 32.1 and 30.0 µg/L, respectively.
    g. The un-named tributary of the Burn of Weisdale at TWE1 in March by 1.9 µg/L.
- The 'good' ES standard for the annual mean concentration of bioavailable zinc (10.9 µg/L) was exceeded between September 2024 and August 2025 at sample locations LU1, LU2, RB2 and RB6 by 4.2, 8.7, 30.8 and 69.1 µg/L, respectively.

None of the other watercourse samples exceeded the trigger threshold values for any of the other determinands in this round of sampling.

6.6.2 Lochs

- The baseline trigger threshold of 100 mg/L for total suspended solids was exceeded on at least one occasion between September 2024 and August 2025 at one sample location at Petta Water by 67.1 mg/L.
- The baseline trigger threshold of 200 µg N/L for total TON (nitrate) was exceeded on at least one occasion between September 2024 and August 2025 at sample location MAA1L at Maa Water by 18 µg N/L.

- The loch specific baseline trigger threshold of 2.50 mg/L for dissolved calcium was exceeded in the July samples LB1L, LB2L, MAA1L and MAA2L by 2.11, 2.09, 2.67 and 1.41 mg/L, respectively (Table 4).
- The loch specific baseline trigger threshold of 4.00 mg/L for dissolved calcium was exceeded in the July samples TR1L and TR2L by 0.51 and 0.48 mg/L, respectively (Table 4).

None of the other loch samples exceeded the trigger threshold values for any of the other determinands in this round of sampling.

7. INTERPRETATION

7.1 Acidity (pH)

7.1.1 Watercourses

There are continuing inputs of acidic waters at the headwaters of the Red Burn from the base of the former borrowpit KBP02. These acidic waters are currently being treated with crushed shells to neutralise the acidity. The improvements to this treatment system have resulted in the annual mean pH for this last year being between 0.6 and 0.8 pH units higher than that for the previous year (2023 to 2024) in the Burn of Lunklet as well as the Red Burn (Headley 2024 and Table 5). As a consequence, the annual mean pH in the Burn of Lunklet is now within the 'good' ES threshold for 'clear' water rivers.

Because the discharge of water from the base of the hard standing with turbine T026 is much lower the neutralisation of the acidity in this source of water is more effective and as a result the annual mean pH in the TWE tributary has been above 6.0 for the last two years (Table 5 and Headley 2024). This watercourse also flows over an exposure of metamorphosed limestone shortly before reaching sample location TWE1, which will also raise the pH (Figure 1).

7.2 Total suspended solids

7.2.1 Lochs

There was only one sample that was responsible for the highest TSS in Petta Water being above the baseline trigger threshold, and this was taken in October 2024. As there was no construction work within the catchment of this loch, and it is most likely that this highly unusual high concentration of TSS was due to the sampler or wave action disturbing a lot of the peaty sediment when collecting the water sample from the loch.

7.3 Calcium

7.3.1 Watercourses

The treatment of the acidic waters in the Red Burn with crushed shells is the main reason for the concentrations of dissolved calcium in the Burn of Lunklet being above the baseline trigger threshold of 10 mg/L (Table 2). The exposure of large quantities of bedrock in the former borrowpit NBP05 at the headwaters of the Burn of Flamister is almost certainly the reason for the concentrations of dissolved calcium in the Burn of Flamister being above its baseline trigger threshold of 10 mg/L (Table 2). Calcium based minerals, such as calcite, will be readily leached by rainwater by solution weathering into the groundwaters that subsequently drain into the streams. The concentrations of dissolved calcium measured in the Burn of Lunklet and Burn of Flamister are well within the range seen in other watercourses within the development and controls, such as the Seggie Burn.

7.4 Nitrate

7.4.1 Watercourses

The concentrations of TON, principally nitrate, in the Burn of Sandgarth is almost certainly related to the catchment of this watercourse being intensively used by a farmer/crofter. The application of significant quantities of manure and/or fertilisers as well as large quantities of dung being deposited in the fields by their livestock means that there can be elevated concentrations of nitrate in the water. It is for this reason that the monitoring of this 'control' watercourse was stopped in May of this year. The Seggie Burn is being used as a more effective control for the slightly more base-rich watercourses within the Viking Energy Wind Farm as it does not have any improved pastures within its catchment.

7.4.2 Lochs

The baseline trigger threshold for TON of 200 µg N/L was exceeded in both samples taken from Maa Water in October 2024 and one sample taken in February 2025. The most likely source of this nitrate is the explosives used in the nearby borrowpit KBP03. This borrowpit was only a few hundred metres up slope to the east of Maa Water (Figure 1). The concentrations of TON have been decreasing over the last three years, so that in July both samples from this loch are below the limit of detection (Table 4 and Figure 3).

7.5 Cadmium

7.5.1 Watercourses

The occurrence of dissolved cadmium concentrations above the maximum threshold of 0.45 µg/L includes all three of the control watercourses, and some of the watercourses away from the Scallafield Scord area (Headley 2024). As mentioned previously, the most likely explanation is that there is a background level of atmospheric pollution, including the presence of cadmium, that may be contributing to the presence of cadmium (Baker 2001, Vincent & Passant 2006). Also, the historical legacy of air pollution at the peak of the industrial revolution in the nineteenth century means that the peat across Mainland Shetland is likely to have a background level of heavy metals, including cadmium within it (Ballabio *et al.* 2004, Livett *et al.* 1979). It is worth noting that those watercourses with large areas of eroding peat within their catchment, for example the Burn of Gossawater, Burn of Pettawater, Easter and Wester Filla Burns, have annual mean and maximum concentrations of dissolved cadmium above the 'good' ES thresholds. Therefore, the erosion of any peat on Mainland Shetland is likely to re-mobilise these metals present in the surface layers of peat. Thus, a combination of past and present atmospheric pollution and peat erosion may well be giving rise to the occasional small peaks above background levels of dissolved cadmium and other heavy metals.

The exceedance is at most 320 ng/L, i.e. 3 parts in every 10,000,000,000 parts of water. This deviation is so small and close to the limits of detection that it means that some doubt has to be cast on its significance. Also, it is highly unlikely that it will have any detectable ecological impact.

7.5.2 Lochs

The maximum and mean concentrations of dissolved cadmium in all of the lochs, including the controls, straddle the relevant 'good' ES thresholds (Table 6). The concentrations of dissolved cadmium could be from virtually zero to the upper limits of the ranges, and therefore no conclusions can be made as to their significance. The data indicates that there is a background level of contamination of the catchments across much of Mainland Shetland given that the ranges in mean concentration of cadmium in the control lochs are in the same range as those for the 'impacted' lochs (Table 6).

7.6 Nickel and Zinc

7.6.1 Watercourses

The exceedances of the dissolved and bioavailable thresholds for zinc and nickel are due to the high concentrations in the groundwaters entering the headwaters of the Red Burn. The shell treatments remove some of these metals, but much of the reduction in concentration is a result of dilution by other watercourses joining the Red Burn below the shell treatment systems. It is worth noting that the exceedances of the 'good' ES or baseline trigger thresholds are not as large or as frequent over for this last year's monitoring period than the previous year's (Table 5 and Headley 2024). The maximum allowable nickel concentration is no longer exceeded in the Burn of Lunklet at LU1 (Table 5).

8. REFERENCES

Baker, S.J. 2001. *Trace and major elements in the atmosphere at rural locations in the UK: summary of data for 1999*. Report for Department of the Environment, Transport and the Regions; the Scottish Executive; the National Assembly for Wales and the Department of the Environment in Northern Ireland. AEA Technology Environment, Abingdon.

Ballabio, C., Jones, A. & Panagos, P. 2024. Cadmium in topsoils of the European Union – an analysis based on LUCAS topsoil database. *Science of the Total Environment* **912**, 1-12.

Headley, A.D. 2020. *Viking Energy Wind Farm: Baseline Hydrochemical Monitoring*. Report to Waterside Ecology. October 2020.

Headley, A.D. 2021. Viking Energy Wind Farm: Addendum to the Baseline Hydrochemical Monitoring. Report to Waterside Ecology. April 2021.

Headley, A.D. 2024. *Viking Energy Wind Farm: Hydrochemical quarterly report 17*. Report to Waterside Ecology. 17th October 2024.

Kelly, M. 2025. Viking Wind Farm: Freshwater diatom survey, February 2025. Report to SSE.

Livett, E.A., Lee, J.A. & Tallis, J.H. 1979. Lead, zinc and copper analyses of British blanket peats. *Journal of Ecology* **67 (3)**, 865-891.

The Scottish Government 2014. Environmental Protection: *The Scotland River Basin District (Standards) Direction 2014.*

Vincent, K. & Passant, N. 2006. Assessment of heavy metal concentrations in the United Kingdom. Report to The Department for Environment, Food and Rural Affair; Welsh Assembly Government: The Scottish Executive and the Department of the Environment for Northern Ireland. AEA Technology plc.

9. TABLES

Table 1. *Results of field measurements taken from the routine watercourse sample locations on the 15th of June; 6th of July; and 10th of August 2025. Concentrations of a determinand that are below the minimum recorded during the extended baseline monitoring period they are highlighted in blue and those above the maximum for the same baseline data are highlighted in yellow. Abbreviations: W.M. level = height of the Burn of Weisdale (m) at Weisdale Mill; JC = J. Clarkson; RF = Rob Fray; LJ = Logan Johnson; EC = electrical conductivity (µS cm^{-1}); Temp = temperature (°C); DO = dissolved oxygen (% saturation); Turb. = turbidity (NTU); nd = readings were not determined due to the meter being repaired or producing doubtful results.*

Watercourse	sample code	easting	northing	date sampled	time	sampler	flow	W.M. level	sample location	pH	EC	Temp	Turb.	odour	suspended solids	signs of oil	colour/notes
South Burn of Burrafirth	BF1	436686	1157506	15/06/2025	12:20	RF	Low	0.35	right bank	6.8	160	13.3	2.63	None	None	None	
	BF2	436709	1156888	15/06/2025	14:05	RF	Low	0.35	midstream	7.1	154	14.6	0.75	None	None	None	
Burn of Crookadale	CR1	443382	1153916	15/06/2025	09:30	RF	Low	0.35	midstream	7.5	159	12.2	1.99	None	None	None	
Burn of Droswall	DR1	439987	1154926	15/06/2025	11.00	JC	Low	0.35	midstream	6.2	260	12.3	5.65	None	few	None	fish, fine sediment/algae
Burn of Flamister	FL1	443790	1155040	15/06/2025	10:00	RF	Low	0.35	midstream	6.7	188	12.3	2.15	None	None	None	
Burn of Laxobigging	LB1	441717	1172666	15/06/2025	15:20	RF	Low	0.35	midstream	6.6	157	12.9	0.00	None	None	None	
Burn of Lambawater	LM1	437444	1157103	15/06/2025	13:45	RF	Low	0.35	midstream	6.2	137	13.3	0.41	None	None	None	
Burn of Lunklet	LU1	437378	1157306	15/06/2025	12:50	RF	Low	0.35	midstream	6.3	214	12.7	15.45	None	None	None	
Burn of Grunnafirth	LU2	437692	1157515	15/06/2025	13:00	RF	Low	0.35	midstream	6.7	215	12.8	13.27	None	None	None	
Red Burn	RB2	438096	1157299	15/06/2025	13:20	RF	Low	0.35	midstream	6.4	248	12.1	20.99	None	None	None	
Burn of Marrofield Water	MA1	437332	1157322	15/06/2025	12:45	RF	Low	0.35	midstream	6.7	155	13.1	3.74	None	None	None	
Burn of Quoys	QU1	444728	1155349	15/06/2025	10:25	RF	Low	0.35	midstream	6.7	171	12.8	4.6	None	None	None	
Seggie Burn	SE1	443947	1163764	15/06/2025	11:45	RF	Low	0.35	midstream	7.5	242	13.2	0.23	None	None	None	
Burn of Weisdale	WE1	440152	1154376	15/06/2025	14.20	JC	Low/Medium	0.35	right bank	7.5	300	13.5	3.67	None	None	None	submerged and emergent macrophytes, 5% filamentous algae
	WE2	440222	1155258	15/06/2025	13.58	JC	moderate	0.35	left bank	7.4	260	12.5	4.08	None	yes	None	submerged & emergent macrophytes, minimal filamentous algae
	WE3	440502	1156741	15/06/2025	13.25	JC	moderate	0.35	midstream	7.1	240	12.6	4.94	None	yes	None	20% filamentous algae, emergent macrophytes
	WE4	440524	1157802	15/06/2025	13.00	JC	moderate	0.35	midstream	7.0	220	11.0	5.57	None	few	None	emergent macrophytes, algae 20% cover
	WE5	440474	1158600	15/06/2025	12.20	JC	low/med	0.35	midstream	6.7	220	11.5	5.46	None	few	None	emergent and submerged macrophytes
	TWE1	440436	1157936	15/06/2025	12.39	JC	moderate	0.35	midstream	7.0	220	11.6	8.09	Yes	few	None	
Wester Filla Burn	WF1	441528	1162320	15/06/2025	11:25	RF	Low	0.35	midstream	6.7	272	12.3	3.18	None	None	None	
South Burn of Burrafirth	BF1	436686	1157506	06/07/2025	11:40	RF	moderate/high	0.47	right bank	5.8	117	14.8	1.11	None	None	None	
	BF2	436709	1156888	06/07/2025	13:25	RF	moderate/high	0.46	midstream	6.1	110	15.4	1.69	None	None	None	
Burn of Crookadale	CR1	443382	1153916	06/07/2025	09:00	RF	moderate/high	0.48	midstream	6.6	160	12.4	1.69	None	None	None	
Burn of Droswall	DR1	439987	1154926	06/07/2025	10.00	JC	moderate	0.48	midstream	6.3	180	13.5	2.35	None	None	None	
Burn of Flamister	FL1	443790	1155040	06/07/2025	09:30	RF	moderate/high	0.48	midstream	6.5	132	12.5	2.52	None	None	None	
Burn of Laxobigging	LB1	441717	1172666	06/07/2025	14:40	RF	moderate/high	0.45	midstream	6.5	101	14.0	0.77	None	None	None	
Burn of Lambawater	LM1	437444	1157103	06/07/2025	13:05	RF	moderate/high	0.46	midstream	5.2	122	15.1	1.28	None	None	None	

