VIKING ENERGY WIND FARM

Invertebrate monitoring, autumn 2025

November 2025

Aquaterra Ecology

Waterside Ecology




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1 Background

Changes to the hydrochemistry of Burn of Lunklet occurred during the construction of the Viking Energy Wind Farm. These included periods of very low pH (acidity), reduced concentration of dissolved organic carbon (DOC), increased concentrations of metals including aluminium, zinc, nickel and manganese, and elevated nitrate (TON) (Headley 2023). Some impacts on water quality are still evident, but pH has increased significantly over the past 18 months and metals concentrations have reduced substantially (Headley 2025). These improvements in water quality are likely to have resulted from treatment of water emanating from borrow pit KPB02 on Scallafield Scord and from the capping of the borrow pit with peat. Further details of impacts and mitigations are provided in the monthly and quarterly routine hydrochemical monitoring reports.

By May 2022 substantial deposits of ochreous material were observed on the streambed of Burn of Lunklet (Aquaterra Ecology 2022). Headley (2022) found that the deposits had very high levels metals including iron, manganese, nickel and zinc. The invertebrate community in the stream during spring 2022 was clearly impacted by the changes in water and habitat quality, with declines in invertebrate abundance and numbers of acid intolerant species (Aquaterra Ecology 2022). Sampling in October 2022 showed that the invertebrate fauna of Burn of Lunklet was very severely impacted, with few animals in the samples and a loss of all but the most pollution tolerant taxa (Watt & Emes 2022). By spring 2024 and 2025, there were indications of some limited recovery although invertebrate abundance and diversity remained significantly impacted (Emes & Watt 2024, 2025). The routine spring sampling was supplemented with autumn sampling in 2024 with similar results (Watt & Emes 2024).

Runoff from Scallafield Scord also impacted on the middle reaches of Burn of Weisdale. Here the main recorded changes were increases in calcium, zinc and other metals at monitoring sites WE4 and WE3. These sites are upstream of and adjacent to the converter station respectively. The source of the contaminated runoff is likely to have been turbine base T026, entering Burn of Weisdale via a small tributary just upstream of WE4. Cabling work is also likely to have contributed to some contamination at WE3. Metal concentrations in water samples from Burn of Weisdale have dropped over the past two years and, during the post construction period, have largely remained within the Good environmental standard given in The Scotland River Basin District (Standards) Directions 2014 (Headley et al. in prep).

As noted above, the developer has now put in place mitigation measures aimed at increasing pH and reducing metal concentrations in Burn of Lunklet and Burn of Weisdale. An enhanced monitoring regime has been put in place which includes increased hydrochemical sampling and two-season sampling of freshwater invertebrates. The main aims of the increased monitoring are to:

- Ensure there is up to date knowledge of the current status of water quality and fauna in affected streams;
- Assess the efficacy of mitigation measures in improving conditions for biota.

This report presents data from Burn of Lunklet and Burn of Weisdale from the autumn 2025 sampling period. In addition to providing an update in relation to these watercourses along with appropriate control sites, it also includes assessments of invertebrate fauna at one site (BF1) in Burn of Burrafirth, downstream of the Burn of Lunklet confluence. Site MA1 is Burn of Marrofield Water is included, as results of a recent fish survey at this site were poor (Waterside Ecology 2025). Sites GR1 and GR2 on Burn of Grunnafirth are also included, as some results from the spring invertebrate monitoring were suggestive of poor water quality. However, no significant impacts on water quality were reported from Burn of Grunnafirth during or post-construction (Headley et al in prep), so inclusion in the current sampling period is considered precautionary.

2 Sites and methods

Sampling sites are listed in Table 1. Tables and Figures are located towards the end of this report.

All sites were sampled by kick sampling for a period of 3 minutes, the same technique used for routine invertebrate monitoring around the Viking Energy Wind Farm. Aquaterra Ecology (2020) provides details of sampling methods, analytical methods, biotic indices and classifications. The kick samples were taken on 13th and 14th October 2025. Water levels were low to moderate, providing suitable conditions for sampling.

Table (i) below summarises the indices that were calculated for each sample. Details are provided in Aquaterra Ecology 2020.

Table (i). Water quality indices calculated for each sample.

Index	Description
BMWP & ASPT	Designed for assessment of organic pollution but useful indicators of general degradation. Low score bad. High score good.
WHPT NTAXA	Number of scoring taxa for Water Framework Directive (WFD) compliant assessment. Low score bad. High score good.
WHPT ASPT	Average score per taxon present (WFD compliant). Low score bad. High score good.
Water Chemistry Status	An index of acidity/acidification. 1 = circumneutral; 2 = not significantly acidified; 3 = potentially acidified
PSI	Proportion of sediment intolerant species. Low score bad. High score good.
EPT%	Percent of Ephemeroptera, Plecoptera and Trichoptera. These groups are suggestive of good water quality. Low score bad. High score good.

3 Results and discussion

3.1 Autumn 2025

3.1.1 Burn of Lunklet

Visible ochre deposits remained on the surface substrates at LU1 and LU2 at the time of sampling, but the subjective impression was that sedimentation of streambed substrates at LU1 was less than that observed during the August fish survey. No change was observed at LU2, where thick ochre deposition was very apparent. Despite some possible improvement at LU1, dense silty deposits remained present under and around stones and clouds of red-brown sediment were released when substrates were disturbed during kick sampling. Macrophytes were absent from both sites.

Invertebrate numbers remained low at LU1 and LU2, with totals of 22 and 21 individual animals per sample respectively (Table 2). The paucity of invertebrates means that the calculated values for some indices, in particular ASPT, WHPT-ASPT and PSI should be treated with caution. ASPT was classified as B (fair) at both sites while WHPT-ASPT was classified as G (good) and M (moderate) at LU1 and LU2 respectively. Although potentially unreliable due to the small numbers of animals in the samples, these classifications do reflect the fact that some relatively pollution intolerant species were present. The high-scoring stonefly *Leuctra hippopus* was present at LU1. This species is acid tolerant, but requires low levels of organic pollution. The Trichoptera species *Rhyacophila dorsalis* and *Plectronemia conspersa* were also present in the samples. Both carry relatively high scores for ASPT. The ASPT metric was developed primarily to assess organic pollution, but is also used as a general indicator of degradation.

