

Sediment Management Strategy Review

Report by Senior Waterways and Recreation Officer and Rivers Engineer

Summary: This report sets out the review of the Sediment Management Strategy (SMS) and officers' proposals for issues that should be prioritised in the updated SMS and its Action Plan. The report also proposes an alternative methodology for assessing and reporting on compliance with the SMS Waterway Specifications upon which members' views are sought.

Recommendations:

- (i) That the revised SMS and its action plan should focus on the issues outlined in the table at Appendix 2 to this report.
- (ii) That in future compliance monitoring reporting is based on an assessment the total bed area of the waterway specification envelope in each management unit and the percentage of the management unit that would be economic to dredge rather than by cross section analysis.
- (iii) That future dredging operations should be programmed based on an assessment of non compliant areas using the trigger levels of 10% of the total area of the waterway specification envelope being non compliant and sediment depth above compliance being greater than 300mm as set out in paragraph 6.2 to this report.

1 Background

- 1.1 The Sediment Management Strategy (SMS) was endorsed by the Broads Authority and published in January 2007. The SMS set out a framework for the sustainable long term management of sediment within the Broads in order to protect the integrity of the navigation area and the internationally important wetland. The SMS defined the key issues and principles for addressing the task of sediment management and allowed the Authority to take a proactive, rather than a reactive, approach to the dredging of the navigation area for the first time.
- 1.2 The main objectives of the SMS have been reviewed and progress noted in Table 1 below:

Table 1

Objective	Progress
<ul style="list-style-type: none"> To identify sources and volume of sediment entering the Broads 	Completed
<ul style="list-style-type: none"> To reduce sediment load to the waterways through partnership working 	Ongoing
<ul style="list-style-type: none"> To balance sediment inputs with future planned dredging (following removal of the current sediment backlog) 	Backlog removal ongoing
<ul style="list-style-type: none"> To define waterways specifications, and hence the dredging requirement and having done so evaluate and minimise its environmental impact 	Completed
<ul style="list-style-type: none"> To maximise beneficial reuse of sediment 	Ongoing
<ul style="list-style-type: none"> To target and prioritise expenditure 	Ongoing
<ul style="list-style-type: none"> To adopt a risk based approach to planning works 	Ongoing
<ul style="list-style-type: none"> To influence wider legislation and policy for sustainable and integrated management on a catchment scale. 	Ongoing

- 1.3 Since the SMS was published several key factors have changed and progress has been made on the priorities agreed in the original strategy document. The strategy also set out a five year programme for sediment management actions and the strategy and action plan are now due for review. This report sets out the progress made to date, considers future priorities and options on reporting on compliance data.

2 Strategy Review

- 2.1 The sediment management strategy has now been reviewed. The strategic approach and key principles set out in the document regarding the processes used for the quantitative and qualitative management of sediment in the system are still considered to be robust, appropriate and proportionate. Ongoing updates have been made to the Waterway specifications during the 5 years since the Strategy was published which have taken account of stakeholder comments. Appendix 1 shows the current Waterway Specification which forms the basis for the specification of future dredging works.
- 2.2 Since the SMS was published in 2007 a number of legislative, economic, technical and operational developments have occurred which have changed in the way in which the Authority deals with sediment management. Perhaps the most significant change is that the May Gurney dredging operation was taken in house in October 2007 which demonstrated the Authority's commitment to dredging of the navigation area. This has also enabled the Authority to improve on delivery of the annual dredging programme and demonstrate the cost effectiveness of its operations. In the first year of its operation the Authority was able achieve a 23% increase in the volume of

dredged material removed from the system above the programmed target with cost savings of £45,000. In 2009/10 the corporate target of 50,000m³ was exceeded, and the targeted programmed volume removed was 97.5% achieved. The Authority was also able to show that carrying out the same works with contractors would have been 23% more expensive. This demonstrates that the Authority has a sustained commitment to dredging, budgeting over £550,000 per year on plant, staff, materials and disposal costs.

