

FEARNA STORAGE

Fearna Pumped Storage Hydro Scheme CAR Licence Report

Appendix D – Geomorphology Report – Southern Access Route

September 2025



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Fearna Pumped Storage Hydro Scheme Geomorphology Report: A. Southern Access Route

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INTRODUCTION

██████████ was commissioned by Gilkes Energy Ltd to undertake geomorphic assessments relating to waterbodies influenced by the proposed Loch Farna pumped storage scheme on the River Garry system, Inverness-shire. This is separated into three discrete elements:

- A. The stream crossings of the Southern Access Route (SAR).
- B. The streams captured by the proposed extents of the scheme reservoir (i.e. the extension of Loch Farna).
- C. The opportunities for mitigative habitat enhancement in the River Garry downstream from Loch Garry.

This report relates to element A, the assessment of the SAR, with elements B and C addressed in associated reports.

SAR STREAM CROSSINGS

1. A survey of all of the observable streams crossings along a 26.8 km section of the proposed route of the SAR between the White Bridge over the River Garry (OS NGR NH 2835 0136) upstream to the proposed new bridge crossing of the Gearr Garry ~1.2 km downstream of the Loch Cuaich dam (OS NGR NH 0810 0194).
2. The survey was split into two sections. First, the ~19.2 km section between the bridge over the Allt Choire a' Bhalachain (OS NGR NN 1280 9998) downstream to the White Bridge was undertaken on the 24th April 2025 in fine weather/ good visibility and low stream flow conditions. Vehicle access west beyond the Allt Choire a' Bhalachain bridge was not possible so a second survey on 1st August 2025 (with good visibility and normal summer stream flows) covered the upstream/ westerly section of the SAR (a length of 7.6 km).
3. The survey on 1st August 2025 was split into two sub-sections; the length of existing track between the Allt Choire a' Bhalachain and the River Kingie (OS NGR NN 0904 9981) and the furthest upstream stretch of the proposed SAR where there is not currently any track (from the River Kingie to the westerly limit downstream of the Cuaich Dam).
4. The section of the proposed SAR route between OS NGRs NH 0893 0137 and NN 0905 9981 (a distance of ~2.4 km) could not be surveyed as, currently, this section is covered by dense commercial forestry plantation. However, there are at least two significant stream crossings through this section that will require to be visited at a later date.
5. All sizes of observable streams that the SAR crossed were assessed, from very small non-alluvial seeps to the larger tributaries (e.g. Allt Choire a' Bhalachain) and the mainstem River Garry (i.e. the White Bridge and the proposed new upstream crossing). In total, 51 stream/ ditch crossings were identified through the surveyed extents of the SAR (Tables 1 and 2, Figures 1 to 12). Due to issues of vegetation cover and accessible observation, some smaller streams may have been missed in the survey, although all of the major crossings have been identified.
6. No structural assessment made of bridge/ culvert crossings were undertaken, only their interaction with fluvial processes (i.e. conveyance of flow and how that might be impacted by sediment transport/ storage).
7. The assessment of the current suitability of culverts/ bridges was based on their dimensions in relation to the size of stream (i.e. catchment area, indexing flow conveyance) and evidence of sediment transport regime (i.e. volumes and grade of sediment stored within the channel proximal to the structure, especially immediately upstream). Furthermore, an allowance for the effects of climate change (i.e. more extreme flood events and increased sediment transport/ supply) are included in the assessments, to consider the potential for resilience to potential future imposed conditions.
8. Tables 1 and 2 present the results of the stream SAR crossing assessment. The tables includes the crossing/ structure number (see Figures 1 to 12), the Ordnance Survey grid reference (OS NGR), the catchment area of the stream at the location of the SAR crossing (as an index of stream size/ flow magnitude), a reference to the photo of the stream crossing (presented in Appendix A) and notes on the field observations relating to the structure (including the name of the larger streams and an estimate of culvert pipe diameter, if appropriate). The predicted suitability of the current crossing (as per point 7, above) is summarised in a colour code scheme:
 - Green – the current crossing is considered appropriate (31 of 51 structures, 61%);