PSI scores for sedimentation gave classifications of 'slight' sedimentation, clearly at odds with the visible condition of the streambed.

Values based on the numbers of invertebrates and numbers of taxa are likely to be realistic. BMWP classifications, based on the Scottish River Classification scale used by SEPA, were C (poor) at both sites. The WHPT-NTAXA classifications, based on number of scoring taxa present, were B (bad) and M (moderate) at LU1 and LU2 respectively.

Both sites were classified at 2 for Water Chemistry Status, suggesting the stream is no longer classified as significantly acidified. The score was due to the presence of the mayfly species *Baetis rhodani* at both sites. No other acid intolerant species were present (Appendix 8.2).

3.1.2 Burn of Marrofield Water

At the time of sampling Burn of Marrofield Water was running clear. There were no visible silt or ochre deposits and the silt plume when sampling was minimal. Algal cover was low at 5%.

Total number of invertebrates at MA1 was 61 (Table 2). The sample was dominated by EPT[1] species (Table 2, Figure 1) with a high proportion of Trichoptera (caddisflies).

A total of 14 taxa were present of which 11 scored for BMWP and the BMWP score of 59 is classified as Fair. ASPT was 5.36 (A2 or Good). Where sufficient animals are present, ASPT is generally considered a more reliable index than BMWP. The Water Framework Directive compliant WHPT-NTAXA and WHP-ASPT classifications (Table 4) were both H (high). The PSI of 73.8 indicates slightly sedimented conditions.

Together, the scores and indices from MA1 suggest good water quality and substrate conditions in Burn of Marrofield Water.

3.1.3 Burn of Burrafirth

Site BF1 is downstream of Burn of Lunklet and therefore receives run-off from KPB02, albeit in a more diluted form than Burn of Lunklet itself. Changes in water chemistry, including elevated levels of metals attributable to KPB02 have been recorded at BF1. No changes to physical habitats were recorded at BF1 during the current survey and the site remains dominated by clean, stable cobble and boulder substrates.

No invertebrates were present in the sample from BF1. As a result, it is not possible to calculate indices. No pollution or other events have been recorded that would explain the lack of invertebrates.

3.1.4 Burn of Weisdale

Three sites were sampled in Burn of Weisdale, WE2, WE3 and WE4. WE5, which was upstream of WE4 and the “TWE tributary” draining Scallafield Scord was not sampled as suitable habitat is no longer present in that reach.

A light coating of ochre was visible on the stones throughout the reach between the TWE tributary and WE3. This coating was much thinner and lighter than that noted in Burn of Lunklet and only moderate plumes of red-brown sediment were released when sampling at WE4. No ochre was present at WE2 where substrates were clean, with minimal release of silt or fines when disturbed. Some colmation[2] was apparent at WE3 and the substrate was difficult to disturb in places.

During the current survey, the total number of invertebrates sampled at WE2, WE3 and WE4 were 103, 26 and 118 respectively. The sample size at WE3 is unusually low but diversity remained within the expected range with 11 taxa present. The Water Framework Directive WHPT-NTAXA classification was H (high) at all three sites.

EPT percent was just over 30% at all three sites in Burn of Weisdale. This is lower than would be expected for clean, upland watercourses. PSI classifications suggested moderate sedimentation at all sites.

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[1] Ephemeroptera, Plecoptera and Trichoptera species indicative of clean unpolluted water.

[2] Colmation is a process whereby fine sediment accumulates within coarser bed substrate. It can lead to clogging and binding of streambed material.

BMWP was classified as B (fair) at WE2 and as C (poor) at WE3 and WE4. The SEPA ASPT scores, generally considered more stable and reliable than BMWP, ranged from 4.8 at WE4 to 5.4 at WE2 and WE3 (Table 2). WE4 was classified at B for this metric and the other two sites as A2 (good). WHPT-ASPT classifications were H at WE2 and G at the other two sites (Table 4).

Overall, the data are suggestive of moderate to good water quality, with some concerns over low EPT scores and potential streambed impacts from fine sediment deposition. Comparisons with baseline and other data are considered further in section 3.2.

3.1.5 Burn of Grunnafirth

Two sites were sampled in Burn of Grunnafirth, GR1 and GR2. Substrates at both sites were clean and free from visible silt or ochre at the time of sampling. A little alga (< 5%) was present at GR1 but macrophytes were absent at GR1.

Only 27 invertebrates were present in the sample from GR1, but the sample was moderately diverse with 11 taxa present. Ten of these taxa score on the WHPT classification and WHPT-NTAXA at GR1 was classified as H (high). The sample at GR2 was larger with 72 invertebrates and 15 taxa, of which 10 score on the WHPT classification; WHPT-NTAXA was also classified as H.

EPT percentages were 44% and 51% at GR1 and GR2 respectively indicative of good to moderate water quality. PSI scores and classifications were indicative of moderate sedimentation, but this seems at odds with notably clean substrate, which was free of silt and with minimal sand.

BMWP scores were under 50 at both sites, resulting in classifications of C (poor). However, the SEPA ASPT classifications were both A2 (good) while the WHPT-ASPT classifications were G (good) and H (high) at GR1 and GR2 respectively.

Despite relatively low invertebrate density, the autumn 2025 samples from Burn of Grunnafirth suggest ongoing good water quality.

