

ENVIRONMENT AGENCY

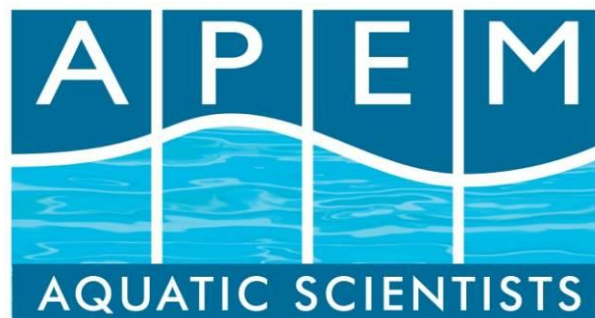
**RURAL SEDIMENT TRACING
PROJECT**

**RIVER WENSUM CATCHMENT
REPORT**

FINAL REPORT

April 2010

APEM REF: 410987



CLIENT: **ENVIRONMENT AGENCY**

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PROJECT No: **410987**

DATE OF ISSUE: **April 2010**

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1 INTRODUCTION

1.1 Background to the project

The Environment Agency (EA) initiated the Rural Sediment Tracing Project in 2009 with the aim of identifying and classifying catchment sources of fine sediment inputs to streams and rivers within 11 priority catchments in rural areas across England. The selected catchments are the top failing salmon catchments in England, where fine sediment is a known problem. The project was funded by Defra and supports the work being undertaken by the EA to achieve the environmental targets set out in the Water Framework Directive (WFD). The project also complements other initiatives being undertaken by the EA, Natural England and other partners to reduce the negative environmental effects of land-use practices in river catchments, such as England Catchment Sensitive Farming Initiative (ECSFI) and the Sediment Matters Project.

The WFD requires the attainment of good ecological status or potential on prescribed time scales and the UK Technical Advisory Group (UKTAG) for the WFD has recently concluded that fine sediment has the potential to threaten the ecological status of surface waters and their resident biota (APEM, 2007). This is further supported by the 'reasons for failure' information contained within the first River Basin Management Plans which demonstrates the very widespread nature of the problem and its degree of impact on ecosystems and species. Unlike other pressures on freshwater systems, the WFD does not provide a standard by which we can manage sediment. Instead, we must look at the impacts sediments cause on the ecology of freshwater systems to target where measures are required.

This project sets out to identify key point sources of fine sediment in these high-priority catchments by carrying out walkover surveys. The purpose is to help Environment Agency operational staff and partners to demonstrate the scale of the problem and target local effort for dealing with sediment problems and extending this understanding to other impacted water bodies. It also helps to contribute to the evidence base on the scale and magnitude of excessive fine sediment inputs into rivers in England. Historically, excessive fine sediment input to rivers has been regarded as diffuse pollution – and thereby association presents a problem often perceived as too difficult to solve in river catchments. However, in many cases land runoff is channelled and actually enters rivers at discrete points. This project aims to identify these discrete points and to provide the evidence base needed to tackle the problem of excessive fine sediment input at source and before it is mobilised to enter river channels.

The 11 priority river catchments were selected by the EA on the basis of being important ecologically and for known detrimental effects on salmon conservation objectives caused by fine sediment impacting on egg survival. Several of these rivers have poor records of compliance to the salmon conservation limits (i.e. the minimum desirable spawning stock levels) identified by the EA's 5-year Salmon Action Plans (Wooland *et al.*, 2004). Excessive inputs of fine sediment were considered to be causing failure of salmon conservation targets in many of these rivers, or impacting on their production and affecting their overall status for WFD and economic value. In the larger river catchments, sub-catchments were identified by local EA staff and in

consultation with staff from the ECSFI and the Association of Rivers Trusts (Eden Rivers Trust, Ribble Catchment Conservation Trust and the Wye and Usk Foundation). They identified where inputs of fine sediment were greatest and survey effort was to be targeted. Survey teams aimed to cover up to 300 km of continuous watercourse by walking in each river catchment. The catchments and sub-catchments were:

- River Tamar (River Ottery and River Carey sub-catchments, Cornwall, South West England)
- River Axe (Devon, South West England)
- River Avon (River Nadder, River Wyle, River Ebble and Upper River Avon sub-catchments, Wiltshire, Southern England)
- River Test (Hampshire, Southern England)
- River Itchen (Hampshire, Southern England)
- River Wensum (Norfolk, Eastern England)
- River Wye (River Lugg sub-catchment, Herefordshire, Midlands)
- River Wyre (Cam Brook, River Brock and New Draught sub-catchments, Lancashire, North West England)
- River Ribble (River Loud, Stock Beck and Dinkley Brook sub-catchments Lancashire, North West England)
- River Eden (Rivers Eamont, Roe, Leith, Lyvennet, Hoff Beck and Mill Beck sub-catchments Cumbria, North West England)
- River Tees (River Leven sub-catchment, Yorkshire, North East England)

The focus of this current study was on the identification of sources of excessive fine sediment, primarily from field runoff, and not on the specific environmental fate and ecological consequences of this sediment in rivers as this is already known and demonstrated by fish survey and previous sediment studies on spawning areas and egg survival.

1.2 Methodology

The project involved teams of trained field scientists undertaking standardised and systematic walkover surveys along continuous reaches of watercourses from December 2009 to March 2010.

1.2.1 Baseline surveys

Baseline walkover surveys were undertaken first, which were independent of prevailing weather conditions and covered all of the survey reaches. Each catchment or sub-catchment was surveyed on foot by a team of up to ten field scientists, working individually. A 'leap-frogging' approach was adopted, with individuals walking along the river to a predefined location where a vehicle had been left by a team member who had walked upstream from that point. Critical point sources of fine sediment entering the watercourses were classified and mapped. The origins of these sources were traced by walking and, if possible, using aerial photography.

Point sources were classified on a scale of Grade 1 to Grade 3; Grade 1 being the most severe (Table 1). (N.B. This grading system is not to be confused with the EA

Common Incident Classification System (CICS).) A field handbook, which clearly defined the different grades of sediment source using text and photographic examples, was provided to each field worker. The field handbook is included in the national report.

Table 1: Definitions and examples of fine sediment sources of Grades 1 to 3, as classified during the baseline survey.

Grade	Definition	Example
1	Observed (or potential for) widespread deposition of instream sediment causing localised and widespread impacts more than 100m from the point or diffuse source.	<ul style="list-style-type: none"> • Fields with major erosion gullies • Fields with evidence of large-scale overland flow • Major instream works (such as dredging) • Heavily poached and trampled fields • Farm tracks with evidence of overland flow • Drains and ditches discharging large quantities of fine sediment
2	Observed (or potential for) local deposition of instream sediment causing noticeable impacts within 100m of the point or diffuse source.	<ul style="list-style-type: none"> • Fields with evidence of localised runoff • Localised poaching • Drains and ditches discharging small quantities of fine sediment
3	Minimal observed (or potential for) deposition of instream sediment with very localised deposition in the immediate vicinity of the input.	<ul style="list-style-type: none"> • Minor land drains, • Ditches • Road drains and other pipes • Minor stocking drinking areas and other points of livestock access

N.B. Some of the assessments in the baseline survey that were judged as having a potential impact were highlighted for follow-up repeat visits during wet weather to confirm the scale of the problem. This was particularly the case for fine sediment inputs from drains, pipes and ditches.

