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A55 Junction 16 Improvements: Survey of the Macroinvertebrate Community of the Lower Reach of the Afon Gyrach

for

WELSH GOVERNMENT

October 2019

3066

RML

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A55 JUNCTION 16 Improvements: Survey of the Macroinvertebrate Community of the Lower Reach of the Afon Gyrach

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1 GLOSSARY AND ABBREVIATIONS

1.1 Glossary

Benthic Algae – Diverse group of micro-organisms including algae and diatoms that develop as a film on the rocky/stoney bed of rivers and streams particularly in shallow riffle areas.

Discharge – Volume of stream water passing a point over a set time period (metres cubed per second).

Filamentous Algae – Algal species that attach to stream substrate and grow as hair-like strands or filaments within the water flow. Often associated with nutrient enrichment.

Electrical Conductivity - A measure of waters ability to pass electrical flow. This ability is directly related to the concentration of conductive ions in the water. Ions include dissolved salts and inorganic materials such as alkalis, chlorides, sulphides, and carbonate compounds.

Glide – Stretch of flowing stream water. A transition zone out of a pool and into a riffle zone.

Invertebrates - Animals without backbones and bony skeletons.

Macrophyte – Aquatic / semi aquatic plants that grow in or near water. Plants can be submerged, emergent or floating.

Pool – Stretch of flowing stream water characterised by greater depth and smooth quiet surface movement.

Riffle – Stretch of flowing stream water characterised by shallow flow over rough stoney/ rocky streambed substrate, creating broken and noisy surface water.

Riparian – Zone of habitats that interface between terrestrial and stream habitats.

Turbidity – A measure of the degree to which stream water loses its transparency due to the presence of suspended solids.