3.1.6 Control sites

3.1.6.1 Seggie Burn

Two sites were sampled in Seggie Burn, SB1 and SB2. Substrates were clean at both sites, without ochre. Silt release during kick sampling was minimal. Site SE1, the more downstream of the two, has become more difficult to sample in recent years due to armouring. Substrates are largely composed of immobile cobble and boulder that is difficult to move during kick sampling. As a result, the sample from SE1 was collected as a composite from of several small patches of streambed.

Total invertebrate numbers at SE1 and SE2 were 66 and 48 respectively. Twelve taxa were present at SE1 and 13 at SE2. The WHPT NTAXA classifications were G and H at SE1 and SE2 respectively.

EPT was rather low at SE1, at 35% of the sample, but over 50% of the sample at SE2 comprised EPT species. As there are no significant intervening tributaries or sources of pollution between the two sites, it is likely that the low EPT at SE1 reflects the physical habitat rather than any water quality problems. PSI at SE1 was relatively low at 34.9 (Table 2), indicating moderately sedimented conditions. PSI at SE2 was higher (54%), indicating only slight sedimentation.

The BMWP classifications for both sites were B (fair) while the SEPA ASPTs were both A2 (good). The WHPT-ASPT indices were G and H at SE1 and SE2 respectively.

3.1.6.2 Burn of Laxobigging

The more downstream site in Burn of Laxobigging (LB1) showed little morphological change compared with previous visits. However, some spate-induced changes were evident at LB2, with the erosion of a point bar and slight reduction in the shallow, run and riffle area.

Invertebrate numbers were exceptionally low at both sites, with only 14 in the sample at LB1 and 6 at LB2 (Table 2). With such small samples, the scores for some indices are likely to be unreliable.

EPT proportions at both sites were low, at 29% and 33% at LB1 and LB2 respectively. Half of the sample at LB2 comprised oligochaete worms (n = 3) the rest being composed of a single chironomid and two caddisfly larvae (Appendix 8.1).

Numbers of taxa were low, with 8 at LB1 and 4 at LB2 and the WHPT NTAXA classifications were both B (bad). The SEPA BMWP classifications were both C (poor), also reflecting low invertebrate numbers and diversity.

SEPA ASPT classifications were A2 (good) and B (fair) at LB1 and LB2 while the WHPT-ASPT classifications were both G (good). Neither classification is likely to be reliable for such small samples. This is also true of PSI, which was classified at moderate for both sites (Table 4).

It is possible that the low numbers of invertebrates at Burn of Laxobigging resulted from a spate in the weeks preceding survey. However, this is conjecture and it is worth noting that invertebrate numbers at both sites during spring and autumn have been declining in recent years (Figure 2).

3.2 Comparison with baseline and previous data

3.2.1 Burrafirth catchment

The total lack of invertebrates in the sample from BF1 cannot easily be explained. Although water level had been moderately high in the weeks preceding survey, potentially displacing some invertebrates, this would not be expected to result in total absence of fauna from the routine sample area. No sources of pollution were evident that could have had such an impact on stream fauna. It is likely that the result is an anomaly, but clearly the site should be re-sampled in the coming year.

The main focus of concern in the Burrafirth catchment has been Burn of Lunklet, as it is known to have suffered serious contamination. Water quality has improved over the past 18 months. In particular, pH has risen and at the sample sites the stream is no longer significantly acidified. This is reflected in the continuing presence of *Baetis rhodani* (a common, acid-intolerant mayfly) in both samples from this watercourse (LU1 and LU2). There has also been an upswing in invertebrate numbers and diversity (Figure 3). Streambed impacts remain a concern and it is possible that this, rather than water quality per-se, may currently be the limiting factor for recovery. Headley (2025) presented data suggesting that the current mitigation put in place to improve water quality, comprising treatment with crushed shells, have been effective at raising pH but less effective at removing some metals. Plans are in place to improve metal retention in the treatment areas, but it is not known when or if the existing streambed contamination might clear.

The current data from site MA1 on Burn of Marrofield Water indicate little change from baseline conditions. Classifications for all major indices (Table 4) remain as per baseline and suggest good water quality. The total number of invertebrates sampled in autumn 2025 was substantially lower than the autumn baseline, but as this was the case at all but one sample site (WE4) this is not a major concern.

3.2.2 Weisdale catchment

Physical habitats at WE2 seemed largely unchanged when compared with baseline. However, the estimated proportions of pebble and cobble at WE4 have declined from 60% and 20% respectively during the 2019 baseline to 40% and 10% during the current study. The proportion of sand and gravel has risen from 17% to 40% over that period. These changes may affect the composition of invertebrate communities and might explain the relatively low PSI value at this site.

EPT proportions at all three sites have declined substantially compared with baseline (Table 3), but, as noted above, this was also the case in Seggie Burn (SE1 and SE2), the most appropriate control for Burn of Weisdale, and at most other sites. This may suggest a regional fluctuation in in faunal composition in late 2025, rather than any negative change due to habitat changes or construction effects.

The total numbers of invertebrates in samples from Burn of Weisdale declined compared to baseline. But, again, this was also the case at other sites including controls, suggesting the shift is unrelated to wind farm construction or operation. Despite the smaller sample sizes and decline in EPT proportions, the biomonitoring classifications (Table 4) showed very few changes compared to baseline and the data suggest that water quality remains good.

3.3 Burn of Grunnafirth and Burn of Marrofield Water

Sampling of these two watercourses was a precaution due to concerns over low scores on some indices in spring or poor results from summer fish surveys. Data from autumn 2025 suggest that water quality in both remains good.

3.4 Control streams

Although total number of invertebrates at SE1 and SE2 in Seggie Burn declined compared with baseline the numbers of taxa present were comparable and there were few changes to classifications. WHPT ASPT declined by one class from H to G at SE1. Shifts of one class are commonly observed. The WHPT ASPT at SE2 remained H. EPT percent declined at both sites and the decline at SE1 was particularly large, from 87.5% EPT species in the autumn baseline to 34% in the current survey. This clearly suggests that observed declines in EPT at some impact sites cannot be assumed to indicate construction effects.

