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River Habitat Appraisal Report

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A30 River Habitat Appraisal

WSP Parsons Brinckerhoff

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Tom Napier-Munn, Peter Dennis

Contents

1. Introduction

APEM Ltd. was commissioned by WSP Parsons Brinkerhoff in October 2016 to undertake a river habitat appraisal on several water courses in or near the A30 corridor between Chiverton Cross and Carland Cross in Cornwall, where engineering works are planned. The main objective of the survey was to identify aquatic habitats within the footprint of the works, notably those used by designated species, which would inform the need for further fish and aquatic macroinvertebrate surveys in the area. The survey, carried out in November and December 2016, focussed on watercourses and still waters in the vicinity of the route options.

1.1 Requirements

The habitat appraisal was required to inform the requirement for subsequent fish, invertebrate and pond surveys which would provide a baseline for the works and inform as to the presence of designated species. These surveys would, in turn, identify any potential effects of development works on fish and invertebrate communities in the watercourses within the scheme footprint. A survey was commissioned to map the spatial distribution of the quality and quantity of functional habitats in the reach, notably those pertaining to designated fish species (e.g. Atlantic salmon). The survey was tailored to identify those habitats and the species and life stages which may be temporally sensitive to the proposed engineering work in the A30 corridor.

The agreed outputs from the survey were; a report detailing the methods used and providing habitat maps, and recommendations regarding the locations and number of fish and invertebrate surveys required in each of the watercourses. These recommended surveys would provide a robust baseline data set against which any impacts of the scheme could be established. In addition, walkover data were to be provided on a DVD containing all ArcGIS layers.

2. Methods

The walkover survey covered approximately 7.5 km of water courses that were within the vicinity of the proposed route options (Figure 2–1); all water courses, still waters and their tributaries within 100m of an option boundary (as visible on OS10k mapping) were included within the scope of the walkover. Of each watercourse identified, at least 500m was surveyed (survey reach), from the upstream extent. Figure 2–2 presents the location of the ponds surveyed.

Any revisions to the scheme footprint will be critically reviewed as part of subsequent ecological surveys to ensure that the geographical scope of surveys remains valid.