1.2 Abbreviations

ASPT score – Average Score Per Taxon score

BMWP score – Biological Monitoring Working Party score

EQR's – Environmental Quality Ratios

IUCN – International Union for Conservation of Nature

N-TAXA – Number of taxa

RICT – River Invertebrate Classification Tool

RIVPACS – River Invertebrate Prediction and Classification System

WFD – Water Framework Directive

2 INTRODUCTION

2.1 Purpose of Study

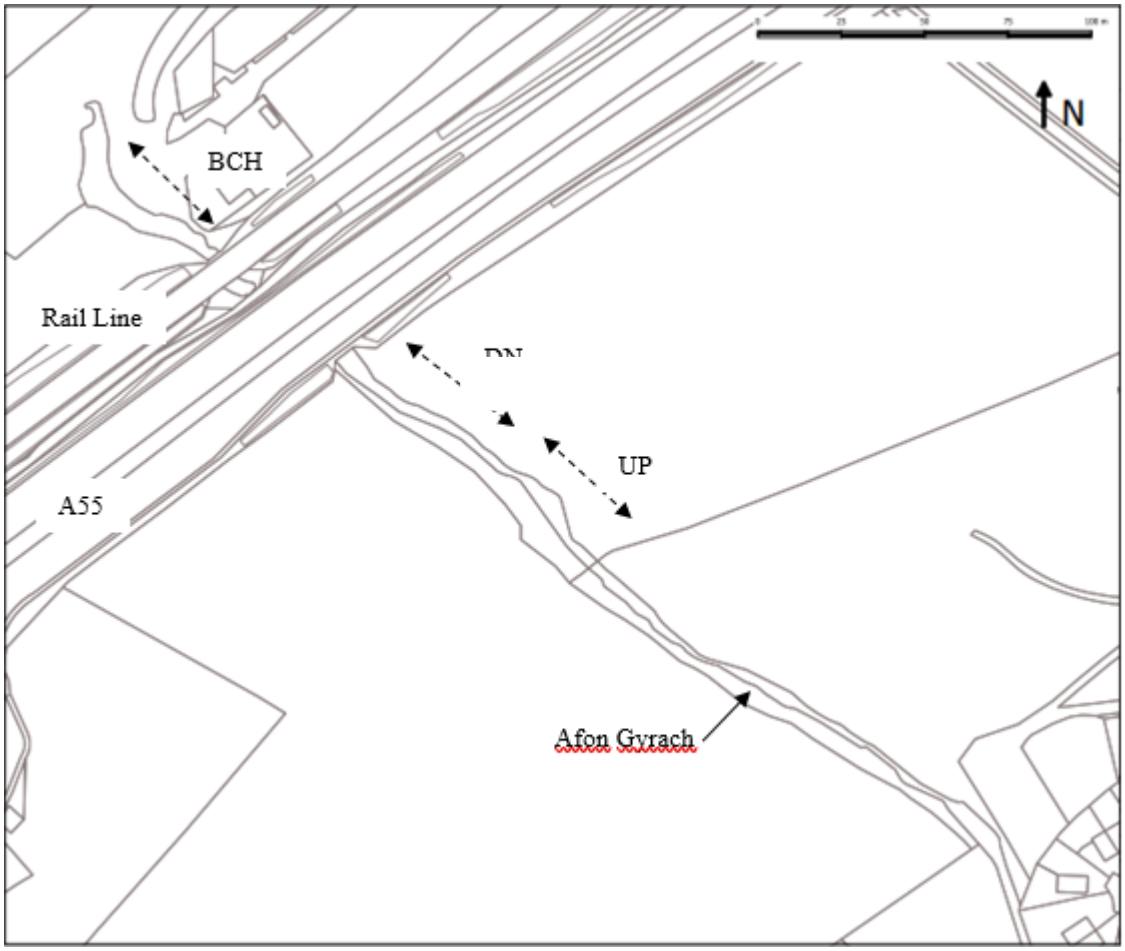
2.1.1 Improvements are planned to the A55 at Junction 16, Penmaenmawr and Dwygyfylchi, Conwy County in North Wales. Richards, Moorehead & Laing Ltd were commissioned to undertake ecological surveys of surrounding habitats and species to determine the ecological value of the site and its surroundings. This survey work and report specifically targeted the aquatic macroinvertebrate community in the lower section of the Afon Gyrach which passes through the proposed development site and under the proposed new bridge/culvert. Its purpose was to provide baseline data on invertebrate community assemblages and to calculate indices that would describe the biological quality statuses of the habitats surveyed and enable mitigation for works affecting the watercourse to be planned effectively.

2.1.2 Improvements works to the road have potential to impact on the ecological quality of the Afon Gyrach both during construction and after through pollution, disturbance of in-stream and riparian habitats, loss of habitat and run-off from land disturbance and road surfaces. Aquatic macroinvertebrates assemblages are a good long-term indicator of water quality and habitat health and will provide a reliable source of information and baseline for incorporation into the ecological impact assessment for the road improvement scheme.

2.2 Survey Location

2.2.1 The Afon Gyrach has a small catchment area on the North Wales coast between Bangor and Conwy. It has its source at an altitude of approximately 300m and runs generally north for a length of 4.6 km. At its lower reach it passes along the eastern edge of Dwygyfylchi before passing under the A55 (grid ref. SH 73578 77762) and then the immediately adjacent and parallel railway line before discharging into the sea. The survey locations were immediately north and south of the current road and rail bridge (see Figure. 1).

Figure 1. Map of the lower reach of the Afon Gyrach.



3 METHODS

3.1 Invertebrate Sampling

3.1.1 Surveys were conducted over two seasons; Spring (24th May 2019) and Summer (2nd August 2019) Frequency of survey, site location and sample number were chosen in line with guidance provided with the River Invertebrate Classification Tool (RICT), (*www.sepa.org.uk/environment/water/aquatic-classification/river-invertebrate-classification-tool/* & Murry-Bligh, 1999). The location of survey sites is given as grid references in Appendix 1., Table 1. Two stream sampling sections were chosen south of the road (see Figure 1.). Both sections were similar in character apart from the density of tree canopy. The upstream section (labelled UP) had open to sparse tree cover in comparison to the downstream section (labelled DN) that had moderate levels of cover from a thin border of riparian trees. These upstream sections were also separated by a discharge pipe. The origin and type of discharge from this pipe is not known to the author. Downstream of these sections the stream passed underneath the road and rail crossings where the substrate consisted of mainly flat concrete slab. A third sample site (labelled BCH) was surveyed immediately north of the rail overpass where the stream returned to typical substrate for a short section before passing onto the tidal beach habitat. This further site was the only possible survey site downstream of the intended construction site.