In addition to the primary categorisation of the perceived threat posed by fine sediment sources, the origin of each input was also recorded during the baseline survey. This facilitated GIS analysis of the spatial and numerical distribution of each of the Grade 1 sources. The origin of each source was recorded as shown in Table 2.

Table 2: Types into which fine sediment sources were categorised.

Category	Source	Type	Abbreviation
A	Arable	Overland runoff (cropland)	OR
		Arable field drain	FD
		Arable drainage pipe	ADP
B	Livestock	Farmyard runoff	FR
		Poaching	PO
		Trampling	TRP
		Overland runoff (Grassland))	POR
C	Conduits	Road	RR
		Track	TR
		Drainage ditch (non-agricultural)	DD
		Drainage pipe (non-agricultural)	DP
D	Instream works	Dredging	DR
		Bank clearance	BC
		Earth works	EW
E	Non-agricultural	Sewage treatment works	STW
		Road works	RW
		Footpath	FP
		Construction site	CS
		Spoil heap	SH
		Woodland runoff	WR

1.2.2 Wet weather Surveys

Following the baseline surveys, and when weather allowed, four catchments were revisited during wet weather events, when precipitation was above the threshold to cause significant runoff from land. Given the short survey time window available, priority was given to the most severe sources, which were revisited and information was collected regarding runoff and where the sources of runoff originated.

Water samples were collected manually upstream and downstream of each point source and at strategic nodal points throughout the catchment, upstream and downstream of major tributaries. The water samples were returned immediately to APEM laboratories, where the concentration of total suspended solids was measured in each sample by standard gravimetric methods.

The purpose of collecting water samples in this way was to obtain empirical evidence to support the observational evidence collected. Sampling of the nodal points was undertaken:

- i) to characterise the suspended solids concentrations across a catchment, including ‘control’ reaches without significant inputs of sediment solids;
- ii) to assess the relationship between the total number of upstream fine sediment sources in a tributary and the impact on the receiving watercourses; and

- iii) to determine the relationship between different types of severity of input, i.e. whether the cumulative effect of many Grade 2 or Grade 3 sources is greater than just one or a few Grade 1 sources.

1.2.3 Aerial Surveys

In addition to the field surveys, aerial surveillance was undertaken in several catchments to provide further observational evidence, to help with interpretation of ground surveys, and also to help identify potential sources of sediment away from the main river.

1.3 Purpose of this report

The results for each catchment are reported separately. The aim of this report is to describe and summarise the findings of the sediment survey for the River Wensum catchment. Every source of fine sediment recorded in the catchment is shown on a GIS map (page 7). The locations of the most severe fine sediment sources (Grade 1) are shown on a separate map (page 8). The catchment has been split up into chapter sections with each river reach or major tributary analysed separately.

This report presents the findings of the baseline walkover survey in the Wensum catchment. Wet weather surveys and aerial surveys were not carried out in this catchment because suitable weather did not occur during the project timescale.

1.4 River Wensum Catchment

The Wensum catchment is situated in Norfolk and is a tributary of the River Yare. The Wensum flows westwards from Whissonett, close to Raynham and Sculthorpe, through Fakenham to Great Ryburgh. It then continues close to Swanton Morley and Lenwade before entering Norwich where it finally joins the Yare. The entire river is designated as a Site of Special Scientific Interest (SSSI) and a Special Area of Conservation (SAC). The catchment is very low lying with a maximum elevation of 94 m. The underlying geology is chalk overlain mainly by boulder clay but with gravels and sands in the valley bottoms. Arable farming is the dominant land use, occupying 74 % of the catchment area. Grassland and woodland are also present to a much lower extent. Rainfall is low (600-700 mm).

Throughout most of the survey areas there are non-calcareous, loamy soils with slowly permeable subsoils in chalky drift which become calcareous with depth. These are affected by slight, but somewhat variable, seasonal waterlogging. There is moderate risk to structural degradation with a tendency for lateral water movement above the slowly permeable layers where slopes allow. Eastern tributaries near Norwich are in deep, permeable well drained non-calcareous sandy soils with high risk to structural degradation and soil erosion. Western headwaters, south and west of Fakenham have deep, well drained, permeable, non-calcareous loamy over clayey soils mixed with deep, permeable, well drained sandy soils that are at high risk of structural degradation and lateral movement of water.

2 RESULTS

In section 2, every potential source of fine sediment classed as a Grade 1 during the baseline survey is described, giving information about its location, the type of fine sediment input and the likely cause of the high fine sediment input. The suspended fine sediment concentration of the runoff water during wet weather is shown (where applicable), together with the suspended fine sediment concentrations of the river water upstream and downstream of the input, to give an indication of the effect of the input. In addition aerial surveillance imagery is included to aid interpretation (where applicable).