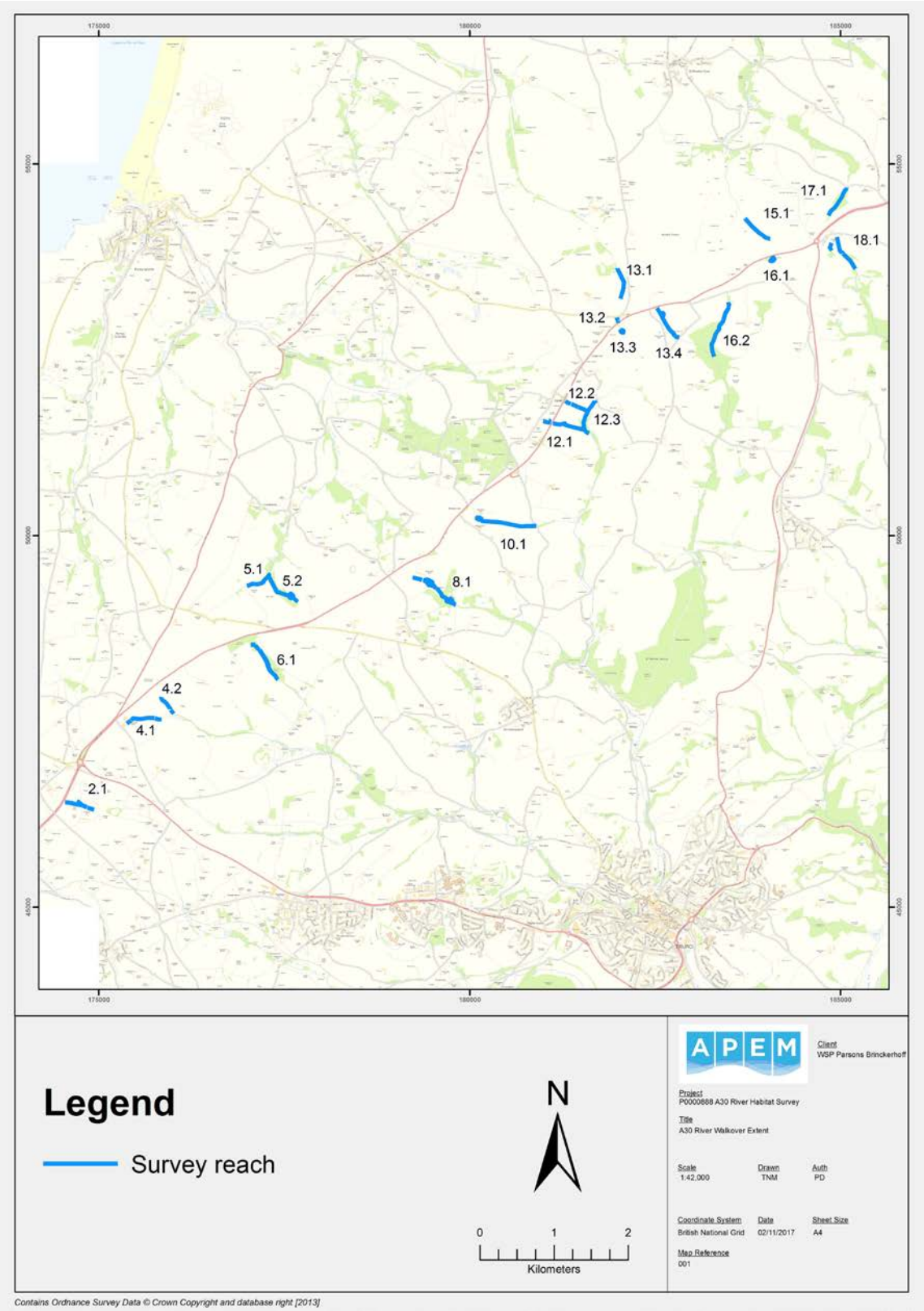

Figure 2–1 The extent of the reaches covered by the habitat walkover survey (note 13.3 and 16.1 are stillwaters)