Data from Burn of Laxobigging are much more difficult to interpret. As noted above (section 3.1.6.2 and Figure 2) there seems to have been a decline in invertebrate numbers in this stream since 2020. Numbers in current samples were extremely low and resulting indices are unlikely to be reliable. No changes to hydrochemistry have been observed that would result in such a decline in invertebrate fauna (Headley et al. 2025). The autumn 2025 data may be an anomaly and both sites should be re-sampled in spring 2026.

4 Conclusions and recommendations

4.1 Conclusions

- Observations during summer 2025 and the survey suggest that streambed conditions in the Burn of Lunklet remain poor. The invertebrate fauna remains impacted with fewer taxa and invertebrates present than would be expected. Nevertheless, recent improvements in water quality have been associated with some limited recovery of the invertebrate assemblage. The continued presence of *Baetis rhodani*, one of the acidity indicator species has coincided with the increased pH in the stream resulting from shell treatments and capping of the borrow pit. The number of taxa at LU2 has risen since 2023.
- Interpretation of data in autumn 2025 is made difficult by the severe decline in invertebrate numbers in one of the control streams, Burn of Laxobigging. Time series data suggest this decline has been underway for some time, but the cause is unknown. Similarly, there is no clear explanation for the total absence of invertebrates in the sample from BF1.
- Most water quality index scores and classifications from WE3 and WE4 are now comparable with baseline. This is consistent with the improving quality of runoff from the east side of Scallafield Scord.

4.2 Recommendations

- Efforts to improve the capture the capture of metals in the water treatments on Scallafield Scord should continue.

- Autumn data in 2024 and 2025 have added little to the interpretation of potential impacts over and above those collected in the spring of each year. Furthermore, heavy rains in September and October can make interpretation of autumn data difficult. Autumn sampling should be suspended unless either: i) substantial changes are made to the shell treatments after the spring sampling period, or ii) spring data indicate that autumn sampling is required.
- Spring sampling should continue at BF1, BF2, LU1, LU2, WE2, WE3 and WE4 along with control sites in Seggie Burn and Burn of Laxobigging. The need or otherwise for spring sampling at any other sites should be identified based on the ongoing review of seven years of monitoring data (Headley et al. in prep).

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6 Tables

Table 1 Sampling sites and rationale for sampling at each, autumn 2025

Site	Watercourse	NGR	Autumn baseline data	Other autumn sampling	Rational for inclusion in current round of sampling
GR1	Burn of Grunnafirth	HU 45707 58838	2019	None	Poor results from spring invertebrate sampling 2025 and low fish density summer 2025
GR2	Burn of Grunnafirth	HU 45248 58108	2019	None	Poor results from spring invertebrate sampling 2025
BF1	Burn of Burrafirth	HU 36686 57507	2019	2022, 2023, 2024	Receives runoff from Burn of Lunklet resulting in increase in metals concentrations.
LU1	Burn of Lunklet	HU 37380 57302	2019	2021, 2022, 2023, 2024	Reduced pH and increased metals. Metal contamination of sediments.
LU2	Burn of Lunklet	HU 37724 57519	None	2021, 2022, 2023	Low pH and high levels of metals. Metal contamination of sediments.
MA1	Burn of Marrofield Water	HU 37337 57310	2019	2023	Elevated levels of aluminium and zinc in 2022-23. Low fish density summer 2025.
WE2	Burn of Weisdale	HU 40222 55270	2019	2020, 2022, 2023, 2024	Few impacts on water quality – well downstream of contaminated runoff. Important reach for Atlantic salmon.
WE3	Burn of Weisdale	HU 40511 56722	2019	2020, 2022, 2023, 2024	Elevated metals in some samples. Light ochre deposition.
WE4	Burn of Weisdale	HU 40525 57790	2019 & 2020	2022, 2023, 2024	Elevated metals. Moderate ochre deposition. Approx. 100 m downstream of contaminated TWE tributary.
SE1	Seggie Burn	HU 43950 63766	N/A	2019, 2020, 2021, 2022, 2023, 2024	Control site with similar baseline chemistry to Burn of Weisdale
SE2	Seggie Burn	HU 43609 64718	2019	2023, 2024	Control site with similar baseline chemistry to Burn of Weisdale
LB1	Burn of Laxobigging	HU 41416 72398	N/A	2019, 2020 & 2021, 2023, 2024	Control site
LB2	. Burn of Laxobigging	HU 41416 72398	2019	2020, 2023, 2024	Control site

Green fill indicates control sites

Table 2 Biological Monitoring Scores and Classifications autumn 2025

Site	Total Invertebrates (n)	Number of Taxa (n)	BMWP score	BMWP class SEPA	Scoring taxa (n)	ASPT score	ASPT class SEPA	WHPT BMWP	WHPT scoring taxa (n)	WHPT ASPT	PSI	Water Chemistry status	EPT (%)
GR1	27	12	40	C	8	5	A2	56.1	10	5.61	53.8	1	44.44
GR2	72	15	48	C	9	5.33	A2	59.3	10	5.93	55.0	1	51.39
BF1	0	0	0	D	0	0.00			0				
LU1	22	6	24	C	5	4.80	B	28.1	5	5.62	63.6	2	81.82
LU2	21	8	33	C	7	4.71	B	36.1	7	5.16	66.7	2	57.14
MA1	61	14	59	B	11	5.36	A2	74.5	11	6.77	71.4	2	73.77
WE2	103	13	59	B	11	5.36	A2	72.5	12	6.04	60.0	1	32.04
WE3	26	11	43	C	8	5.38	A2	52.5	9	5.83	56.3	1	34.62
WE4	118	14	43	C	9	4.78	B	61.7	11	5.61	44.4	1	30.51
SE1	66	12	51	B	10	5.10	A2	58.8	10	5.88	55.6	1	34.85
SE2	48	13	65	B	11	5.91	A2	75.2	12	6.27	72.2	1	54.17
LB1	14	8	20	C	4	5.00	A2	32.5	6	5.42	50.0	2	28.57
LB2	6	4	17	C	4	4.25	B	22.1	4	5.53	50.0	3	33.33

