

Appendix 6

Appendix 6.1

Salmonid Habitat Walkover Survey Descriptions



Appendix 6.1. Salmonid habitat grades of watercourses potentially affected by the Burnfoot Flood Relief Scheme.

Skeoge River

Watercourse: Lower Main channel Skeoge River	Upstream of Burnfoot River confluence to c. 6-700m u/sd
<p>This survey section included downstream from the confluence with the Burnfoot River, upstream to just above the extent of the proposed embankment removal section on the true right bank. Overall, from the downstream extent, the channel is straight and has been subject to arterial drainage. It is sluggishly flowing, deep (over 1.0m), and wide (8-9m), and is very turbid with high suspended sdeiment load. There is little riparian vegetation although some has been removed by heavy plant along the true right enbankment top. The channel gradually narrows to c. 5-7m before widening again to between 7.5-9.0m. The overall habitat classification of the entire channel upstream to above th extent of the embankment removal at a clear-span bridge, is Grade 2 Holding pools. The bed consists mainly of fine sedimetrn, silt and some pebbles. The channel would support few resident trout given the lack of riparian and in-stream cover but would act as a corridor for migratory fish movement.</p>	
	
<p><i>Immediately above the R238 Bridge in Burnfoot - Clear gravels in the centre of the image showing likely trout spawning redd (nest)</i></p>	<p><i>View downstream of high gradient riffle consistent with grade 2 nursery habitat</i></p>
	
<p><i>View downstream along this homogenously deep channel form the clear span bridge just above the upper extent of the embankment section proposed for removal</i></p>	<p><i>View upstream of clear span bridge along the same channel. Greater area of the channel is covered by emergent and floating macrophytes but overall, it is largely Grade 2 Holding habitat</i></p>

Burnfoot

Lower Burnfoot River upstream the Skeoge River confluence – parallel to the length of the proposed embankment length to be removed from the true right bank of the lower Skeoege River.

Watercourse: Lower Burnfoot River	From confluence with Skeoge River to c. 700m upstream
<p>Surveys were conducted May 2020 for North-West Greenway and in February 2023 for verification of any changes in habitat class and grade</p>	
<p style="text-align: center;">Description:</p> <p>The Lower Burnfoot River moving upstream to an area opposite of where the proposed embankment removal on the Skeoge River is proposed, has been arterially drained with a marked embankment on the true left side, reduced substrate complexity and areas of siltation, and a dearth of riparian vegetation. The main habitat type is holding pool of Grade 2/3 with a largely fines dominated riverbed. These habitat types and grades were largely similar during the updated survey in Feb. 2023 as compared to May 2020 (for the NW Greenway). As in May 2020, Nursery habitat was present in the lower reach towards where a noticeable gradient change is associated with bedrock and riffle/run flows that provide refuge for juvenile salmonids. Here the habitat is Grade 2 and 3 Nursery and was shown to support juvenile trout Aged 1+ and older, including several sea trout smolts, in May 2020. The main change noted in February 2023 was the presence of a short section of Grade 3 Spawning habitat (S3), which occurred c. 140-160m upstream of the confluence with the Skeoge River and above the section of bedrock and riffles noted previously. This small area of gravels has the potential to support some spawning adult trout/ sea trout.</p>	
	
<p><i>Grade 3 pool habitat in the upper end of the survey section May 2020. Note the limited riparian cover & in-stream fish habitat</i></p>	<p><i>Similar habitat observed during February 2023 re-surveys</i></p>



Grade 2 and 3 nursery habitat in the L. Burnfoot above the foot bridge viewed from d/s (May 2020).