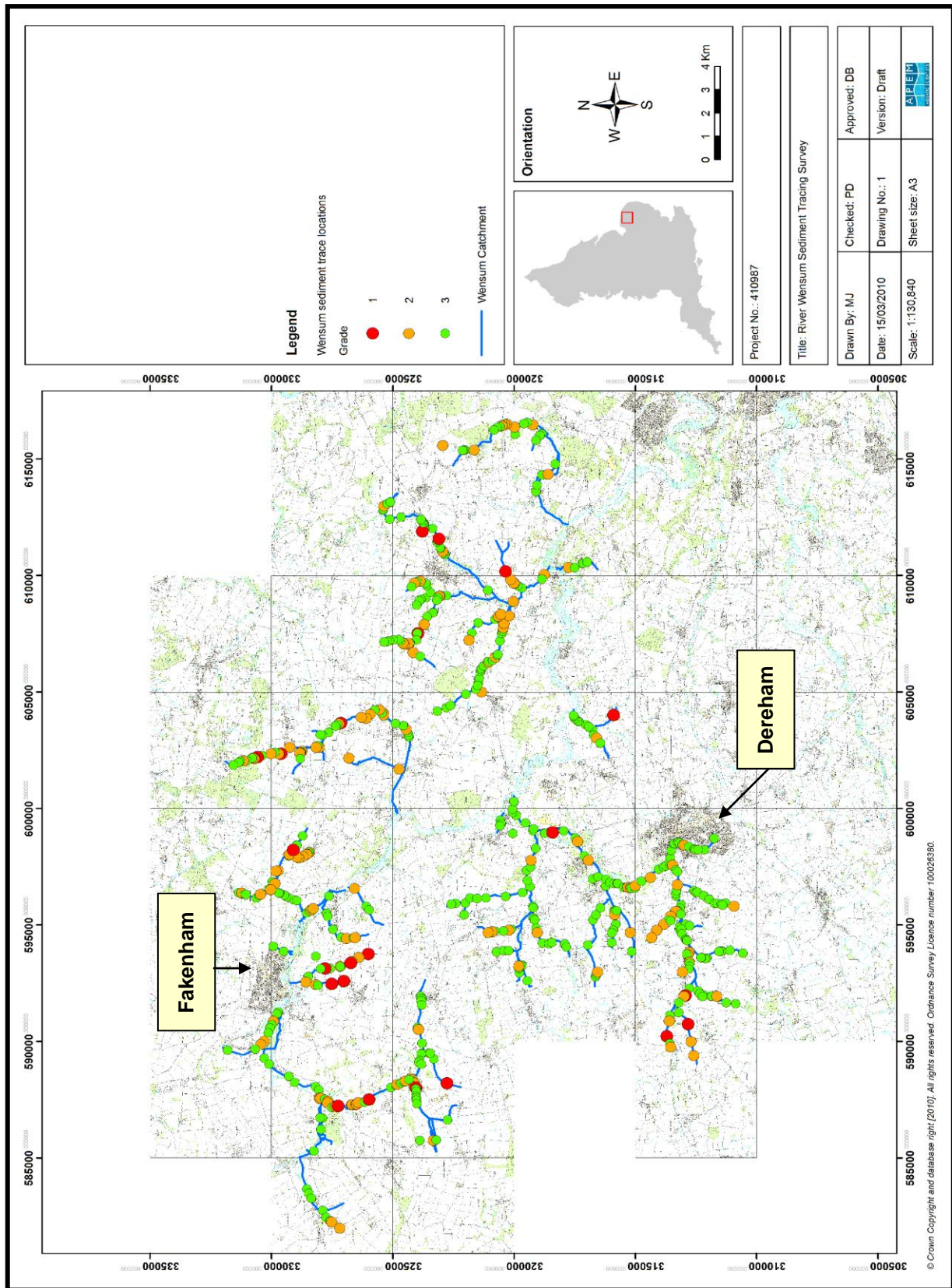
It is intended that this information will provide a comprehensive picture of the problems associated with excessive fine sediment input in the catchment, allowing remediation measures to be targeted at the worst affected locations. A priority rating is also given from LOW – HIGH providing support for local EA teams during catchment management decisions.

An interactive GIS product of the findings of this report can be interrogated by viewing the contents of the DVD attached to this report in Appendix I.

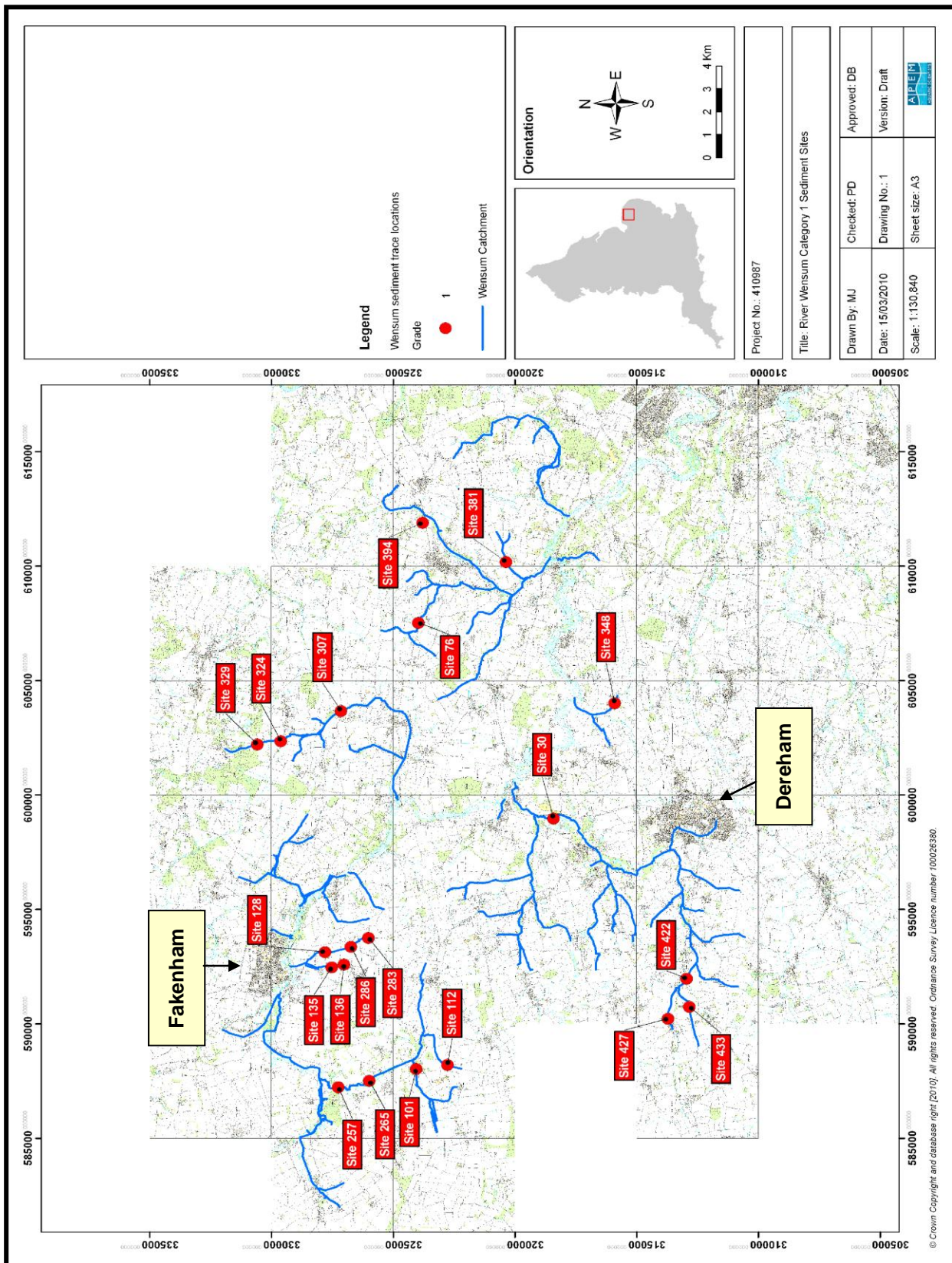
2.1 Catchment sediment source overview

Maps of the sources of fine sediment recorded across the entire River Wensum catchment are shown below, together with a table which lists every Grade 1 fine sediment source, type and location.