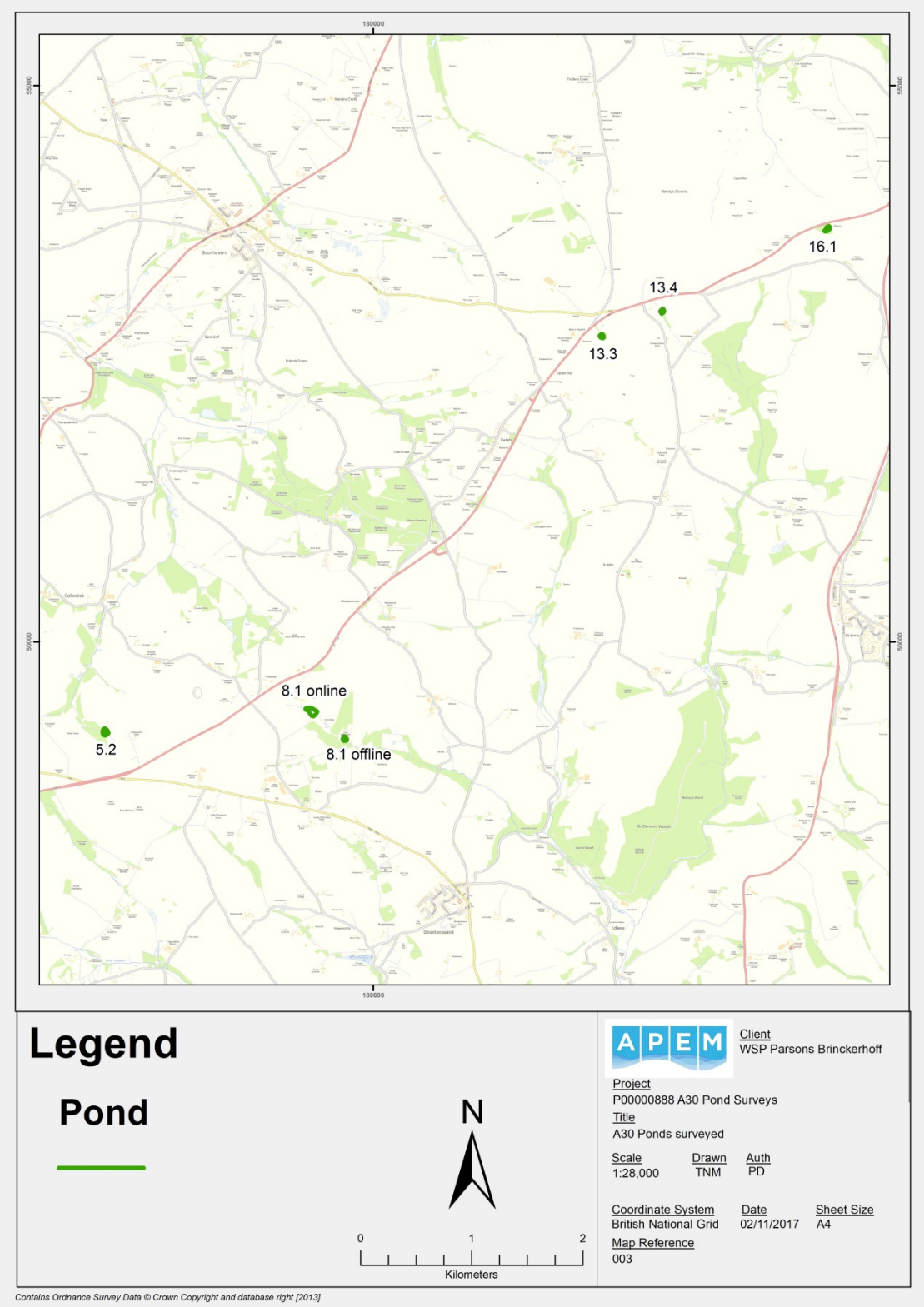

Figure 2–2 Location of the ponds surveyed

2.1 Habitat walkover method

The habitat walkover survey was tailored towards SAC species; i.e. Atlantic salmon (*Salmo salar*), sea lamprey (*Petromyzon marinus*), brook lamprey (*Lampetra planeri*), river lamprey (*Lampetra fluviatilis*), and bullhead (*Cottus gobio*) (JNCC, 2016). These species generally share comparable habitat preferences for spawning and this was considered in designing the survey methodology.

The principal in-stream physical habitat variables that determine suitability for juvenile salmonids are: water depth, water velocity, streambed substratum and cover (Heggenes, 1990). The preferred spawning site is the transitional area between pool and riffle where the flow is accelerating and the depth decreasing. Gravel of suitable coarseness is also required with interstices, the voids between gravel particles, cleaned by current or upwelling (Peterson, 1978).

Salmon fry and parr occupy shallow, fast-flowing water, with a moderately coarse substrate with cover (Baglinere and Chamigneulle, 1986). Deep or slow moving water, particularly when associated with a sand or silt substrate does not support resident juvenile salmonids (Peterson, 1978). Suitable cover for juveniles includes areas of moderate-depth water, surface turbulence, loose substrate, large rocks and other submerged obstructions, undercut banks, overhanging vegetation, woody debris lodged in the channel and aquatic vegetation (JNCC, 2016).

The relative position of habitat types is also of importance. For instance, the proximity of juvenile habitat to spawning gravels may be significant to their utilisation. In addition, adults will require holding pools immediately downstream of spawning gravels in which they can congregate prior to spawning.

Optimal juvenile lamprey habitat was defined as stable silt deposits over 15cm deep, in areas of low water velocity with the presence of organic detritus (Harvey and Cowx, 2003) (APEM, 2002). Sub-optimal habitat was defined as patchy shallow sediment interspersed with coarser sediment with a lack of or low organic content detritus (Harvey and Cowx, 2003) (APEM, 2002).

In addition, still waters were assessed for submerged and emergent macrophyte cover and potential for supporting fish populations, with a view to recommending National Pond Surveys, which are in-depth surveys used to assess the biological quality of the ponds based on the plant and animal communities recorded from the pond (Pond action, 1998).

This field mapping technique entails hand drawing habitat parcels onto high-resolution maps (OS 1km tiles) at a scale of 1:10,000. Each habitat parcel was designated a depth and flow velocity category (Table 2-1), and the predominant substrate type was recorded. Further observations noted included anthropogenic alterations to the channel which could affect fish migration and sources of sediment input in the form of poaching or runoff. Additional prominent features (e.g. coarse woody debris/macrophyte cover/depositional bars) were also recorded together with GPS coordinates (grid references) to aid their accurate location on maps. The resulting habitat mosaic of was subsequently digitised using ArcGIS mapping techniques.

Table 2-1- Classification of flow categories for walkover survey

Habitat Type	Depth (m)			Velocity (m/s)			Description
	A	B	C	1	2	3	
	0–0.49	0.5-1.0	>1.0	0.05-0.15	0.16-0.40	>0.4	
Standing Water (SW)	A-C			0			No perceivable flow, variable depths
Eddy (ED)	A-C			1-3			Vortexing water, mixed flow / depth
Riffle (RI)	A-C			3			Fast flowing, shallow, audible
Glide (GL)	A-C			1-3			Unbroken surface, often entire channel
Run (R)	A-C			1-3			Broken Surface, often interface between habitat

The following additional features were also recorded when observed in the field:

- Pools
- Cascades
- Coarse woody debris
- Barriers to fish movement (graded)
- Potential sediment sources
- Channel shading
- Overhanging riparian vegetation
- Channel modifications
- Depositional features e.g. bars

3. Results

There were 18 reaches in the survey area which may be impacted by the proposed works. Due to the independent and varied nature of each reach the findings of the walkover survey are discussed on a reach by reach basis below. An example of the GIS mapping of habitat is provided in Figure 3–1. The full extent of the habitat data will be provided in GIS format.