Watercourse	sample code	easting	northing	date sampled	time	sampler	flow	W.M. level	sample location	pH	EC	Temp	Turb.	odour	suspended solids	signs of oil	colour/notes
Burn of Lunklet	LU1	437378	1157306	06/07/2025	12:15	RF	moderate/high	0.46	midstream	5.5	144	14.5	2.86	None	None	None	
	LU2	437692	1157515	06/07/2025	12:30	RF	moderate/high	0.46	midstream	5.5	144	14.3	2.01	None	None	None	
Red Burn	RB2	438096	1157299	06/07/2025	12:50	RF	moderate/high	0.46	midstream	5.5	201	13.4	7.86	None	None	None	
Burn of Marrofield Water	MA1	437332	1157322	06/07/2025	12:10	RF	moderate/high	0.46	midstream	5.7	103	14.8	1.14	None	None	None	
Burn of Quoys	QU1	444728	1155349	06/07/2025	09:50	RF	moderate/high	0.48	midstream	6.9	116	13.5	1.81	None	None	None	
Seggie Burn	SE1	443947	1163764	06/07/2025	11:05	RF	moderate/high	0.47	midstream	7.0	107	14.0	0.89	None	None	None	
Burn of Weisdale	WE1	440152	1154376	06/07/2025	13.00	JC	moderate	0.46	right bank	7.2	220	15.0	2.54	None	None	None	submerged & emergent macrophytes
	WE2	440222	1155258	06/07/2025	12.30	JC	High	0.46	left bank	7.1	210	15.0	2.52	None	None	None	submerged & emergent macrophytes
	WE3	440502	1156741	06/07/2025	12.02	JC	High	0.47	midstream	6.7	160	14.0	1.95	None	Few	None	minimal filamentous algae, emergent macrophytes
	WE4	440524	1157802	06/07/2025	11.39	JC	High	0.47	midstream	6.6	130	13.0	1.96	None	None	None	emergent & submerged macrophytes, minimal algae
	WE5	440474	1158600	06/07/2025	11.05	JC	low/moderate	0.47	midstream	6.5	130	13.0	1.72	None	None	None	emergent macrophytes, filamentous algae 5%
	TWE1	440436	1157936	06/07/2025	11.24	JC	moderate/high	0.47	midstream	6.7	150	14.0	2.44	None	None	None	submerged macrophytes
Wester Filla Burn	WF1	441528	1162320	06/07/2025	10:45	RF	moderate/high	0.47	midstream	6.7	157	12.9	1.19	None	None	None	
South Burn of Burrafirth	BF1	436686	1157506	10/08/2025	13:15	RF	moderate/high	0.47	right bank	6.2	129	14.5	0.73	None	None	None	
	BF2	436709	1156888	10/08/2025	15:05	RF	moderate/high	0.46	midstream	6.4	124	15.6	2.40	None	None	None	
Burn of Crookadale	CR1	443382	1153916	10/08/2025	09:45	RF	moderate/high	0.49	midstream	6.8	171	12.3	1.85	None	None	None	
Burn of Droswall	DR1	439987	1154926	10/08/2025	10.00	JC	moderate	0.48	midstream	6.3	180	13.5	2.35	None	None	None	fish, fine sediment/algae
Burn of Flamister	FL1	443790	1155040	10/08/2025	10:20	RF	moderate/high	0.48	midstream	6.8	158	13.0	2.32	None	None	None	
Burn of Laxobigging	LB1	441717	1172666	10/08/2025	16:15	RF	moderate/high	0.46	midstream	6.4	113	14.4	0.36	None	None	None	
Burn of Lambawater	LM1	437444	1157103	10/08/2025	14:40	RF	moderate/high	0.47	midstream	6.1	125	14.7	1.25	None	None	None	
Burn of Lunklet	LU1	437378	1157306	10/08/2025	13:50	RF	moderate/high	0.47	midstream	5.7	159	14.3	0.00	None	None	None	
	LU2	437692	1157515	10/08/2025	14:05	RF	moderate/high	0.47	midstream	5.6	161	14.4	4.52	None	None	None	
Red Burn	RB2	438096	1157299	10/08/2025	14:20	RF	moderate/high	0.47	midstream	5.6	212	13.5	9.38	None	None	None	
Burn of Marrofield Water	MA1	437332	1157322	10/08/2025	13:40	RF	moderate/high	0.47	midstream	5.4	119	14.4	0.55	None	None	None	
Burn of Quoys	QU1	444728	1155349	10/08/2025	10:45	RF	moderate/high	0.48	midstream	6.8	137	13.6	2.37	None	None	None	
Seggie Burn	SE1	443947	1163764	10/08/2025	12:05	RF	moderate/high	0.48	midstream	7.2	120	13.9	0.51	None	None	None	
Burn of Weisdale	WE1	440152	1154376	10/08/2025	16.35	JC	Low-moderate	0.46	right bank	7.0	230	15.0	2.92	None	None	None	Submerged and emergent macrophytes
	WE2	440222	1155258	10/08/2025	16.07	JC	moderate/high	0.46	left bank	6.8	230	14.5	2.61	None	None	None	Submerged & emergent macrophytes
	WE3	440502	1156741	10/08/2025	15.44	JC	High	0.46	midstream	6.4	170	14.0	3.04	None	None	None	Minimal filamentous algae, emergent macrophytes
	WE4	440524	1157802	10/08/2025	15.19	JC	High	0.46	midstream	6.5	160	14.0	2.71	None	None	None	Emergent and submerged macrophytes
	WE5	440474	1158600	10/08/2025	14.45	JC	low	0.47	midstream	5.7	150	13.0	3.26	None	yes	None	Submerged and emergent macrophytes
	TWE1	440436	1157936	10/08/2025	15.06	JC	moderate	0.46	midstream	6.0	170	14.0	3.66	None	None	None	Submerged macrophytes
Wester Filla Burn	WF1	441528	1162320	10/08/2025	11:45	RF	moderate/high	0.48	midstream	6.5	158	13.5	1.04	None	None	None	

***Table 2**. The results of all the laboratory analysis of the water samples collected on the 15th of June; 6th of July; and 10th of August 2025 from the routine watercourse sample locations within the Viking Energy Wind Farm. Control sites are highlighted in lilac. Concentrations of a determinand that are below the minimum recorded during the extended baseline monitoring period they are highlighted in blue and those above the maximum for the same baseline data are highlighted in yellow. Numbers in bold and red indicate they exceed the appropriate trigger threshold values. Abbreviations: EC = electrical conductivity; DOC = dissolved organic carbon; ANC = acid neutralising capacity; TSS = total suspended solids; Turb. = turbidity; TAN = total ammoniacal-nitrogen; TON = total oxidised inorganic nitrogen (nitrate); SRP = soluble reactive orthophosphate: TP = total phosphorus; Ca = calcium; Al = aluminium; Fe = iron; Diss. = dissolved; Tot. = total; Bio. = bioavailable; n/a = not applicable; <LOD = below the limit of detection.*

Date sampled	Date received	Report due	Sample code	Acidity	EC	Gran Alkalinity		DOC	ANC	TSS	TAN	TON	Diss. Ca	Tot. Ca	Diss. Al	Tot. Al	Diss. Fe	Tot. Fe
				pH	(µS/cm)	(µeq/L)	(mg $CaCO_3$/L)	(mg/L)	(µeq/L)	(mg/L)	(µg N /L)		(mg/L)	(mg/L)	(µg/L)	(µg/L)	(mg/L)	(mg/L)
15/06/2025	19/06/2025	04/07/2027	**BF1**	6.6	176	333	16.6	9.8	382	1.7	<LOD	<LOD	7.67	7.81	57.5	73.3	0.81	1.09
15/06/2025	19/06/2025	04/07/2027	**BF2**	6.5	162	300	15.0	10.1	350	1.4	<LOD	<LOD	5.78	5.87	47.4	59.3	0.73	0.94
15/06/2025	19/06/2025	04/07/2027	**CR1**	7.1	275	1014	50.7	10.6	1067	1.2	44	12	18.80	19.18	104.8	-	1.15	-
15/06/2025	19/06/2025	04/07/2027	**DR1**	7.3	231	1071	53.6	4.3	1092	1.3	6	26	21.54	22.02	50.0	63.7	0.89	1.25
15/06/2025	19/06/2025	04/07/2027	**FL1**	7.2	213	862	43.1	10.2	913	1.5	6	5	**13.93**	14.47	62.0	-	0.92	-
15/06/2025	19/06/2025	04/07/2027	**LB1**	7.0	173	535	26.8	11.1	590	0.5	<LOD	<LOD	6.60	6.73	51.1	-	0.49	-
15/06/2025	19/06/2025	04/07/2027	**LM1**	6.5	155	164	8.2	6.9	198	1.2	<LOD	<LOD	5.92	5.99	56.9	69.2	0.32	0.49
15/06/2025	19/06/2025	04/07/2027	**LU1**	6.6	211	325	16.3	7.4	362	2.6	11	14	**15.19**	15.54	143.7	191.5	1.54	2.42
15/06/2025	19/06/2025	04/07/2027	**LU2**	6.5	299	220	11.0	6.9	255	2.4	13	25	14.92	15.13	178.3	225.1	1.49	2.18
15/06/2025	19/06/2025	04/07/2027	**RB2**	6.6	263	237	11.9	9.5	284	3.2	66	40	20.56	20.66	198.9	290.8	1.48	2.64
15/06/2025	19/06/2025	04/07/2027	**MA1**	6.5	166	327	16.4	8.4	369	1.2	<LOD	<LOD	6.27	6.36	60.4	74.1	0.84	1.12
15/06/2025	19/06/2025	04/07/2027	**QU1**	6.8	183	614	30.7	12.7	677	1.4	10	26	10.20	10.38	64.3	-	2.23	-
15/06/2025	19/06/2025	04/07/2027	**SE1**	7.5	252	1621	81.1	10.9	1675	0.4	<LOD	<LOD	24.02	24.44	29.1	-	0.54	-
15/06/2025	19/06/2025	04/07/2027	**WE1**	7.3	256	1292	64.6	2.8	1306	1.2	6	<LOD	26.78	27.25	38.6	53.1	0.79	1.13
15/06/2025	19/06/2025	04/07/2027	**WE2**	7.5	247	1258	63.0	6.4	1290	2.2	<LOD	<LOD	26.35	26.71	50.3	69.4	0.84	1.19
15/06/2025	19/06/2025	04/07/2027	**WE3**	7.2	204	1016	50.8	4.0	1036	1.9	<LOD	<LOD	18.64	18.78	66.1	83.0	1.02	1.50
15/06/2025	19/06/2025	04/07/2027	**WE4**	7.1	197	804	40.2	5.9	833	1.7	<LOD	5	13.92	14.15	94.3	114.5	1.20	1.70
15/06/2025	19/06/2025	04/07/2027	**WE5**	7.1	183	849	42.5	8.1	890	1.8	26	17	14.44	14.66	74.5	94.7	1.05	1.56
15/06/2025	19/06/2025	04/07/2027	**TWE1**	7.0	177	682	34.1	10.3	734	1.6	24	4	14.29	14.57	149.8	174.9	1.82	2.40
15/06/2025	19/06/2025	04/07/2027	**WF1**	7.2	268	1547	77.4	8.2	1587	1.2	10	13	27.93	28.20	62.2	-	1.23	-
06/07/2025	10/07/2025	25/07/2025	**BF1**	6.1	135	66	3.3	9.3	113	1.9	<LOD	<LOD	4.09	4.12	153.2	180.3	0.56	0.92
06/07/2025	10/07/2025	25/07/2025	**BF2**	6.1	127	72	3.6	11.2	128	1.1	<LOD	<LOD	3.45	3.48	125.0	137.8	0.48	0.65
06/07/2025	10/07/2025	25/07/2025	**CR1**	6.8	176	397	19.9	18.2	488	1.8	<LOD	<LOD	10.78	10.80	136.4	-	0.94	-
06/07/2025	10/07/2025	25/07/2025	**DR1**	7.1	165	453	22.7	22.6	566	1.1	<LOD	<LOD	10.83	10.89	207.8	296.3	1.02	1.70
06/07/2025	10/07/2025	25/07/2025	**FL1**	6.9	151	409	20.5	31.5	567	1.4	<LOD	23.8	8.01	8.09	183.0	-	0.85	-
06/07/2025	10/07/2025	25/07/2025	**LB1**	6.5	115	168	8.4	19.8	267	1.2	<LOD	<LOD	2.64	2.66	198.3	-	0.64	-
06/07/2025	10/07/2025	25/07/2025	**LM1**	5.9	144	40	2.0	6.6	73	1.0	<LOD	<LOD	4.33	4.34	80.6	91.9	0.34	0.48
06/07/2025	10/07/2025	25/07/2025	**LU1**	6.2	164	85	4.3	8.8	129	1.5	<LOD	<LOD	6.94	6.97	294.5	357.2	0.99	1.34
06/07/2025	10/07/2025	25/07/2025	**LU2**	6.1	162	74	3.7	8.3	115	1.5	9.4	6.7	7.08	7.09	302.1	383.1	0.92	1.30
06/07/2025	10/07/2025	25/07/2025	**RB2**	5.5	225	29	1.5	6.1	57	3.2	32.3	18.6	14.20	14.26	323.8	784.0	0.40	1.36
06/07/2025	10/07/2025	25/07/2025	**MA1**	5.7	121	55	2.8	11.9	114	1.1	<LOD	<LOD	2.71	2.73	168.1	182.8	0.63	0.83
06/07/2025	10/07/2025	25/07/2025	**QU1**	6.6	133	227	11.3	15.3	303	1.7	<LOD	15.8	4.24	4.29	128.9	-	1.07	-