2.1.1 Catchment map – All sites



2.1.2 Catchment map – Grade 1 sites only

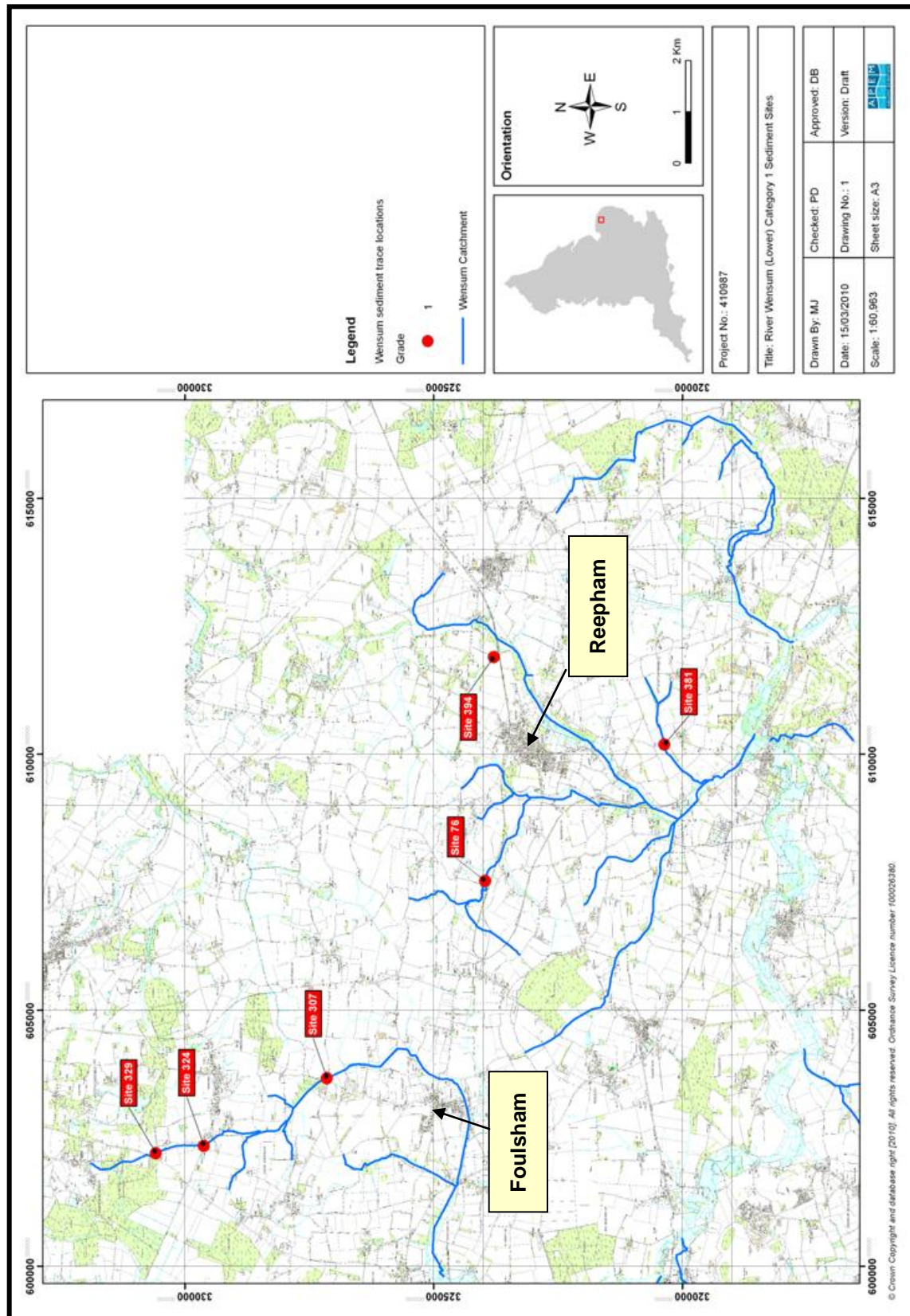


2.1.3 Summary of Grade 1 fine sediment sources identified during the baseline survey

Site	Watercourse	Type	Grid Reference
30	Blackwater main stem	Track runoff	TF9898618419
76	Reepham	Road and arable runoff	TG0753523966
101	Wensum West	Bank clearance and straightening	TF8803124056
112	Wensum West	Arable runoff	TF8821022770
128	Racecourse tributary	Arable field drain	TF9314627793
135	Racecourse tributary	Dredging	TF9247727526
136	Racecourse tributary	Arable field drain	TF9259927024
257	Wensum (upper)	Bank clearance	TF8723627252
265	Wensum	Bank clearance	TF8752025985
283	Great Ryburgh	Resectioned bank	TF9376626018
286	Great Ryburgh	Resectioned bank	TF9337426736
307	Foulsham 6	Arable runoff	TG0367727145
324	Foulsham 7	Road runoff and poaching	TG0235629619
329	Foulsham	Earth mound, field runoff and ford	TG0221230583
348	Pennyspot E 1	Road runoff	TG0402215902
381	Reepham	Road runoff	TG1019520360
394	Cawston 5	Track runoff	TG1190323791
422	Wend 4	Earth pile, road runoff	TF9197612941
427	Wend 4	Soil pile at side of river and track runoff	TF9023413711
433	Wend 4	Soil pile draining into river	TF9075012831

2.2 Chapter One - Lower Wensum

2.2.1 Lower Wensum – Grade 1 sites



Site 76

Project	410987	River/Beck	Wensum - Reepham
Date	18.02.10	NGR	TG0753523966
Type of input	Fine sediment, sand, fine gravel	Priority	
Description	Road and arable runoff		
Land use	LHB: Rough pasture	RHB: Arable	HIGH
Vegetation	LHB: Grass	RHB: Crops	


Comments:

Road run off from 200m on the left hand bank and 150m from the right hand bank, plus additional arable run off.

**Synopsis:**

Fine sediment is transported into the river at site 76 as road runoff. The runoff was evident 200m up the road on the left hand bank and 150m up the road on the right hand bank. At either side of the road bridge channels have been dug to allow the water to flow into the river. Arable fields are located on the right hand bank and are contributing to the fine sediment runoff which is gathering on the road.


Site 307

Project	410987	River/Beck	Wensum - Foulsham 6
Date	16.02.10	NGR	TG0367727145
Type of input	Fine sediment	Priority	
Description	Road runoff, arable runoff		
Land use	LHB: Broadleaf woodland and tilled land	RHB: Tilled land	HIGH
Vegetation	LHB: Broadleaf trees and grasses	RHB: Bare	
Comments: <p>Thick heavy fine sediment deposits collecting at the side of the road from a large tilled field. This is then running into the channel. There is also run-off from the surrounding land, including the wooded area and the fields on the left hand bank.</p>			
			

Synopsis:

Fine sediment enters the river at site 307 via tilled land runoff and road runoff. Several roads converge near to the road bridge and in heavy rain the sediment will run off the roads into the river. Upstream and downstream of the bridge, on the left hand bank, are tilled fields which are just bare soil with runoff entering the river. Tractor activity at the field entrance further contributes to the fine sediment load being input to the river. There is also some runoff from the broadleaved woodland on the left hand bank.