Figure 3–1 An example of the fish habitat mapping output.

3.1 Survey Reaches

3.1.1 Reach 2.1

Reach 2.1 was approximately 400m in length and lies at the western extent of the survey area. The water on the day of the survey was very shallow (<5cm) and the channel was narrow (0.5m) throughout the reach walked. The substrate clast size was heterogeneous throughout and potentially suitable for juvenile salmonids and macroinvertebrates however, however a layer of fine sediment silt was observed throughout the reach. This siltation may be in part due to track runoff from the two road crossings. A short section had recently been dredged (Figure 3–2), which would have improved the flow, though would likely have suspended a significant amount of silt. Due to the size, the observed flow and the state of the substrate, this reach may support a population of small fish such as bullhead or stickleback and macroinvertebrates however; this would depend on connectivity downstream of the surveyed reach.

Figure 3–2 Reach 2.1 – Dredged section

3.1.2 Reach 4.1

Reach 4.1 was 500m long and lies at the western end of the survey area. The stream was shallow with flow barely perceptible at the time of the walkover survey. The channel was dry at the upstream extent at the time of survey, with ponding further down, eventually turning into a slowly flowing run and glide. The substrate was silted throughout, potentially due to arable runoff from surrounding farm land. The channel has been modified to act as a farm drain with re-profiled banks evident along the reach (Figure 3–3). The channel was inundated by dense vegetation cover; particularly towards the downstream end of the reach Reach 4.1 is very unlikely to support fish or significant macroinvertebrate populations with presence of conservation species thought to be particularly improbable due to the lack of habitat and the ephemeral nature of the flow in the area.

Figure 3–3 Reach 4,1 –Modified channel

3.1.3 Reach 4.2

Reach 4.2, approximately 300m long, lies at the western end of the survey extent and was very shallow with high gradient and fast flowing water. This water became slightly deeper downstream, though the entire reach was generally less than 5cm deep. The channel was

approximately 1m wide throughout the reach surveyed, although the wetted width at the time of survey was significantly narrower.

The substrate of Reach 4.2 was of mixed grain size including pebble and gravel with a layer of silt and silted interstices evident. The source of the reach was from a pipe flowing from under a recently developed solar farm, from which sediment-rich runoff was considered highly likely. The water was sediment laden on the day of the walkover survey, with evidence of deposition throughout the reach. A culvert was creating a small barrier to fish movement near the downstream end of the reach (Figure 3-4).

This reach was thought to be unlikely to support a salmonid population due to the shallow nature and silted substrate however, it may support smaller fish species like bullhead or stickleback and limited macroinvertebrates communities are likely to be present.

Figure 3–4 Reach 4.2 – Barrier to fish movement

3.1.4 Reach 5.1

Not surveyed, access permission not obtained. Reach 5.2 is located in close proximity to reach 5.1; reach 5.2 is closer to the proposed route options and confluences with reach 5.1, therefore in the absence of any specific data, reach 5.2 is considered to be a good proxy.

3.15 Reach 5.2

Reach 5.2 was approximately 500m long and lies at the western end of the surveyed area and flows from south to north. The reach was divided into to two sections by a large pond. The upstream section was notably shallow and extensively impacted by silted deposition. Downstream of the pond the water was slightly deeper, though generally less than 5cm, and the substrate was less affected by silt deposition (Figure 3–5).

In Reach 5.2 there was a large barrier at the pond outfall, thought to be impassable to all fish species under all flow conditions. This reach was considered unlikely to support a significant fish population, though designated species such as bullhead and lamprey may be present. It is also likely that limited macroinvertebrate populations are present. Downstream of the pond, sub-optimal lamprey habitat around coarse woody debris was observed with the possibility of a small lamprey population within these small patches of habitat.