Date sampled	Date received	Report due	Sample code	Acidity	EC	Gran Alkalinity		DOC	ANC	TSS	TAN	TON	Diss. Ca	Tot. Ca	Diss. Al	Tot. Al	Diss. Fe	Tot. Fe
				pH	(µS/cm)	(µeq/L)	(mg $CaCO_3$/L)	(mg/L)	(µeq/L)	(mg/L)	(µg N /L)		(mg/L)	(mg/L)	(µg/L)	(µg/L)	(mg/L)	(mg/L)
06/07/2025	10/07/2025	25/07/2025	**SE1**	6.9	123	306	15.3	18.3	397	0.9	<LOD	<LOD	5.47	5.49	178.7	201.5	1.07	-
06/07/2025	10/07/2025	25/07/2025	**WE1**	7.2	202	703	35.2	11.5	761	1.2	<LOD	16.0	17.52	17.59	178.4	219.5	0.94	1.27
06/07/2025	10/07/2025	25/07/2025	**WE2**	7.3	195	662	33.1	16.1	743	1.7	<LOD	14.8	17.52	17.68	196.3	251.3	0.88	1.27
06/07/2025	10/07/2025	25/07/2025	**WE3**	6.7	153	405	20.3	15.1	481	2.3	<LOD	21.0	9.85	10.04	222.8	266.8	0.90	1.39
06/07/2025	10/07/2025	25/07/2025	**WE4**	6.5	132	263	13.2	15.3	340	2.7	<LOD	<LOD	5.75	5.79	161.5	200.5	0.78	1.42
06/07/2025	10/07/2025	25/07/2025	**WE5**	6.4	130	285	14.2	14.5	357	2.7	<LOD	7.7	5.63	5.70	307.2	373.8	1.24	1.39
06/07/2025	10/07/2025	25/07/2025	**TWE1**	6.7	141	210	10.5	12.0	269	1.9	<LOD	<LOD	7.01	7.15	201.6	-	0.93	1.73
06/07/2025	10/07/2025	25/07/2025	**WF1**	7.0	176	609	30.5	31.4	766	0.9	<LOD	14.1	12.13	12.22	153.2	180.3	0.56	-
10/08/2025	14/08/2025	29/08/2025	**BF1**	6.2	121	74	3.7	13.5	141	1.5	<LOD	<LOD	4.39	4.39	136.3	160.2	0.59	0.8
10/08/2025	14/08/2025	29/08/2025	**BF2**	6.0	150	78	3.9	15.3	155	1.4	<LOD	<LOD	3.73	3.79	95.9	120.4	0.43	0.7
10/08/2025	14/08/2025	29/08/2025	**CR1**	6.5	199	320	16.0	22.0	430	1.6	5	<LOD	9.69	9.69	114.9		0.77	-
10/08/2025	14/08/2025	29/08/2025	**DR1**	6.5	186	427	21.4	12.5	489	0.8	<LOD	7	11.41	11.52	119.7	150.6	0.72	1.0
10/08/2025	14/08/2025	29/08/2025	**FL1**	6.5	188	397	19.9	22.0	507	0.7	<LOD	17	9.17	9.23	140.9		0.71	-
10/08/2025	14/08/2025	29/08/2025	**LB1**	5.9	116	86	4.3	22.1	197	0.5	<LOD	<LOD	2.39	2.42	167.8		0.54	-
10/08/2025	14/08/2025	29/08/2025	**LM1**	5.7	151	43	2.1	10.5	95	1.1	<LOD	<LOD	4.40	4.45	85.4	109.0	0.51	0.8
10/08/2025	14/08/2025	29/08/2025	**LU1**	6.0	165	70	3.5	10.7	124	1.5	6	<LOD	7.56	7.69	213.8	320.0	0.76	1.3
10/08/2025	14/08/2025	29/08/2025	**LU2**	5.8	170	62	3.1	10.4	114	1.6	10	<LOD	7.80	7.86	255.2	350.8	0.85	1.3
10/08/2025	14/08/2025	29/08/2025	**RB2**	5.4	212	21	1.0	7.1	53	2.7	43	11	14.10	14.23	261.7	642.2	0.33	1.3
10/08/2025	14/08/2025	29/08/2025	**MA1**	5.6	139	46	2.3	16.0	125	1.4	26	<LOD	2.98	3.01	148.9	172.6	0.60	0.8
10/08/2025	14/08/2025	29/08/2025	**QU1**	6.4	163	207	10.4	18.7	301	1.4	<LOD	<LOD	4.96	5.02	93.7		1.03	-
10/08/2025	14/08/2025	29/08/2025	**SE1**	6.5	145	225	11.3	24.9	350	0.5	<LOD	<LOD	5.01	5.06	130.9		0.47	-
10/08/2025	14/08/2025	29/08/2025	**WE1**	6.7	223	609	30.5	12.7	673	0.4	<LOD	<LOD	16.82	16.87	115.1	137.3	0.79	1.0
10/08/2025	14/08/2025	29/08/2025	**WE2**	6.8	224	584	29.2	13.3	650	0.9	<LOD	<LOD	17.12	17.15	122.3	142.2	0.74	1.0
10/08/2025	14/08/2025	29/08/2025	**WE3**	6.5	178	350	17.5	13.2	416	1.5	4	<LOD	9.90	10.01	151.7	184.3	0.81	1.2
10/08/2025	14/08/2025	29/08/2025	**WE4**	6.2	156	217	10.8	12.8	281	1.2	<LOD	<LOD	5.98	6.04	156.4	184.6	0.72	1.1
10/08/2025	14/08/2025	29/08/2025	**WE5**	6.2	152	213	10.7	12.2	274	1.5	8	<LOD	5.67	5.76	107.7	129.1	0.60	0.9
10/08/2025	14/08/2025	29/08/2025	**TWE1**	6.5	167	187	9.4	12.9	251	1.2	6	<LOD	7.51	7.61	239.6	281.6	1.08	1.4
10/08/2025	14/08/2025	29/08/2025	**WF1**	6.7	189	461	23.1	21.5	568	0.9	<LOD	13	10.40	10.53	178.4		0.74	-
Detection limits		June 2025		n/a	1.0		0.1	0.2		0.1	3	3	0.01	0.002	2.5	5.2	0.0002	0.009
		July 2025		n/a	1.0		0.1	0.5		0.1	4	5	0.24	0.35	4.5	2.8	0.1	0.0004
		August 2025		n/a	1.0		0.1	0.4		0.1	8	3	0.01	0.002	2.4	3.1	0.003	0.0006
Accuracy				0.01	1.0		0.1											

Table 2. continued.

Sample code	Sample Date	Manganese			Zinc			Nickel			Copper			Lead			Arsenic		Cadmium	
		Diss.	Tot.	Bio.	Diss.	Tot.	Bio.	Diss.	Tot.	Bio.	Diss.	Tot.	Bio.	Diss.	Tot.	Av.	Diss.	Tot.	Diss.	Tot.
		(µg/L)			(µg/L)			(µg/L)			(µg/L)			(µg/L)			(µg/L)		(µg/L)	
BF1	15/06/2025	28.7	36.0	9.9	2.6	<LOD	0.8	<LOD	<LOD	<0.2	0.7	<LOD	0.03	7.2	1.8	0.7	<LOD	<LOD	<LOD	<LOD
BF2	15/06/2025	8.4	18.0	3.4	2.9	<LOD	0.9	<LOD	<LOD	<0.2	1.6	<LOD	0.07	<LOD	<LOD	<0.6	<LOD	<LOD	<LOD	<LOD
CR1	15/06/2025	233.1	-	41.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DR1	15/06/2025	208.3	219.0	48.4	1.7	<LOD	0.8	2.2	2.5	0.8	0.9	<LOD	0.05	<LOD	<LOD	<1.5	<LOD	<LOD	<LOD	<LOD
FL1	15/06/2025	6.2	-	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LB1	15/06/2025	28.1	-	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LM1	15/06/2025	22.4	29.9	7.9	4.8	4.8	2.1	<LOD	2.5	<0.3	0.8	<LOD	0.05	<LOD	<LOD	<0.9	<LOD	<LOD	<LOD	<LOD
LU1	15/06/2025	298.9	319.6	59.6	9.6	11.1	3.8	9.4	8.5	2.1	1.4	<LOD	0.07	<LOD	<LOD	<0.9	<LOD	<LOD	<LOD	<LOD
LU2	15/06/2025	419.9	425.2	84.4	13.0	13.7	5.6	12.1	12.7	2.7	2.0	<LOD	0.12	<LOD	<LOD	<0.9	<LOD	<LOD	<LOD	<LOD
RB2	15/06/2025	598.6	597.9	102.3	**18.4**	21.0	6.4	18.0	20.9	3.5	3.1	<LOD	0.13	<LOD	<LOD	<0.7	<LOD	<LOD	<LOD	<LOD
MA1	15/06/2025	12.8	17.7	5.0	3.7	4.2	1.4	1.5	2.4	<0.4	<LOD	<LOD	<0.04	<LOD	<LOD	<0.8	<LOD	<LOD	<LOD	<LOD
QU1	15/06/2025	236.4	-	69.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SE1	15/06/2025	15.2	-	6.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WE1	15/06/2025	11.3	21.9	3.0	<LOD	<LOD	<1.0	<LOD	<LOD	<0.5	1.5	<LOD	0.13	<LOD	<LOD	<2.2	<LOD	<LOD	<LOD	<LOD
WE2	15/06/2025	14.8	26.4	5.1	<LOD	<LOD	<0.6	1.3	<LOD	<0.4	<LOD	<LOD	<0.02	<LOD	<LOD	<1.0	<LOD	<LOD	<LOD	<LOD
WE3	15/06/2025	100.4	105.8	19.3	<LOD	<LOD	<0.9	<LOD	<LOD	<0.4	1.5	<LOD	0.09	<LOD	<LOD	<1.6	<LOD	<LOD	<LOD	<LOD
WE4	15/06/2025	123.4	127.4	24.9	<LOD	<LOD	<0.7	1.5	2.3	0.4	1.4	<LOD	0.06	<LOD	<LOD	<1.0	<LOD	<LOD	<LOD	<LOD
WE5	15/06/2025	165.1	177.6	33.8	3.2	<LOD	1.1	<LOD	<LOD	<0.3	0.6	<LOD	0.02	<LOD	<LOD	<0.8	<LOD	<LOD	<LOD	<LOD
TWE1	15/06/2025	229.0	233.0	49.2	8.3	8.9	2.3	5.5	6.1	1.0	1.3	<LOD	0.03	<LOD	<LOD	<0.6	<LOD	<LOD	<LOD	<LOD
WF1	15/06/2025	26.7	-	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF1	06/07/2025	55.0	86.8	34.7	8.4	8.4	3.1	3.3	3.6	0.7	<LOD	<LOD	<0.22	<LOD	<LOD	<0.3	<LOD	<LOD	<LOD	0.2
BF2	06/07/2025	24.8	32.8	24.2	4.1	4.0	1.3	2.1	2.1	0.4	<LOD	<LOD	<0.17	<LOD	<LOD	<0.3	<LOD	<LOD	<LOD	<LOD
CR1	06/07/2025	50.5	-	16.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DR1	06/07/2025	153.4	344.0	50.3	4.4	6.7	0.6	3.3	4.4	0.3	<LOD	<LOD	<0.05	<LOD	<LOD	<0.2	<LOD	<LOD	<LOD	<LOD
FL1	06/07/2025	26.3	-	11.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LB1	06/07/2025	15.0	-	15.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LM1	06/07/2025	26.2	27.8	13.4	4.8	5.0	2.5	3.3	4.1	0.8	<LOD	<LOD	<0.33	<LOD	<LOD	<0.5	<LOD	<LOD	<LOD	<LOD
LU1	06/07/2025	238.6	242.5	89.3	**16.9**	16.9	6.5	8.9	11.3	1.9	3.1	3.5	0.23	<LOD	<LOD	<0.4	<LOD	<LOD	<LOD	<LOD
LU2	06/07/2025	285.1	289.2	104.0	**19.2**	19.7	8.1	11.8	13.3	2.5	3.7	3.5	0.33	<LOD	<LOD	<0.4	<LOD	<LOD	<LOD	<LOD
RB2	06/07/2025	624.9	627.4	**134.4**	**47.1**	47.1	25.5	31.3	32.3	7.0	4.7	5.1	0.61	<LOD	<LOD	<0.5	<LOD	<LOD	<LOD	<LOD
MA1	06/07/2025	63.3	65.7	63.3	8.7	8.7	2.6	4.4	4.7	0.8	<LOD	<LOD	<0.16	<LOD	<LOD	<0.3	<LOD	10.2	<LOD	<LOD
QU1	06/07/2025	62.4	-	50.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SE1	06/07/2025	2.4	-	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WE1	06/07/2025	58.4	61.8	13.1	3.7	4.1	0.9	2.1	2.6	0.4	<LOD	<LOD	<0.06	<LOD	<LOD	<0.3	<LOD	<LOD	<LOD	<LOD

