ERS invertebrate habitat survey of the rivers Eden in Cumbria and Irwell in Lancashire

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Summary

Exposed Riverine sediments (ERS) support a large number of specialist invertebrates including many nationally rare and scarce species and some UK Biodiversity Action Plan species. Previous studies on ERS invertebrates on the River Eden and other catchments have suggested that the amount of ERS habitat in suitable condition for ERS invertebrates may be seriously limited by a number of factors, including stock access, human trampling and gravel extraction.

This ERS invertebrate habitat assessment pilot study was undertaken to assess the amount of potential ERS habitat on two contrasting rivers in north west England; the River Eden in Cumbria and the River Irwell in Lancashire. The aim was to evaluate the amount of ERS resource in good condition for specialist invertebrates.

A draft ERS Habitat Assessment Form was developed and trialled in this study. The main stems of the River Eden and the River Irwell were walked and all ERS deposits of 20m² or more were photographed and recorded on the standard ERS Habitat Assessment Form. Google Earth was used with mixed results to identify ERS deposits for survey.

235 ERS deposits were recorded on the two rivers in the study using the pilot ERS Habitat Assessment Form. Based on data recorded on the Habitat assessment forms, values were calculated by which each deposit could be scored and ranked by both potential value to ERS invertebrates and present condition for ERS invertebrates.

Of the 118 deposits assessed along the length of the main stem of the River Eden, only two (<2%) were considered to be in good condition for ERS invertebrates. Another 20 to 25 (21%) might be considered to be of some value to ERS invertebrates and the remainder (77%) were in poor condition due to a number of different factors and were consequently of low value to ERS specialist invertebrates. 117 ERS deposits were evaluated on the River Irwell. One deposit was considered to be in 'good condition'. 18 deposits (15%) reached 'fair' condition. The remaining 98 sites (84%) were in 'poor' condition.

The assessment scores and ranking system is a crude beginning and further refinement is required. Nevertheless a study of this kind can provide an indication of the amount and distribution of suitable quality ERS invertebrate habitat at a given moment. On this basis it would appear that, on the river stretches in this study, the percentage of ERS habitat presently in good condition for ERS invertebrates is very limited.

This ERS habitat evaluation methodology has the potential to provide a useful tool in the strategic restoration of ERS on rivers and to guide the conservation of ERS species through monitoring of habitat status. Once refined, the Habitat Condition Scores could be used to evaluate the broad ERS resource on a river, enabling the identification of key deposits and stretches. The Habitat Potential Scores could also be of value in identifying individual or series of deposits in poor condition which could, under suitable management, be improved. This should enable targeting of effort and resources to best effect in enhancing the ERS habitat resource of rivers.

1. Introduction

Exposed Riverine sediments (ERS) support a large number of specialist invertebrates including many nationally rare and scarce species and some UK Biodiversity Action Plan (BAP) species (e.g. Eyre *et al.* 2000; Sadler & Bell, 2002, Hewitt *et al* 2000, 2005; Lott, 2006; Drake *et al* 2007). ERS deposits are fluvially accreted in the deposition zone of rivers as they slow in their lower reaches. Consequently ERS deposits are best developed on the spate rivers of the hilly areas of northern and western Britain. These deposits are dynamic features, constantly eroded and reformed by flood events. Different ERS specialist invertebrates have different requirements in terms of substrate grade and micro-habitat. In particular it has been found that a good percentage of sand in the ERS deposits supports a number of ERS specialists. Consequently river catchments with significant sand bearing strata generally support the most diverse and important ERS invertebrate communities.

Previous studies on ERS invertebrates on the River Eden and other catchments (e.g. Bates *et al* 2007; Hewitt *et al* 2007) have suggested that the amount of ERS habitat in suitable condition for ERS invertebrates may be seriously limited by a number of factors, including stock access, human trampling and gravel extraction.

This ERS invertebrate habitat assessment pilot study was undertaken to assess the amount of potential ERS habitat on two contrasting rivers in north west England; the River Eden in Cumbria and the River Irwell in Lancashire. The aim was to evaluate the amount of ERS resource in good condition for specialist invertebrates.

The Eden is a long, largely natural river flowing through a generally rural environment. It has been the subject of several ERS invertebrate surveys and has been shown to be one of the most important river systems for ERS invertebrates in Britain, although most of the best ERS invertebrate sites are off the main stem of the river. A river corridor habitat survey of the main stem of the River Eden, conducted by the Environment Agency in 199#, identified numerous areas of ERS on the river. Although no assessment of the quality of the deposits for ERS invertebrates was made in that survey, it was felt that the existence of that dataset might enable some useful comparative analysis. In particular it was felt desirable to test the possible assumption that "The Eden is known to be good for ERS invertebrates, the river corridor survey has shown there is plenty of ERS on the main stem of river, therefore there is plenty of habitat available for ERS specialist invertebrates."

The River Irwell is a short river with a relatively small catchment, which has been highly engineered and developed for industry in the past. There has been ongoing dredging of ERS deposits on the river on the assumption that they pose a flood risk. The river has had little or no assessment of its potential ERS invertebrate interest.

2. Methods

A draft ERS Habitat Assessment Form was devised and circulated to national experts for comment and amendment. The form was designed to identify and record the different ERS invertebrate habitats present on a deposit and to record any factors impacting on the quality and condition of the available habitat.
The resulting pilot ERS Habitat Assessment Form (see appendix 1) was trialled in this study.

Fowles (2005) provides a definition of ERS: *Exposed, within channel, fluvially deposited sediments (sands, gravels and silts) that lack continuous vegetation cover, whose vertical distribution lies between the levels of bankfull and the typical base flow of the river*.

Hewitt *et al* (2007) provide a broader definition: *Exposed, fluvially accreting riverine sediments with or without vegetation cover, whose vertical distribution lies between the levels of the top of the bank and the typical base flow of the river*, which allows the inclusion of specialist invertebrates requiring fluvially deposited sand on top of riverbanks. For the purposes of this study we looked only at 'in channel' ERS deposits that would come within the definition provided by Fowles. There is no minimum size for an ERS deposit in reality, so for practical purposes only those 'in-channel' ERS deposits of 20m² or greater were recorded in this study.

Due to consistently high river-flows resulting from the wet summer of 2008 and as it was late in the season when the contract was issued, it was necessary to defer the survey to the winter period when it was anticipated the vegetation would have died back and it was hoped that dry periods would allow river levels to drop. Periods of dry weather from Christmas 2008 through to March 2009 enabled the assessments to be conducted.

The main stems of the River Eden and the River Irwell were walked and all ERS deposits of 20m² or more were photographed and recorded on the standard ERS Habitat Assessment Form. Google Earth was used with mixed results to identify ERS deposits for survey. With careful cross-reference to OS maps it was possible to use Google Earth to get a good feel for the topography of the rivers and so identify deposition zones. Larger ERS deposits were readily apparent and although smaller and shaded deposits might not be obvious it was generally possible to pick out stretches where sediment was or wasn't being deposited.

3. Results and analysis

235 ERS deposits were recorded on the two rivers in the study using the pilot ERS Habitat Assessment Form. The individual Habitat Assessment forms for each ERS deposit are provided in Appendix 3.

Based on data recorded on the Habitat assessment forms, values were calculated by which each deposit could be scored and ranked:

- An area value was given for each deposit: <100m²=1; 100-1000 m²=2; 1000-10000 m²=3; 10000+ m²=4
- A topography value of 1, 2 or 3 was allocated according to whether the deposit was flat (1), humped (2) or complex (3).
- A habitat diversity score was calculated from the number of ERS micro-habitats, of 10m² or more, recorded on the deposit.
- A habitat continuity score was calculated from the proximity of the nearest ERS deposits: 2 other deposits within 100m=3; 2 other deposits within 500m=2; 2 other deposits within 1000m=1; no deposits with 1000m=0.

A habitat potential score (HPS) for each deposit was calculated by summing the above four values.