Figure 3–5 Reach 5.2 – Downstream habitat

3.1.6 Reach 6.1

Reach 6.1 was approximately 600m long and was characterised by very shallow water and a narrow channel approximately 0.5m wide (Figure 3–6).The reach was split into two parallel streams, running on both sides of an old boundary wall. The substrate of both watercourses was dominated by gravel and pebble though which was covered by fine sediment throughout. Several likely sources of siltation were identified, including woodland runoff, drainage pipes, arable runoff and track runoff from a solar farm. It is thought that the reach is unlikely to support any significant fish populations, with salmonids unlikely to be present, although limited macroinvertebrate and smaller fish species, including bullhead may be capable of tolerating the conditions.

Figure 3–6 Reach 6.1 – Typical habitat

3.1.7 Reach 8.1

Reach 8.1, approximately 700m long, lies near the middle of the survey area. The section upstream of the online pond was very shallow, narrow and silted throughout, the likely source of which was thought to be the surrounding livestock fields. A culvert was identified which was creating a barrier to fish movement in the middle of the reach. There were also two culverts at the downstream end of the pond, which were and considered impassable under any flow conditions. The section downstream of the pond was narrow and very shallow, though the run and glide sections and some coarse woody debris provided some varied habitat within the reach.

The downstream section of reach 8.1 around Little Nanteague was somewhat deeper with heterogeneous instream habitat recorded (Figure 3–7). This reach was interspersed by woody debris causing varied flow types with a series of micro pools and runs cleaning the gravel substrate required by salmonids for spawning. Some small accumulations of deeper fine organic sediment were also observed in the deeper glide sections which are thought to be suitable as juvenile lamprey nursery habitat.

Reach 8.1 was also thought to be suitable for a range of macroinvertebrate species with a range of instream and marginal refuge available throughout.

Figure 3–7 Typical habitat in lower stretches of Reach 8.1

3.1.8 Reach 10.1

Reach 10.1 was approximately 800m long and predominantly shallow in a deeply incised channel approximately 1m wide (Figure 3–8), though it was wider in places. The reach is fed by a pond in the headwaters of the catchment, which was not accessed due to landowner restrictions. Other small tributaries were also observed entering from the southern bank

The substrate of the survey reach was dominated by gravel and pebble although fine sediment was observed smothering the substrate at a number of locations. The sources of silt were likely to be from bank erosion and intermittent cattle poaching.

An established fish and macroinvertebrate community is thought to be unlikely in the each surveyed due to depth of the water and the denuded nature of the substrate. However, minor species such as stickleback and tolerant macroinvertebrate species may be capable of establishing intermittent communities.

Figure 3–8 Narrow, incised channel in Reach 10.1

3.1.9 Reach 12.1

Reach 12.1 lies near the middle of the A30 survey footprint and flows into reach 12.3. The survey stretch was 600m long and was narrow and shallow throughout. The gravel / pebble substrate in Reach 12.1 was extensively silted throughout, which was thought to be the result of cattle poaching on the banks and instream (Figure 3–9). It is thought that the reach upstream of the A30 is unlikely to support a significant fish or macroinvertebrate population due to its water depth and denuded substrate, although immediately downstream of the A30, where the water is deeper there may be a limited aquatic ecological community including fish and macroinvertebrates.

Figure 3–9 Reach 12.1 – Upstream of the A30

3.1.10 Reach 12.2

Reach 12.2 flows into reach 12.3 and is approximately 300m long. The reach was narrow, shallow and slow flowing throughout. The substrate was generally homogenous with silt and fine sediment dominating throughout. The stream initially flows through a wooded area before entering a cattle field where extensive poaching was observed which was thought to be the source of the fine sediment (Figure 3–10). The aquatic habitat of reach 12.2 was considered to be poor and unlikely to support any significant fish or macroinvertebrate populations.

Figure 3–10 Reach 12.2 – Poaching of the stream in Reach 12.2

3.1.11 Reach 12.3

Reach 12.3 was approximately 500m long and was fed by reaches 12.1 and 12.2, both of which are extensively poached and denuded. The reach was narrow and shallow throughout (<10cm), with substrate a mix of fine grained sediment with some gravel and pebble present. Shallow glide and run dominated the flow types though several slightly deeper areas were observed, which may serve as holding areas for salmonid fish (Figure 3–11). Poaching was present along much of the reach, which was a likely source of the silt as well as the inflow from reaches 12.1 and 12.2.

Due to heterogeneous instream habitat and the presence of coarse woody debris and deeper holding areas, this reach may support a limited salmonid and macroinvertebrate population.