- Orange - the current crossing may be impacted by high flows and sediment transport processes and consideration should be given to modifying the structure (15 of 51 structures, 29%);
 - Red – the current crossing is likely compromised by imposed flow and sediment transport regime and modification to the structure is advised (5 of 51 structures, 10%).
9. The current reporting is based on a visual assessment of the current flow capacity of culverts/ bridges; more detailed numerical calculations of flow conveyance and sediment transport could be undertaken, as necessary. Importantly, consideration of the potential reduction in the capacity of culverts/ bridge apertures due to sediment accumulation (possibly increasing in the future due to climate change and land-use management, e.g. forestry) was included in the assessment. Based on this assessment, five stream crossings are identified where it is advised that the current culvert requires to be upgraded (ideally changed to a box culvert or a single span bridge, to minimise impact to fluvial/ sediment transport processes and to allow a natural substrate bed through the structure). There are 15 other crossings where, given that the SAR is to be upgraded in places, that improvements to culverts and bridges should be considered. There is a cluster of three red-classed streams crossings in centre of the assessed section of SAR (locations 16, 18 and 19), identified on the basis of their apparently high sediment transport regime. The significant sediment supply in these streams probably relates to local geology (e.g. overlying glacial/ fluvio-glacial sediment deposits) and possibly land management activities (e.g. forestry practice) in this region of the wider Garry catchment; culvert re-design needs to account for these factors. Crossing 16 is perhaps the most impacted in terms of the interaction of fluvial process vs culvert dimension, given the size (i.e. flow rate) of the stream. However, not accounting for stream size (i.e. catchment area), crossings 19 and 40 exhibit the greatest potential degree of evidence of impact to sediment transport (i.e. storage of sediment just upstream of the culvert). Although not an issue with the stream itself, proposed crossing 42 appears to be associated with a partial avulsion a short distance upstream from the survey location (i.e. OS NGR NH 08934 01376). At this location, a proportion of flow under higher stage events leaves the main channel on the river right/ west bank and has resulted in significant peat erosion downstream (Figure 13). This condition may be related to artificial management of the stream in this section, since it borders the commercial forestry plantation in its extents proposed for the SAR crossing. The works associated with the construction of the SAR may be able to consider this issue and address it.

Table 1. Summary of the SAR assessment for the downstream 28 stream crossings. * Figures (photos) are provided in Appendix A.