Site 324

Project	410987	River/Beck	Wensum - Foulsham 7
Date	16.02.10	NGR	TG0235629619
Type of input	Fine sediment, sand, fine gravel	Priority	
Description	Road runoff, poaching		
Land use	LHB: Rough pasture	RHB: Rough pas	HIGH
Vegetation	LHB: Grasses	RHB: Grasses	
Comments: Large amount of road run-off creating a channel in the bank adjacent to the road. The channel then flows down and into the main channel potentially discharging a large volume of fine sediment and road run-off.			
			

Synopsis:

Fine sediment enters the river at site 324 by several ditches that have been dug out of the bank. This allows the runoff from the road to enter ditches that run perpendicular to the tributary before flowing into the tributary. There was also excessive poaching along both banks of the river.

Site 329

Project	410987	River/Beck	Wensum - Foulsham
Date	16.02.10	NGR	TG0221230583
Type of input	Fine sediment, fine gravel	Priority	
Description	Ford and run-off from improved grassland.		
Land use	LHB: Improved grassland	RHB: Rough pas	HIGH
Vegetation	LHB: Grass, shrubs	RHB: Grass, shrubs	

Comments:


Runoff from rutted farmer's track into main channel.



Synopsis:

Fine sediment enters the river at site 329 by a combination of sources. There is a large churned up area of bare soil on the left hand bank. It looks like the field is used regularly by tractors and this is causing a large amount of fine sediment to enter the river. There is a minor ford which is again used by the tractors and causes fine sediment input. In a wet weather event all of this bare earth will be transported into the river.

Site 381

Project	410987	River/Beck	Wensum - Reepham
Date	17.02.10	NGR	TG1019520360
Type of input	Fine sediment, sand, fine gravel	Priority	
Description	Road runoff		
Land use	LHB: Rough pasture	RHB: Rough pa	HIGH
Vegetation	LHB: Grasses, shrubs	RHB: Grasses, shrubs	
Comments:			
Relatively large amount of run-off entering stream from road.			
			

Synopsis:

Fine sediment enters the river at site 381 via road runoff through several drainage channels. Downstream of the road bridge, on both banks, are improved grassland fields which have muddy entrances to the field which is contributing to fine sediment in the road. Fine sediment deposits can be seen within the channel downstream of the road bridge.

Site 394

Project	410987	River/Beck	Wensum - Cawston 5
Date	18.02.10	NGR	TG1190323791
Type of input	Fine sediment, sand	Priority	
Description	Fine sediment run off from adjacent track		
Land use	LHB: Plantation	RHB: Plantation	HIGH
Vegetation	LHB: Coniferous trees	RHB: Coniferous trees	

Comments:

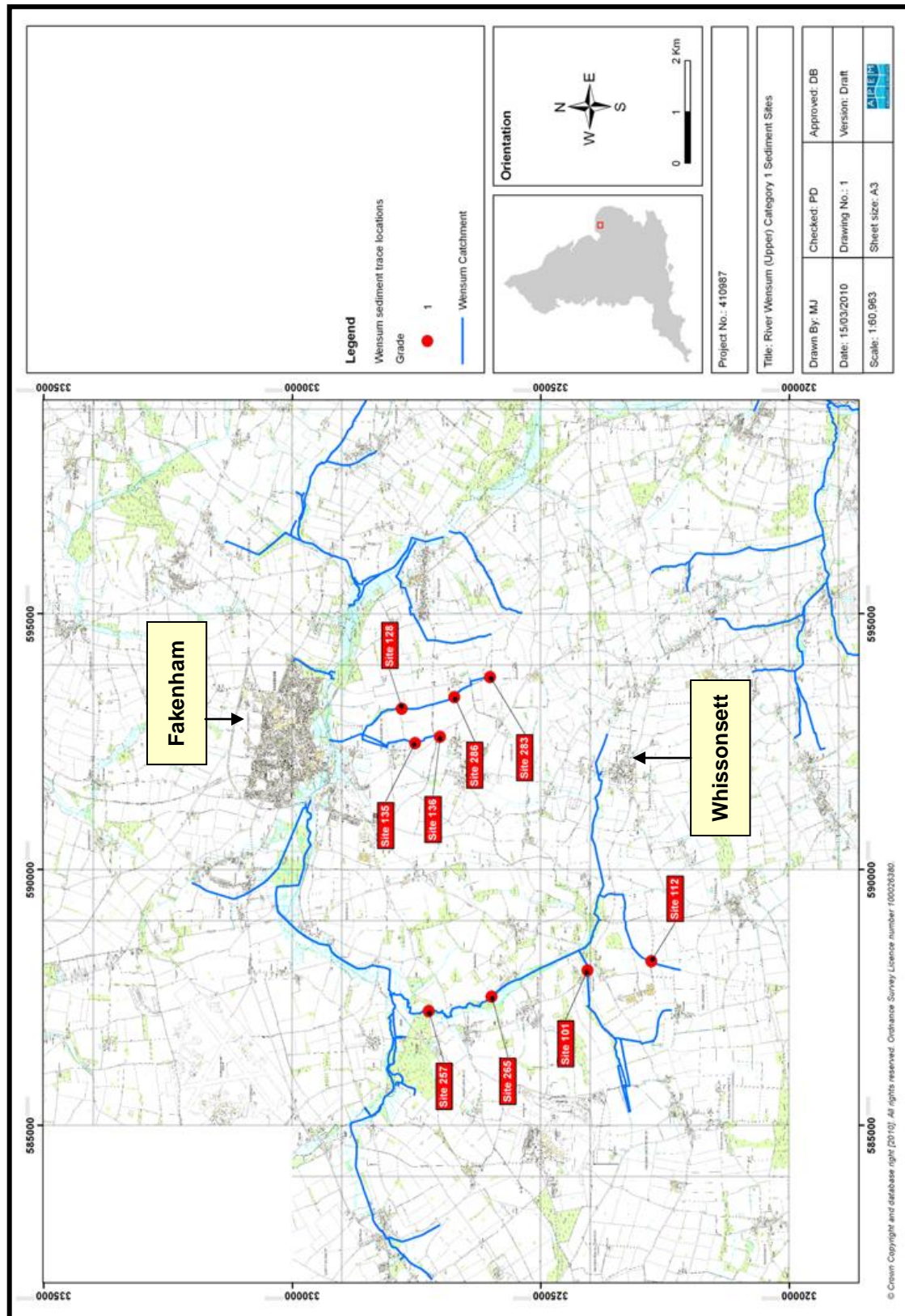
Fine sediment entering stream from bare, churned up areas used by vehicles. Run-off is flowing down a track and into the stream causing heavy siltation.