Table 3 Biomonitoring scores, comparison of autumn baseline and autumn 2025

Site	Number of taxa (n)		BMWP Score		ASPT score		WHPT scoring taxa (n)		WHPT ASPT		PSI Score		Water Chemistry Status		EPT %	
	Baseline	Autumn 2025	Baseline	Autumn 2025	Baseline	Autumn 2025	Baseline	Autumn 2025	Baseline	Autumn 2025	Baseline	Autumn 2025	Baseline	Autumn 2025	Baseline	Autumn 2025
GR1	6	12	22	40	5.50	5.00	4	10	6.18	5.61	66.7	53.8	2	1	45.8	44.4
GR2	11	15	42	48	5.25	5.33	8	10	5.98	5.93	66.7	55.0	2	1	69.2	51.4
BF1	14	0	49	0	5.44	0.00	12	0	6.71	N/A	73.9	N/A	2	N/A	93.2	N/A
LU1	12	6	46	24	5.75	4.80	9	5	6.42	5.62	65.0	63.6	2	2	75.5	81.8
LU2	N/A	8	N/A	33	N/A	4.71	10	7	N/A	5.16	N/A	66.7	N/A	2	N/A	57.1
MA1	18	14	62	59	5.17	5.36	13	11	6.42	6.77	66.7	71.4	2	2	95.1	73.8
WE2	16	13	67	59	5.58	5.36	13	12	6.30	6.04	68.0	60.0	1	1	67.3	32.0
WE3	13	11	45	43	5.00	5.38	11	9	5.77	5.83	62.5	56.3	2	1	78.5	34.6
WE4	16	14	49	43	5.44	4.78	10	11	6.14	5.61	56.5	44.4	1	1	80.4	30.5
SE1	14	12	51	51	5.67	5.10	8	10	6.88	5.88	71.4	55.6	2	1	87.5	34.8
SE2	14	13	57	65	5.18	5.91	11	12	6.40	6.27	68.2	72.2	1	1	76.8	54.2
LB1*	18	8	74	20	5.69	5.00	15	6	6.31	5.42	69.2	50.0	1	2	69.0	28.6
LB2*	15	4	67	17	6.09	4.25	12	4	6.65	5.53	83.3	50.0	2	3	75.5	33.3

*Values for LB1 and LB2 are from autumn 2020 as 2019 data were impacted by spates

Table 4 Total invertebrates and biomonitoring classifications, comparison of autumn baseline and autumn 2025

Site	Total invertebrates in sample		BMWP class		ASPT class		WHPT-NTAXA class		WHPT ASPT class		PSI class	
	Baseline	Autumn 2025	Baseline	Autumn 2025	Baseline	Autumn 2025	Baseline	Autumn 2025	Baseline	Autumn 2025	Baseline	Autumn 2025
GR1	48	27	C	C	A2	A2	B	H	H	G	Slight	Moderate
GR1	117	72	C	C	A2	A2	H	H	H	H	Slight	Moderate
BF1	322	0	C	N/A	A2	N/A	H	B	H	N/A	Slight	N/A
LU1	139	22	C	C	A2	B	H	B	H	G	Slight	Slight
LU2	N/A	21	N/A	C	N/A	B	N/A	M	N/A	M	N/A	Slight
MA1	445	61	B	B	A2	A2	H	H	H	H	Slight	Slight
WE2	205	103	B	B	A2	A2	H	H	H	H	Slight	Moderate
WE3	121	26	C	C	A2	A2	H	H	H	G	Slight	Moderate
WE4	107	118	C	C	A2	B	H	H	H	G	Moderate	Moderate
SE1	160	66	B	B	A2	A2	H	H	H	G	Slight	Moderate
SE2	177	48	B	B	A2	A2	H	H	H	H	Slight	Slight
LB1	129	14	A2	**C**	A2	A2	H	B	H	G	Slight	Moderate
LB2	106	6	B	C	A1	B	H	B	H	G	Unsedimented	Moderate

Red font indicates declines of more than two classifications, the proposed threshold for detection of potential impact

7 Figures

Figure 1. Invertebrate groups: percentages of sample by number autumn 2025.