The same area viewed in Feb. 2023 from u/s



Small area of Grade 3 Spawning gravels observed only in Feb. 2023 upstream of the Grade 2/ 3 Nursery indicated above

Burnfoot River downstream of Burnfoot Village Bridge (R238)

Watercourse: main channel Burnfoot River	Bridge in main street to ca. 280m d/s
<p>This survey section largely covers the main option locations for hard engineering for flood management. Here, the Burnfoot River is low gradient with high levels of bed sediment composed of silt and sand. In the lower reach of the survey extent, significant deposits of pebbles occur that would be suitable for trout spawning though the quality is undermined by underlying deep fine sediment. There are good sections of moderate quality nursery habitat and holding pools with larger and deeper pools towards riverbends. A section of good quality nursery habitat (N2) occurs downstream of the main bridge in Burnfoot village. Overall, the section would support low numbers of juvenile trout and provide a corridor for upstream movement of pre-spawning resident and migratory (sea) trout. Whether lamprey spp. are present, and in particular, ammocoete larval stages (given the generally silty nature of many run margins) is unknown.</p>	
	
<p><i>View u/s towards Burnfoot village bridge - riffle and run habitat is likely to provide moderate quality nursery habitat for juvenile trout</i></p>	<p><i>Run/ glide flow habitat towards the end of the survey section showing extensive deposits of pebbles/ gravels that are underlain by sediment</i></p>

Burnfoot River – upstream of Burnfoot Village Bridge (R238)

<p>Watercourse: main channel Burnfoot River</p>	<p>Upstream of Bridge in main street to ca. 600m u/sd</p>
<p>This survey section also covers the main option locations for hard engineering for flood management. This section of the Burnfoot River is of low to moderate gradient although the level of silt within the riverbed is noticeably lower possibly due to improved flows. The landuse is a mixture of residential, embankments and pastoral grazing by cattle and sheep. Salmonid habitat is mainly nursery grade 2 and 3 in riffle and runs with some deeper areas of grade 3 nursery providing resting areas. There are several candidate grade 2 and 3 spawning areas in glide flow habitat with adjacent pools that would provide resting areas for adult resident and migratory trout. Salmonid habitat in this section would be considered moderate to good quality and thus potentially sensitive to scheme effects such as the release of sediment and other pollutants, as well as potential habitat loss depending on the nature of proposed (if any) in-stream works.</p>	
	
<p>Immediately above the R238 Bridge in Burnfoot - Clear gravels in the centre of the image showing likely trout spawning redd (nest)</p>	<p>View downstream of high gradient riffle consistent with grade 2 nursery habitat</p>
 <p>Spawning gravels in the channel behind a farm shed at 38457 173847</p>	

Burnfoot River – Middle section

Watercourse: main channel Burnfoot River	Middle section ca. 1300m u/s Burnfoot village
<p>Habitat surveys covered the lower and upper part of an areas delineated for the possibility of natural flood management measures (NFM). A significant improvement in flows, and an increase in the coarseness of the riverbed substrate (cobble and boulder), saw a greater proportion of habitat classified as grade 2 nursery, with grade 2 and 3 spawning gravels also present. Fine sediment cover of the riverbed also was low and there was little evidence of livestock damage to the banks largely because sheep grazing appeared more prevalent than cattle grazing. There was evidence of extensive bank protection through stacking of boulders in several locations. Overall, the river in these areas would be potentially very productive for trout given the good quality nursery, identified spawning fords and pockets of gravel that were evident in many locations. Any NFM options should be planned sympathetically with the good habitat quality present to minimise impacts on fisheries.</p>	
	
<p><i>Large potential spawning ford at the lower end of the survey reach consistent with grade 3 spawning habitat. Note the boulder revetment along the bank edge.</i></p>	<p><i>Good quality nursery habitat characterised by high gradient riffles and runs</i></p>
	
<p><i>Small embankment topped by large boulders</i></p>	<p><i>Good quality nursery habitat in the upper part of the survey section</i></p>