3.1.2 Aquatic macroinvertebrates were collected from the in-stream substrate using a standard kick-netting technique. Samples were taken from riffle habitats using a long handle net with a 400µm mesh and collection bottle attachment. At each of the sampling positions a 3-minute kick netting transect across all in-stream habitat types (including differing substrate and flow characteristics) was undertaken. Additionally, sampling included a search of larger riverbed boulders and sweeping along submerged and overhanging riparian vegetation where it was present. This method followed standard practice for sampling shallow lotic habitats (Murry-Bligh, 1999) and is in line with requirements for analysis using the River Invertebrate Classification Tool RICT. All macroinvertebrates were sorted from sediment and debris and preserved in 70% ethanol. Identification was undertaken with a low-power light microscope to species where possible. Difficult to identify taxa were either taken to family or genera level.

3.2 Assessing Conservation Status

3.2.1 Current conservation status of the species identified was established in reference to the guidelines published by the International Union for Conservation of Nature (IUCN) (IUCN, 2012a, b & 2013) and the subsequent species reviews (Macadam, 2015 & 2016. Wallace, 2016). These provided a current review of threat status for various invertebrate taxa. International Union for Conservation of Nature procedures firstly record taxa 'threatened in the region of interest', then adjust those records to account for 'interactions with populations of taxa in neighbouring regions' (IUCN 2013). In parallel, the standard Great Britain system of assessing rarity which only uses GB distribution as a guide to status was also recorded. International Union for Conservation of Nature species status reviews inform British species protection legislation. Schedule 5 of the Wildlife and Countryside Act 1981 lists 70 invertebrate species, few of which are likely to be encountered within the Afon Gyrach. However, the list was reviewed and cross checked with survey results to identify any species that were listed.

3.3 Environmental Data Sampling

3.3.1 Additional data collected at sites included mean depth, mean width, velocity (gathered to calculate discharge category) and estimates of percentage substrate composition. Electrical conductivity was recorded using a portable Shayson water quality test meter. Further reference statistics were gathered from a 1:25000 ordnance survey map. These included National Grid Reference, altitude, slope, and distance from source. Procedures for collection of the above data followed the UK invertebrate sampling and analysis procedure for STAR project (2004); as required by RICT protocols *(www.sepa.org.uk/environment/water/aquatic-classification/river-invertebrate-classification-tool/* .)

3.4 Statistical Indices

3.4.1 The statistical scoring methodology followed the Biological Monitoring Working Party (BMWP) protocol also set out in UK Invertebrate (2004) which was devised to detect adverse inputs of organic materials (carbohydrates, fats and proteins) in watercourses but is used widely as a scoring system of general water quality. Within

this protocol, scoring taxa are those whose presence has a positive or negative correlation with clean water. Scoring invertebrate families are assigned a score 1-10. High-scoring aquatic macroinvertebrate taxonomic families are those that require well-oxygenated unpolluted water. These include certain families of Ephemeroptera (mayflies), Plecoptera (stoneflies) and Tricoptera (caddisflies). Low-scoring families are more tolerant of poorly oxygenated polluted water (these include the Chironomidae midges and Oligochaeta worms). Not all families are used in the system. The sum of BMWP scores was then totalled to give an overall BMWP score for each survey site.

3.4.2 Total BMWP was then divided by the number of scoring taxa N-TAXA to give the Average Score Per Taxon (ASPT). ASPT is useful as it reduces the effect that small numbers of very high or low scoring taxa can have on a sample score. ASPT scores are also considered to be less prone to both differences in sampling effort and seasonal changes in invertebrate community composition in comparison to BMWP scores. A low ASPT implies that the invertebrate community occupying a sampled section of stream may be experiencing persistent or episodic pollution events.