Sample code	Sample Date	Manganese			Zinc			Nickel			Copper			Lead			Arsenic		Cadmium	
		Diss.	Tot.	Bio.	Diss.	Tot.	Bio.	Diss.	Tot.	Bio.	Diss.	Tot.	Bio.	Diss.	Tot.	Av.	Diss.	Tot.	Diss.	Tot.
		(µg/L)			(µg/L)			(µg/L)			(µg/L)			(µg/L)			(µg/L)		(µg/L)	
WE2	06/07/2025	46.9	52.2	12.7	4.0	4.4	0.7	1.9	1.4	0.3	<LOD	<LOD	<0.05	<LOD	<LOD	<0.2	<LOD	<LOD	<LOD	<LOD
WE3	06/07/2025	88.8	93.8	29.0	4.4	5.4	0.9	2.2	2.4	0.3	<LOD	<LOD	<0.07	<LOD	<LOD	<0.2	<LOD	<LOD	<LOD	<LOD
WE4	06/07/2025	94.1	99.1	49.2	5.6	6.1	1.2	2.8	3.0	0.4	<LOD	<LOD	<0.08	<LOD	<LOD	<0.2	<LOD	<LOD	<LOD	<LOD
WE5	06/07/2025	77.8	129.0	40.9	3.7	4.1	0.8	<LOD	<LOD	<0.2	<LOD	<LOD	<0.09	<LOD	<LOD	<0.2	<LOD	<LOD	<LOD	<LOD
TWE1	06/07/2025	162.4	166.4	63.8	13.2	14.5	3.3	7.8	9.9	1.2	<LOD	<LOD	<0.08	<LOD	<LOD	<0.3	<LOD	<LOD	<LOD	<LOD
WF1	06/07/2025	16.2	-	4.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF1	10/08/2025	92.4	95.1	69.6	8.2	8.4	2.1	4.3	5.6	0.7	<LOD	<LOD	<0.04	<LOD	<LOD	<0.5	<LOD	<LOD	<LOD	<LOD
BF2	10/08/2025	41.8	46.2	41.8	3.4	3.8	0.8	2.2	<LOD	0.3	<LOD	<LOD	<0.03	<LOD	<LOD	<0.4	<LOD	<LOD	<LOD	<LOD
CR1	10/08/2025	100.9	-	41.5	-	-	-	<LOD	-	<0.2	<LOD	-	<0.03	-	-	<0.3	-	-	-	-
DR1	10/08/2025	229.0	233.8	63.1	3.7	4.7	1.0	3.2	4.2	0.5	<LOD	1.3	<0.03	<LOD	<LOD	<0.5	4.1	<LOD	<LOD	<LOD
FL1	10/08/2025	50.0	-	21.8	-	-	-	<LOD	-	<0.3	1.3	-	0.04	-	-	<0.3	-	-	-	-
LB1	10/08/2025	78.7	-	78.7	-	-	-	<LOD	-	<0.3	<LOD	-	<0.03	-	-	<0.3	-	-	-	-
LM1	10/08/2025	59.5	66.5	42.5	8.3	8.8	2.9	2.6	4.1	0.5	<LOD	<LOD	<0.05	<LOD	<LOD	<0.6	<LOD	<LOD	<LOD	<LOD
LU1	10/08/2025	282.0	289.3	111.1	**17.8**	18.7	6.5	9.6	12.1	1.9	1.7	2.6	0.11	<LOD	<LOD	<0.6	5.0	<LOD	<LOD	<LOD
LU2	10/08/2025	327.5	332.3	**126.2**	**20.0**	21.6	7.5	11.3	13.8	2.2	2.2	3.1	0.15	6.2	<LOD	0.6	<LOD	<LOD	<LOD	<LOD
RB2	10/08/2025	641.1	644.9	**142.8**	**45.0**	45.8	22.6	28.8	30.2	6.3	2.2	3.6	0.24	<LOD	<LOD	<0.9	3.0	<LOD	<LOD	<LOD
MA1	10/08/2025	89.1	90.8	89.1	9.4	9.7	2.1	3.4	5.2	0.5	<LOD	1.2	<0.03	<LOD	<LOD	<0.4	3.5	<LOD	<LOD	<LOD
QU1	10/08/2025	96.8	-	84.8	-	-	-	<LOD	-	<0.3	3.7	-	0.12	-	-	<0.4	-	-	-	-
SE1	10/08/2025	22.0	-	20.0	-	-	-	<LOD	-	<0.3	<LOD	-	<0.03	-	-	<0.3	-	-	-	-
WE1	10/08/2025	72.4	76.2	14.9	3.0	2.6	0.8	<LOD	2.9	<0.3	<LOD	1.5	<0.03	<LOD	<LOD	<0.5	<LOD	<LOD	<LOD	<LOD
WE2	10/08/2025	61.6	64.1	12.5	3.4	3.8	0.8	2.2	<LOD	0.3	<LOD	1.1	<0.02	<LOD	<LOD	<0.5	<LOD	<LOD	<LOD	<LOD
WE3	10/08/2025	112.7	120.6	35.7	4.8	5.3	1.3	3.7	3.5	0.7	1.1	1.3	0.04	<LOD	<LOD	<0.5	<LOD	<LOD	<LOD	<LOD
WE4	10/08/2025	118.7	125.9	55.7	6.1	6.7	1.7	2.4	3.2	0.4	<LOD	<LOD	<0.04	<LOD	<LOD	<0.5	<LOD	<LOD	<LOD	<LOD
WE5	10/08/2025	145.2	151.3	70.6	4.8	5.7	1.4	1.7	<LOD	0.3	<LOD	<LOD	<0.04	<LOD	<LOD	<0.5	<LOD	<LOD	<LOD	<LOD
TWE1	10/08/2025	182.6	185.6	72.4	13.6	14.7	3.5	7.5	8.9	1.4	<LOD	<LOD	<0.03	<LOD	<LOD	<0.5	3.7	<LOD	<LOD	<LOD
WF1	10/08/2025	41.1	-	15.0	-	-	-	<LOD	-	<0.2	1.4	-	0.04	-	-	<0.3	-	-	-	-
Detection limits	June 2025	0.2	0.2	-	1.6	3.5	-	1.2	2.2	-	0.6	3.5	-	6.1	7.4	-	6.4	6.8	0.38	0.55
	July 2025	0.4	0.2	-	0.5	0.4	-	1.4	0.9	-	2.9	2.4	-	3.2	2.4	-	9.6	9.4	0.41	0.21
	August 2025	0.2	0.1	-	0.2	0.7	-	1.5	2.6	-	0.8	1.1	-	6.0	8.6		2.6	5.5	0.69	0.77

Table 3. *Results of field measurements taken from the routine loch sample locations on the 19th and 20th of July 2025. Abbreviations are the same as those used in Table 1. Control lochs are highlighted in lilac. Concentrations of a determinand that are below the minimum recorded during the extended baseline monitoring period they are highlighted in blue and those above the maximum for the same baseline data are highlighted in yellow. nd = not determined*

Water-body	Site code	easting	northing	Date sampled	Time	sampler	level	wind direction	waves	Sample location	pH	EC	Temp	Turb	odour	Suspended solids	Signs of oil	notes
Lamba Water	LB1L	438199	1155683	19/07/2025	10:25	RF	Low	SE	Yes	SW bank	6.3	129	18.3	0.56	None	None	None	Waves not breaking
	LB2L	437888	1156055	19/07/2025	10:50	RF	Low	SE	Yes	NW corner outflow	6.5	127	19.1	0.00	None	None	None	Waves not breaking
Maa Water	MAA1L	437997	1154961	19/07/2025	11:35	RF	Low	SE	No	SE corner inflow	6.2	134	18.0	5.09	None	None	None	
	MAA2L	437441	1155090	19/07/2025	13:25	RF	Low	SE	Yes	SW corner outflow	6.4	119	20.1	0.00	None	None	None	Waves breaking
Truggles Water	TR1L	437191	1154457	19/07/2025	12:05	RF	Low	SE	Yes	SE corner inflow	6.5	127	19.7	0.00	None	None	None	Waves not breaking
	TR2L	437053	1154430	19/07/2025	12:40	RF	Low	SE	Yes	SW corner outflow	6.2	124	19.5	0.42	None	None	None	Waves not breaking
Petta Water	PE1L	441574	1159374	20/07/2025	12.35	JC	Low	NE	calm	Inflow area	6.7	190	20.0	1.34	none	none	None	
	PE2L	441608	1158847	20/07/2025	13.00	JC	Low	NE	calm	Outflow area	6.9	180	21.0	1.53	none	few	None	
Sand Water	SA1L	441249	1154978	19/07/2025	14:10	RF	Low	SE	Yes	NW inflow	6.4	270	19.8	4.33	None	None	None	Waves not breaking. Foam on shoreline
	SA2L	441478	1155153	19/07/2025	14:30	RF	Low	SE	Yes	N shore inflow	6.8	272	18.5	2.01	None	None	None	Waves not breaking. Foam on shoreline
	SA3L	441556	1155108	19/07/2025	14:50	RF	Low	SE	No	NE shore minor inflow	7.7	175	20.0	0.00	None	None	None	
	SA4L	441652	1154540	19/07/2025	15:20	RF	Low	SE	No	Longa Ness	7.9	166	21.6	0.98	None	None	None	
Loch of Benston	BE1L	445737	1153373	20/07/2025	13.37	JC	Low	NE	Small waves	Inflow area	8.6	270	21.0	2.87	none	yes	None	
	BE2L	446632	1153710	20/07/2025	14.00	JC	Low	NE	calm	Outflow area	8.9	270	22.0	3.68	none	none	None	
Smerla Water	SM1L	438199	1160459	20/07/2025	11.00	JC	Low	NE	Small waves	Inflow area	6.5	120	18.0	1.33	none	none	None	
	SM2L	430866	1160563	20/07/2025	11.20	JC	Low	NE	Medium waves	Outflow area	6.5	120	18.0	0.64	none	few	None	

Table 4. *The results of all the laboratory analysis of the water samples collected on the 19th and 20th of July 2025 from the routine loch sample locations within the Viking Energy Wind Farm and the control lochs. Concentrations that exceed the appropriate trigger threshold values are in bold red. Control sites are highlighted in pink. Concentrations of determinands outside the range of values recorded during the baseline monitoring period are highlighted in various colours. Cells highlighted in blue are below the minimum whilst cells highlighted in yellow are above the maximum. Abbreviations are the same as those used in Table 2.*

Date sampled	Date received	Report due	Loch	Sample code	Acidity	EC	Gran Alkalinity		DOC	ANC	TSS	TAN	TON	TP	Diss. Ca	Diss. Fe	Diss. Mn	Diss. Al	Bioav. Mn
					pH	(µS/cm)	(µeq/L)	(mg $CaCO_3$/L)	(mg/L)	(µeq/L)	(mg/L)	(µg N/L)		(µg P/L)	(mg/L)	(mg/L)	(µg/L)	(µg/L)	(µg/L)
19/07/2025	24/07/2025	08/08/2025	Lamba Water	**LB1L**	5.9	161	45	2.3	9.2	92	0.9	9	<LOD	<LOD	**4.61**	0.39	67.2	85.3	37.7
19/07/2025	24/07/2025	08/08/2025		**LB2L**	5.9	155	36	1.8	9.3	83	1.0	6	<LOD	<LOD	**4.59**	0.38	31.0	81.9	17.7
19/07/2025	24/07/2025	08/08/2025	Maa Water	**MAA1L**	6.3	159	143	7.1	15.2	219	4.5	<LOD	<LOD	<LOD	**5.17**	1.02	477.5	155.8	311.7
19/07/2025	24/07/2025	08/08/2025		**MAA2L**	6.1	161	52	2.6	7.8	91	1.1	7	<LOD	<LOD	**3.91**	0.19	6.6	65.3	3.9
19/07/2025	24/07/2025	08/08/2025	Truggles Water	**TR1L**	6.5	145	107	5.4	10.5	160	1.5	5	<LOD	<LOD	**4.51**	0.46	59.5	73.2	32.9
19/07/2025	24/07/2025	08/08/2025		**TR2L**	6.2	169	97	4.9	10.3	149	2.2	<LOD	<LOD	<LOD	**4.48**	0.40	31.6	69.0	18.6
20/07/2025	24/07/2025	08/08/2025	Petta Water	**PE1L**	7.0	190	426	21.3	15.5	503	1.6	<LOD	<LOD	<LOD	8.24	0.31	9.0	68.1	3.3
20/07/2025	24/07/2025	08/08/2025		**PE2L**	7.1	179	403	20.2	15.9	483	1.9	<LOD	<LOD	<LOD	7.87	0.32	4.5	73.0	1.8
19/07/2025	24/07/2025	08/08/2025	Sand Water	**SA1L**	7.3	275	1115	55.8	17.9	1204	7.4	32	<LOD	<LOD	23.77	0.30	4.0	36.7	1.1
19/07/2025	24/07/2025	08/08/2025		**SA2L**	7.3	309	1320	66.1	13.5	1388	1.7	9	<LOD	<LOD	25.27	0.64	3.0	50.5	0.8
19/07/2025	24/07/2025	08/08/2025		**SA3L**	7.3	193	656	32.8	18.0	746	2.3	13	<LOD	<LOD	13.20	0.41	4.4	62.2	1.1
19/07/2025	24/07/2025	08/08/2025		**SA4L**	7.4	249	950	47.5	20.0	1050	14.1	43	<LOD	<LOD	17.19	0.53	12.6	29.9	3.5
20/07/2025	24/07/2025	08/08/2025	Loch of Benston	**BE1L**	8.7	280	918	45.9	9.1	963	4.7	9	<LOD	19	16.46	0.02	0.9	20.2	0.9
20/07/2025	24/07/2025	08/08/2025		**BE2L**	8.8	269	923	46.2	8.7	967	1.3	7	<LOD	10	16.75	0.01	1.0	18.3	1.0
20/07/2025	24/07/2025	08/08/2025	Smerla Water	**SM1L**	6.1	121	45	2.3	7.9	85	0.7	4	39	<LOD	1.51	0.29	14.2	71.4	14.2
20/07/2025	24/07/2025	08/08/2025		**SM2L**	6.3	120	43	2.2	8.1	84	0.5	8	30	<LOD	1.47	0.19	9.1	63.1	9.1
	Detection limits				n/a	1.0		0.1	0.2		0.1	4	5	9	0.01	0.005	0.1	0.2	
	Accuracy				0.01	1.0	2	0.1		2									