**Synopsis:**


Fine sediment is entering the river at site 394 via track runoff. Upstream of the bridge there are coniferous plantations which have been accessed regularly by vehicles. This has caused several areas to be churned up close to the river. In heavy rainfall this earth is washed into the river and fine sediment deposits can clearly be seen downstream of the bridge.

2.3 Chapter Two - Upper Wensum

2.3.1 Upper Wensum – Grade 1 sites



Site 101

Project	410987	River/Beck	Wensum – South Raynham	
Date	16.02.10	NGR	TF8803124056	
Type of input	Fine sediment, dredged material	Priority		
Description	Channel dredging			
Land use	LHB: Grassland	RHB: Grassland	HIGH	
Vegetation	LHB: Grasses	RHB: Grasses		
Comments:				
Digger lifting fine sediment from drain and dumping on field. Run off into drain, clear plume of fine sediment downstream.				
				

Synopsis:

Fine sediment was being actively transported into the channel at the time of this survey. A digger was seen to be involved in bank clearing and channel dredging. Any fine sediment that was being removed from the channel was placed in the field beside the channel. Downstream of where this was occurring was extremely turbid and fine sediment deposits were visible. The piles of earth that were placed in the field would also contribute to fine sediment in the channel during heavy rain.

Site 112

Project	410987	River/Beck	Wensum West
Date	16.02.10	NGR	TF8821022770
Type of input	Fine sediment, topsoil	Priority	
Description	Run off from arable field		
Land use	LHB: Arable field	RHB: Arable field	HIGH
Vegetation	LHB: Short crops	RHB: Short crops	

Comments:

Modified banking with a steep downward slope. Immediately above is a tilled field creating siltation runoff into the main channel.



Synopsis:

Fine sediment and clay enter the channel at site 112 as runoff from arable fields. The ditch has been resectioned and over deepened leaving bare soil on the banks. In a rainfall event this soil will be transported straight into the river. This combined with the runoff from the arable fields meant that the water was visibly turbid approximately 100m from the source.

Site 128


Project	410987	River/Beck	Wensum - Racecourse tributary
Date	17.02.10	NGR	TF9314627793
Type of input	Fine sediment, topsoil	Priority	
Description	Bank clearance		
Land use	LHB: Arable	RHB: Arable	HIGH
Vegetation	LHB: Short stubble	RHB: Short stubble	
Comments:			
Bare soil over a 500m stretch of bank.			



Synopsis:

Fine sediment enters the channel at site 128 as runoff from arable fields. The channel has recently been resectioned and over deepened over a 500m stretch and the excavated soil has been placed next to the water course. This has left exposed bare soil which is subject to runoff in a rainfall event. Stubble fields are located on both banks and this is also contributing to fine sediment flowing into the channel. From the photograph you can see the extent of the siltation in the channel and this extends much further downstream.


Site 135

Project	410987	River/Beck	Wensum - Racecourse Tributary
Date	17.02.10	NGR	TF9247727526
Type of input	Fine sediment, topsoil	Priority	
Description	Channel clearance		
Land use	LHB: Arable	RHB: Arable	HIGH
Vegetation	LHB: Grasses, crops	RHB: Grasses, crops	
Comments:			
Heavily modified, over-deepened channel with straightened plan form.			
			

Synopsis:

Fine sediment enters the channel at site 135 as arable runoff due to bank side clearance. The channel has been resectioned, over deepened and straightened. This has exposed approximately 500m of bare soil along the bank which will runoff into the channel with any amount of rain. The land use on either side of the channel is stubble fields and due to the slight incline of the fields any surface water will runoff straight into the channel taking any loose fine sediment with it.

Site 136

Project	410987	River/Beck	Wensum - Racecourse Tributary
Date	17.02.10	NGR	TF9259927024
Type of input	Fine sediment, topsoil, fine gravel	Priority	
Description	Bank clearance and arable runoff		
Land use	LHB: Road, arable field	RHB: Arable field	HIGH
Vegetation	LHB: Grasses	RHB: Bare soil	
Comments: Runoff from arable fields and road combined with bank clearance resulting in fine sediment input into the river.			
			

Synopsis:

Fine sediment enters the channel at site 136 as arable and road runoff and bank clearance. The channel has recently been resectioned and over deepened leaving bare soil banks which are causing fine sediment input into the channel. On either side of the channel are ploughed fields with runoff which is contributing to the channel being completely silted up. Another contributing factor is road runoff and channels have been cut into the bank to divert the water from the road into the channel.

Site 257

Project	410987	River/Beck	Wensum
Date	16.02.10	NGR	TF8723627252
Type of input	Fine sediment, topsoil	Priority	
Description	Runoff from bare soil on banks		
Land use	LHB: Woodland	RHB: Woodland	HIGH
Vegetation	LHB: Tree, shrubs	RHB: Trees, shrubs, grass	

Comments:

Grass/hay cutting, tree felling on both banks creating exposed soil. Relatively large area of bare ground allowing fine sediment to run-off and enter channel.



Synopsis:

Site 257 is characterised by periodic expanses of loose silty topsoil, for approximately 750m, through the wooded area of Tatterford Common. Sources are present on both banks and are caused by a combination of hay cutting and tree felling, which had been recently undertaken. Fine sediment enters the watercourse entrained in overland flow during periods of high rainfall.

Site 265

Project	410987	River/Beck	Wensum
Date	17.02.10	NGR	TF8752025985
Type of input	Fine sediment, topsoil	Priority	
Description	Runoff from bare soil on banks		
Land use	LHB: Woodland	RHB: Pasture, a improved grassla	HIGH
Vegetation	LHB: Broadleaf trees	RHB: Grass	

Comments:


750m of bare top soil left following bank clearance, allowing fine sediment to run off and enter channel.



Synopsis:

Fine sediment enters the watercourse at Site 265 entrained in overland flow during periods of high rainfall. Bare unconsolidated silty topsoil is found periodically on both banks for approximately 750m upstream of the start NGR. These fine sediment sources are a product of recent hay cutting.


Site 283

Project	410987	River/Beck	Wensum - Great Ryburgh
Date	17.02.10	NGR	TF9376626018
Type of input	Fine sediment, topsoil	Priority	
Description	Re-sectioned bank, runoff from unconsolidated top soil		
Land use	LHB: Pasture	RHB: Pasture	HIGH
Vegetation	LHB: Grasses	RHB: Grasses	
Comments: Large drainage channel with a considerable amount of loose top soil entering the channel.			
			

Synopsis:

Site 283 is characterised by extensive recent bank resectioning of this field drainage channel. The works have left the banks with no vegetation and unconsolidated fine sediment which enters the watercourse entrained in overland flow during periods of high rainfall. The steep gradient of the resectioned channel has lead to bank collapse in places.