3.4.3 Reference, environmental and biological index data were then entered into the RIVPACS IV (River Invertebrate Prediction and Classification System IV) analysis package which is now incorporated into RICT (*www.sepa.org.uk/environment/water/aquatic-classification/river-invertebrate-classification-tool/*). RIVPACS predicts BMWP indices under best watercourse conditions using reference, physical and chemical data. It then divides observed indices by expected to produce Environmental Quality Indices (EQI). The closer the value is to 1 the better the water quality of the survey site.

3.4.4 However, RICT have incorporated the new RIVPACS IV as the official system for the Water Framework Directive macroinvertebrate classification of sites used by UK environmental protection agencies. RICT calculates Environmental Quality Ratios EQR's using the same methods as for EQI's but introduces bias data that represents sample analysis efficiency (likely occurrence of misidentification in the invertebrate data) and a corrective value that changes RIVPACS predictions into reference values.

EQR's were then assigned a Water Framework Directive WFD biological status in line with ranges given in this Survey Report Appendix 2., Table 4.

3.4.5 The accuracy of RIVPAVCS classifications and predictions is enhanced when data from two or more seasons is used to describe invertebrate communities and the physical and chemical characteristics of the watercourse. As such, physical and chemical data for the two seasons sampled for each site were averaged before being entered into RICT. When calculating BMWP, ASPT and N-TAXA scores for input into RICT invertebrate family lists for each season (Spring and Summer) were combined to give a score that represents the year, not an average of seasons.

4 RESULTS

4.1 Survey and Site Conditions

4.1.1 For both Spring and Summer survey dates weather was warm, clear and calm. Discharge was moderate with low turbidity and insignificant sand or fine sediment inundation around a streambed dominated by cobbles and boulders at all survey sites. On both dates' substrate was generally covered in benthic algae with a very low occurrence of filamentous algae. Riparian trees provided light to moderate shade along survey site DN only. Sites UP and BCH experienced little to no canopy shading. The stream sloped gently through all sites creating a sequence of short riffle, pool and shallow glide habitats; pools where generally shallow and less common. The only in-stream macrophyte present at sites was the aquatic moss *Fontinalis antipyretica*, mainly present at site UP. For all physical and chemical data gathered from site and maps for entry into RICT, see this Survey Report Appendix 1., Tables 2 & 3.

4.1.2 Raw invertebrate data results for all three survey sites are described in Appendix 3., Table 5. Combined season BMWP system indices for each survey site are displayed in Table 1., section 4.3. Across all sites 34 invertebrate families where identified, 30 of which were BMWP scoring taxa. BMWP scores recorded at UP (150) and DN (135) of above 100 are generally regarded as signifying that the invertebrate community experiences clean unpolluted water and unimpacted habitat. The score at BCH (58) signifies a moderately impacted water quality and habitat.

4.2 Conservation Status: Notable Species

4.2.1 All but one species listed in this Survey Report Appendix 4, Table 6, are classed as of Least Concern (LC) under the IUCN threat category column. LC is defined as a tax on that 'does not qualify for Critically Endangered (CR), Endangered (EN), Vulnerable (VU), or Near Threatened (NT)'. The exception is *Wormaldia mediana*. This is a caddis species from the family Philopotamidae. At the larval stage it is not possible to separate it from *Wormaldia occipitalis* and *Wormaldia subnigra* which are both classed LC. The current status of *W. mediana* is Data Deficient (DD). DD is defined as when there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status. DD is not a category of threat. DD indicates that more information is required and acknowledges

the possibility that future research will show that threatened classification is appropriate.

4.2.2 Under the GB Rarity Status in this Survey Report Appendix 4. Table 6., *W. mediana* is also classed as Nationally Rare NR and *W. subnigra* is classed as Nationally Scarce NS. Also, of note is the mayfly *Rhithrogena germanica* from the family Heptageniidae which has a GB Rarity Status of NS. *R. germanica* is indistinguishable from *Rhithrogena semicolorata* at the larval stage; both have an IUCN Status of LC.