***Table 5**. The annual statistics (mean, maximum or percentile) are presented, for deteminands with trigger thresholds/EQS values for September 2024 to August 2025. See Table 2 for abbreviations for determinands. Annual means, maximum allowable (max.) and percentiles are based on the period August 2022 to July 2023. Numbers in bold and red exceed the 'good' ES threshold. Cells highlighted in mid-green, pale green and yellow indicate that they achieve the 'High', 'Good' and 'Moderate' ES thresholds, respectively. Cells highlighted in blue indicate that the exceedance of the trigger threshold is equivocal due to the range in mean or maximum values straddling the relevant trigger threshold. Control sites are highlighted in pink. Sample locations highlighted in beige indicate these watercourses are classed as 'humic' waters whilst those that are not highlighted are 'clear' waters based on the mean DOC concentrations being less than 10 mg/L.*

Sample code	Determinand, statistic and unit of measurement																						
	Acidity	Temp	DO	EC	DOC	ANC	TSS	TAN	TON	SRP	TP	Diss. Al	Diss. Fe	Bioav. Mn	Diss. As	Diss. Cd		Diss. Cr	Bioav. Cu	Diss. Ni	Bioav. Ni	Avail. Pb	Bioav. Zn
	mean	98th %tile	10th %tile	mean				90th %tile	max	mean						mean	max	mean		max.	mean		
	pH	°C	% sat	µS/cm	mg/L	µequ./L	mg/L	µg N/L		µg P/L		µg/L	mg/L	µg/L	µg/L	µg/L		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BF1	6.5	16.9	-	158	9.9	205	1.8	16	102	0 - 2	2 - 5	130	0.70	37.4	0.4 – 5.2	0.40 - **1.50**	0.05 - **0.49**	0.1-0.3	0.1	7.0	0.7	0.1-0.3	5.5
BF2	6.4	19.1	-	145	10.4	193	1.3	<8	142	0 - 3	3 - 7	145	0.62	18.8	0.0 – 5.5	0 - **0.51**	0 - **1.50**	0.1-0.5	0-0.1	4.1	0.3-0.4	1.1-**1.6**	1.0-1.1
CR1	7.0	13.0	96	227	13.2	675	1.3	46	109	1 - 4	3 - 8	96	1.05	45.6	0 - 4.5	0.02 - **0.58**	0.24 - **1.50**	0-0.4	<0.1	1.6-1.9	0.5-0.7	0.3-0.4	0.5-0.7
DR1	7.2	14.1	-	206	9.3	771	1.3	37	94	1 - 3	2 - 7	128	1.00	76.3	1.5 – 6.1	0.04 - **0.52**	0.38 - **1.50**	0.2-0.5	<0.1	4.2	0.7-0.8	0.1-0.5	1.2
EF1	7.3	14.9	96	212	11.5	903	0.8	<8	181	5 - 7	5 - 8	84	0.69	31.8	1.6 - 4.9	**0.11 - 0.56**	**0.77 - 1.50**	0.3-0.7	<0.1	0 - 1.2	0 - 0.3	0.2-0.4	0.5
FL1	7.0	13.1	93	191	15.1	656	1.0	19	166	3 - 7	6 - 12	134	0.98	17.8	2.0 – 6.2	0 - **0.58**	0 - **1.50**	0.3-0.6	<0.1	2.3	0.1-0.3	0.1-0.4	0.5-0.7
GI1	7.1	13.6	92	189	12.1	611	1.0	<7	140	2 - 4	3 - 4	113	0.63	16.5	0.5 – 4.6	0.06 - **0.61**	0.43 - **1.50**	0.1-0.4	0-0.03	0.5-1.9	0.1-0.2	0.1-0.3	0.9
GO1	6.7	16.1	95	134	14.1	257	1.5	<7	75	1 - 3	4 - 7	98	0.42	22.3	1.0 - 4.5	**0.10 - 0.64**	**0.48 - 1.50**	0.4-0.6	0-0.1	0-1.9	0.1-0.3	0.1-0.3	0.5
GR1	7.1	13.2	95	172	13.1	573	0.9	<8	137	2 - 4	2 - 6	101	1.09	31.2	1.7 – 5.3	0.01 - **0.58**	0.05 - **1.50**	0.2-0.5	<0.1	<1.9	0-0.3	0.2-0.4	0.6
KI1	7.1	13.2	-	166	9.8	698	1.2	43	66	2 - 4	5 - 7	101	1.11	50.4	1.7 - 4.4	0.01 - **0.57**	0.07 - **1.50**	0.2-0.4	0-0.03	1.9	0.1-0.3	0-0.4	0.7
LA1	7.0	14.7	95	164	12.9	512	1.2	<8	94	1 - 3	4 - 8	88	0.54	19.2	0.9 - 4.9	0 - **0.58**	0 - **1.50**	0.2-0.5	0-0.03	1.0-1.9	0.1-0.3	0.2-0.3	0.5
LM1	6.2	16.6	-	152	8.7	143	1.7	8	71	0 - 3	3 - 8	103	0.42	21.4	0 - 5.5	0 - **0.51**	0 - **1.50**	0.1-0.4	0.1	5.7	0.7	0.1-0.5	3.0
LU1	6.3	16.2	-	208	7.7	189	4.0	62	56	0 - 3	2 - 7	214	0.88	122.8	0.4 – 5.7	0.04 - **0.53**	**0.48 - 1.50**	0.1-0.5	0.2	33.2	**4.3**	0.3-0.7	**15.1**
LU2	6.0	16.6	-	221	6.8	131	4.8	66	49	0 - 4	1 - 5	246	0.78	**139.7**	0.7 – 6.2	0.01 - **0.49**	0.07 - **1.50**	0.1-0.3	0.3	**38.9**	**5.2**	0.3-0.7	**19.6**
RB2	**5.8**	16.1	-	271	5.2	103	6.9	140	71	0 - 4	35-86	341	0.80	**148.5**	0.9 – 5.7	0.07 - **0.56**	0.41-**1.50**	0.1-0.3	0.8	**73.7**	**10.2**	0.6-1.2	**41.7**
RB6	**5.8**	10.0	-	329	4.0	97	12.6	196	79	0 - 1	0 - 4	240	1.51	**148.1**	0 - 4.2	**0.19 - 0.31**	**0.68**	0.2-0.4	0.8	**106.2**	**16.5**	0.5-0.6	**80.0**
MA1	6.3	16.7	-	162	11.2	219	1.9	26	54	1 - 3	4 - 8	137	0.79	43.6	0.9 – 5.7	**0.10 - 0.55**	**0.55 - 1.50**	0.1-0.5	0-0.1	4.8	0.5-0.6	0.1-0.4	1.9
PW1	7.0	12.7	-	205	10.4	729	1.4	32	128	1	4	124	0.58	8.8	0.4 - 4.4	0.05 - **0.55**	0.44 - **1.50**	0.2-0.5	0-0.03	1.0-1.9	0.1-0.3	0.1-0.4	0.6
PW2	6.9	12.7	-	189	10.8	605	2.4	36	100	1 - 3	4 - 8	139	0.46	10.4	0.4 - 4.4	**0.10 - 0.59**	**0.45 - 1.50**	0.4-0.5	0-0.03	<1.9	0-0.3	0.1-0.4	0.6
QU1	6.8	14.2	99	176	14.0	463	1.7	30	83	0 - 2	3 - 6	100	1.09	75.9	0 – 3.5	0.01 - **0.45**	0.06 - **1.50**	0.1-0.3	<0.05	1.3-1.9	0.1-0.2	0.1-0.3	0.4-0.6
WE1	7.3	17.1	-	237	8.0	1,001	1.8	14	150	2 - 4	5 - 8	114	1.02	27.7	1.4 – 6.4	0.05 - **0.53**	0.38 - **1.50**	0.1-0.4	0-0.1	3.2	0.4-0.6	0.2-0.6	1.0-1.1
WE2	7.5	17.1	-	230	9.0	936	2.5	23	149	1 - 3	4 - 7	127	0.97	28.7	0.8 – 5.8	0 - **0.51**	0 - **1.50**	0.2-0.4	0-0.04	4.0	0.4-0.6	0-0.5	0.8-0.9
WE3	7.0	14.0	-	187	9.2	684	2.7	38	50	1 - 3	3 - 6	149	1.11	38.8	1.0 – 5.9	0.05 - **0.54**	**0.51 - 1.50**	0.3-0.5	0-0.06	4.2	0.4-0.5	0-0.5	1.2-1.3
WE4	6.8	13.9	-	170	9.8	521	2.3	35	38	1 - 4	5 - 10	171	1.17	53.8	0.8 – 6.1	0 - **0.51**	0 - **1.50**	0.1-0.5	<0.07	5.4	0.5	0-0.5	1.8-1.9
WE5	6.7	12.9	-	153	9.8	543	2.5	26	28	-	4 - 11	128	1.06	68.2	0.6 – 5.9	0.03 - **0.52**	0.37 - **1.50**	0.2-0.5	<0.06	2.9	0.2-0.4	0-0.4	0.2-0.4
TWE1	6.9	14.0	-	173	10.0	455	2.1	36	29	-	-	259	1.68	68.6	0.7 – 5.7	0 - **0.51**	0 - **1.50**	0.2-0.4	0-0.1	13.4	1.7	0.2-0.5	4.7
WF1	7.1	13.5	-	235	12.6	994	13.8	26	186	2 - 3	8 - 9	122	0.98	14.6	1.2 – 3.2	0.05 - **0.39**	**0.51 - 1.50**	0.2-0.3	0-0.1	1.6-1.9	0.1-0.2	0.1-0.3	0.6
LB1	6.8	16.8	88	152	12.6	382	0.9	8	42	3 - 5	6 - 9	107-112	0.58	38.0	1.5 – 5.4	0.05 - **0.55**	**0.54 - 1.50**	0.1-0.4	<0.1	0.7-1.2	0.1-0.3	0.1-0.4	0.4-0.6
SA1	7.5	13.3	98	287	5.6	1,128	1.9	<8	**231**	1 - 4	6 - 10	73	0.72	46.1	0.7 – 4.4	**0.09 - 0.65**	**0.73 - 1.50**	0.2-0.5	0-0.1	4.6	0.3-0.5	0.4-0.8	0.9
SE1	7.3	16.1	-	190	13.5	901	0.6	12	91	2 - 3	3 - 5	83	0.64	18.5	1.3 – 3.9	0.06 - **0.49**	**0.62 - 1.50**	0.1-0.4	0-0.03	1.4-1.9	0.1-0.3	0.1-0.4	0.3-0.4

Table 6. *The annual statistics (mean, maximum or percentile) are presented, for deteminands with trigger thresholds/EQS values for the lochs between October 2024 and July 2025. See Table 2 for abbreviations for determinands. Numbers in bold and red exceed the 'good' ES threshold. Cells highlighted in orange exceed the appropriate baseline trigger threshold value. Cells highlighted in mid-green, pale green and orange indicate that they achieve the 'High', 'Good' and 'Poor' ES thresholds, respectively. Cells highlighted in blue indicate that the exceedance of the trigger threshold is equivocal due to the range in mean or maximum values straddling the relevant trigger threshold. Control sites are highlighted in pink and 'impacted' lochs highlighted in beige indicate these watercourses are classed as 'humic' waters whilst those that are not highlighted are 'clear' waters based on the annual mean DOC concentration being less than 10 mg/L. Abbreviations for the determinands, units of measurement and statistic are the same as those given in Table 2.*

LOCH	Determinand, unit and statistic																						
	Acidity		EC	Alkalinity	DOC	ANC	TSS	TAN	TON	SRP	TP	Diss. Fe	Diss. Al	Bioav. Mn	Diss. As	Diss. Cd		Diss. Cr	Bioav. Cu	Bioav. Ni	Avail. Pb		Bioav. Zn
	pH		µS/ cm	µeq./L	mg/L	µeq./L	mg/L	µg N/L		µg P/L		mg/L	µg/L	µg/L	µg/L	µg/L		µg/L	µg/L	µg/L	µg/L		µg/L
	min	mean	mean	min	max.	mean	max.	90th %tile	max	max	mean	mean	max	mean	mean	max.	mean	mean	mean	mean	mean	max.	mean
Lamba Water	5.2	5.6	165	23	11.8	76	3.4	9	61	<2	2-7	0.41	154.8	25.2	0-1.4	<**0.78**	0.06-**0.34**	0-1.1	0.1-0.2	0.8	0-0.3	<0.7	4.0
Maa Water	5.5	5.9	163	36	15.2	97	4.5	8	**218**	<2	0-6	0.34	122.5	86.0	0.3-1.6	<**0.78**	0.05-**0.34**	0-0.7	0.1-0.2	0.6	0-0.8	<0.6	2.3
Truggles Water	5.7	6.0	164	40	10.5	109	12.1	10	150	<2	1-7	0.37	96.1	39.5	0.3-1.6	<**0.78**	0.06-**0.34**	0-1.4	0-0.2	0.5	0-0.4	<0.7	3.1
Petta Water	6.3	6.8	174	124	15.9	323	**167.1**	<6	57	<2	12-15	0.29	94.5	7.1	1.3-1.9	<**0.78**	0-**0.33**	0-0.7	0-0.04	0-0.1	0-0.3	<0.5	0.4
Sand Water	6.4	7.1	221	215	20.0	678	28.0	24	50	<2	7-10	0.43	90.7	20.1	0.2-1.5	<**0.78**	0.02-**0.33**	<0.8	<0.1	<0.4	0-0.3	<0.5	0.5-0.6
Gossa Water	5.9	6.4	136	72	17.5	200	2.9	<7	62	3	11-71	0.34	114.8	10.5	1.0-2.4	<**0.78**	0.04-**0.45**	0-1.0	0-0.3	0-0.2	0-0.4	<0.4	1.1
Loch of Skellister	5.2	6.1	154	44	22.3	149	3.3	<6	174	<3	11-12	0.53	160.4	16.9	0.6-2.3	<**0.78**	0-**0.33**	0-1.0	0.1-0.2	0.1	0-0.2	<0.5	1.1
Loch of Benston	7.3	7.9	281	915	9.1	1,020	4.7	9	481	<2	14	0.03	39.1	1.2	0.7-1.7	<**0.78**	0-**0.33**	0-0.7	0.1	0.1-0.3	0-0.6	<1.4	0.2-0.3
Smerla Water	5.8	6.0	134	39	8.1	84	1.6	9	57	<2	2-7	0.31	77.5	17.2	0.3-1.6	<**0.78**	0-**0.33**	0-0.7	0.1	0.1-0.2	0-0.5	<1.0	1.1
Laxo Water	5.9	6.3	159	60	18.5	164	3.4	<6	64	<3	10-11	0.31	99.2	15.6	0.8-2.4	<**0.78**	0-**0.44**	0-1.0	0-0.3	0.1-0.2	0.1-0.4	<0.4	0.8