Burnfoot River – Carnashannagh Stream, upper section

Upper section above and below area of proposed hard engineering	
 <p>10/12/2020</p>	 <p>10/12/2020</p>
<p><i>Grade 3 nursery in the steep upper part of this stream</i></p>	<p><i>Stream culvert outlet d/s farm track – Grade 2 nursery immed. d/s in location of proposed hard engineering.</i></p>
 <p>10/12/2020</p>	 <p>10/12/2020</p>
<p><i>Grade 3 nursery immediately u/s of culvert is habitat</i></p>	<p><i>Grade 3 nursery adjacent to lane above area of proposed hard engineering and impassable falls.</i></p>

Burnfoot River – Carnashannagh Stream, lower section

Lower section largely very poor salmonid habitat quality; shallow, mainly a sand/ silt bed with no complexity. Above this there is an area of moderate flows with some pebbles and cobble consistent with grade 3 nursery; however, the stream then flows under the road via a concrete pipe culvert that is sloped and immediately upstream is an impassable falls ca. >1m high. This, and the poor habitat, would preclude any upstream movement of migratory trout from the main Burnfoot River.

Lower section below road to Burnfoot River confluence



View d/s to the confluence of with the Burnfoot River. Note the extensive coverage of sand and silt on the riverbed.



View of culvert outlet ca. 55m u/s of outlet. Note the impassable falls at the upper end of the culvert.

Appendix 6.2

Invertebrate Inventory

Appendix 6.2. Inventory of macroinvertebrate taxa and their relative abundance in each of the site samples collected in August 2021 for Burnfoot Flood Scheme. Taxa are allocated to Groups A-E (sensitive to Most Tolerant) as per Toner et al. 2005.

Site	Group A	No.	Group B	No.	Group C	No.	Group D	No.	Group	No.	non tubificidae Oligochaeta	No.
7 Control – Carnashannagh Stream Upper	Heptageniidae	4	Sericostomatidae	1	<i>Gammarus</i>	25	Ephemereilidae	1	Sphaeriidae	7	Lumbriculidae	5
			Leutridae	12	Elmidae	5			Hydrobiidae	40		
					<i>Baetis rhodani</i>	150						
					Simuliidae	10						
					Tipulidae	20						
					Chironomidae	4						
					Planariidae	1						
					Polycentropodidae	5						
				Rhyacophilidae	2							
				Scirtidae	1							
6 - Impact – Carnashannagh Stream	Heptageniidae	1	Limnephilidae	2	<i>Gammarus</i>	11			Hydrobiidae	20	Lumbriculidae	3
			Leutridae	9	Elmidae	2			Erpobdellidae	5		
					<i>Baetis rhodani</i>	12						
					Simuliidae	25						
					Chironomidae	10						
					Gerridae	1						
					Polycentropodidae	4						
					Rhyacophilidae	1						
				Scirtidae	5							
				Ancylidae	13							
4 - Control – Burnfoot Upper	Heptageniidae	2			<i>Baetis rhodani</i>	65					Lumbriculidae	25
	Nemouridae	1			Simuliidae	2			<i>Glossiphoniidae</i>	3		
					Chironomidae	10			<i>L. peregra</i>	4		
					Dytiscidae	1						
					Hydrobiidae	25						
					Tipulidae	30						
					<i>Gammarus</i>	35						
				Rhyacophilidae	11							
				Ancylidae	2							
3 - control – Burnfoot Middle			Leutridae	70	<i>Baetis rhodani</i>	55			Sphaeriidae	3	Lumbriculidae	15
			Sericostomatidae	2	Simuliidae	5			<i>Glossiphoniidae</i>	2		
					Ephemereilidae	90			<i>L. peregra</i>	2		
					Hydropsychidae	1						
					Hydrobiidae	21						
					Tipulidae	60						
					<i>Gammarus</i>	15						
					Rhyacophilidae	15						
					Ancylidae	15						
					Elmidae	14						
				Scirtidae	1							
				Philopotamidae	2							
1. Impact – Burnfoot Lower	Heptageniidae	25	Leutridae	6	<i>Baetis rhodani</i>	65			Erpobdellidae	1	Lumbriculidae	25
	Chloroperlidae	1			Simuliidae	30						