Figure 3–11 Typical habitat at Reach 12.3

3.1.12 Reach 13.1

Reach 13.1 was 500m in length and lies near the eastern end of the survey footprint. Upstream of the village of Lemain the stream was shallow and inundated by silt, making it generally unsuitable for fish and macroinvertebrate populations. While downstream, the habitat was more diverse, including gravel and pebble substrates and limited cobble and boulder pockets. Shallow glide and run dominated the flow types throughout the reach however, some deeper sections (<30cm) were recorded, which may provide holding areas for salmonid species (Figure 3–12). It is thought that the reach could support fish and macroinvertebrate populations and that salmonid species may be present in deeper areas.

Figure 3–12 Fish habitat in the downstream stretch of Reach 13.1

3.1.13 Reach 13.2

Reach 13.2 was approximately 100m long and was connected to reach 13.1, with a large dry section in-between. This reach was made up of several overgrown, ponded sections (Figure 3–13), which likely are fed by intermittent runoff from the three road crossings. There was no evidence of recent connectivity up or downstream. The ephemeral nature of this reach makes it unlikely to support fish or meaningful macroinvertebrate populations.

Figure 3–13 Reach 13.2 – Typical ponded stream with limited aquatic habitat

3.1.14 Reach 13.4

Reach 13.4 was approximately 500m long with a narrow, incised, channel throughout. Very little flow was observed in the upper reaches, although the channel was slightly wider downstream of an online pond in the lower reaches. The substrate was generally gravel and pebble with a covering of fine sediment thought to be originating from overland runoff from adjacent arable fields and horse poaching (Figure 3–14).

Due to the depth, lack of habitat diversity, presence of silt and an impassable barrier at the downstream extent, Reach 13.4 was thought to be unlikely to support significant fish populations though smaller species such as bullhead and limited macroinvertebrate communities may be present.

Figure 3–14 Reach 13.4 – Horse poaching

3.1.15 Reach 15.1

Reach 15.1, was dominated by a narrow and steep channel with fast flowing, shallow water throughout, although some pooled areas were observed in a woodland area (Figure 3–15). Very little optimal fish and macroinvertebrate habitat was observed during the survey with fine sediment dominating substrate. It is also thought that the flow is ephemeral in Reach 15.1 with a likelihood of desiccation during the summer.

Figure 3–15 Reach 15.1 –Pooled woodland reaches

3.1.16 Reach 16.2

Reach 16.2 was approximately 800m long with a deep and incised channel in many areas (Figure 3–16). The reach was split into two channels within a section of deciduous woodland, with accretion of flow from the surrounding land observed.

Flow types were heterogeneous throughout the reach with glide, run, riffle and cascade all present over a mixed substrate, which included gravel, pebble and limited cobble. Siltation was evident within the interstices of all substrate types. The reach is generally unlikely to be to be capable of supporting a well-developed salmonid population, although intermittent fish and macroinvertebrate communities are likely where the habitat allows.

Figure 3–16 Incised channel in reach 16.2

3.1.17 Reach 17.1

Reach 17.1 was 450m long and lies at the eastern extent of the survey footprint. The reach was generally shallow and narrow with varied flow types, notably shallow run and glide (Figure 3–17). The substrate was dominated by compacted gravel and pebble, which was extensively silted. Arable runoff was observed at the upstream extent of the reach, which was likely contributing to the siltation of the reach.

An obstruction to fish movement was recorded in the lower catchment, in the form of a culverted road crossing, limiting upstream movement of fish into this reach. It is therefore considered that this reach is unlikely supports a significant fish population due to the shallow depth, compacted substrate and lack of connectivity. However, some minor fish species and macroinvertebrates may be present where the habitat allows.

Figure 3–17 Typical habitat in Reach 17.1

3.1.18 Reach 18.1

Reach 18.1was approximately 600m with a narrow, heavily modified channel to serve as a field drain. There were multiple potential sediment inputs due to small or absent arable field buffers (Figure **3**–**18**). The stream has been dredged, deepened and the course has been altered from its original woodland path. A Tributary, entering from the east, near the downstream extent of the reach, increases the depth and flow of the stream. Due to the heavy modification of the channel and shallow homogeneous nature of the flow, this reach is considered unlikely to support a fish or macroinvertebrate population.

Figure 3–18 **Lack of field buffer on Reach 18.1**

3.2 Stillwater Assessment

6 still waters were identified within the footprint of the proposed works, some of which have direct connectivity to the proposal for ground works to expand the A30 within the survey area. Due to the independent and varied nature of each pond, the findings of the walkover survey are discussed on a pond by pond basis below.