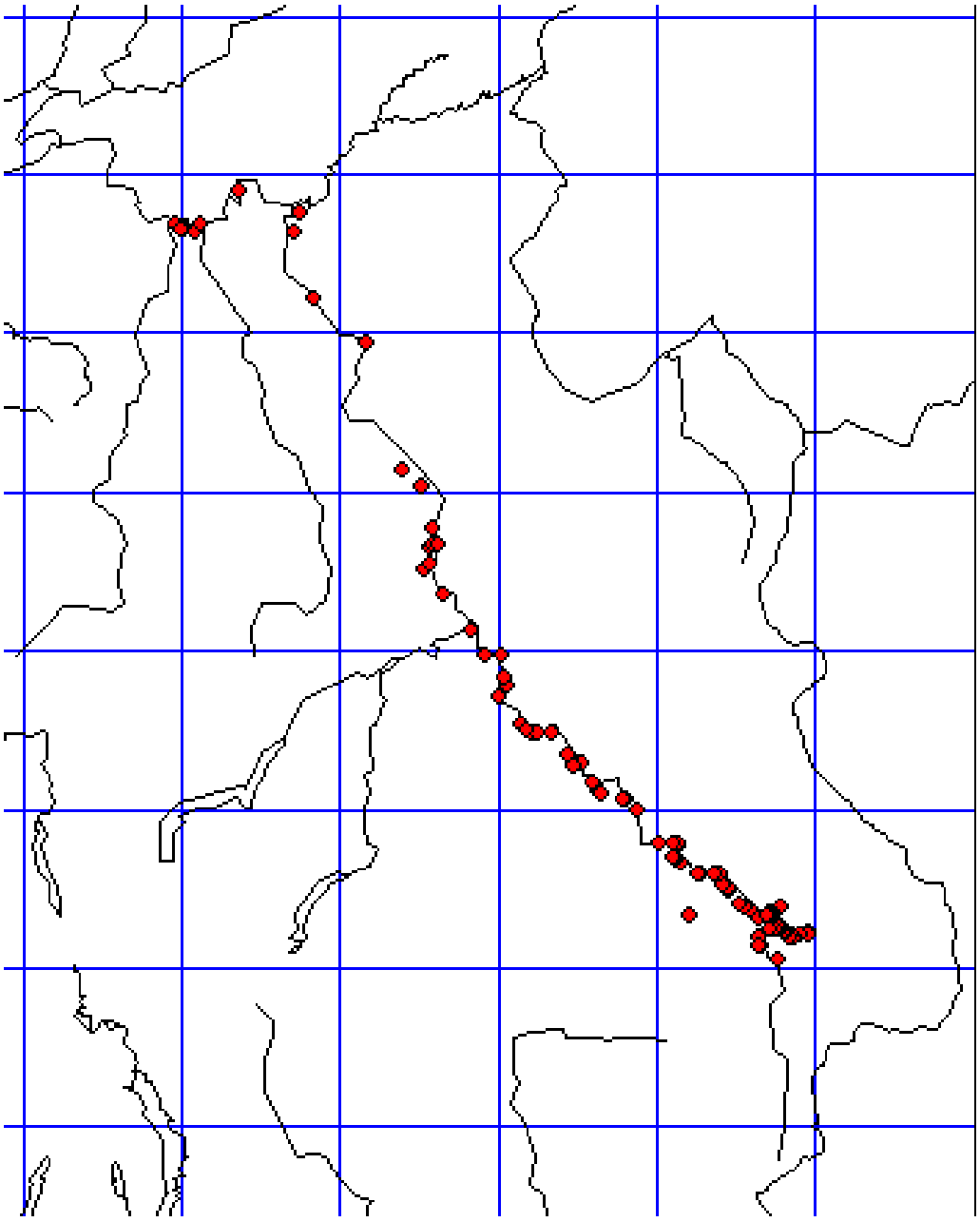
A similar set of values to assess the impact of various detrimental factors were also calculated using the criteria set out in the notes on the recording form (appendix 1) - stock trampling and dunging, development of stabilising vegetation cover, human trampling, vehicular compaction, gravel extraction, siltation, erosion, shading and other detrimental impacts. These were then summed to give an environmental impact score (EIS). The EIS was then subtracted from the HPS to give a Habitat Condition Score (HCS) which provides a crude indication of the condition of each deposit for ERS invertebrtes.

Appendix 2 presents tables of ERS deposits for each river, ranked by HPS and HCS.

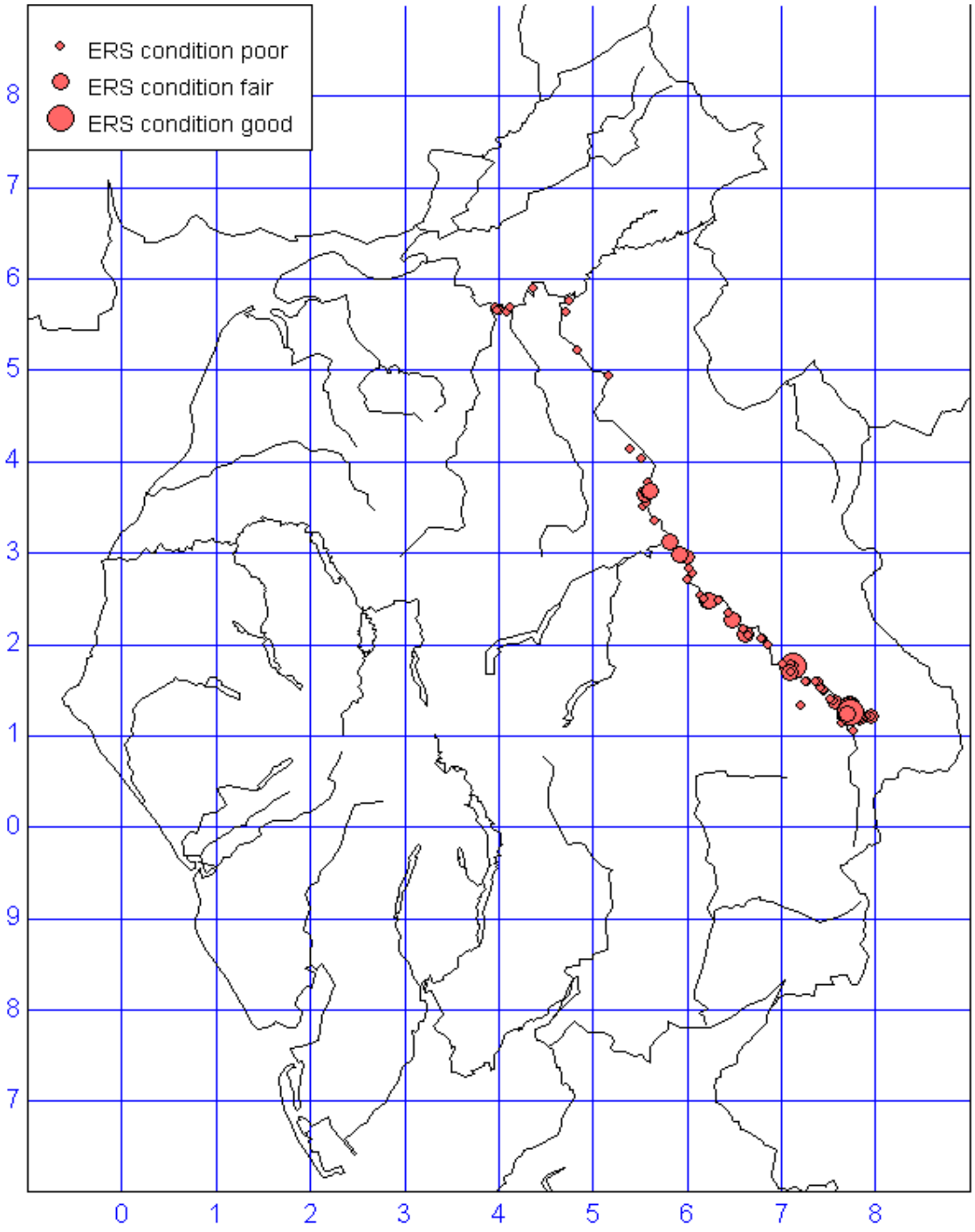
This analysis is very crude and considerable work is required to refine the analysis, possibly by weighting scores for different attributes and impacts to better reflect the differing levels of importance on ERS invertebrate communities.

As a rough indication of the broad validity of the rankings, we also recorded our own 'expert assessment' (or gut reaction) of the value of the deposits for ERS invertebrate communities. These were recorded as a score out of 10, with 10 being the perfect deposit for ERS invertebrates. 10 is an impossible score on the Eden and the highest score we would give to a deposit on the Eden catchment would be 9 for Kellwood on the Irthing/Kingwater(not included in this study). It can be seen from tables 2 and 5 that our gut-feeling scores broadly agree with the rankings resulting from the Habitat Assessment Forms, although there are some exceptions which it would be interesting to study further.

Map 1 ERS deposts on the R. Eden visited and assessed using Habitat Assessment Form



Map 3. ERS deposits on the River Eden scaled by ERS condition score



3.1 River Eden

118 ERS deposits were evaluated on the main stem of the River Eden and lower reaches of some tributaries. These were recorded using the standard Habitat Assessment Form. Map 1 shows the distribution of the ERS deposits identified.

Of the 118 deposits assessed along the length of the main stem of the River Eden, only two (<2%) were considered to be in good condition for ERS invertebrates. Another 20 to 25 (21%) might be considered to be of some value to ERS invertebrates and the remainder (77%) were in poor condition due to a number of different factors and were consequently of low value to ERS specialist invertebrates.

Selected data from the Habitat Assessment forms for the River Eden are presented in Appendix 2: tables 1 and 2. Table 1 ranks the sites on the Eden in order of ERS invertebrate habitat potential and table 2 ranks them in order of ERS invertebrate habitat condition. Map 2 shows the distribution of ERS deposits on the Eden main stem, scaled by their ERS invertebrate habitat condition scores.

Using our 'gut-feeling' values to provide a calibration to the HCS we consider that HCS values greater than 14 indicate sites in good condition for ERS invertebrates. Whilst HCS values from 9 to 14 represent deposits in fair condition and HCS below 9 refer to deposits in poor condition.