Crossing No.	OS NGR	CA (km ²)	Figure No.*	Notes
1	NN 12799 99979	14.3	A1	Allt Choire a' Bhalachain. Furthest upstream bridge - undynamic channel, suitable span.
2	NN 12968 99571	0.71	A2	Small stream but potentially under-sized culvert. Some sed build up. Low dynamic channel.
3	NN 13338 99414	0.57	A3	Small steep bedrock dominated stream. Culvert pipe (~900mm). Little sediment storage.
4	NN 13970 99402	<0.5	A4	Very small stream but some gravel storage. Pipe culvert (~600mm).
5	NN 14050 99403	1.39	A5	Significant tributary (Allt Fionn-dhail) but bedrock dominated and little sediment storage. Pipe culvert (~2m).
6	NN 14147 99408	<0.5	A6	Very small stream. Some gravel gravel storage. Pipe culvert (~400mm).
7	NN 15199 99486	0.51	A7	Small steep stream but significant coarse sed transport. Pipe culvert (~500mm) - undersized and perched on downstream side.
8	NN 15897 99187	<0.5	A8	Very small stream. Some gravel storage. Pipe culvert (~400mm).
9	NN 15855 98852	17.7	A9	Significant tributary (Allt Garaidh Ghualaich). Bedrock channel - little sediment supply or storage. HP intake ~100m dstm with no evidence of significant sediment storage in headpond.
10	NN 16188 98967	<0.5	A10	Very small stream. Runs into ditch along track after coming off slope before passing through culvert. Some fine gravel storage. Pipe culvert (~400mm pipe).
11	NN 16991 99641	<0.5	A11	Very small stream. Some gravel/ cobble storage. Pipe culvert (~600mm).
12	NN 18009 99314	0.85	A12	Small stream with very little sediment. Pipe culvert (~400mm).
13	NN 18109 99221	<0.5	A13	Small stream. Not much obvious coarse sediment supply but fine gravel deposited in pool downstream. Pipe culvert (~400mm).
14	NN 18742 99279	8.96	A14	Significant tributary (Greenfield Burn). Steep channel with bedrock, boulders and patches of gravel/ cobble deposits (although relatively low sediment storage). Appropriate bridge crossing.
15	NN 18927 99405	1.92	A15	Moderately sized tributary (Allt na Gearr Leacainn). Reasonable gravel/ cobble stored in bar feature. About appropriate single span bridge crossing (could be slightly wider, ideally).
16	NN 19635 99427	1.12	A16	Moderately sized tributary (Allt Giubhais). Significant gravel/ cobble transport and storage. Pipe culvert (~1.2m) likely undersized for imposed sediment supply/ transport conditions.
17	NN 19750 99432	<0.5	A17	Very small stream. Some gravel transport/ storage. Pipe culvert (~600mm). Perched outfall on downstream side, with coarser sediment in channel.
18	NN 20211 99579	0.86	A18	Small, steep stream (Allt nan Corp). Some gravel/ cobble transport/ storage. Pipe culvert (~600 pipe) and perched on the downstream side - likely too small.
19	NN 20552 99744	0.84	A19	Small, steep tributary (Allt na Plaide) but with significant sediment accumulation at undersized pipe culvert (~600mm).
20	NN 20723 99706	<0.5	A20	Small stream, with some evidence of gravel/ cobble transport/ storage. Pipe culvert (~900mm), oblique to flow upstream and with perched outfall downstream.
21	NH 21535 00219	0.71	A21	Small stream (Allt Criche) with little sediment transport/ storage. Pipe culvert (~500mm).
22	NH 21606 00288	<0.5	A22	Very small stream, with some gravel deposition downstream. Double pipe culvert (~200mm and ~300mm).
23	NH 22286 00371	<0.5	A23	Very small stream draining wetland area with little evidence of sediment transport. Pipe culvert (~600mm).
24	NH 22982 00252	15.5	A24	Significant, steep tributary (Allt Ladaidh) with bedrock and cobble/ boulder bed. River left (i.e. west) bridge abutment will impede high flows.
25	NH 23891 00461	0.59	A25	Small stream (Dubh Uisce) with little gravel/ cobble transport/ storage and boulders downstream of outfall. Pipe culvert (~1.2m).
26	NH 24793 00810	0.50	A26	Small stream (Allt Bolinn) but some gravel transport/ storage. Pipe culvert (~400mm).
27	NH 24986 00801	<0.5	A27	Very small stream with limited gravel transport/ storage. Pipe culvert (~500mm).
28	NH 28362 01344	360.1	A28	White Bridge over River Garry. River right (i.e. west) pier in high flow channel - single span would be better in relation to physical processes.

Table 2. Summary of the SAR assessment for the upstream 23 stream crossings. * Figures (photos) are provided in Appendix A.