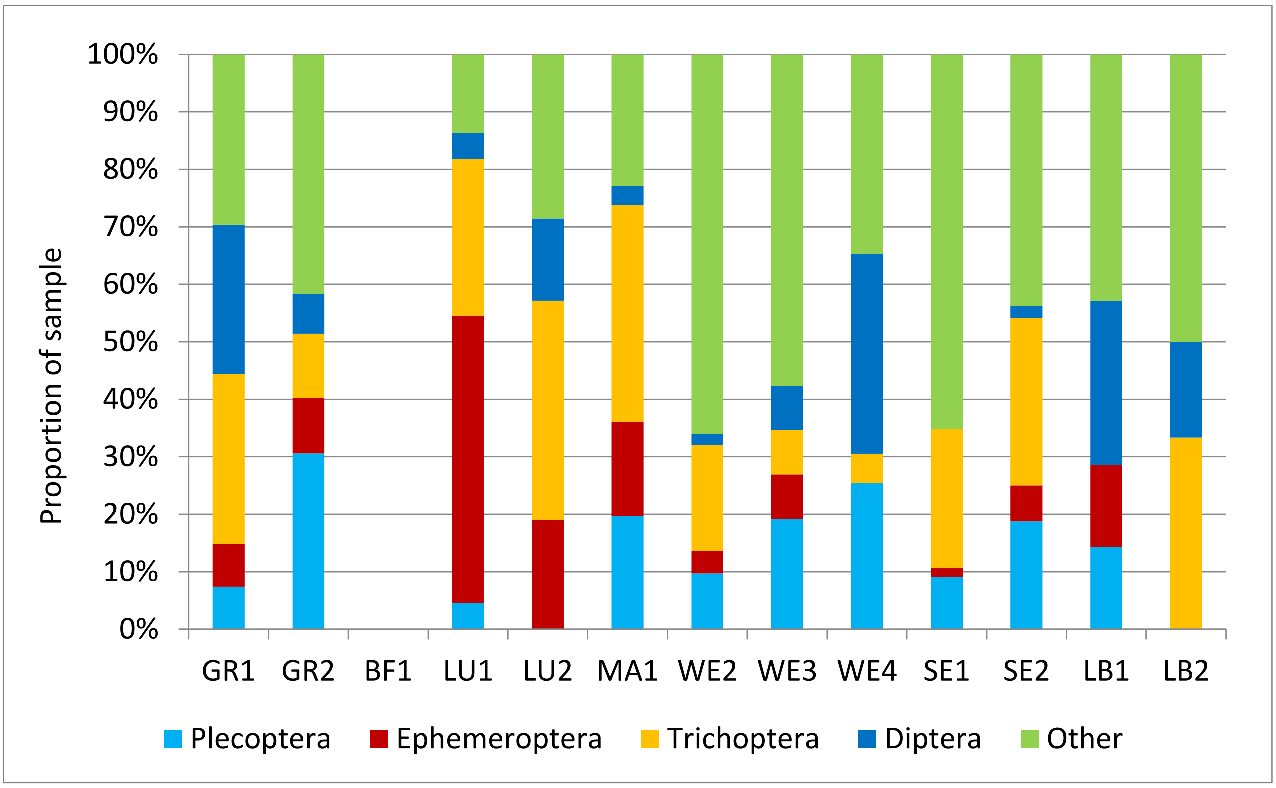


Figure 2. Total number of invertebrates in spring and autumn samples 2019 to 2025, Burn of Laxobigging

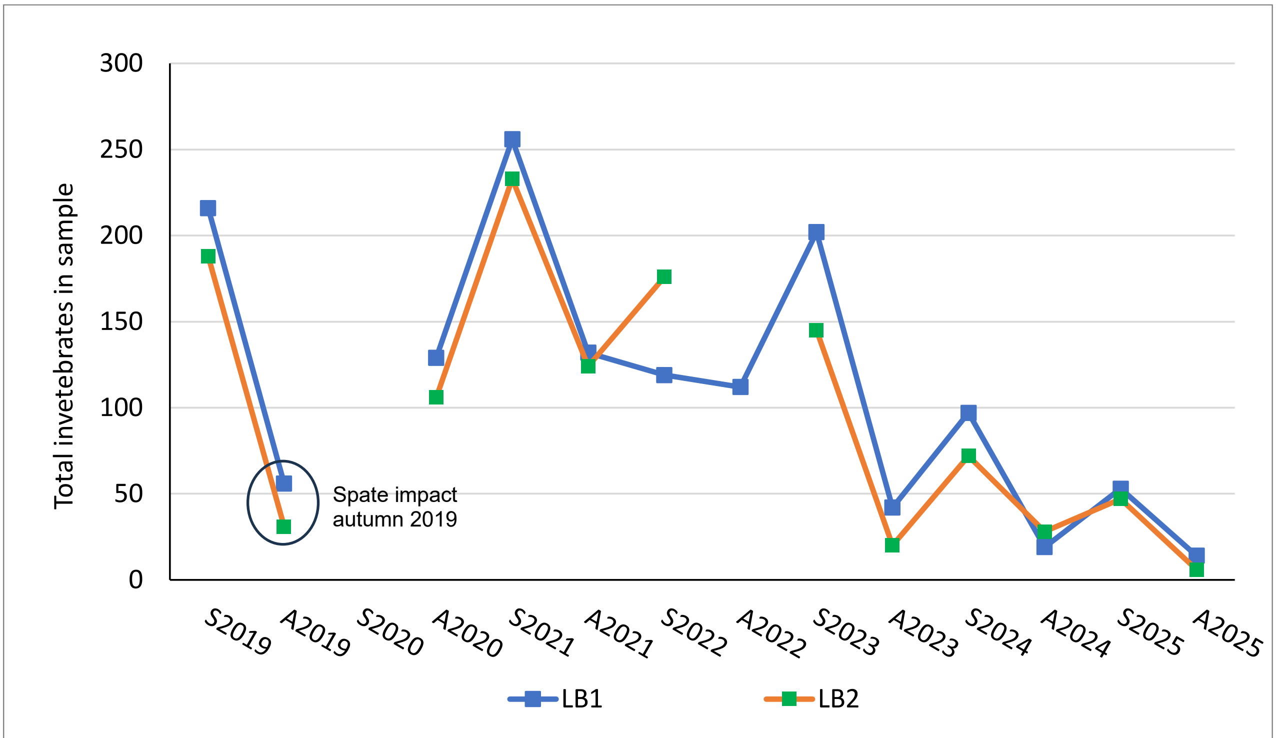


Figure 4. Total number of invertebrates in spring and autumn samples 2019 to 2025, Burn of Lunklet and BF1.