3.2 River Irwell

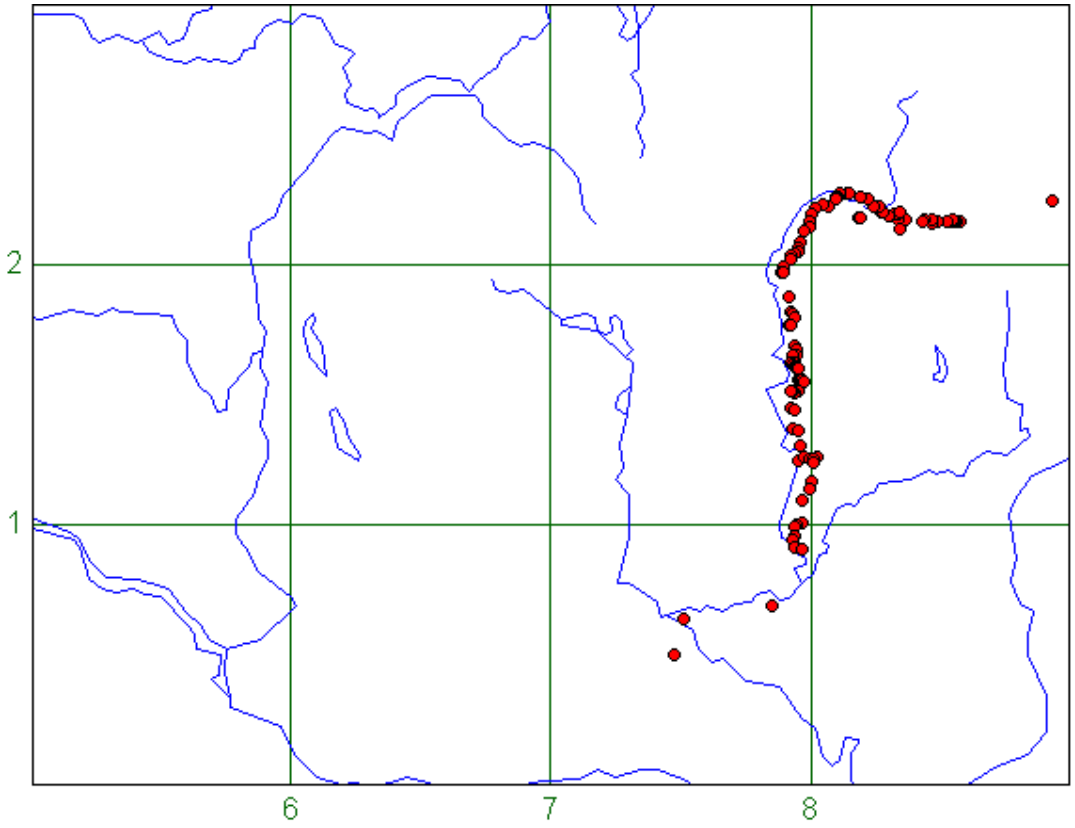
117 ERS deposits were evaluated on the River Irwell and recorded on the ERS Habitat Assessment Form. Map 3 shows the distribution of these deposits on the river. Appendix 3 provides the completed forms for each deposit.

Tables 3, 4 and 5 in Appendix 2 present the corresponding data for the River Irwell with deposits ranked by ERS habitat potential score (table 4) and ERS habitat condition score (table5). Map 4 shows the ERS deposits on the Irwell, scaled by their invertebrate habitat condition scores. One deposit attained the 'good condition' HCS value of 16. 18 deposits (15%) reached 'fair' condition HCS values. The remaining 98 sites (84%) were in 'poor' condition using this interpretation of their HCS values. Although the number of deposits on the Irwell in good, fair and poor condition were roughly similar to those on the Eden, the 'gut-feeling' scores for the Irwell were considerably lower than those given on the Eden. It would be interesting to get some data on the ERS invertebrate communities on the best ERS deposits on the Irwell to see whether the gut-feeling or HCS values best represent the true situation.

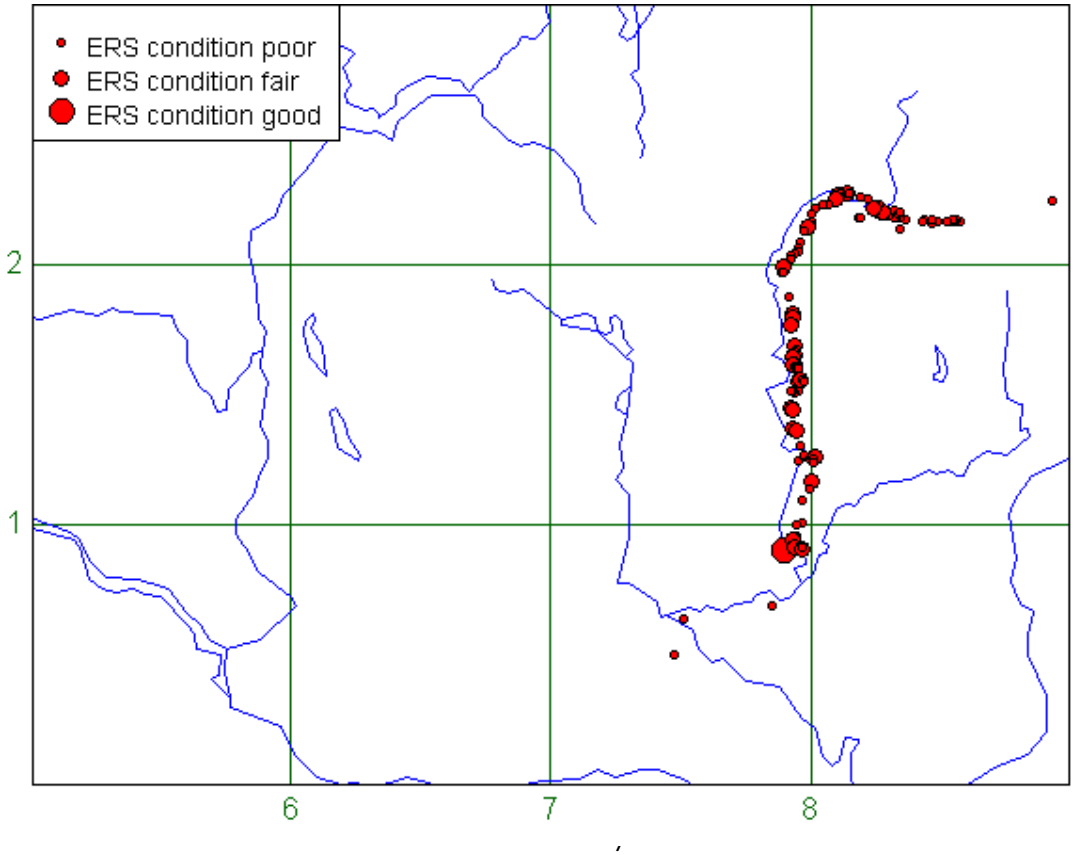
Also included in tables 1 and 2 for the Eden are the number of ERS invertebrate species and ERS Quality Scores (ERS QS) for those deposits in this study that have been previously surveyed for ERS invertebrates in recent years. It must be remembered that the deposits will have altered, for better or worse, since the years in which the surveys were conducted. Again the results for the few deposits previously surveyed broadly comply with the rankings in table 6, but again with some notable exceptions which are discussed below. Such comparative data is only available for the Eden and rather different nature and history of the River Irwell may make our 'expert assessment' of the value of the deposits on that river less reliable. It would be useful to survey some of the better sites on the Irwell to establish exactly what ERS invertebrate interest there is on that river.

Again it must be stated that these scores and assessments are very crude and require considerable refinement and improvement. However they do give a broad impression of the general state of ERS habitat on these rivers.

Map 3. Sites visited on the River Irwell



Map 4. ERS deposits on the River Irwell scaled by condition score



4. Discussion

The pilot surveys of the Eden and Irwell have provided much information and interesting results, which require further careful analysis. The most striking result is that the percentage of ERS in good condition is low for both rivers. This may appear at odds with the reputation of the Eden as one of the best rivers in Britain for ERS invertebrates. However, the best ERS sites on the Eden catchment are on the tributaries of the Kingwater, Irthing and Caldew, which were not included in this survey of the main stem of the river. Historically (Hewitt *et al*, 2000), one of the best sites on the whole catchment was on the main stem at Great Salkeld, but deposits in this stretch are presently in rather poor condition.

The deposits on the Eden score more highly than those on the Irwell and although this is probably not unexpected, with a higher sand content and less engineered system on the Eden, it ought to be tested by survey of the ERS invertebrates on the Irwell. The total lack of information regarding the occurrence of ERS invertebrates on the Irwell makes it difficult to assess the true meaning of the habitat assessment on that river and put it in context with better studied rivers such as the Eden. The intensive industrial history of the Irwell, with the accompanying damage to water quality and ERS sediment condition and availability must have had great impact on the ERS invertebrates of the river and to what extent any populations may have survived or recovered is unknown.

The factors impacting on ERS invertebrate habitat are markedly different on each river. Stock trampling is perhaps the single most significant detrimental impact on the Eden, with gravel extraction also impacting and human trampling and alien plants being locally significant. On the Irwell, engineering and gravel extraction may be the most damaging factors, although trampling from the public, alien plant cover and water quality also appear harmful.

The timing of any single ERS habitat assessment study will have an impact on the results. In this case, circumstances led us to conduct the assessments in late winter. At this season, the deposits, washed clear of dead plant material and freshly re-graded by winter flood events, were looking their best. Thus Habitat Potential scores will have been at their highest. Conversely, with much stock inside for the winter, human visitor pressure at its lowest and any extraction activities largely masked by re-grading of the sediments by recent spates, detrimental impacts affecting the deposits may have been under-estimated. Steps were taken to take these factors into account in the assessments, with stock impact being measured on the adjacent land use and effectiveness of fencing protecting the ERS deposits, proximity and popularity of public footpaths etc. Nonetheless, a study at a different time of year may well have produced different results. The use of the Habitat Assessment Form may need to be adjusted to accommodate conditions at different times of year.

Further refinement of the ERS Habitat Assessment Form is required. The ERS micro-habitats were found to be unsatisfactory when used across a number of sites and these need further consideration and rationalisation, including weighting of the habitat scores to reflect the greater value to ERS invertebrates of some habitats. Assessing the impact of different factors on each micro-habitat proved problematic to evaluate, particularly with regard to stabilising vegetation cover where it was frequently unclear which specific micro-habitat had been smothered and indeed whether these areas should still be included as part of the ERS deposit.

The assessment scores and ranking system is a crude beginning and further refinement is required. The expert assessment ranks are broadly in line with the rankings but there are several aberrations. Whether these discrepancies are due to mood swings on the part of the 'experts' or inaccuracies in the assessment from requires further investigation. Once refined, this habitat assessment methodology and the resulting Habitat Condition Scores have clear potential to evaluate the broad ERS resource on a river and its distribution, enabling the identification of key deposits and stretches where a series of connected deposits

form significant 'meta-sites'. Serial ERS deposits in close proximity are very important to ERS invertebrate populations, allowing a range of different successional stages of ERS deposit to be present within the range of an individual population and therefore allowing a number of species with various specific habitat requirements to be supported. The Habitat Potential Scores could also be of value in identifying individual or series of deposits in poor condition which could, under suitable management, be brought into good condition. This would enable targeting of effort and resources to the most productive areas, greatly enhancing the ERS habitat resource of a river.