Table 7. Trigger threshold values for physico-chemical variables measured a) in the field, and b) in the laboratory for all watercourses and therefore apply to all sample locations. The criteria for which threshold values were determined are based on The Scotland River Basin District (Standards) Directions 2014 and the full suite of data obtained between April 2019 and March 2020.

a)

Determinand	units	statistic	trigger threshold	Criteria for threshold
Temperature	°C	98th %tile	>20	'high' ES threshold for salmonid rivers
Dissolved Oxygen	% sat.	any single sample	<65	'moderate' ES threshold for salmonid rivers
		10th %tile	≤75	'good' ES threshold for salmonid rivers
Electrical Conductivity	μS cm^{-1}	any sample	>1,000	level that indicates saline influence
Turbidity	NTU	any sample	>68	Equivalent to a TSS of 80 mg L^{-1}
acidity	pH	any sample	<4.6 or >8.5	Values just outside the range (4.8 to 8.0) observed across all the baseline samples

b)

Determinand	units	statistic	trigger threshold	Criteria for threshold
EC	μS cm^{-1}	annual mean	>400	Just above the baseline maximum
Total Suspended Solids	mg L^{-1}	any sample	>100	Just above the baseline maximum
Dissolved Organic Carbon	mg L^{-1}	any sample	>40	Just above the baseline maximum
Acidity	pH	annual mean	humic <4.6	'good' EQS threshold for salmonid rivers
			clear <6.0	
Acid Neutralising Capacity	μeq. L^{-1}	annual mean	humic <50	'good' EQS threshold for salmonid rivers
			clear <40	
ammonium-nitrogen (total)	μg N L^{-1}	any sample	>700	The 'good' EQS thresholds for river types 1, 2, 4 and 6
		90^{th} %tile	>300	
Total Oxidised Nitrogen	μg N L^{-1}	any sample	>200	Above the baseline maximum
bioavailable manganese	μg L^{-1}	any sample	>500	Above the baseline maximum
		annual mean	>123*	'good' EQS threshold
dissolved arsenic	μg L^{-1}	annual mean	>50	'good' EQS threshold
dissolved cadmium	μg L^{-1}	any sample	>0.45	The 'good' EQS thresholds for hardness Class 1 (<40 mg $CaCO_3$/L)
		annual mean	>0.08	
dissolved chromium	μg L^{-1}	annual mean	>4.7	'good' EQS threshold
bioavailable copper	μg L^{-1}	annual mean	>1	'good' EQS threshold
dissolved nickel	μg L^{-1}	any sample	>34	'good' EQS threshold
bioavailable nickel		annual mean	>4	'good' EQS threshold
available lead	μg L^{-1}	any sample	>14	Just above the baseline maximum
		annual mean	>1.2	'good' EQS threshold
dissolved zinc	μg L^{-1}	any sample	>15	Just above the baseline maximum
bioavailable zinc		annual mean	>10.9	'good' ES threshold

Table 8. The sample location specific trigger threshold values for particular determinands for each of the various watercourses/sample locations.

determinand	Alkalinity	ANC	SRP	TP	diss. Na	diss. Ca	diss. Fe	diss. Al
Units	µeq. L^{-1}	µeq. L^{-1}	µg P L^{-1}		mg L^{-1}	mg L^{-1}	mg L^{-1}	µg L^{-1}
statistic	any sample		mean	any sample				
BF1 & BF2	-	<1	>13	>50	>25	>6	>2.0	>250
CR1	<1	<10	>19	>30	>35	>18	>2.6	>300
DR1	<10	<100	>19	>50	>25	>25	>2.6	>350
EF1	-	<10	>19	>50	>28	>25	>1.0	>350
FL1	-	<1	>14	>50	>28	>10	>1.5	>400
GI1	-	<1	>18	>50	>28	>15	>1.2	>300
GO1	<1	<10	>13	>75	>25	>6	>0.8	>250
GR1	<1	<10	>17	>30	>25	>15	>2.2	>300
KI1	<10	<10	>19	>100	>25	>25	>2.6	>300
LA1	<1	<10	>17	>50	>28	>15	>1.0	>200
LM1	-	<10	>13	>50	>25	>6	>1.6	>200
LU1	-	<10	>13	>50	>25	>10	>3.5	>350
MA1	-	<10	>13	>50	>28	>10	>2.0	>300
PW1 & PW2	<10	<100	>20	>40	>28	>30	>1.0	>300
QU1	<1	<10	>15	>30	>30	>12	>4.0	>300
WE1, WE2, W3	<10	<100	>24	>50	>25	>30	>4.0	>400
WE4	<10	<10	>16	>30	>25	>25	>4.0	>400
WF1	<10	<10	>21	>50	>35	>35	>2.0	>350

Table 9. Trigger threshold values for the physico-chemical variables measured (a) in the field, and (b) in the laboratory for all lochs. The criteria for which threshold values were determined are based on The Scotland River Basin District (Standards) Directions 2014and the full suite of data obtained between the 17th May 2019 and 25th February 2021.

(a)

Determinand	units	statistic	trigger threshold	Criteria for threshold
Dissolved Oxygen	mg L^{-1}	July & August	<7	‘moderate’ ES threshold for salmonid lochs
Electrical Conductivity	µS cm^{-1}	any sample	>1,000	level that indicates saline influence
Turbidity	NTU	any sample	>68	Equivalent to an estimated TSS of 80 mg/L
Acidity	pH	any sample	<4.5	Below the minima for Lamba Water, Loch of Skellister, Maa Water and Truggles Water
			<5.0	Below the baseline minimum for Petta Water and Gossa Water
			<5.5	Below the baseline minimum for Sand Water

(b)

Determinand	units	statistic	trigger threshold	Criteria for threshold
EC	µS cm^{-1}	annual mean	>500	Just above the baseline maximum
Total Suspended Solids	mg L^{-1}	any sample	>100	Just above the baseline maximum
Dissolved Organic Carbon	mg L^{-1}	any sample	>40	Just above the baseline maximum
Alkalinity	µeq. L^{-1}	any sample	<0	Just below the baseline minimum
Acid Neutralising Capacity	µeq. L^{-1}	annual mean	<20	'good' EQS threshold for salmonid lochs
ammonium-Nitrogen (total)	µg N L^{-1}	any sample	>700	The same standard as that used for watercourses
		90^{th} %tile	>300	The 'good' ES for low alkalinity lochs
Total Oxidised Nitrogen	µg N L^{-1}	any sample	>200	Just above the baseline maximum
Soluble Reactive Phosphate	µg P L^{-1}	any sample	>25	Just above the baseline maximum
dissolved iron	mg L^{-1}	any sample	>2.0	Just above the baseline maximum
		annual mean	>1.0	'good' ES threshold for lochs
bioavailable manganese	µg L^{-1}	annual mean	>123	'good' ES threshold for lochs
dissolved aluminium	µg L^{-1}	any sample	>400	Just above the baseline maximum
dissolved arsenic	µg L^{-1}	annual mean	>50	'good' ES threshold for lochs
dissolved cadmium	µg L^{-1}	any sample	>0.45	'good' ES threshold for hardness class 1 (<40 mg $CaCO_3$/L)
		annual mean	>0.08	
dissolved chromium	µg L^{-1}	annual mean	>4.7	'good' ES threshold for lochs
bioavailable copper	µg L^{-1}	annual mean	>1	'good' ES threshold for lochs
bioavailable nickel	µg L^{-1}	annual mean	>20	'good' ES threshold for lochs
bioavailable lead	µg L^{-1}	any sample	>14	'good' ES threshold for lochs
		annual mean	>1.2	
bioavailable zinc	µg L^{-1}	annual mean	>10.9	'good' ES threshold for lochs

Table 10. The sample location specific trigger threshold values for particular determinands for each of the lochs. The criteria for which threshold values were determined are based on a full suite of data obtained between May 2019 and January 2021, and The Scotland River Basin District (Standards) Directions 2014.

determinand	Acidity	Total Phosphorus	dissolved sodium	dissolved calcium
Units	pH (lab)	µg P L^{-1}	mg L^{-1}	mg L^{-1}
statistic	annual mean		any sample	
Gossa Water	<5.9	>13	>25	>4.0
Lamba Water	<5.3	>7	>25	>2.5
Loch of Skellister	<6.0	>13	>30	>4.0
Maa Water	<5.4	>9	>25	>2.5
Petta Water	<6.2	>17	>30	>20.0
Sand Water	<6.4	>20	>35	>35.0
Truggles Water	<5.7	>10	>25	>4.0

10. FIGURES

Figure 1. Map showing the water sampling locations for watercourses and lochs within and immediately surrounding the Viking Energy Wind Farm development site. Stars represent watercourse sample locations and triangles represent loch sample locations. 'Impact' watercourse and loch sample locations are shown in red and 'control' sample locations are in green. Other symbols represent the following features: red line = boundary to the development; yellow circles with a cross = wind turbines; tracks = grey lines; purple dashed lines = watersheds; orange square = construction compounds; brown polygon = SHETL converter platform; pink hashed areas = borrowpit search areas.

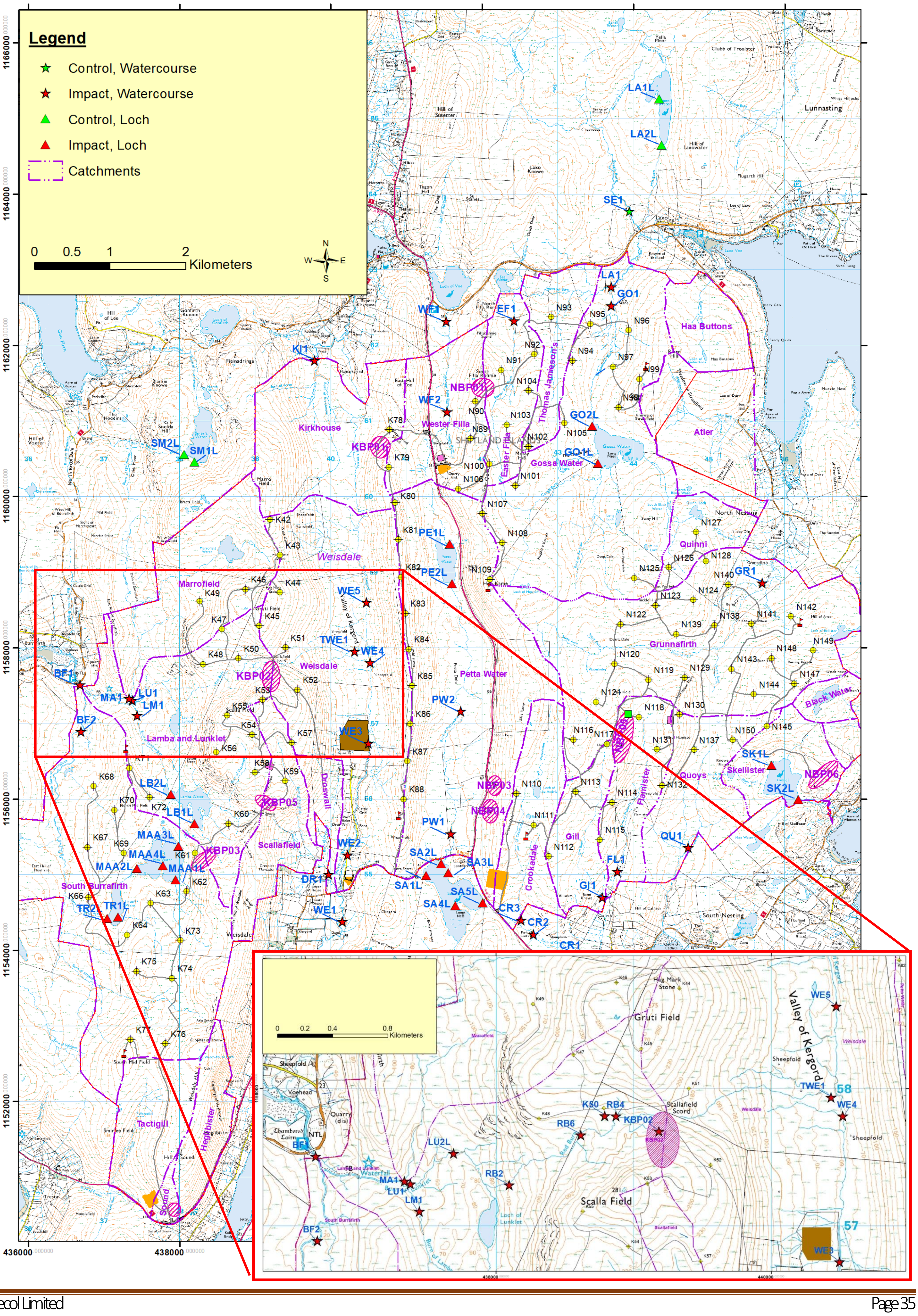


Figure 2. The changes in the laboratory determinations of pH (proton concentration) at the various routine watercourse sample locations draining the Scallafield Scord area and one control (LB1) since January 2024.