Crossing No.	OS NGR	CA (km ²)	Figure No.*	Notes
29	NN 12507 99784	<0.5	A29	Very small stream with little sediment transport/ storage. Pipe culvert (~400mm pipe).
30	NN 11539 99926	0.51	A30	Very small stream with little sediment transport/ storage. Pipe culvert (~500mm).
31	NN 11484 99952	<0.5	A31	Very small stream with little sediment transport/ storage. Pipe culvert (~500mm).
32	NH 10694 00096	0.95	A32	Moderate sized stream (Allt Lochan na Curra) with some gravel storage upstream but not at culvert. 2m diameter pipe culvert- no sediment issues.
33	NH 10406 00119	<0.5	A33	Drainage ditch for track with little sediment transport/ storage. Pipe culvert (~500mm).
34	NH 10196 00122	<0.5	A34	Very small stream/ track ditch with little sediment transport/ storage. Pipe culvert (~500mm).
35	NH 10086 00110	<0.5	A35	Very small stream/ track ditch with little sediment transport/ storage. Pipe culvert (~500mm).
36	NH 10062 00126	<0.5	A36	Very small stream/ track ditch with little sediment transport/ storage. Pipe culvert (~500mm). Just west of cattle grid.
37	NH 09938 00058	0.52	A37	Small, steep stream with some sediment transport/ storage. Concrete pipe culvert (~600mm), perched on downstream side.
38	NH 09677 00011	<0.5	A38	Small, steep stream with little sediment transport/ storage. Metal pipe culvert (~1.2m).
39	NH 09437 00035	<0.5	A39	Small track ditch with little sediment transport/ storage. Concrete pipe culvert (~300mm).
40	NN 09163 99871	<0.5	A40	Small stream but reasonable sediment transport/ storage. Pipe culvert (~300mm), perched downstream - too small given sediment supply.
41	NN 09045 99811	58.8	A41	River Kingie . Bedrock channel - very little evidence of of sediment transport/ storage. Bridge soffit likely too low for extreme floods. Also two piers within channel - not ideal.
42	NH 08934 01376	<0.5	A42	Small, incised stream with some evidence of sediment transport/ storage. Possible partial avulsion upstream causing overland flow into peat (causing erosion).
43	NH 08819 01444	<0.5	A43	Very small channel with no flow and limited sediment transport/ storage.
44	NH 08754 01499	<0.5	A44	Very small channel with no flow and limited sediment transport/ storage.
45	NH 08726 01516	<0.5	A45	Small, entrenched stream. Limited sediment transport/ storage.
46	NH 08656 01559	<0.5	A46	Small, entrenched stream. Limited sediment transport/ storage.
47	NH 08502 01734	<0.5	A47	Small, entrenched stream. Limited sediment transport/ storage.
48	NH 08259 01823	<0.5	A48	Very small seep - no sediment issues.
49	NH 08218 01853	<0.5	A49	Very small seep - no sediment issues.
50	NH 08179 01860	<0.5	A50	Very small stream - no sediment issues.
51	NH 08144 01961	134.2	A51	Approx location of proposed SAR crossing of Gearr Garry. Bedrock control, little sediment accumulation and undynamic channel.



Figure 1. Location of the downstream 28 stream crossings identified on the 24th April 2025 survey (see Table 1). Colour coding refers to the categories in point 8 and included in Table 1.



Figure 2. Location of the downstream 23 stream crossings identified on the 1st August 2025 survey (see Table 2). Colour coding refers to the categories in point 8 and included in Table 2.



Figure 3. Location of stream crossings 1 to 6 (refer to Table 1 and point 8).



Figure 4. Location of stream crossings 7 to 11 (refer to Table 1 and point 8).



Figure 5. Location of stream crossings 12 to 17 (refer to Table 1 and point 8).



Figure 6. Location of stream crossings 18 to 22 (refer to Table 1 and point 8).



Figure 7. Location of stream crossings 23 to 25 (refer to Table 1 and point 8).



Figure 8. Location of stream crossings 26 to 28 (refer to Table 1 and point 8).



Figure 9. Location of stream crossings 29 to 31 (refer to Table 2 and point 8).



Figure 10. Location of stream crossings 32 to 37 (refer to Table 2 and point 8).



Figure 11. Location of stream crossings 38 to 41 (refer to Table 2 and point 8).



Figure 12. Location of stream crossings 42 to 51 (refer to Table 2 and point 8).



Figure 13. Erosion of peat associated with the stream proposed for SAR crossing 42.