Site 286

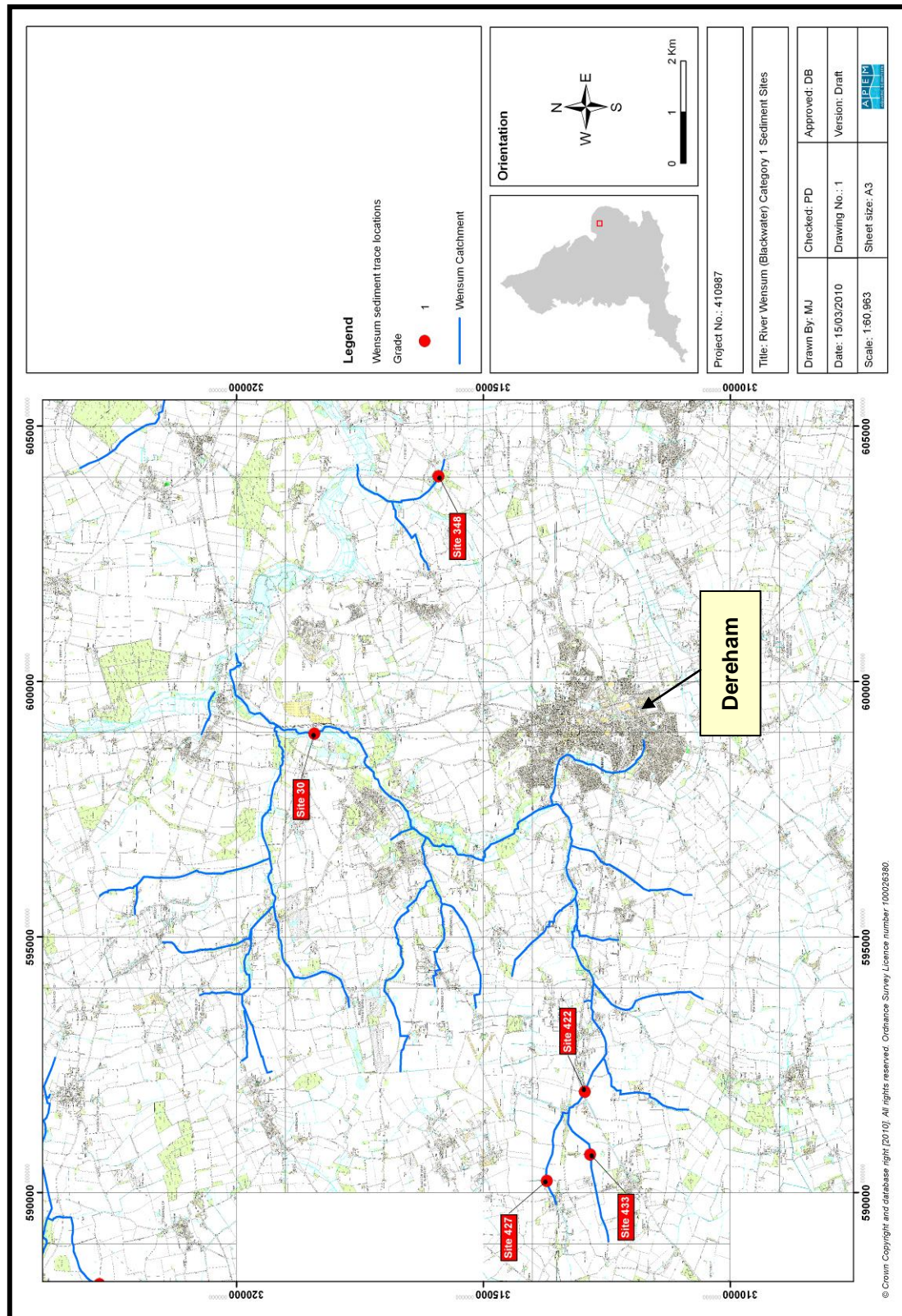
Project	410987	River/Beck	Wensum - Great Ryburgh
Date	17.02.10	NGR	TF9337426736
Type of input	Fine sediment, topsoil	Priority	
Description	Re-sectioned bank, runoff from exposed soil		
Land use	LHB: Tilled field	RHB: Tilled field	HIGH
Vegetation	LHB: Grain crop	RHB: Grain crop	
Comments: Heavily modified drainage channel about 750m long. There was evidence of bank collapsing and potential for a large amount of loose topsoil to flow into the channel.			
			

Synopsis:


Recent resectioning of this field drainage channel has left large source areas of unconsolidated silty topsoil. Sources are present periodically on both banks for approximately 1km downstream of the start NGR. Fine sediment enters the watercourse entrained in overland flow during periods of high rainfall.

2.4 Chapter Three - Blackwater

2.4.1 Blackwater – Grade 1 sites




Site 30

Project	410987	River/Beck	Wensum - Blackwater		
Date	16.02.10	NGR	TF9898618419		
Type of input	Fine sediment, sand, clay, fine gravel	Priority			
Description	Sand and fine sediment run off from road				
Land use	LHB: Rough pasture, woodland	RHB: Rough pasture	HIGH		
Vegetation	LHB: Grass, trees	RHB: Grass, trees			
Comments:					
Track crossing river was very sandy. Vegetation to both sides of track was yellow from sand spray. Piles of grit and sand ran onto track and into the river.					
					

Synopsis:

Fine sediment, sand and gravel enter the channel at site 30 as track runoff. The track was very sandy due to vehicles transporting material from the sand/gravel pit. On the left hand bank are piles of gravel and sand which produce runoff onto the track and then into the channel in rainy conditions. Entering the river from the left hand bank is a tributary which is very sandy due to rough pasture runoff. Woodland is also present on the left hand bank and this is contributing to fine sediment input into the river.


Site 348

Project	410987	River/Beck	Wensum - Pennyspot E 1
Date	16.02.10	NGR	TG0402215902
Type of input	Fine sediment, fine gravel	Priority	
Description	Run off from road and pipe		
Land use	LHB: Broadleaf woodland/ rough pasture	RHB: Broadleaf woodland/ road	HIGH
Vegetation	LHB: Trees, grasses, shrubs	RHB: Trees, grasses, shrubs	
Comments: Drainage pipe discharging into channel with evidence of fine sediment plume and deposits. There is also run- off from the road that crosses the stream.			
			

Synopsis:

Fine sediment enters the river at site 348 via a road drainage pipe. There were significant amounts of fine sediment being transported down the road and a plume was visible in the channel. This picture was taken in relatively dry weather so in a wet weather event the amount of fine sediment entering the channel will increase significantly.