3.2.1 Pond 5.2

Pond 5.2 was a small, manmade waterbody with angler's access at a number of locations. The waterbody was inundated with emergent macrophyte, with a significant amount of submerged macrophyte cover throughout (Figure 3–19). Upstream fish movement into the pond is impeded by a barrier at the outfall. Habitat within the pond was considered favourable for supporting a small coarse fish population however no fish were observed at the time of survey and it is unclear whether the pond has been stocked. It is thought that the pond is capable of supporting a well-developed still water macroinvertebrate community.

Figure 3–19 Online pond with submerged and emergent macrophyte cover

3.2.2 Ponds 8.1 (on and offline)

The online pond 8.1 has commercial fishing lake usage, although the stocking of fish is unconfirmed. The pond appears to be deep with a uniform depth throughout. Connectivity to the pond is limited with movement of fish from downstream impeded by barriers at the pond outfall. Emergent macrophyte was observed around the margins of the pond (Figure 3–20) but is relatively under established, suggesting the pond has been recently excavated. It is thought that the pond is capable of supporting a well-developed fish population and still water macroinvertebrate community.

Figure 3–20 Online pond 8.1 used for angling

The offline pond 8.1 at Little Nanteague is a well-established, mature waterbody which is inundated with submerged macrophyte. Marginal emergent macrophyte stands were also observed throughout (Figure 3–21). Assuming that the water quality is satisfactory the pond would provide ideal habitat for cyprinid fish species such as carp and roach and it is likely to have been colonised by a diverse macroinvertebrate community.

Figure 3–21 Well-established offline pond 8.1

3.2.3 Pond 13.3

Pond 13.3 is a small pond at the upstream extent of reach 13.2. Some evidence of historical connectivity was observed, though there was no evidence of recent flow. It was shallow and silted and there was no obvious use other than a livestock drink (Figure 3–22). Limited emergent and submerged macrophyte was recorded. Although a fish and macroinvertebrate community may be present in the waterbody it is unlikely that the population diversity will be high.

Figure 3–22 Shallow, homogenous habitat at Pond 13.3

Pond 13.4

Pond 13.4 was near the upstream extent of reach 13.4 and was fed by the main stream. It was shallow and inundated by fine sediment. Very sparse marginal emergent macrophyte was recorded with no submerged features favoured by fish and macroinvertebrates. It is thought that this pond may dramatically reduce in size during the summer, limiting its capacity to support aquatic ecological populations.

Pond 16.1

Pond 16.1 was a flooded quarry with very steep banks and no access to the waters edge (Figure 3–23). There was no obvious macrophyte cover and due to its inaccessibility is considered unlikely to have been stocked with fish in the past. An extensively overgrown dry ditch leading to the site through dense gorse was observed, though this was likely to be an old quarry access track rather than a feeder tributary.

Although containing a large volume of water it is thought that pond 16.1 is unlikely to support a significantly population of fish unless previous introductions have occurred. A

macroinvertebrate population would be expected at the site, which in the absence of fish may be diverse and well developed.

Figure 3–23 Deep water at Pond 16.1

4. Recommendations for further surveys

4.1 Predicted impacts on stream reaches

Recommendations for surveys of fish and invertebrate populations on the surveyed reaches have been divided into two sections; those reaches that are directly crossed by the proposed A30 route options and those that may be indirectly impacted by the footprint of the proposed works.

4.1.1 Directly impacted reaches

There are four reaches (2.1, 12.1, 12.2 and 13.4) which would potentially be intersected by the proposed A30 route options. These watercourses may be impacted by direct intrusion (cutting or realignment) or be affected by temporary crossings which can result in reduction in bank stability and/or generation of sediment to the watercourses. Site work at these locations is likely to cause significant impacts on fish and invertebrate populations and associated habitats where present.

Although the aquatic ecological communities at each of these sites is thought to be limited, it is suggested that fully quantitative population surveys should be undertaken for fish and macroinvertebrates in order to establish baseline population data and to ascertain the presence / absence of conservations species at each site. This data could also be used to inform the requirement of fish relocation if instream works are proposed at these four sites.

4.1.2 Indirectly impacted reaches

The remaining 14 reaches were assessed to have potential for indirect impacts from the proposed route options, with notable potential for downstream sediment ingress via site runoff. This would be of particular concern on the watercourses which are thought to be suitable for salmonid populations, such as Reach 12.3. It is thought that, although unlikely at some sites, bullhead or lamprey could be present in the remaining streams. Using a precautionary approach, it is recommended that these watercourses should also be semi-quantitatively surveyed in order to obtain basic fish and macroinvertebrate baseline data.