APPENDIX A

Site photographs



Figure A1. Photograph of stream crossing 1. Looking downstream.



Figure A2. Photograph of stream crossing 2. Culvert entrance.



Figure A3. Photograph of stream crossing 3. Culvert outfall.



Figure A4. Photograph of stream crossing 4. Culvert entrance.



Figure A5. Photograph of stream crossing 5. Culvert entrance.



Figure A6. Photograph of stream crossing 6. Culvert outfall.



Figure A7. Photograph of stream crossing 7. Culvert outfall.



Figure A8. Photograph of stream crossing 8. Culvert entrance.



Figure A9. Photograph of stream crossing 9. Looking upstream.



Figure A10. Photograph of stream crossing 10. Culvert entrance.



Figure A11. Photograph of stream crossing 11. Culvert entrance.



Figure A12. Photograph of stream crossing 12. Culvert outfall.



Figure A13. Photograph of stream crossing 13. Culvert outfall.



Figure A14. Photograph of stream crossing 14. Looking downstream.



Figure A15. Photograph of stream crossing 15. Looking upstream.



Figure A16. Photograph of stream crossing 16. Culvert entrance.



Figure A17. Photograph of stream crossing 17. Culvert entrance.



Figure A18. Photograph of stream crossing 18. Culvert entrance.



Figure A19. Photograph of stream crossing 19. Culvert entrance.



Figure A20. Photograph of stream crossing 20. Culvert outfall.



Figure A21. Photograph of stream crossing 21. Culvert entrance.



Figure A22. Photograph of stream crossing 22. Culvert outfall.



Figure A23. Photograph of stream crossing 23. Culvert outfall.



Figure A24. Photograph of stream crossing 24. Looking upstream.