Site 422

Project	410987	River/Beck	Wensum - Wendling
Date	17.02.10	NGR	TF9197612941
Type of input	Fine sediment, clay, organic	Priority	
Description	Runoff from road, track and excavated top soil pile		
Land use	LHB: Rough pasture	RHB: Rough pa	HIGH
Vegetation	LHB: Grasses	RHB: Grasses	
Comments:			
Fine sediment runoff from A47, a farm track and a large mound of clay and manure.			
			

Synopsis:

Fine sediment enters the channel at site 422 as road runoff from the A47 and from a regularly used farm track. Running parallel to the A47 are drainage ditches which are carrying fine sediment from these roads into the river. At the edge of the farm track is a mound of clay and manure which is producing runoff in any rainfall event.

Site 427

Project	410987	River/Beck	Wensum - Wendling
Date	17.02.10	NGR	TF9023413711
Type of input	Fine sediment, organic	Priority	
Description	Runoff from top soil pile, over adjacent farm track into beck		
Land use	LHB: Agricultural	RHB: Agriculture	HIGH
Vegetation	LHB: Grasses	RHB: Grasses	

Comments:


Large heap of manure and earth with fine sediment freely running off across a track and into the main channel.



Synopsis:

Fine sediment enters the channel as track runoff from a mound of earth and manure and also from the arable field which is located behind the mound. This photograph was taken in light rainfall and it was evident that there was fine sediment flowing across the track and into the channel. In heavy rain the fine sediment load in the channel will be increased.

Site 433

Project	410987	River/Beck	Wensum - Wendling
Date	17.02.10	NGR	TF9075012831
Type of input	Fine sediment, organic	Priority	
Description	Top soil pile running off via drain directly into stream		
Land use	LHB: Agricultural	RHB: Agricultural	HIGH
Vegetation	LHB: Grasses	RHB: Grasses, short crops	
Comments:			
Walled area containing earth and possibly manure discharging into the channel via drainage channels.			
			

Synopsis:

Piles of earth have been deposited next to the river and are entering the channel at site 433. The mound of earth is contained within a concrete platform with several drainage channels emerging from this. These transport a significant amount of fine sediment and organic matter into the channel. On both banks there are ploughed fields which have the potential to produce a significant amount of runoff into the river.

3 CATCHMENT SUMMARY

The underlying geology of the Wensum survey area is chalk which overlain by boulder clay and gravels. Sands were the most common substrate type in the valley bottoms where sluggish reaches more suited to coarse fish were prevalent. The dominant land use in the Wensum survey area was reported to be arable farming. Grassland and woodland were also widespread but were recorded much less frequently.

In total 553 fine sediment sources were recorded in the Wensum catchment, with a relatively small proportion, 20, being classed as Grade 1 (Table 3).

Table 3: Number of fine sediment sources of each grade recorded in the Wensum catchment.

Grade	Number
1	20
2	140
3	393
Total	553



Figure 1. Resectioned bank with bare soil prone to slippage during wet weather.

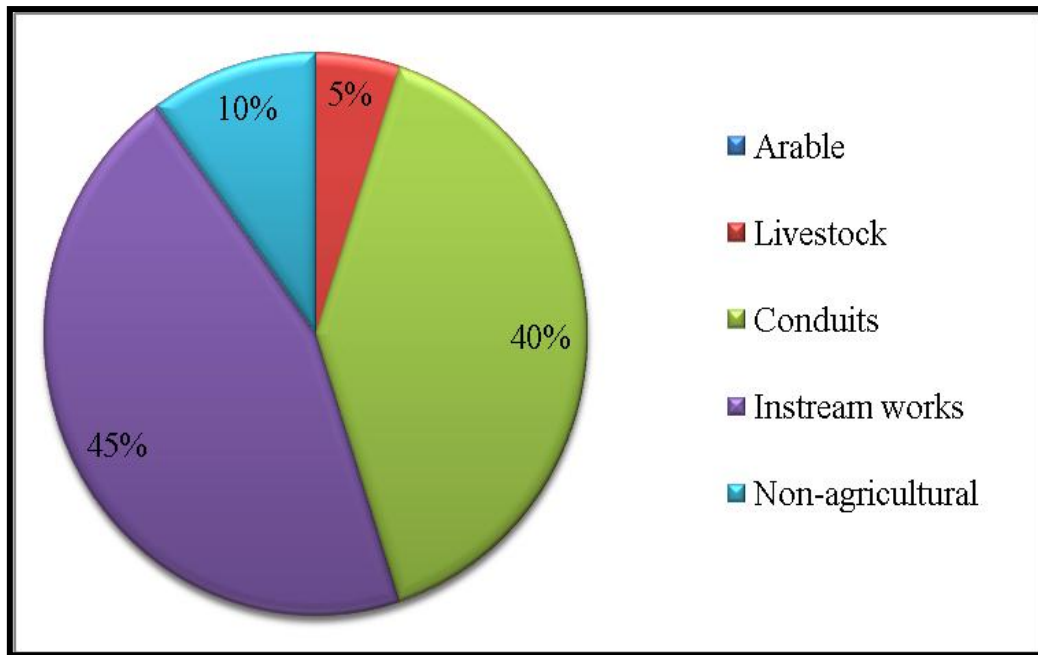


Figure 2. Percentage contribution of the Grade 1 sources in the Wensum catchment.

Bank clearance and resectioning of channels was common throughout the Wensum survey area (Figure 1). Where channels had been cleared of vegetation and over deepened, bare soil may be subject to washing into the channel during rainfall events. This type of fine sediment input accounted for 45% of all Grade 1 sources on the Wensum (Figure 2).

Other common fine sediment sources reported during the baseline survey were inputs from roads, farm tracks and drainage ditches, which contributed 40% of all Grade 1 reports. However, it is thought likely that these pathways are acting as conduits for runoff from other sources, notably arable farmland which was widespread throughout the survey reach. Wet weather surveys would help determine the origin of many of these sources. Direct fine sediment inputs to streams from livestock pasture comprised only 5% of sources (Figure 2) and there was no direct input from arable land.

The greatest numbers and most common origin of Grade 1 fine sediment sources were recorded in the upstream tributaries of the River Wensum, particularly around Fakenham, where arable agriculture was prevalent. A further observation made was that many of the waterways in the survey region were prone to fine sediment transportation from arable land via the wind, particularly where a lack of riparian growth was recorded.

APPENDIX I – CD OF GIS OUTPUTS

Instructions

- All fine sediment sources identified during the 2009/2010 APEM Rural Sediment Tracing Survey can be seen and interrogated using the CD attached below. Sites can be automatically activated as themes upon opening the ArcMap file.
- The characteristics of each of the sources, including its exact location (10-figure NGR), type of input (grain size etc) and its suspected source can be interrogated by opening the attributes table for the sediment sources theme.
- All images, footage and aerial surveillance imagery along with a profile synopsis of each Grade 1 site is hyperlinked to corresponding points. To view this information simply hover over the site and click on the dot icon when it becomes highlighted.