Of the remaining watercourses only 4 were deemed completely unsuitable for all fish and macroinvertebrates communities (4.1, 5.1, 13.2 & 18.1). These streams were ephemeral, too shallow and narrow for aquatic ecology to establish or so denuded to be ineffectual for fish and macroinvertebrates.

4.1.3 Type of survey and timing recommended

In order to establish a baseline ecological data set for the watercourses above it is suggested that survey strategy and timings follow the standard monitoring protocols for the target species. This would particularly be the case for species which have prescriptive habitat preferences such as lamprey (APEM 2002). Other fish should be surveyed by using electric fishing undertaken within enclosures, in order to provide a population density. A number of sites would be surveyed on the target watercourse, including in the footprint of the crossing points.

The Macroinvertebrate baseline data set should be captured by by using the River Invertebrate Classification Tool (RICT). This classification method enables the assessment of invertebrates in rivers (in relation to general degradation, including organic pollution) according to the requirements of the Water Framework Directive. The classification comprises two metrics that are assessed separately and then combined in a "worst of" approach to provide the overall invertebrate classification; RICT output includes an Ecological Quality Ratios (EQRs) which are based on observed data and site specific predicted reference values derived from physical and chemical parameters which would be collected in the field. For a site to be classified, two macro–invertebrate samples and associated environmental measurements should be collected per year.

A summary of the recommended surveys for the stream walked is provided in Table 4.1.

Table 4.1 Recommended surveys and timing for each reach

Potential impact	Reach	Fish (incl .lamprey)	Invertebrates	
		Late summer	Spring	Autumn
Direct (Fully quantitative surveys required)	2.1	Y	Y	Y
	12.1	Y	Y	Y
	12.2	Y	Y	Y
	13.4	Y	Y	Y
Indirect (Semi quantitative surveys required for fish)	4.1	N	N	N
	4.2	Y	Y	Y
	5.1	N	N	N
	5.2	Y	Y	Y
	6.1	Y	Y	Y
	8.1	Y	Y	Y
	10.1	Y	Y	Y
	12.3	Y	Y	Y
	13.1	Y	Y	Y
	13.2	N	N	N
	13.4	Y	Y	Y
	15.1	Y	Y	Y
	16.2	Y	Y	Y
	17.1	Y	Y	Y
	18.1	N	N	N

4.2 Predicted impacts on still waters

As all of the six still waters surveyed are within the proposed works footprint (1km footprint), it is thus suggested that there is potential for all ponds to be affected by the proposed work. Pond 16.1 was a flooded quarry with very steep banks and no access to the waters edge. There was no obvious macrophyte cover and due to its inaccessibility is considered unlikely to have been stocked with fish. An extensively overgrown dry ditch leading to the site

through dense gorse was observed, which is likely to be an old quarry access track rather than a feeder tributary. No additional surveys are recommended on health and safety grounds. As such, National Pond Surveys are recommended for 5 of the 6 ponds initially surveyed.

For a full National Pond Survey assessment, ponds are surveyed in three seasons: spring, summer and autumn. Only invertebrates and some water chemistry and environmental parameters need to be surveyed on all three visits with macroinvertebrate species recorded from the pond, ideally for three seasons of the year: spring (March-May), summer (June-August) and autumn (September-November) with estimates of their abundance. A summary of the recommended surveys is provided in Table 4.2.

Table 4.2 Recommended pond surveys

	National Pond Survey		
Pond	**Spring**	**Summer**	**Autumn**
5.2	Y	Y	Y
8.1 online	Y	Y	Y
8.1 offline	Y	Y	Y
13.3	Y	Y	Y
13.4	Y	Y	Y
16.1	N	N	N

4.3 Additional recommendations

The site work on the A30 development has potential to affect all surface waters with connectivity to the works footprint. It is recommended that a series of mitigation measures are adopted to minimise the potential impacts on aquatic ecological in these waterbodies;

- Contractors limit tracking machinery where possible
- Tracking mats, or alternative suitable material is placed on the bank top, to protect direct impact to and erosion of the surrounding land
- When temporary crossings are removed, the channel bed and banks are reinstated to their original profile, at a stable angle to prevent any subsequent erosion or undercutting (given the shallow profile of the watercourses a deficit in material volumes required to do so is not anticipated).
- Contractors limit moving excavated material around the site. If any rainfall runoff events occur it may be necessary to surround the stockpile with a bund to prevent it from being washed back into the watercourse.

- Sediment curtains or matting are installed in appropriate locations at each of the sites crossed (with adequate replacement sets available should one set need to be cleaned while the other set is being used).

5. References

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