4.3 RICT RESULTS

4.3.1 RICT produces EQR's and classification status for N-TAXA and ASPT, giving six outcomes in Table 1. Of these six, three have a HIGH status, two GOOD and one BAD. The latter being for BCH N-TAXA. These data are produced by statistical comparison with an extensive and historical reference data set to provide robust ecological quality classifications (See *www.sepa.org.uk/environment/water/aquatic-classification/river-invertebrate-classification-tool/*)

Table 1: RICT RESULTS: Observed and Expected BMWP Indices, EQR's and Classification

Site	Index	Observed	Expected ref.adj.	EQR	WFD Biological Status
UP	BMWP	150	172.181	_	_
UP	N-TAXA	23	24.474	0.965	High
UP	ASPT	6.52	6.211	1.007	High
DN	BMWP	135	170.518	_	_
DN	N-TAXA	19	24.227	0.817	Good
DN	ASPT	7.1	6.183	1.091	High
BCH	BMWP	58	168.448	_	_
BCH	N-TAXA	10	23.627	0.473	Bad
BCH	ASPT	5.8	6.097	0.902	Good

5 DISCUSSION

5.1 Sampling Sites

5.1.1 UP and DN sites each recorded favourable EQR's and associated WFD Biological Statuses which suggests relatively unpolluted and robust habitats that support healthy invertebrate community assemblages. The RICT quality status (BAD) recorded at the BCH site stood out as the only EQR status below GOOD. There may have been several reasons for this result. Firstly, the site was somewhat isolated from the upstream sites separated by road and rail crossings. Underneath the crossings the substrate changed to approximately 40m of concrete slab (with a short break between the bridges). Light conditions underneath were dark producing little benthic algal food resource over flat substrate. This poor habitat is likely to have resulted in comparatively low recruitment from natural drift of species (as waterborne larvae and flying insects) into site BCH from upstream. No recruitment would occur from the downstream beach habitat.

5.1.2 Secondly, it is possible that the BCH site is subject to occasional saltwater inundation on seasonal high tides due to its close proximity to the tidal beach. Although not a regular occurrence, the effects on the freshwater invertebrate community would be significantly detrimental.

5.1.3 These two factors described above have the potential to reduce N-TAXA. In contrast ASPT status at BCH was GOOD, suggesting that species that have made it to the site enjoy clean freshwater conditions; however temporary that may be. Although BCH is the only possible sampling site downstream of the construction area, it may not be sensible to use it in future as an invertebrate sampling site as its N-TAXA may fluctuate significantly or remain significantly depressed as a result of the issues above.

5.2 Potential Effects of Construction on the Macroinvertebrate Community

5.2.1 The construction of a bridge or culvert to span the Afon Gyrach is likely to have three main impacts on the macroinvertebrate community. Firstly, at DN the possible replacement of the structurally complex streambed with a concrete slab (as with the

two existing bridges) would result in the loss of in-stream and riparian habitats for that section of stream. Secondly, at all sites the activity of machines disturbing soils on and around the site could increase the amount of fine sediments entering the flow and settling into the streambed causing detrimental effects on invertebrates. Lastly, at all sites again, the use of heavy machinery could result in the spillage of toxic fuels and oils etc. into the waters and riparian areas. It is unclear where the limits of construction activity will reach at the site. It would be advantageous if the top end of the field containing site UP was retained as an unimpacted zone to allow the stream section in this area to be kept as a reference/control site to assess against impacts at DN and BCH closer to the construction site. If this is not possible another reference site further upstream should be sought.

5.2.2 The surface substrate of the Afon Gyrach is composed of mainly boulders and cobbles. In addition, the subsurface substrate also includes a complex mixture of silt, sand, gravels. The arrangement of these is influenced by the flow regime, topography, geology and riparian vegetation to create a diverse set of physical meso-habitats both across the stream and along it. Each invertebrate species is adapted to use a particular or set of these habitats in order to find food and refuge resources. When the complexity of these habitats is reduced by the use of hard engineering, the capacity of the stream to support a diverse range of invertebrates is also reduced within the affected section of stream.