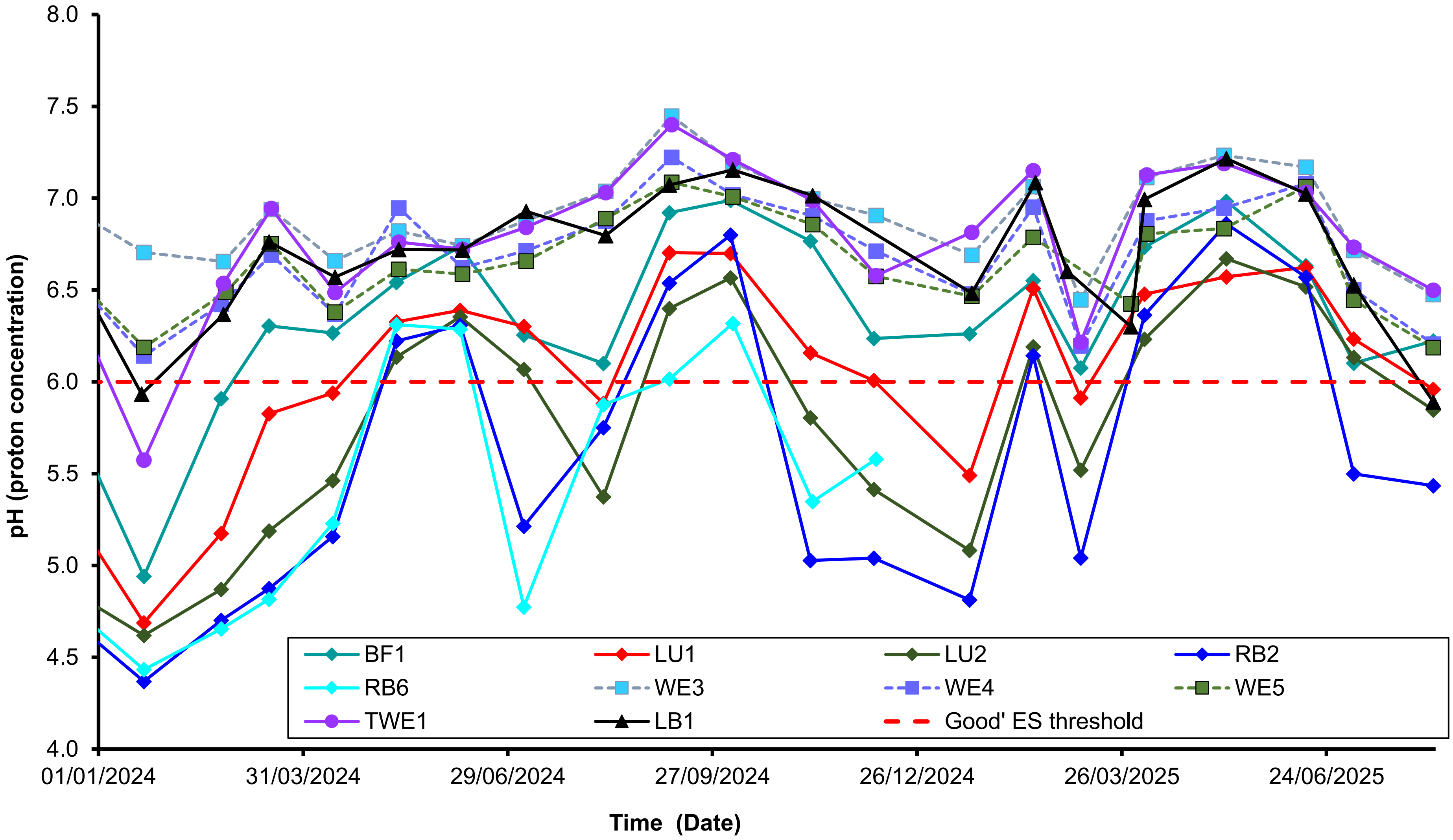


Figure 3. The mean concentration of total oxidised inorganic nitrogen (nitrate + nitrite) for each of the 'impacted' lochs through the construction phase of the Viking Wind Farm. Whiskers represent minimum and maximum values.

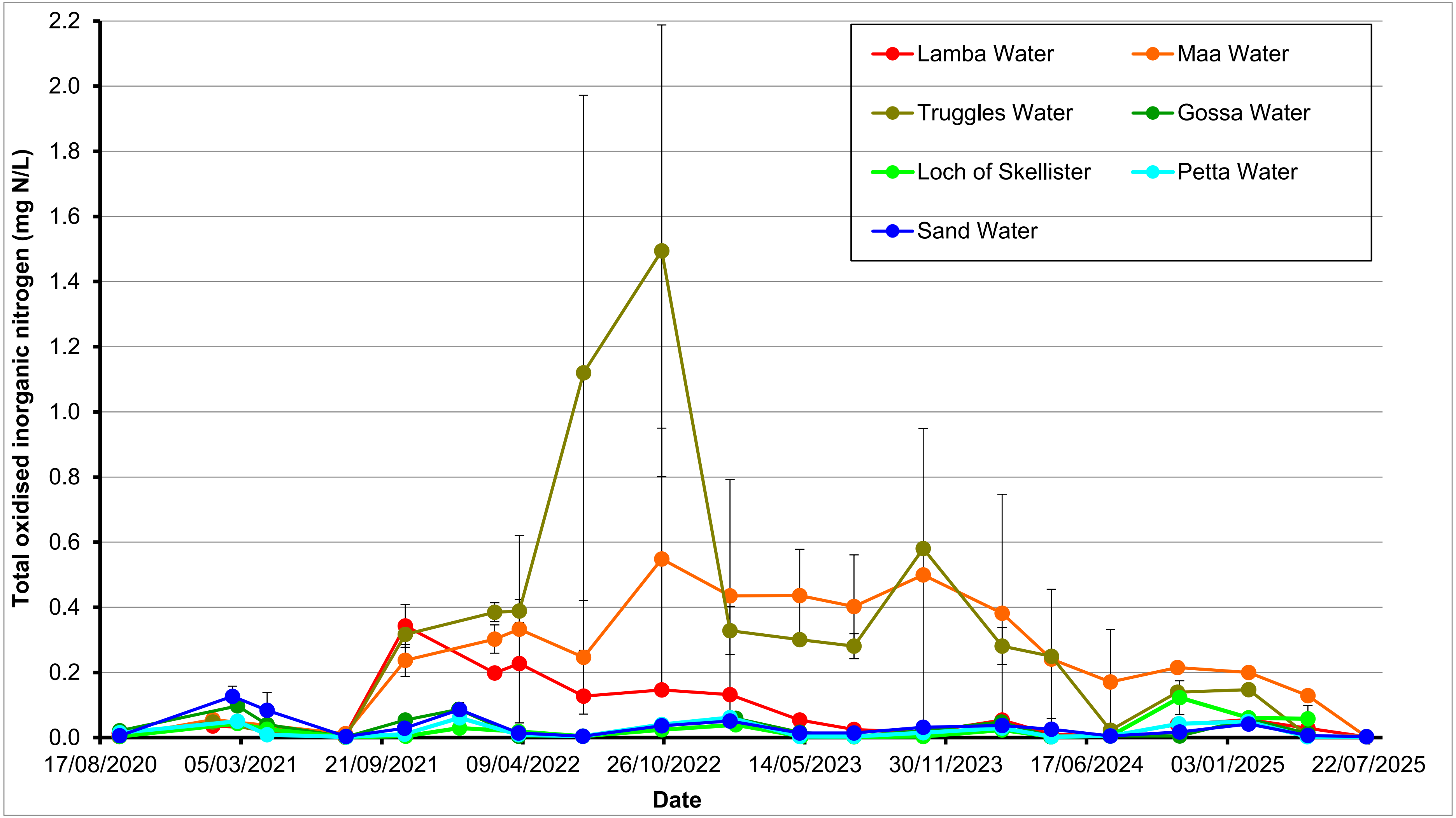


Figure 4. The changes in the concentration of bioavailable manganese in the watercourses draining the Scallafield Scord area and one control (LB1) since January 2023.

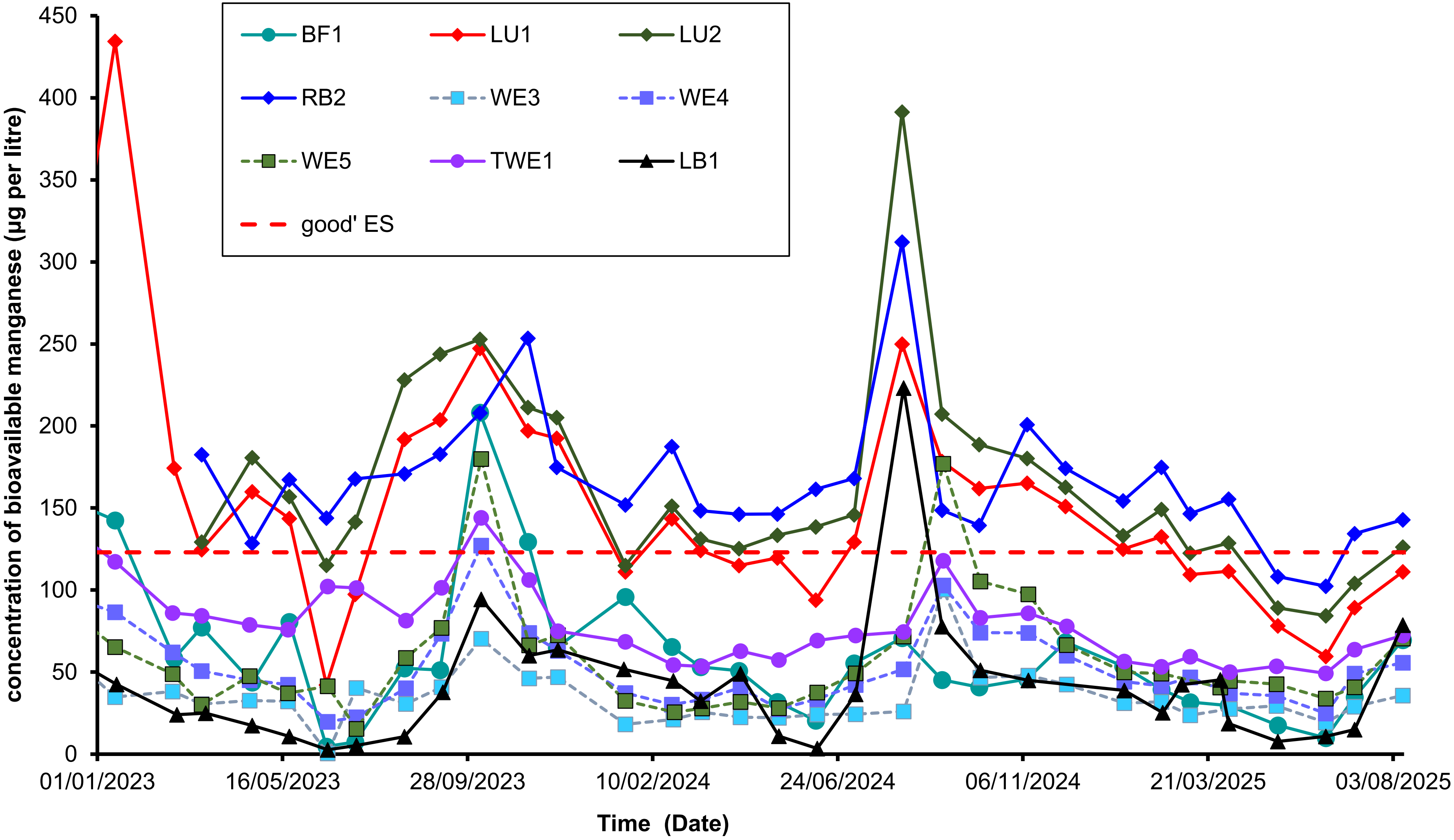
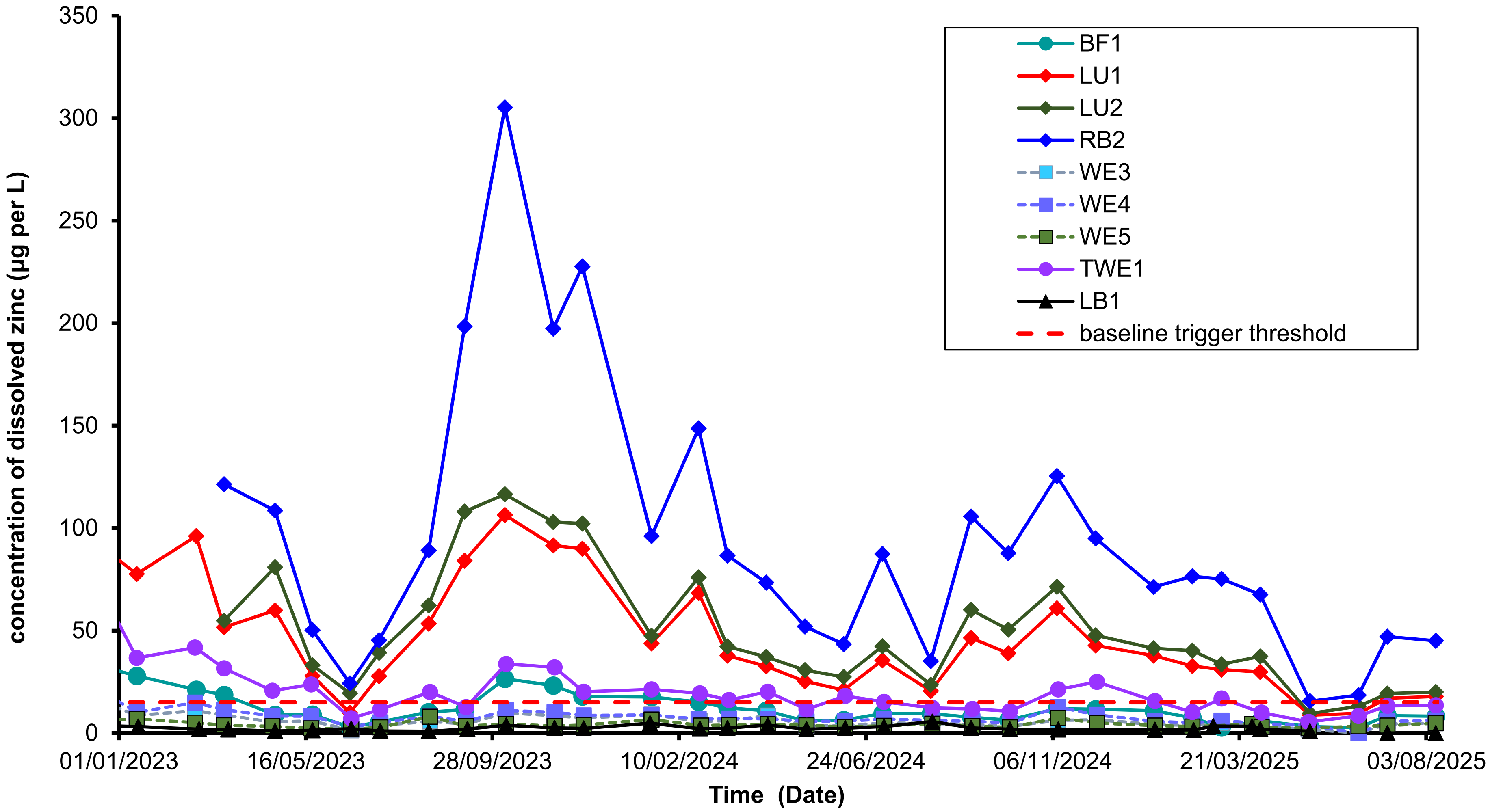
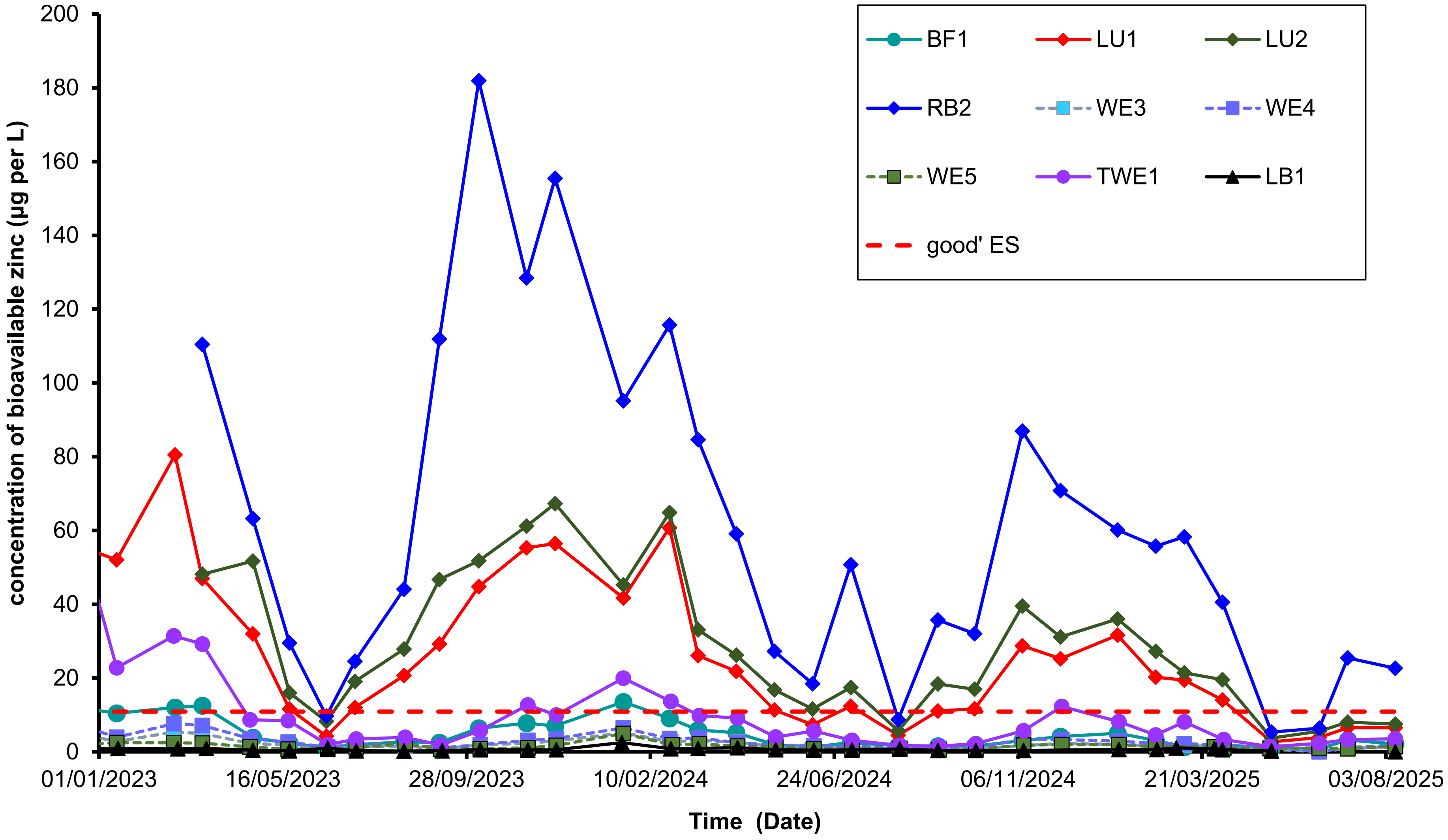