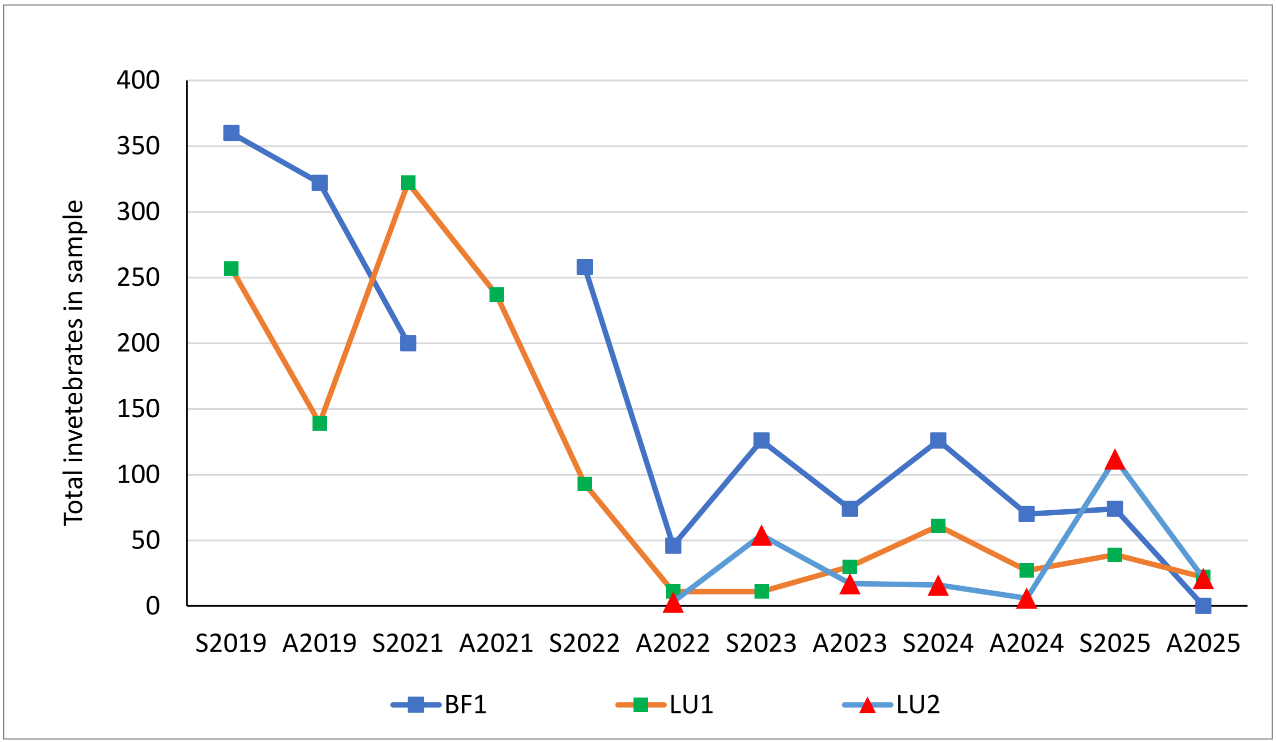
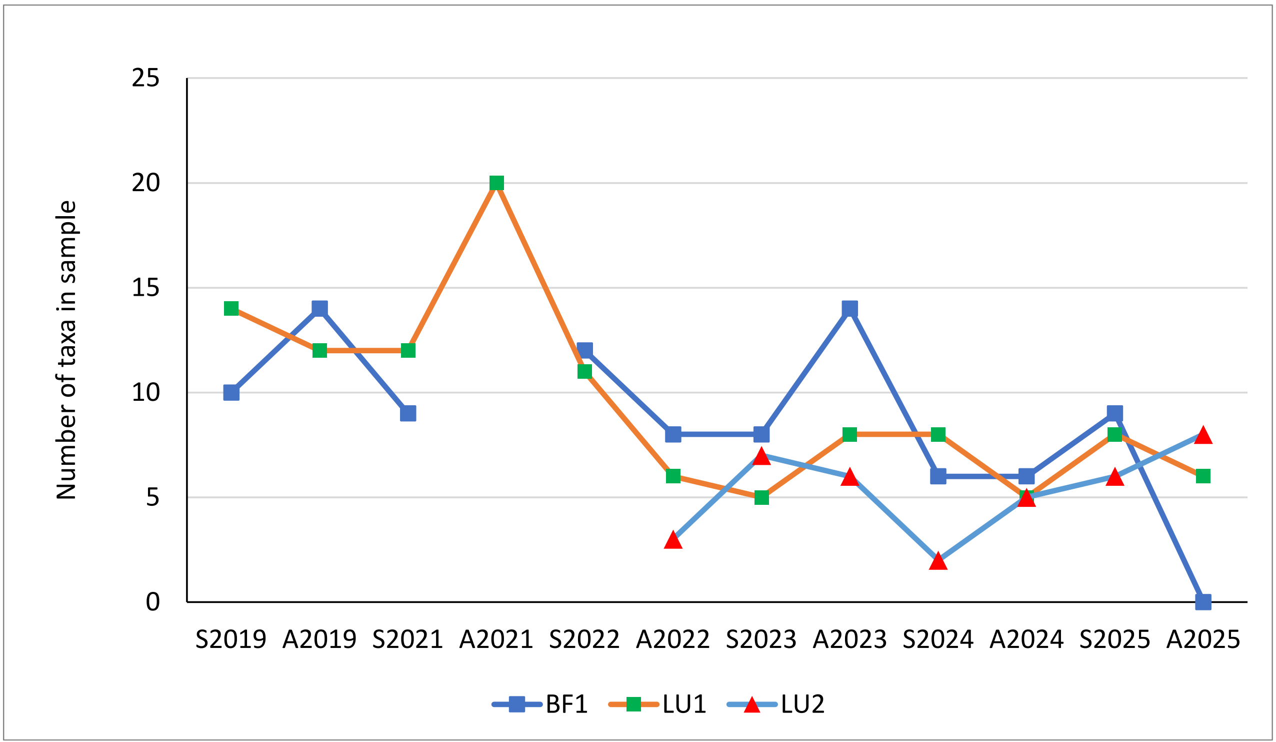


Figure 5. Total number of taxa in spring and autumn samples 2019 to 2025, Burn of Lunklet and BF1.