5.2.3 The movement of fine sediments downstream is a natural process and its extent is different for each stream according to the catchment it flows through. The addition of extra fine sediments through agricultural and construction activities can act to fill up the interstices between larger substrate. This will reduce the surface area of the habitat, eliminate refuge zones, bury sedentary species and reduce primary production by hindering the attachment of benthic algal; the food source of grazing invertebrates. Fine sediments can also have a direct effect on the invertebrates themselves by abrasion of their soft tissues and the clogging up of filter feeding apparatus and gills (Jones et. al. (2012).

5.2.4 Smith (2009) found that spillage of diesel into a stream could reduce abundance of invertebrates by over 90% and almost half the diversity of families present. Green & Trett (1989) reported that recovery of invertebrate communities from such a

pollution event was slow and could take many months with impacts on the whole freshwater stream community. As the proposed construction site is positioned at the end of the Afon Gyrach, the spillage of toxic fluids into and around the stream would have impacts in both the remaining freshwater habitat and the marine habitat that it enters. This could have implications for marine species and anadramous species such as Eel *Anguilla anguill*a Sea Trout *Salmo trutta*.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

6.1.1 The current WFD Biological Status on the lower reach of the Afon Gyrach is generally HIGH to GOOD.

6.1.2 Invertebrates of concern because of their GB Rarity Status are the caddis fly *W.mediana* and *W.subnigra*, as well as the mayfly *R. germanica*. Identification of these to species is not possible at the larval stage. However, the possibility exists that they are present. Survey of adult stages would be problematic due to unpredictable emergence times and low abundance.

6.1.3 The main threats to the whole aquatic macroinvertebrate community from construction works are loss of habitat, the addition of fine sediments into the flow and spillage of toxic fuels and oils etc.

6.2 Recommendations

6.2.1 Water quality status should be maintained and monitored during the construction works and post works period.

6.2.2 The southern end of the survey site should remain off limits for works activities to allow the stream section in that area to be used as a reference site.

6.2.3 Efforts should be made in all phases of works to limit habitat loss, reduce additional loading of silt and fine sediments from site works and road run-off and stop chemical spillage into and around the affected watercourse.

7 REFERENCES

- Green, J. & Trett, A.W. (1989) The fate and effects of oil in freshwater. Elsavier Applied Science. London, UK.
- IUCN (2012a) IUCN Red list categories and criteria. Version 3.1 . 2nd Ed., IUCN Species Survival Commission IUCN, Gland.
- IUCN (2012b) Guidelines for application of IUCN Red List categories at region and national levels. Version 4, IUCN Species Survival Commission IUCN, Gland.
- IUCN (2013) Guidelines for using the IUCN Red List categories and criteria. Version 10, IUCN Species Survival Commission IUCN, Gland.
- Jones, J.I., Murphy, J.F., Collins, A.L., Sear, D.A. (2012) The impact of fine sediments on macroinvertebrates. Rivers Research and Applications 28(8), 1055-1071.
- Macadam, C.R. (2015) A review of the status of stoneflies (Plecoptera) of Great Britain – Species Status No.20. Natural England Commissioned Report, No. 174.
- Macadam, C.R. (2016) A review of the status of the mayflies (Ephemeroptera) of Great Britain – Species Status No.28. Natural England Commissioned Report, No. 193.
- Murry-Bligh, J.A.D., (1999) Procedure for collecting and analysing macroinvertebrate samples. Quality management systems for environmental monitoring. Biological techniques BT001. Version 2.0. Bristol Environment Agency.
- Smith, P. (2009) The effects of a diesel spill on freshwater macroinvertebrates in UK Invertebrate sampling and analysis procedure for STAR project (2004) http://www.eu-star.at/pdf/RivpacsMacroinvertebrateSamplingProtocol.pdf
- Wallace, I. (2016) A review of the status of the caddis flies (Tricoptera) of Great Britain – Species Status No.27. Natural England Commissioned Report, No. 191.
- www.sepa.org.uk/environment/water/aquatic-classification/river-invertebrate-classification-tool/

Survey Report Appendices

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Appendix 1

Table 2. Reference data.