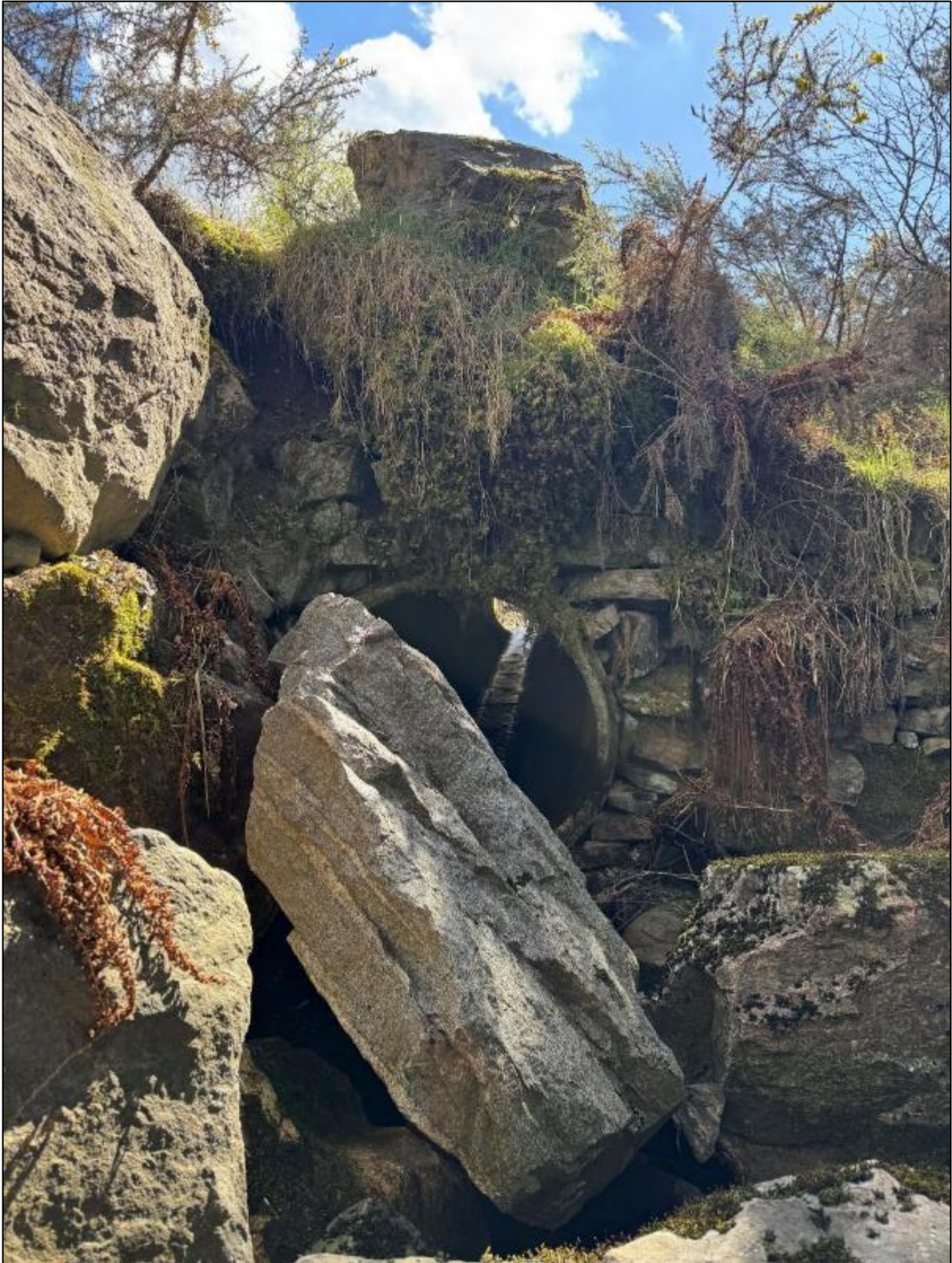


Figure A25. Photograph of stream crossing 25. Culvert outfall.



Figure A26. Photograph of stream crossing 26. Culvert entrance.



Figure A27. Photograph of stream crossing 27. Culvert outfall.



Figure A28. Photograph of stream crossing 28 (White Bridge over River Garry). Looking upstream.



Figure A29. Photograph of stream crossing 29. Culvert entrance.



Figure A30. Photograph of stream crossing 30. Culvert entrance.



Figure A31. Photograph of stream crossing 31. Culvert outfall.



Figure A32. Photograph of stream crossing 32. Culvert entrance.



Figure A33. Photograph of stream crossing 33. Culvert outfall.



Figure A34. Photograph of stream crossing 34. Culvert entrance.



Figure A35. Photograph of stream crossing 35. Culvert entrance.



Figure A36. Photograph of stream crossing 36. Culvert outfall.



Figure A37. Photograph of stream crossing 37. Culvert entrance.



Figure A38. Photograph of stream crossing 38. Culvert entrance.



Figure A39. Photograph of stream crossing 39. Culvert entrance.



Figure A40. Photograph of stream crossing 40. Culvert entrance.



Figure A41. Photograph of stream crossing 41. River Kingie, looking upstream.



Figure A42. Photograph of proposed stream crossing 42 (no culvert at present). Looking upstream.



Figure A43. Photograph of proposed stream crossing 43 (no culvert at present). Looking upstream.



Figure A44. Photograph of proposed stream crossing 44 (no culvert at present). Looking upstream.



Figure A45. Photograph of proposed stream crossing 45 (no culvert at present). Looking upstream.



Figure A46. Photograph of proposed stream crossing 46 (no culvert at present). Looking upstream.



Figure A47. Photograph of proposed stream crossing 47 (no culvert at present). Looking upstream.



Figure A48. Photograph of proposed stream crossing 48 (no culvert at present). Looking downstream.



Figure A49. Photograph of proposed stream crossing 49 (no culvert at present). Looking upstream.



Figure A50. Photograph of proposed stream crossing 50 (no culvert at present). Looking upstream.



Figure A51. Photograph of proposed stream crossing 51 (Gearr Garry, no culvert at present). Looking upstream.