Due to the very dynamic nature of individual sites it is not possible to make any very meaningful assessment of ERS value of a site from one year to the next although useful information on habitat potential and condition could still be gathered. The greater value of this system will be at a strategic level, to monitor the ERS resource and condition on a river or catchment wide scale over time.

There is an interesting debate to be had on the relative importance of a single deposit within a 'meta-site' series and an individual isolated deposit not connected to other ERS deposits on the river. The meta-site may be the core site on the river for some of the rarest and most specialised species and whilst damage to a single deposit within this meta-site may have a short term impact on these populations, in such a dynamic system it could also quickly recover and be readily recolonised. An isolated deposit is less likely to support the rarest ERS species on the river, however damage to such a deposit could result in the loss of some species from their only site on that stretch of the river and recolonisation would be much more problematic.

The ranking of the deposits by habitat condition should not be used as a means of assessing whether or not to grant extraction licences. In theory the habitat potential scores, if sufficiently refined and robust, could be used with caution to inform a decision on an extraction licence application. Gravel extraction of course not only damages the deposit being extracted but also removes that sediment from the system, to the detriment of all the deposits downstream.

The number of ERS specialist species and the ERS QS values of sites previously surveyed on the Eden, broadly support the rankings of the Habitat Assessment Form for that river. Some of the sites appear lower in the present rankings than they were when they were surveyed some years ago. This is not necessarily inconsistent with changes in these sites over time. Swindale Beck at Hallgarth for example has been heavily poached by stock following the wash out of the fences there in 2005. And the deposit at Kellwood D appears to have lost a significant amount of quality habitat in recent years, possibly due to more natural causes as part of a natural cycle.

5. Conclusion

Of the 100+ deposits assessed along the length of the main stem of the River Eden, only two (2%) were considered to be in good condition for ERS invertebrates. Another 20 to 25 might be considered to be of some value to ERS invertebrates and the remainder were in poor condition due to a number of different factors and were consequently of low value to ERS specialist invertebrates. Although the Eden is still one of the best rivers in Britain for ERS invertebrates, the best sites on the catchment are presently large and or serial deposits on tributaries outwith this study. Historically, site on the main stem of the river were of at least equal significance to the best sites on the tributaries today. The main stem of the river has thus suffered greater damage and disruption to its ERS deposits and this situation largely persists.

117 ERS deposits were recorded on the River Irwell. Although these deposits received lower scores than those for the Eden, a number of deposits were noted that appear to have significant potential for ERS invertebrates. Lack of any ERS invertebrate survey data for the Irwell makes interpretation of these scores

difficult at this stage. The history of that river, with high levels of engineering and gravel extraction coupled with poor water quality until quite recently will have had a serious impact on ERS invertebrates such that it is unknown what may have survived on the river.

It is important to remember that ERS is a very dynamic habitat and that the results of this study represent a snap-shot in time, which will change with the next major flood event. Nevertheless a study of this kind can provide an indication of the amount and distribution of suitable quality ERS invertebrate habitat at a given moment. On this basis it would appear that the percentage of ERS habitat that is in good condition for ERS invertebrates is small. Although the condition and ERS invertebrate value of a single deposit may change from one year to the next, the distribution of these deposits along the river will remain generally the same over time. ERS deposits naturally go through a cycle of accretion, stabilisation and erosion and different ERS specialist invertebrates occupy different niches available at different stages of this cycle. It is therefore important that a number of deposits at different stages of development and providing a range of habitats are available within the emigration range of individual ERS specialist invertebrates.

This ERS Habitat Evaluation methodology has the potential to provide a valuable tool in the strategic restoration of ERS on rivers and to guide the conservation of ERS species through monitoring of habitat status.

6. Further Work

Revisit a sample of sites in summer season to assess impact of other factors such as gravel extraction and alien vegetation that may not have been apparent in the winter survey.

A survey to 'ground truth' the ERS habitat scores for some of the sites on the Eden, particularly the higher scoring ones that have not previously been looked at.

Survey the best sites on the Irwell to assess the ERS invertebrate potential of the river.

In the light of the results of the previous point, consider survey to compare ERS invertebrate communities of extracted and non-extracted deposits on the Irwell.

Develop an ERS Habitat Assessment Handbook through refinement of present methodology, ground truthing and consultation with experts.

7. Acknowledgements

This study was commissioned by Buglife and funded by the Environment Agency. We are grateful to Martin Drake, Derek Lott, Vicky Kindemba, Craig McAdam and Alan Stubbs for valuable comments on a draft of the ERS Habitat Assessment Form and also to Vicky and Alan for helpful comments on an early draft of this report.

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Appendix 1

ERS Habitat Assessment Form

Site Code	
River	

Site Name		Channel width	m
Landowner/ Tenant *(if known)*		Grid Ref	
		Surveyor	

Estimated Total Area of Deposit	m²	Survey Date	

Deposit Type	Point Bar	Lateral Bar	Island	Fan	Braided Channel	Old Channel

Substrate type(s)	Silt	Sand	Gravel	Shingle	Cobble	Boulder

Deposit Topography	Humped	Complex	Flat	% shade from canopy	

Vegetation	Predominantly bare	%	Ruderal	%	Established	%

Distance to nearest ERS deposit (m²)	Upstream		Downstream	

Adjacent land use		River engineering	YES/NO

Brief description of the site

Sketch plan of deposit indicating distribution of microhabitats and position/direction of site photographs

Invertebrate micro-habitats		**Environmental factors** *scale of 0-3 (zero-minor-moderate-major)*												
	Area	**Stock access**	**Stabilising vegetation cover**	**Trampling (non-stock)**	**Vehicle tracking/compaction**	**Shingle extraction/digging**	**Siltation**	**Eroding**	**other:**	**other:**	**other:**			
Stony water's edge (<1m zone)														
Sandy/silty water's edge (> 1m zone)														
Bare shingle slope														
Mixed sand/shingle on top of bar														
Sparsely vegetated dry sand														
Sparsely vegetated shingle														
Sparsley vegetated damp sand														
Water seeping through ERS														
Seasonally vegetated sand														
ERS deposits beneath trees														
Backwater channels														
Cobbles														
Remnant pools on open shingle														

Alien plants *tick if present*

Himalayan Balsam		Japanese Knotweed		Monkey Flower		Giant Hogweed	

Notes on recording form:

Definition of ERS
Exposed riverine sediments are recently accreted, fluvially deposited sediments that are exposed above water level. They may be vegetated or unvegetated.

Type of ERS included in this survey
ERS deposits include both in-channel shoals of sand/gravel/cobbles and riverbank deposits, usually of sand. Only in-channel deposits are included in this survey.

Sediment grades:

Silt	1/256 – 1/16mm
Sand	1/16 – 2mm
Gravel	2 – 10mm
Shingle	10 – 64mm
Cobble	64 – 256mm
Boulder	>256mm

Size threshold of deposit
A minimum area of 10m² is required for a deposit to be included in this survey

Microhabitats
These are mutually exclusive. Do not record any part of the deposit as more than one microhabitat.

Grading environmental impacts
The assessment of degree of impact is bound to be subjective. Take photographs of incidents to allow calibration of scores at a later date.

Stock access – Trampling/dunging/grazing measured by degree of poaching, grazing or dung. If stock not present (or recent flooding has removed signs) assess potential impact by state of fencing and physical access to the ERS. Thus 0 would indicate adjacent land not used for grazing or ERS protected by stock proof fencing;
1 = limited access <10 animals
2 = good access; 11-33 animals
3 = open access >33 animals
At some sites dunging may be by high numbers of ducks or geese usually sustained by supplementary feeding in urban areas or in reared birds put down for shooting.
Stabilising vegetation cover. This measures how much of the deposit has stabilised and effectively developed beyond the stages useful to ERS specialised species. Grade by % of microhabitat stabilised by permanent vegetation cover. 0=none; 1=<25%; 2=26-50%; 3=>50%.
Other trampling. humans or waterfowl impacts etc., trampling by stock will be assessed through dung/grazing assessment. Measure human trampling by visual signs and also public access, proximity to footpath and distance from parking, residential areas (large or small) 0= no significant human access, 1= no open access but some impact from limited numbers e.g. anglers, 2= public access receives moderate trampling but ERS is some distance from housing/road/public parking requiring a significant walk to reach it, 3= easy public access and heavily used.