Survey Site	NGR	Easting	Northing	Altitude (m)	Slope	Discharge Category	Distance from Source (km)
Upstream UP	SH	273638	377719	7	12.5	1	4.5
Downstream DN	SH	273582	377757	5	12.5	1	4.55
Beach BCH	SH	273532	377799	1	12.5	1	4.6

Table 3. Environmental data.

Survey Site	Mean Width (m)	Mean Depth (m)	Boulders & Cobbles (%)	Pebbles & Gravel (%)	Sand (%)	Silt & Clay (%)	Conductivity (µS/cm)	Discharge Category
Upstream UP	2.65	11	85	12	3	0	94	1
Downstream DN	2.52	12.5	90	5	5	0	94	1
Beach BCH	3.2	25.6	95	5	0	0	94	1

Appendix 2

Table 4. RICT WFD biological status ranges.

Status	EQR N-TAXA	EQR ASPT
HIGH	0.85	0.97
GOOD	0.71	0.86
MODERATE	0.57	0.75
POOR	0.47	0.63
BAD	<0.47	<0.63

Appendix 3

Table 5. Invertebrate survey raw data.

ORDER/CLASS **Family**	**BMWP**	***SPECIES***	**ABUNDANCE**					
			Spring			Summer		
		SITES	UP	DN	BCH	UP	DN	BCH
EPHEMEROPTERA								
Baetidae	4	*Baetis rhodani*	7	10	3	1		2
		Baetis niger	7	4	3			
		Baetis vernus		1		9	3	8
Heptageniidae	10	*Rhithrogena germanica/semicolorata*[†]	2		1			
		Ecdyonurus venosus/torrentis/dispar[†]	4		6		2	1
		Heptagenia sp.					1	1
Ephemerellidae	10	*Serratella ignita*				1		5
TRICOPTERA								
Polycentropodidae	7	*sp.*	8	7	3			
		Polycentropus flavomaculatus				6		
		Polycentropus irroratus					3	
Lepidostomatidae	10	*Lepidostoa basale*		2				
Hydropsychidae	5	*Hydropsyche siltalai*	5	9				
Brachycentridae	10	*Brachycentrus subnubilus*	1	3				

Rhyacophilidae	7	*Rhyacophilia dorsalis*	11			7		
		Rhyacophilia obliterata				1		
Philopotamidae	8	*Philopotamus montanus*					3	
		Wormaldia mediana/oecipitalis/subnigra[†]					1	
Sericostomatidae	10	*Sericostoma personatum*				1	5	
Odontoceridae	10	*Odontocentrum albicome*					1	
PLECOPTERA								
Perlidae	10	*Dinocras cephalotes*	12	2		9	10	
Perlodidae	10	*Perlodes mortani*	2	6			4	
		Isoperla grammatica	1					
Chloroperlidae	10	*Chloroperla tripunctata*	5		2			
		Chloroperla torrentium			3			
Nemouridae	7	*Nemurella pictetii*	3					
Leuctridae	10	*Leuctra moselyi*	9			18	21	
		Leuctra fusca	2	3		5		
		Leuctra nigra	9	8				
		Leuctra geniculata	1					
CRUSTACEA								
Gammaridae	6	*Gammarus pulex*	12	9	7	30	16	6
Asellidae	3	*Asellus aquaticus*						2
TURBELLARIA								

Planariidae	5	*sp.*		2				
ANNELIDA								
Hirudinidae	3	*Heamopsis sanguisuga*				1		
Glossiphoniidae	3	*Glossiphonia heteroclita*				1		
DIPTERA								
Pecticiidae		*sp.*		3	1	4	9	7
Limoniidae		*sp.*					2	
Rhagionidae		*sp.*	2					
Muscidae		*sp.*				4		
Simulidae	5	*sp.*	14	25	1			3
Chironomidae	2	*sp.*	114	36	4	14	4	2
COLEOPTERA								
Dryoptidae	5	*sp.*				2		
Elmidae	5	*sp.*	1	8				
Scirtidae	5	*sp*						
Gyrinidae	5	*sp.*	3	6				
MOLLUSCA								
Valvatidae	3	*sp.*	1					
Lymnaeidae	3	*Limnaea pereger*				2	1	