Figure 5. The changes in concentration of (a), dissolved and (b), bioavailable zinc (µg per litre) of the various 'impacted' watercourses draining the Scallafield Scord area and one control (LB1) since January 2023.

(a)



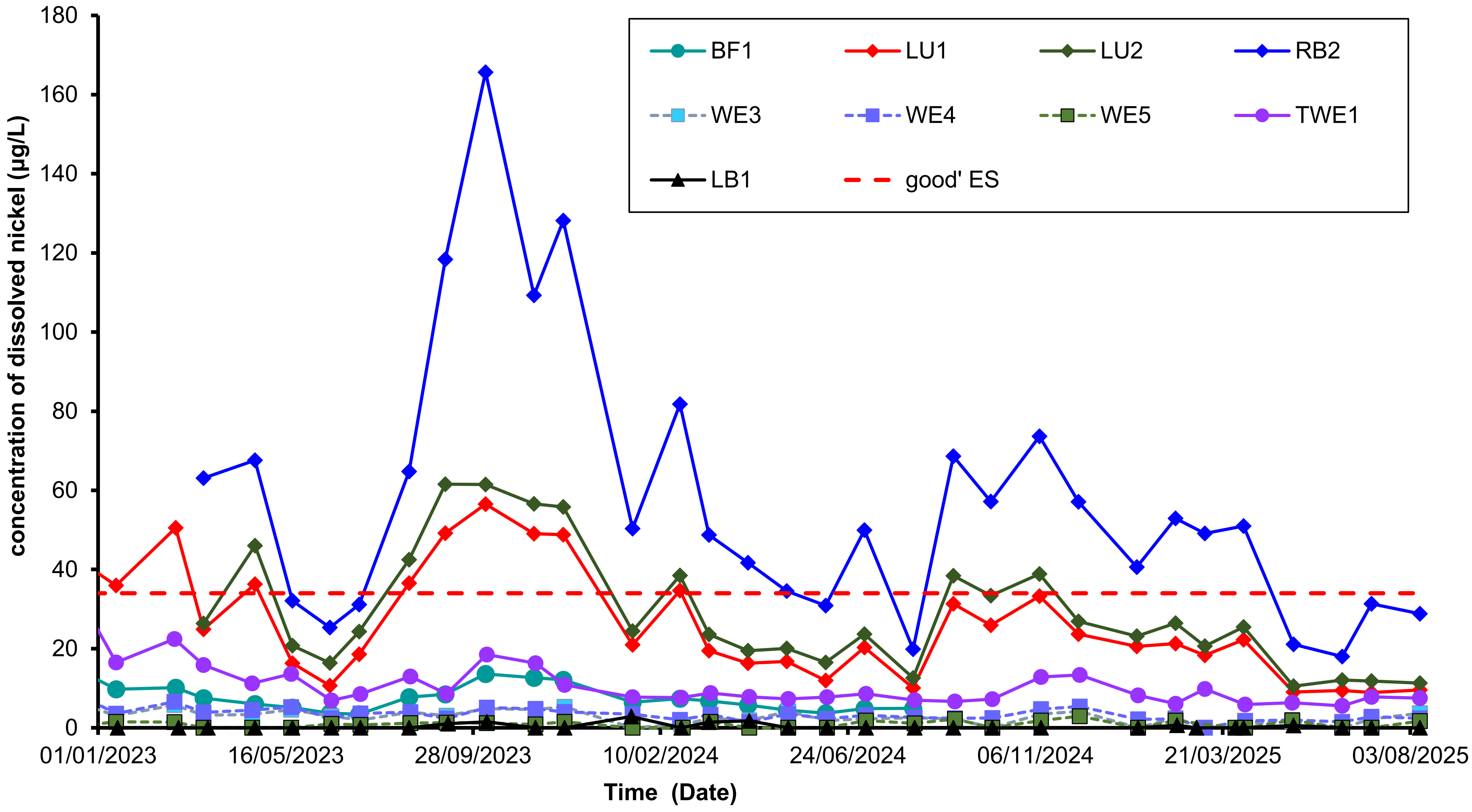
(b)



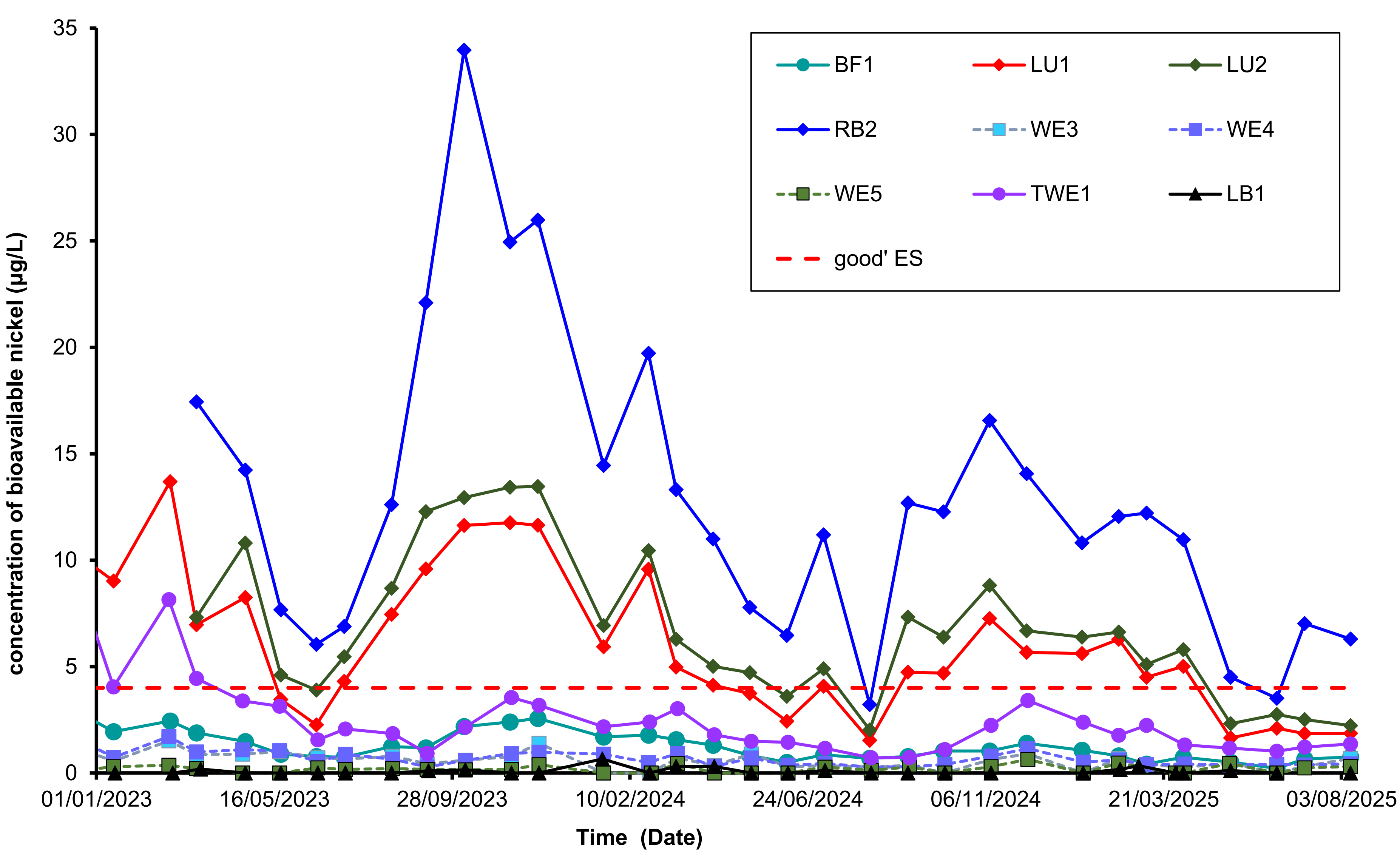
200
180
160
140
120
100
80
60
40
20
0
concentration of bioavailable zinc (µg per L)
01/01/2023
16/05/2023
28/09/2023
10/02/2024
24/06/2024
06/11/2024
21/03/2025
03/08/2025
Time (Date)
BF1
LU1
LU2
RB2
WE3
WE4
WE5
TWE1
LB1
good' ES

Figure 6. The changes in concentration of (a), dissolved and (b), bioavailable nickel (µg per litre) of the various 'impacted' watercourses draining the Scallafield Scord area and one control (LB1) since January 2023.

(a)



(b)



35
30
25
20
15
10
5
0
concentration of bioavailable nickel (µg/L)
01/01/2023
16/05/2023
28/09/2023
10/02/2024
24/06/2024
06/11/2024
21/03/2025
03/08/2025
Time (Date)
BF1
LU1
LU2
RB2
WE3
WE4
WE5
TWE1
LB1
good' ES