Vehicle tracking. This can be an issue where deposits are driven over to ford the river, where vehicles are crossing the deposits to shingle extraction sites, or for leisure use such as vehicular access to anglers. 1=<10% shoal affected (assessed through evidence of tyre tracks or access/compaction caused by vehicles), 2=11-33%; 3=>33%
Shingle extraction. Signs of digging, bulldozing, vehicle tracking and vehicle access onto ERS1=<10% shoal removed, 2=11-33% removed; 3=>33%
Siltation. Clogging of the substrate by silt or algae can be caused by erosion of the riverbanks upstream (e.g. through stock poaching) or enrichment of the river (through runoff of fertilisers etc). Score by area of microhabitat affected

- 0 = none
- 1 = A thin layer of silt of a thickness that its depth doesn't cover the substrate fully and of an area <50% of the deposit
- 1 = A thick silt layer of a thickness that its depth covers the substrate fully and covers an area <25% of the deposit
- 2 = A thin layer of silt at a thickness that the depth doesn't cover the substrate fully and area covers >50% of the deposit
- 2 = A thick silt layer of a thickness that its depth covers the substrate fully and the area cover 26-50% of the deposit
- 3 = A thick layer of silt covering >50% of the existing substrate

Eroding. Erosion is a natural process of renewal of ERS but at this stage the deposits are of more limited value to ERS specialist species as loose, open surface substrate is removed, leaving more compacted layers exposed. Score by area of compaction caused by erosion 0=None, 1=<10% shoal affected, 2=11-33%; 3=>33%

Appendix 2a. Selected data on ERS deposits on the River Eden

Table 1. ERS deposits on the river Eden ranked by ERS invertebrate potential

	Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score	ERS condition	Gut feeling - out of 10	No. ERS spp previously recorded	ERS QS previously recorded	Rank in Cumbria
Far Bank End R. Bank	E17	1900	3	3	9	3	18	1						1			2	16	7			
Belah	B13	300	2	2	10	3	17		1								1	16				
Gt Salkeld lower	E37	2000	3	3	7	3	16	3	1	1							5	11	4.5			
	E49	1700	3	3	7	2	15		2						2		4	11	3.5			
Belah Scar upper	B1	900	2	3	7	3	15	3	2						1		6	9				
Belah	B10	1200	3	2	7	3	15	3	3								6	9				
Belah	B11	250	2	2	8	3	15	3	2			2					7	8				
Winderwath	E29	3400	3	3	7	1	14		1								1	13	6	33	207	8
Gt Salkeld R.bank	E35	360	2	2	7	3	14	2									2	12	3	11	57	23
	E50	550	2	2	8	2	14		3								3	11	2.5			
	E41	450	2	3	7	2	14		2						2		4	10	2			
	E42	900	2	2	8	2	14	1	2						1		4	10	3			
Watersmeet	E30	11000	3	1	8	1	13										0	13	5			
Rudd Hills lower	E3	1800	3	2	6	2	13					1			1		2	11	5			
Belah 15 (bottom)	B15	180	2	2	6	3	13	2									2	11				
Belah	B8	400	2	2	6	3	13		1						1		2	11				
Swindale Beck below Hallgarth	SB11	260	2	2	6	3	13	2									2	11		47	299	4

	Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score 2	ERS condition 2	Gut feeling - out of 10	No. ERS spp previously recorded	ERS QS previously recorded	Rank in Cumbria
Gt Salkeld upper	E36	5000	3	2	5	3	13	2			1					1	4	9	3.5	27	131	13
Belah	B5	1200	3	2	6	2	13	3	1						1		5	8				
Swindale Beck above Hallgarth	SB3	560	2	1	7	3	13	2	3								5	8				
Oglebird	E26	900	2	2	7	2	13	3	1						2		6	7	3.5			
Colby	E24	530	2	2	6	2	12		1								1	11	4			
Swindale Beck below Hallgarth	SB10	720	2	2	5	3	12	2									2	10				
Swindale Beck below Hallgarth	SB7	240	2	2	5	3	12						1	1			2	10				
Culgaith L. Bank	E28	1100	3	3	5	1	12								3		3	9	2			
Vicarage Bank	E12	560	2	2	7	1	12	3	1								4	8	5?			
Rudd Hills	E2	520	2	2	6	2	12	3	1								4	8				
Swindale Beck	SB6	900	2	1	6	3	12	3	3								6	6				
Swindale Beck above Hallgarth	SB2	420	2	1	6	3	12	3	3			1					7	5				
Swindale Beck above Hallgarth	SB1	180	2	2	4	3	11	1									1	10				
	E51	900	2	1	6	2	11		2								2	9	2			
Belah	EB6	160	2	2	5	2	11	1	1								2	9				
Appleby lower	E22	1050	3	1	5	2	11			3							3	8	2.5			
	E48	1400	3	2	5	1	11	2	1								3	8	3.5			
Bermer Scar	E9	320	2	2	5	2	11	3							1		4	7				
Belah 14	EB14	260	2	1	5	3	11	3	1								4	7				
	E16	420	2	2	5	2	11		1	1				1	2		5	6	3.5			
	E39	400	2	2	5	2	11		3					2			5	6	2			

	Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score 2	ERS condition 2	Gut feeling - out of 10	No. ERS spp previously recorded	ERS QS previously recorded	Rank in Cumbria
	E53	2500	3	2	5	1	11		3						2		5	6	2			
Belah	EB9	500	2	1	5	3	11		2			3					5	6				
	E47	1800	3	2	4	2	11	3	2		1						6	5	3			
Swindale Beck above Hallgarth	SB5	1300	3	1	4	3	11	3	3								6	5				
Helm Beck	HB4	140	2	1	4	3	10										0	10	2			
Temple Sowerby	E27	380	2	2	4	2	10		2								2	8	2.5	40	273	5
Helm Beck	HB1	56	1	2	4	3	10	2									2	8	3			
Swindale Beck below Hallgarth	SB9	740	2	1	4	3	10	2									2	8				
Belah Scar lower	EB2	200	2	2	3	3	10	1							2		3	7				
Helm Beck	HB3	80	1	3	3	3	10	1	2								3	7	2.5			
Ploughlands	E8	700	2	2	4	2	10	3							1		4	6				
Belah	B12	280	2	1	4	3	10	1	3								4	6				
L. Salkeld Viaduct	E33	1150	3	1	4	2	10	3		1						1	5	5	2			
Hill Top island	E5	420	2	2	3	2	9										0	9				
Hill top L. Bank	E6	320	2	2	3	2	9										0	9				
Colby/Hoff Beck	CB1	190	2	2	4	1	9			1							1	8				
Helm Beck	HB5	170	2	1	3	3	9									1	1	8	2			
Warcop Br	E11	210	2	2	3	2	9		2								2	7	3			
Far Bank End L. Bank	E18	190	2	2	2	3	9	2	1								3	6	1.5			
Ousenstand Br	E25	270	2	2	3	2	9								3		3	6				
opp. Nunwick Hall	E32	210	2	1	4	2	9	3									3	6	1			

	Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score	ERS condition	Gut feeling - out of 10	No. ERS spp previously recorded	ERS QS previously recorded	Rank in Cumbria
Sandford island	E15	210	2	2	4	1	9	1	2						1		4	5	2.5			
Nunwick upper	E31	950	2	1	4	2	9	3	1								4	5	1			
Langford	E13	1350	3	1	4	1	9	3	1		1						5	4	3			
Bongate	E21	340	2	1	6	0	9			3					2		5	4	2			
Langwathby Br	E38	280	2	1	5	1	9	1		3					1		5	4	1.5	17	54	25
Swindale Beck above Hallgarth	SB4	320	2	1	3	3	9	3	3								6	3				
Thistley Hill	E23	150	2	1	3	2	8										0	8	2			
Ploughlands upper	E7	210	2	1	3	2	8										0	8				
	E44	650	2	1	4	1	8								1		1	7	1.5			
	E46	180	2	1	3	2	8				1						1	7	1			
Belah	B4	140	2	1	3	2	8		1						1		2	6				
	E43	70	1	2	4	1	8		1	2					1		4	4	1.5			
Lazonby Br	E34	1000	2	2	4	0	8	3		3							6	2	2			
Helm Beck	HB2	75	1	2	1	3	7										0	7	2			
Swindale Beck below Hallgarth	SB8	76	1	1	2	3	7										0	7				
Gt Ormside	E20	125	2	1	2	2	7			1							1	6	1.5			
Bermer Hill	E10	180	2	1	2	2	7	1	1								2	5	1			
Scandel Beck	ScB1	140	2	1	2	2	7	2									2	5	1			
Beckwadem Br	E1	720	2	2	3	0	7	3									3	4				
	E40	220	2	1	2	2	7		2					1			3	4	1			
Scandel Beck	ScB2	100	1	1	3	2	7	2	2		1						5	2	1.5			

	Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score 2	ERS condition 2	Gut feeling - out of 10	No. ERS spp previously recorded	ERS QS previously recorded	Rank in Cumbria
	E45	140	2	1	3	1	7	2	1					2	1		6	1	1			
Middle Bank End	E19	310	2	1	2	2	7	3	2				1			1	7	0	1			
	E52	540	2	1	4	0	7	3	2		1	1					7	0	1			
Belah Br	B3	20	1	1	2	2	6	1									1	5				
Musgrave Br	E4	380	2	1	2	1	6	3	1								4	2				
Sandford Br	E14	52	1	2	1	1	5	3									3	2	1			
	E54	20	1	2	1		4		3								3	1	1			
Belah	B7						0										0	0				

Table 2. ERS deposits on the river Eden ranked by ERS invertebrate condition

	Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score	ERS condition	Gut feeling - out of 10	No. ERS spp previously recorded	ERS QS previously recorded	Rank in Cumbria
Far Bank End R. Bank	E17	1900	3	3	9	3	18	1						1			2	16	7			
Belah	B13	300	2	2	10	3	17		1								1	16				
Winderwath	E29	3400	3	3	7	1	14		1								1	13	6	33	207	8
Watersmeet	E30	11000	3	1	8	1	13										0	13	5			
Gt Salkeld R.bank	E35	360	2	2	7	3	14	2									2	12	3	11	57	23
Gt Salkeld lower	E37	2000	3	3	7	3	16	3	1	1							5	11	4.5			
	E49	1700	3	3	7	2	15		2						2		4	11	3.5			
	E50	550	2	2	8	2	14		3								3	11	2.5			
Rudd Hills lower	E3	1800	3	2	6	2	13					1			1		2	11	5			
Belah 15 (bottom)	B15	180	2	2	6	3	13	2									2	11				
Belah	B8	400	2	2	6	3	13		1						1		2	11				
Swindale Beck below Hallgarth	B11	260	2	2	6	3	13	2									2	11		47	299	4
Colby	E24	530	2	2	6	2	12		1								1	11	4			
	E41	450	2	3	7	2	14		2						2		4	10	2			
	E42	900	2	2	8	2	14	1	2						1		4	10	3			
Swindale Beck below Hallgarth	B10	720	2	2	5	3	12	2									2	10				
Swindale Beck below Hallgarth	SB7	240	2	2	5	3	12						1	1			2	10				
Swindale Beck above Hallgarth	SB1	180	2	2	4	3	11	1									1	10				

	Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score 2	ERS condition 2	Gut feeling - out of 10	No. ERS spp previously recorded	ERS QS previously recorded	Rank in Cumbria
Helm Beck	HB4	140	2	1	4	3	10										0	10	2			
Belah Scar upper	B1	900	2	3	7	3	15	3	2						1		6	9				
Belah	B10	1200	3	2	7	3	15	3	3								6	9				
Gt Salkeld upper	E36	5000	3	2	5	3	13	2			1					1	4	9	3.5	27	131	13
Culgaith L. Bank	E28	1100	3	3	5	1	12								3		3	9	2			
	E51	900	2	1	6	2	11		2								2	9	2			
Belah	B6	160	2	2	5	2	11	1	1								2	9				
Hill Top island	E5	420	2	2	3	2	9										0	9				
Hill top L. Bank	E6	320	2	2	3	2	9										0	9				
Belah	B11	250	2	2	8	3	15	3	2			2					7	8				
Belah	B5	1200	3	2	6	2	13	3	1						1		5	8				
Swindale Beck above Hallgarth	SB3	560	2	1	7	3	13	2	3								5	8				
Vicarage Bank	E12	560	2	2	7	1	12	3	1								4	8	5?			
Rudd Hills	E2	520	2	2	6	2	12	3	1								4	8				
Appleby lower	E22	1050	3	1	5	2	11			3							3	8	2.5			
	E48	1400	3	2	5	1	11	2	1								3	8	3.5			
Temple Sowerby	E27	380	2	2	4	2	10		2								2	8	2.5	40	273	5
Helm Beck	HB1	56	1	2	4	3	10	2									2	8	3			
Swindale Beck below Hallgarth	SB9	740	2	1	4	3	10	2									2	8				
Colby/Hoff Beck	CB1	190	2	2	4	1	9			1							1	8				
Helm Beck	HB5	170	2	1	3	3	9									1	1	8	2			

	Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score 2	ERS condition 2	Gut feeling - out of 10	No. ERS spp previously recorded	ERS QS previously recorded	Rank in Cumbria
Thistley Hill	E23	150	2	1	3	2	8										0	8	2			
Ploughlands upper	E7	210	2	1	3	2	8										0	8				
Oglebird	E26	900	2	2	7	2	13	3	1						2		6	7	3.5			
Bermer Scar	E9	320	2	2	5	2	11	3							1		4	7				
Belah 14	EB14	260	2	1	5	3	11	3	1								4	7				
Belah Scar lower	EB2	200	2	2	3	3	10	1							2		3	7				
Helm Beck	HB3	80	1	3	3	3	10	1	2								3	7	2.5			
Warcop Br	E11	210	2	2	3	2	9		2								2	7	3			
	E44	650	2	1	4	1	8								1		1	7	1.5			
	E46	180	2	1	3	2	8				1						1	7	1			
Helm Beck	HB2	75	1	2	1	3	7										0	7	2			
Swindale Beck below Hallgarth	SB8	76	1	1	2	3	7										0	7				
Swindale Beck	SB6	900	2	1	6	3	12	3	3								6	6				
	E16	420	2	2	5	2	11		1	1				1	2		5	6	3.5			
	E39	400	2	2	5	2	11		3					2			5	6	2			
	E53	2500	3	2	5	1	11		3						2		5	6	2			
Belah	EB9	500	2	1	5	3	11		2			3					5	6				
Ploughlands	E8	700	2	2	4	2	10	3							1		4	6				
Belah	EB12	280	2	1	4	3	10	1	3								4	6				
Far Bank End L. Bank	E18	190	2	2	2	3	9	2	1								3	6	1.5			
Ousenstand Br	E25	270	2	2	3	2	9								3		3	6				

	Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score 2	ERS condition 2	Gut feeling - out of 10	No. ERS spp previously recorded	ERS QS previously recorded	Rank in Cumbria
opp. Nunwick Hall	E32	210	2	1	4	2	9	3									3	6	1			
Belah	EB4	140	2	1	3	2	8		1						1		2	6				
Gt Ormside	E20	125	2	1	2	2	7			1							1	6	1.5			
Swindale Beck above Hallgarth	SB2	420	2	1	6	3	12	3	3			1					7	5				
	E47	1800	3	2	4	2	11	3	2		1						6	5	3			
Swindale Beck above Hallgarth	SB5	1300	3	1	4	3	11	3	3								6	5				
L. Salkeld Viaduct	E33	1150	3	1	4	2	10	3		1						1	5	5	2			
Sandford island	E15	210	2	2	4	1	9	1	2						1		4	5	2.5			
Nunwick upper	E31	950	2	1	4	2	9	3	1								4	5	1			
Bermer Hill	E10	180	2	1	2	2	7	1	1								2	5	1			
Scandel Beck	SB1	140	2	1	2	2	7	2									2	5	1			
Belah Br	EB3	20	1	1	2	2	6	1									1	5				
Langford	E13	1350	3	1	4	1	9	3	1		1						5	4	3			
Bongate	E21	340	2	1	6	0	9			3					2		5	4	2			
Langwathby Br	E38	280	2	1	5	1	9	1		3					1		5	4	1.5	17	54	25
	E43	70	1	2	4	1	8		1	2					1		4	4	1.5			
Beckwadem Br	E1	720	2	2	3	0	7	3									3	4				
	E40	220	2	1	2	2	7		2					1			3	4	1			
Swindale Beck above Hallgarth	SB4	320	2	1	3	3	9	3	3								6	3				
Lazonby Br	E34	1000	2	2	4	0	8	3		3							6	2	2			
Scandel Beck	SB2	100	1	1	3	2	7	2	2		1						5	2	1.5			

	Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score 2	ERS condition 2	Gut feeling - out of 10	No. ERS spp previously recorded	ERS QS previously recorded	Rank in Cumbria
Musgrave Br	E4	380	2	1	2	1	6	3	1								4	2				
Sandford Br	E14	52	1	2	1	1	5	3									3	2	1			
	E45	140	2	1	3	1	7	2	1					2	1		6	1	1			
	E54	20	1	2	1		4		3								3	1	1			
Middle Bank End	E19	310	2	1	2	2	7	3	2				1			1	7	0	1			
	E52	540	2	1	4	0	7	3	2		1	1					7	0	1			
Belah	EB7						0										0	0				

Appendix 2b. Selected data on ERS deposits on the River Irwell

Table 3. ERS deposits on the River Irwell in site number order

Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score 2	ERS condition 2	Gut feeling - out of 10
1	110	2	1	5	3	11		1						3		4	7	1.5
2	44	1	2	2	3	8		2								2	6	1
3	22	1	2	1	3	7			3							3	4	0.5
4	80	1	1	2	3	7		2	1							3	4	1
5	80	1	1	2	3	7		3								3	4	1
6	28	1	1	2	3	7		1								1	6	0.5
7	55	1	1	3	3	8		2						3		5	3	1
8	60	1	1	3	3	8		2						2		4	4	1
9	18	1	2	1	3	7		1					3			4	3	0.5
10	40	1	2	3	3	9		2						1		3	6	2
11	35	1	1	2	3	7		3						2		5	2	1
12	40	1	1	2	3	7		2						3		5	2	0.5
13	90	1	2	4	3	10		2						1		3	7	1
14	50	1	1	2	3	7		2								2	5	0.5
15	80	1	2	2	3	8		1						1		2	6	1.5
16	40	1	1	3	3	8		3						1		4	4	1
17	120	2	2	6	3	13		2						1		3	10	2
18	80	1	1	3	3	8		1						2		3	5	1
19	60	1	1	2	3	7		3						1		4	3	1
20	30	1	1	1	3	6		1								1	5	1
21	40	1	1	2	3	7		1						1		2	5	0.5
22	36	1	1	2	3	7		2								2	5	1
23	220	2	1	3	3	9										0	9	1.5
24	28	1	2	2	3	8		1	1							2	6	1
25	550	2	1	5	3	11		1	1							2	9	2
26	160	2	2	4	3	11		3					2			5	6	1
27	400	2	3	5	3	13		1	1					3		5	8	2
28	25	1	2	2	3	8		2					1			3	5	1
29	35	1	1	2	3	7		2								2	5	0.5
30	220	2	3	5	3	13		3						2		5	8	2
31	40	1	2	2	3	8		1						2		3	5	0.5
32	160	2	2	4	3	11		1	1					1		3	8	2

Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score 2	ERS condition 2	Gut feeling - out of 10
33	20	1	2	1	3	7		2						1		3	4	1
34	46	1	1	2	3	7		2					2	1		5	2	1
35	60	1	1	3	3	8		1						3		4	4	0.5
36	110	2	1	3	3	9								3		3	6	1
37	40	1	1	2	3	7		2								2	5	0.5
38	30	1	2	1	3	7		2			1					3	4	1.5
39	280	2	2	6	3	13		1	1							2	11	2.5
40	40	1	1	2	3	7		3					2	1		6	1	0.5
41	30	1	1	2	3	7								1		1	6	0.5
42	120	2	2	2	3	9		3								3	6	1
43	320	2	1	2	3	8							1			1	7	0.5
44	320	2	1	4	3	10		2						1		3	7	1
45	60	1	1	2	3	7	3									3	4	0.5
46	1600	3	3	3	3	12	3									3	9	2.5
47	400	2	2	3	3	10		1	1							2	8	2
48	220	2	1	2	3	8	1							2		3	5	0.5
49	160	2	2	4	3	11		2	1					1		4	7	1.5
50	280	2	1	4	3	10		2	1			2		1		6	4	1.5
51	170	2	1	2	3	8		1						2		3	5	1
52	35	1	1	1	3	6								3		3	3	0.5
53	18	1	2	1	3	7										0	7	0.5
54	240	2	1	3	3	9					3					3	6	1
55	42	1	1	1	3	6										0	6	0.5
56	280	2	2	3	3	10								2		2	8	2.5
57	180	2	2	4	3	11		1						3		4	7	2
58	160	2	1	3	3	9		3					1	3		7	2	0.5
59	550	2	1	5	3	11	1	1						1		3	8	2
60	60	1	1	3	3	8			1					2		3	5	1
61	90	1	1	4	3	9		1						1		2	7	0.5
62	28	1	1	2	3	7	3									3	4	0.5
63	280	2	1	3	3	9								1		1	8	1.5
64	1600	3	2	5	3	13			1							1	12	3
65	80	1	1	2	3	7										0	7	1.5
66	980	2	3	4	3	12	1				2					3	9	2.5
67	260	2	2	3	3	10										0	10	2

Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score 2	ERS condition 2	Gut feeling - out of 10
68	80	1	1	2	3	7								1		1	6	0.5
69	110	2	1	3	3	9					1					1	8	1
70	160	2	2	5	3	12		2								2	10	1.5
71	45	1	2	2	3	8										0	8	1
72	225	2	1	3	3	9		3					1			4	5	1
73	170	2	3	3	3	11		1					1	1		3	8	2
74	65	1	3	2	3	9		2					2	2		6	3	1
75	50	1	1	2	3	7		1	3							4	3	0.5
76	140	2	2	4	3	11		1	3							4	7	2
77	150	2	1	4	3	10			3					2		5	5	1
78	650	2	2	3	3	10			2							2	8	1.5
79	1450	3	2	8	3	16		2	2					2		6	10	2.5
80	220	2	1	3	3	9			1					3		4	5	1
81	25	1	2	1	3	7								1		1	6	1
82	1400	3	1	7	3	14		2	3					3		8	6	2
83	550	2	2	3	3	10		3								3	7	1
84	170	2	2	3	3	10		2					1	1		4	6	
85	1100	3	2	6	3	14		3			1					4	10	2
86	40	1	2	2	3	8		1			3					4	4	1
87	800	2	3	6	3	14		1			2			1		4	10	4
88	145	2	2	2	3	9		1						3		4	5	1
89	350	2	1	3	3	9		1								1	8	1.5
90	700	2	2	5	3	12							1			1	11	4
91	450	2	2	5	3	12					3					3	9	2
92	150	2	1	4	3	10		3	1				2			6	4	1
93	120	2	2	4	3	11			3					1		4	7	1
94	90	1	2	2	3	8			3					2		5	3	1
95	80	1	3	3	3	10		1					2	1		4	6	1.5
96	120	2	2	3	3	10		1	3				2	1		7	3	1
97	1800	3	2	7	3	15		2	3				1			6	9	2
98	90	1	2	3	3	9		1	1					2		4	5	1
99	110	2	2	3	3	10		2					1	1		4	6	1.5
100	1600	3	3	9	3	18		2	1			1	1	1		6	12	3
101	80	1	1	2	3	7		2					1			3	4	0.5
102	110	2	1	2	3	8		3				1	1			5	3	0.5

Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score 2	ERS condition 2	Gut feeling - out of 10
103	320	2	1	3	3	9		3								3	6	1.5
104	240	2	2	3	3	10		2					1	1		4	6	1.5
105	1200	3	2	6	3	14		2						1		3	11	3
106	4000	4	3	9	3	19		2						1		3	16	3.5
107	90	1	2	3	3	9		3	1				1			5	4	1.5
108	320	2	2	6	3	13		2	2			1	1	1		7	6	2
109	900	2	2	3	3	10		3	2					1		6	4	1.5
110	380	2	2	5	3	12		2	1			1				4	8	1.5
111	540	2	1	2	3	8										0	8	1
112	520	2	2	6	3	13		3						1		4	9	
113	170	2	2	2	3	9		1				1				2	7	1.5
114	420	2	1	3	3	9					1					1	8	1.5
115	380	2	1	3	2	8		1								1	7	1
116	45	1	1	1	2	5		3					3			6	-1	1
117	650	2	1	2	2	7						1				1	6	1.5

Table 4. ERS deposits on the R. Irwell ranked by ERS invertebrate potential

Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score 2	ERS condition 2	Gut feeling - out of 10
106	4000	4	3	9	3	19		2						1		3	16	3.5
100	1600	3	3	9	3	18		2	1			1	1	1		6	12	3
79	1450	3	2	8	3	16		2	2					2		6	10	2.5
97	1800	3	2	7	3	15		2	3				1			6	9	2
82	1400	3	1	7	3	14		2	3					3		8	6	2
85	1100	3	2	6	3	14		3			1					4	10	2
87	800	2	3	6	3	14		1			2			1		4	10	4
105	1200	3	2	6	3	14		2						1		3	11	3
17	120	2	2	6	3	13		2						1		3	10	2
27	400	2	3	5	3	13		1	1					3		5	8	2
30	220	2	3	5	3	13		3						2		5	8	2
39	280	2	2	6	3	13		1	1							2	11	2.5
64	1600	3	2	5	3	13			1							1	12	3
108	320	2	2	6	3	13		2	2			1	1	1		7	6	2
112	520	2	2	6	3	13		3						1		4	9	
46	1600	3	3	3	3	12	3									3	9	2.5
66	980	2	3	4	3	12	1				2					3	9	2.5
70	160	2	2	5	3	12		2								2	10	1.5
90	700	2	2	5	3	12							1			1	11	4
91	450	2	2	5	3	12					3					3	9	2
110	380	2	2	5	3	12		2	1			1				4	8	1.5
1	110	2	1	5	3	11		1						3		4	7	1.5
25	550	2	1	5	3	11		1	1							2	9	2
26	160	2	2	4	3	11		3					2			5	6	1
32	160	2	2	4	3	11		1	1					1		3	8	2
49	160	2	2	4	3	11		2	1					1		4	7	1.5
57	180	2	2	4	3	11		1						3		4	7	2
59	550	2	1	5	3	11	1	1						1		3	8	2
73	170	2	3	3	3	11		1					1	1		3	8	2
76	140	2	2	4	3	11		1	3							4	7	2
93	120	2	2	4	3	11			3					1		4	7	1
13	90	1	2	4	3	10		2						1		3	7	1
44	320	2	1	4	3	10		2						1		3	7	1
47	400	2	2	3	3	10		1	1							2	8	2

Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score 2	ERS condition 2	Gut feeling - out of 10
50	280	2	1	4	3	10		2	1			2		1		6	4	1.5
56	280	2	2	3	3	10								2		2	8	2.5
67	260	2	2	3	3	10										0	10	2
77	150	2	1	4	3	10			3					2		5	5	1
78	650	2	2	3	3	10			2							2	8	1.5
83	550	2	2	3	3	10		3								3	7	1
84	170	2	2	3	3	10		2					1	1		4	6	
92	150	2	1	4	3	10		3	1				2			6	4	1
95	80	1	3	3	3	10		1					2	1		4	6	1.5
96	120	2	2	3	3	10		1	3				2	1		7	3	1
99	110	2	2	3	3	10		2					1	1		4	6	1.5
104	240	2	2	3	3	10		2					1	1		4	6	1.5
109	900	2	2	3	3	10		3	2					1		6	4	1.5
10	40	1	2	3	3	9		2						1		3	6	2
23	220	2	1	3	3	9										0	9	1.5
36	110	2	1	3	3	9								3		3	6	1
42	120	2	2	2	3	9		3								3	6	1
54	240	2	1	3	3	9					3					3	6	1
58	160	2	1	3	3	9		3					1	3		7	2	0.5
61	90	1	1	4	3	9		1						1		2	7	0.5
63	280	2	1	3	3	9								1		1	8	1.5
69	110	2	1	3	3	9					1					1	8	1
72	225	2	1	3	3	9		3					1			4	5	1
74	65	1	3	2	3	9		2					2	2		6	3	1
80	220	2	1	3	3	9			1					3		4	5	1
88	145	2	2	2	3	9		1						3		4	5	1
89	350	2	1	3	3	9		1								1	8	1.5
98	90	1	2	3	3	9		1	1					2		4	5	1
103	320	2	1	3	3	9		3								3	6	1.5
107	90	1	2	3	3	9		3	1				1			5	4	1.5
113	170	2	2	2	3	9		1				1				2	7	1.5
114	420	2	1	3	3	9					1					1	8	1.5
2	44	1	2	2	3	8		2								2	6	1
7	55	1	1	3	3	8		2						3		5	3	1
8	60	1	1	3	3	8		2						2		4	4	1

Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score 2	ERS condition 2	Gut feeling - out of 10
15	80	1	2	2	3	8		1						1		2	6	1.5
16	40	1	1	3	3	8		3						1		4	4	1
18	80	1	1	3	3	8		1						2		3	5	1
24	28	1	2	2	3	8		1	1							2	6	1
28	25	1	2	2	3	8		2					1			3	5	1
31	40	1	2	2	3	8		1						2		3	5	0.5
35	60	1	1	3	3	8		1						3		4	4	0.5
43	320	2	1	2	3	8							1			1	7	0.5
48	220	2	1	2	3	8	1							2		3	5	0.5
51	170	2	1	2	3	8		1						2		3	5	1
60	60	1	1	3	3	8			1					2		3	5	1
71	45	1	2	2	3	8										0	8	1
86	40	1	2	2	3	8		1			3					4	4	1
94	90	1	2	2	3	8			3					2		5	3	1
102	110	2	1	2	3	8		3				1	1			5	3	0.5
111	540	2	1	2	3	8										0	8	1
115	380	2	1	3	2	8		1								1	7	1
3	22	1	2	1	3	7			3							3	4	0.5
4	80	1	1	2	3	7		2	1							3	4	1
5	80	1	1	2	3	7		3								3	4	1
6	28	1	1	2	3	7		1								1	6	0.5
9	18	1	2	1	3	7		1					3			4	3	0.5
11	35	1	1	2	3	7		3						2		5	2	1
12	40	1	1	2	3	7		2						3		5	2	0.5
14	50	1	1	2	3	7		2								2	5	0.5
19	60	1	1	2	3	7		3						1		4	3	1
21	40	1	1	2	3	7		1						1		2	5	0.5
22	36	1	1	2	3	7		2								2	5	1
29	35	1	1	2	3	7		2								2	5	0.5
33	20	1	2	1	3	7		2						1		3	4	1
34	46	1	1	2	3	7		2					2	1		5	2	1
37	40	1	1	2	3	7		2								2	5	0.5
38	30	1	2	1	3	7		2			1					3	4	1.5
40	40	1	1	2	3	7		3					2	1		6	1	0.5
41	30	1	1	2	3	7								1		1	6	0.5

Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score	ERS condition	Gut feeling - out of 10
45	60	1	1	2	3	7	3									3	4	0.5
53	18	1	2	1	3	7										0	7	0.5
62	28	1	1	2	3	7	3									3	4	0.5
65	80	1	1	2	3	7										0	7	1.5
68	80	1	1	2	3	7								1		1	6	0.5
75	50	1	1	2	3	7		1	3							4	3	0.5
81	25	1	2	1	3	7								1		1	6	1
101	80	1	1	2	3	7		2					1			3	4	0.5
117	650	2	1	2	2	7						1				1	6	1.5
20	30	1	1	1	3	6		1								1	5	1
52	35	1	1	1	3	6								3		3	3	0.5
55	42	1	1	1	3	6										0	6	0.5
116	45	1	1	1	2	5		3					3			6	-1	1

Table 5. ERS deposits on the River Irwell ranked by ERS invertebrate condition

Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score	ERS condition	Gut feeling - out of 10
106	4000	4	3	9	3	19		2						1		3	16	3.5
100	1600	3	3	9	3	18		2	1			1	1	1		6	12	3
64	1600	3	2	5	3	13			1							1	12	3
105	1200	3	2	6	3	14		2						1		3	11	3
39	280	2	2	6	3	13		1	1							2	11	2.5
90	700	2	2	5	3	12							1			1	11	4
79	1450	3	2	8	3	16		2	2					2		6	10	2.5
85	1100	3	2	6	3	14		3			1					4	10	2
87	800	2	3	6	3	14		1			2			1		4	10	4
17	120	2	2	6	3	13		2						1		3	10	2
70	160	2	2	5	3	12		2								2	10	1.5
67	260	2	2	3	3	10										0	10	2
97	1800	3	2	7	3	15		2	3				1			6	9	2
112	520	2	2	6	3	13		3						1		4	9	
46	1600	3	3	3	3	12	3									3	9	2.5
66	980	2	3	4	3	12	1				2					3	9	2.5
91	450	2	2	5	3	12					3					3	9	2
25	550	2	1	5	3	11		1	1							2	9	2
23	220	2	1	3	3	9										0	9	1.5
27	400	2	3	5	3	13		1	1					3		5	8	2
30	220	2	3	5	3	13		3						2		5	8	2
110	380	2	2	5	3	12		2	1			1				4	8	1.5
32	160	2	2	4	3	11		1	1					1		3	8	2
59	550	2	1	5	3	11	1	1						1		3	8	2
73	170	2	3	3	3	11		1					1	1		3	8	2
47	400	2	2	3	3	10		1	1							2	8	2
56	280	2	2	3	3	10								2		2	8	2.5
78	650	2	2	3	3	10			2							2	8	1.5
63	280	2	1	3	3	9								1		1	8	1.5
69	110	2	1	3	3	9					1					1	8	1
89	350	2	1	3	3	9		1								1	8	1.5
114	420	2	1	3	3	9					1					1	8	1.5
71	45	1	2	2	3	8										0	8	1
111	540	2	1	2	3	8										0	8	1

Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score	ERS condition	Gut feeling - out of 10
1	110	2	1	5	3	11		1						3		4	7	1.5
49	160	2	2	4	3	11		2	1					1		4	7	1.5
57	180	2	2	4	3	11		1						3		4	7	2
76	140	2	2	4	3	11		1	3							4	7	2
93	120	2	2	4	3	11			3					1		4	7	1
13	90	1	2	4	3	10		2						1		3	7	1
44	320	2	1	4	3	10		2						1		3	7	1
83	550	2	2	3	3	10		3								3	7	1
61	90	1	1	4	3	9		1						1		2	7	0.5
113	170	2	2	2	3	9		1				1				2	7	1.5
43	320	2	1	2	3	8							1			1	7	0.5
115	380	2	1	3	2	8		1								1	7	1
53	18	1	2	1	3	7										0	7	0.5
65	80	1	1	2	3	7										0	7	1.5
82	1400	3	1	7	3	14		2	3					3		8	6	2
108	320	2	2	6	3	13		2	2			1	1	1		7	6	2
26	160	2	2	4	3	11		3					2			5	6	1
84	170	2	2	3	3	10		2					1	1		4	6	
95	80	1	3	3	3	10		1					2	1		4	6	1.5
99	110	2	2	3	3	10		2					1	1		4	6	1.5
104	240	2	2	3	3	10		2					1	1		4	6	1.5
10	40	1	2	3	3	9		2						1		3	6	2
36	110	2	1	3	3	9								3		3	6	1
42	120	2	2	2	3	9		3								3	6	1
54	240	2	1	3	3	9					3					3	6	1
103	320	2	1	3	3	9		3								3	6	1.5
2	44	1	2	2	3	8		2								2	6	1
15	80	1	2	2	3	8		1						1		2	6	1.5
24	28	1	2	2	3	8		1	1							2	6	1
6	28	1	1	2	3	7		1								1	6	0.5
41	30	1	1	2	3	7								1		1	6	0.5
68	80	1	1	2	3	7								1		1	6	0.5
81	25	1	2	1	3	7								1		1	6	1
117	650	2	1	2	2	7						1				1	6	1.5
55	42	1	1	1	3	6										0	6	0.5

Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score	ERS condition	Gut feeling - out of 10
77	150	2	1	4	3	10			3					2		5	5	1
72	225	2	1	3	3	9		3					1			4	5	1
80	220	2	1	3	3	9			1					3		4	5	1
88	145	2	2	2	3	9		1						3		4	5	1
98	90	1	2	3	3	9		1	1					2		4	5	1
18	80	1	1	3	3	8		1						2		3	5	1
28	25	1	2	2	3	8		2					1			3	5	1
31	40	1	2	2	3	8		1						2		3	5	0.5
48	220	2	1	2	3	8	1							2		3	5	0.5
51	170	2	1	2	3	8		1						2		3	5	1
60	60	1	1	3	3	8			1					2		3	5	1
14	50	1	1	2	3	7		2								2	5	0.5
21	40	1	1	2	3	7		1						1		2	5	0.5
22	36	1	1	2	3	7		2								2	5	1
29	35	1	1	2	3	7		2								2	5	0.5
37	40	1	1	2	3	7		2								2	5	0.5
20	30	1	1	1	3	6		1								1	5	1
50	280	2	1	4	3	10		2	1			2		1		6	4	1.5
92	150	2	1	4	3	10		3	1				2			6	4	1
109	900	2	2	3	3	10		3	2					1		6	4	1.5
107	90	1	2	3	3	9		3	1				1			5	4	1.5
8	60	1	1	3	3	8		2						2		4	4	1
16	40	1	1	3	3	8		3						1		4	4	1
35	60	1	1	3	3	8		1						3		4	4	0.5
86	40	1	2	2	3	8		1			3					4	4	1
3	22	1	2	1	3	7			3							3	4	0.5
4	80	1	1	2	3	7		2	1							3	4	1
5	80	1	1	2	3	7		3								3	4	1
33	20	1	2	1	3	7		2						1		3	4	1
38	30	1	2	1	3	7		2			1					3	4	1.5
45	60	1	1	2	3	7	3									3	4	0.5
62	28	1	1	2	3	7	3									3	4	0.5
101	80	1	1	2	3	7		2					1			3	4	0.5
96	120	2	2	3	3	10		1	3				2	1		7	3	1
74	65	1	3	2	3	9		2					2	2		6	3	1

Site Code	Area	Area score	topography score	habitat diversity score	habitat continuity score	ERS invert. Potential score	stock impact	stabilisting vegetation cover	pedestran impact	vehicle impact	gravel extraction impact	siltation	eroding	shading	other impact	impact score	ERS condition	Gut feeling - out of 10
7	55	1	1	3	3	8		2						3		5	3	1
94	90	1	2	2	3	8			3					2		5	3	1
102	110	2	1	2	3	8		3				1	1			5	3	0.5
9	18	1	2	1	3	7		1					3			4	3	0.5
19	60	1	1	2	3	7		3						1		4	3	1
75	50	1	1	2	3	7		1	3							4	3	0.5
52	35	1	1	1	3	6								3		3	3	0.5
58	160	2	1	3	3	9		3					1	3		7	2	0.5
11	35	1	1	2	3	7		3						2		5	2	1
12	40	1	1	2	3	7		2						3		5	2	0.5
34	46	1	1	2	3	7		2					2	1		5	2	1
40	40	1	1	2	3	7		3					2	1		6	1	0.5
116	45	1	1	1	2	5		3					3			6	-1	1