Oligochaeta	1	*Haplotaxidae sp.*			1			
	Total Abundance		**236**	**144**	**38**	**116**	**83**	**37**

Appendix 4:

Table 6. Species conservation status

ORDER Family	Species	GB IUCN Status	Rationale	GB Rarity Status	Recorded In Wales
EPHEMEROPTERA					
Baetidae	*Baetis rhodani*	LC	A widespread species found in most running water habitats.		Y
	Baetis niger	LC	A widespread species found in streams and rivers throughout the UK		Y
	Baetis vernus	LC	Widespread species with recent increase in areas of occupancy		Y
Heptageniidae †	*Rhithrogena germanica* *R. semicolorata*	LC LC	Indistinguishable at larval stage from *R. semicolorata*. Survey of adult stage suggests species is widespread but with very localized distribution. Widespread species with recent increases in distribution.	NS	Y Y
†	*Ecdyonurus venosus* *E.torrentis* *E.dispar*	LC LC LC	Some difficulties in separation and identification of larvae however all three are considered to be widespread		Y ? Y
Ephemerellidae	*Serratella ignita*	LC	Widespread species with recent increases in distribution.		Y
TRICOPTERA					

Polycentropodidae	*Polycentropus flavomaculatus*	LC	A widespread and common species of stony rivers and lakes		y
	Polycentropus irroratus	LC	A widespread and common species of stony rivers and lakes		Y
Lepidostomatidae	*Lepidostoma basale*	LC	Locally common in rivers and streams. Associated with dead wood.		Y
Hydropsychidae	*Hydropsyche siltalai*	LC	Widespread and common species of streams and rivers.		Y
Brachycentridae	*Brachycentrus subnubilus*	LC	Widespread and locally abundant river species		Y
Rhyacophilidae	*Rhyacophila dorsalis*	LC	A widespread and common species of stony of streams and rivers		Y
	Rhyacophila obliterata	LC	A widespread stream and river species in Scotland, Wales and south western England		
Philopotamidae	*Philopotamus montanus*	LC	A widespread and common species of fast-flowing rivers in the north and west		y
†	*Wormaldia mediana*	DD LC	It has only been identifiable as an adult comparatively recently and is still not identifiable as a larva. It may have significantly declined post 2000 so a grading of DD has been chosen. It is mainly a northern and western species. The habitat is small fast stony rivers.	NR	Y Y

	W. occipitalis *W. subnigra*	LC	A widespread and common species of small streams and larger trickles, but absent from south east England and East Anglia. A widespread species of rivers, especially those that flow from lakes. It may be declining.	NS	Y
Sericostomatidae	*Sericostoma personatum*	LC	A widespread and common species of streams, rivers and lakes.		y
Odontoceridae	*Odontocentrum albicome*	LC	A widespread and common species of stony streams and rivers		Y
PLECOPTERA					
Perlidae	*Dinocras cephalotes*	LC	Widespread species, recent increase of records		Y
Perlodidae	*Perlodes mortani*	LC	Widespread species, recent increase of records		Y
	Isoperla grammatica	LC	Widespread species, recent increase of records		Y
Chloroperlidae	*Chloroperla tripunctata*	LC	Widespread species, recent increase of records		Y
	Siphonoperla torrentium	LC	Widespread species, recent increase of records		Y
Nemouridae	*Nemurella pictetii*	LC	Widespread species, recent increase of records		Y

Leuctridae	*Leuctra moselyi*	LC	This is a widespread species however it is superficially similar to *L. hippopus*. Many biologists do not separate these species and the recording scheme has many records listed as *Leuctra hippopus/moselyi*.		Y
	Leuctra fusca	LC	Widespread species, recent increase of records		Y
	Leuctra nigra	LC	Widespread species, recent increase of records		Y
	Leuctra geniculata	LC	Widespread species, recent increase of records		Y
KEY: LC – Least Concern DD – Data Deficient NS – Nationally Scarce NR - Nationally Rare. † Where species occur in the same row it has not been possible to separate them taxonomically					