8 Appendices

8.1 Invertebrates present in samples autumn 2025

Taxon	GR1	GR2	BF1	LU1	LU2	MA1	WE2	WE3	WE4	SE1	SE2	LB1	LB2
Plecoptera													
Chloroperlidae													
Chloroperla torrentium		1				1		1			1		
Leuctridae													
Leuctra sp.													
Leuctra hippopus		17		1		10	10	3	26	6	5	1	
Leuctra inermis	2	4				1		1	4		3	1	
Ephemeroptera													
Baetidae													
Baetis rhodani	2	7		11	4	10	3	2		1	3	2	
Caenidae													
Caenis sp.							1						
Trichoptera													
Hydropsychidae													
Hydropsyche siltalai						10	14		2	10	5		
Hydroptilidae													
Hydroptila sp.	1	1								1			1
Oxyethira sp.		1									2		
Limnephilidae													
Potamophlax sp.					1		1			1	1		
Philopotamidae													
Philopotamus montanus													1
Polycentropidae													
Plectronemia conspersa					1	2							
Polycentropus flavomaculatus	4					5	1		2	3	3		
Psychomyiidae													
Metalype fragilis	1									1			
Rhyacophilidae													
Rhyacophila dorsalis	2	6		6	6	6	3	2	2		3		
Diptera													
Ceratopogonidae	1							1	6				
Chironomidae	4	1		1	1	1			21				1
Empididae	2	1					1		1			1	

Taxon	**GR1**	**GR2**	**BF1**	**LU1**	**LU2**	**MA1**	**WE2**	**WE3**	**WE4**	**SE1**	**SE2**	**LB1**	**LB2**
Limoniidae		1											
Muscidae													
Limnophora sp.											1	1	
Pediciidae													
Dicranota sp.		2						1					
Simulidae					2								
Tipulidae						1	1		13			2	
Coleoptera													
Hydraenidae													
Hydraena gracilis						1				1			
Scirtidae													
Elodes sp.											2		
Mollusca													
Hydrobiidae													
Potamopyrgus antipodarum							9			1			
Lymnaeidae													
Radix balthica	2	1					4	2	28	9	5		
Sphaeriidae													
Pisidium sp.						4							
Hirudinea													
Erpobdellidae													
Helobdella stagnalis									1				
Glossiphoniidae													
Glossiphonia sp.								1					
Oligochaeta													
Enchytraeidae	2	3		2	3	3	1	7	1	3		4	3
Lumbricidae	4	25				6	54	5	9	29	14	2	
Lumbriculidae		1		1	3				2				
Erpobdellidae													

8.2 Water chemistry status indicator taxa present in samples

Taxon	GR1	GR2	BF1	LU1	LU2	MA1	WE2	WE3	WE4	SE1	SE2	LB1	LB2
Group 1													
Radix balthica	✓	✓					✓	✓	✓	✓	✓		
Group 2													
Hydropsychidae						✓	✓		✓	✓	✓		
Baetis rhodani	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	
Score	**1**	**1**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**3**

8.3 Ecological Quality Index and Water Framework Directive Ecological Status Class for WHPT NTAXA autumn 2025

Site	Observed WHPT NTAXA	Predicted WHPT NTAXA	WHPT NTAXA EQR	Most Probable Class	Probability of class %					Suitability Code
					H	G	M	P	B	
GR1	10	13.9	0.852	H	60.1	23.1	12.8	3.2	0.9	1
GR1	10	13.9	0.849	H	58.8	24.7	12.5	3.3	0.7	1
BF1	0	13.9	0.126	B	0.0	0.0	0.1	0.1	99.8	1
LU1	5	13.9	0.486	B	2.0	7.1	19.4	23.7	47.8	1
LU2	7	13.9	0.632	M	14.3	21.5	29.9	19.0	15.2	1
MA1	11	13.9	0.924	H	73.7	18.0	6.7	1.4	0.2	1
WE2	12	13.9	0.994	H	84.7	11.3	3.5	0.5	0.1	1
WE3	9	13.9	0.776	H	42.4	27.5	20.3	7.1	2.7	1
WE4	11	13.9	0.924	H	74.2	17.0	7.3	1.3	0.2	1
SE1	10	14.0	0.844	H	58.1	24.1	13.2	3.7	0.9	1
SE2	12	14.1	0.985	H	83.5	11.9	3.9	0.6	0.1	1
LB1	6	13.9	0.561	B	6.4	14.3	27.0	23.7	28.7	1
LB2	4	13.9	0.417	B	0.6	3.0	11.3	17.3	67.8	1

8.4 Ecological Quality Index and Water Framework Directive Ecological Status Class for WHPT ASPT autumn 2025

Site	Observed WHPT ASPT	Predicted WHPT ASPT	WHPT ASPT EQR	Most Probable Class	Probability of class %				
					H	G	M	P	B
GR1	5.61	6.00	0.920	G	24.1	56.1	19.6	0.2	0.0
GR1	5.93	6.00	0.968	H	48.5	45.0	6.4	0.1	0.0
BF1	N/A	6.00	0.541	B	12.6	8.1	14.1	14.5	39.8
LU1	5.62	6.00	0.925	G	30.2	46.4	22.2	1.2	0.0
LU2	5.16	6.00	0.859	M	8.3	39.7	48.3	3.6	0.1
MA1	6.77	6.00	1.093	H	95.9	4.1	0.1	0.0	0.0
WE2	6.04	6.00	0.984	H	58.1	38.3	3.6	0.0	0.0
WE3	5.83	6.00	0.953	G	40.4	49.5	10.1	0.1	0.0
WE4	5.61	6.00	0.920	G	23.5	57.5	18.9	0.2	0.0
SE1	5.88	6.01	0.960	G	44.3	48.0	7.6	0.1	0.0
SE2	6.27	6.01	1.018	H	75.7	23.2	1.1	0.0	0.0
LB1	5.42	6.00	0.897	G	18.6	48.0	31.5	1.9	0.1
LB2	5.53	6.00	0.915	G	27.6	44.3	25.9	2.0	0.2