- 2.3 The legislative framework has also changed. The Water Framework Directive (WFD) has come into force which aims to protect and improve the water environment through measures set out in River Basin Management Plans. The Authority is now obliged to take account of the WFD and the way in which its operations may impact on the Anglian River Basin. The SMS is, in fact, recognised and supported as an example of best practice in the Anglian River Basin Management Plan. A key principle of the WFD is to tackle diffuse pollution, by introducing a catchment management approach to improving water quality. This supports the Authority's aim to improve source control, and thus reduce inputs into the system, although this is largely delivered outside the BA's executive area and through mechanisms such as Catchment Sensitive farming.
- 2.4 Dredging operations are also covered by the Waste Management Regulations 1994 and in some cases the Authority is obliged to apply for exemptions from the regulations for disposal of dredged material. The Environmental Permitting (England and Wales) Regulations 2010 have been published since the SMS was produced and following this the Authority has taken a lead role in formulating new guidance to dredging operators which seeks to promote the sustainable reuse of wet dredging within the framework of these Regulations. This guidance is supported by the regulator and will be published in 2012.
- 2.5 The way in which the needs of isolated water bodies are assessed has also altered in that, whilst the original SMS took a holistic view of sediment removal across the Broads, the Broads Authority subsequently published a Lake Restoration Strategy in May 2008 which now prioritises lake restoration including any requirements for sediment removal taking account of the potential for ecological restoration within the context of climate change.
- 2.6 Research has also progressed through the PRISMA project for which the Authority won funding through the EU Interreg IVA 2 Seas Programme in 2010. The Authority is a partner in the project which aims to develop and promote improved methods for the processing, treatment and reuse of dredged material. The outputs of the project will inform the Authority's technical approach to planning dredging projects in the future.

3 Sediment Management Strategy Action Plan

- 3.1 The SMS Action Plan, which is published annually, sets out the progress achieved in delivering the objectives of the Strategy in terms of the priorities, timescales and costs involved. The Action Plan is based on five themes and

good progress has been made in each of the themes identified. Table 2 provides a summary of the main achievements in each of the themes identified.

Table 2

Theme	Project	Action
Maintenance dredging	Annual navigation dredging programmes 06/07 – 11/12	286,574m ³ sediment removed during the period 50,000m³ programmed for 2013/14
Maintenance dredging	Lake restoration open water bodies 06/07 - 11/12	5180m ³ sediment removed during the period
Strategic disposal sites	Use of setback areas for disposal	Ongoing use of BESL setback areas
Strategic disposal sites	Strategic disposal sites project	Strategic disposal site report completed and published, however due to current land values and landowner attitude is has not been possible to purchase any sites. Further site investigation is therefore required
Source control	Catchment sensitive farming	Joint Initiative being led by EA/NE dealing with issues like sediment input and diffuse pollution
Source control	Decrease sediment input from river banks	Ongoing erosion monitoring through BESL project shows minimal erosion rates. Further surveys have also been completed outside the BFAP Project area for future erosion control project work
Research	Monitor suspended sediment in the headwaters of the River Wensum	Completed
Research	Collate evidence in change in bank erosion rates as a result of the change in strategic flood risk management	Hydrographic survey and monitoring ongoing - system currently stable. Need for the development of a GIS system to identify siltation rates and dredging return periods
Research	Assess environmental impact of delivery of the SMS	Strategic Appropriate Assessment completed and no adverse impact considered. Further site specific impact assessments completed for the dredging of Heigham Sound taking into account risks to fisheries, and Lower Bure re saline incursion Need for further site specific

		assessments in protected areas
Information Management	Work with dredging industry to lobby Government on legislation	Waste Management Regulations exemption secured. Best Practice Guide about to be published
Information Management	Undertake GIS based assessment of disposal opportunities	Completed
Information Management	Feed results of desk based study of sediment inputs into the Catchment Sensitive Farming Appraisal	Completed

4 Outstanding Issues for Inclusion in the updated Action Plan

4.1 Dredging

Since the development of the Sediment Management Strategy in 2007 the Authority has increased annual dredge volumes at relatively low cost and taken huge steps forward in its approach to dredging. This reflects the results of toll payer and NSBA surveys, which still show dredging as a priority issue.

4.2 The use of hydrographic surveys, application of the Sediment Management Strategy and bringing dredging operations in-house has taught the Authority a great deal about the current effectiveness of the operation and the methods used to measure and estimate required cut volumes. Officers consider that the focus in the future should be on achieving more effective dredging operations rather than concentrating on volume targets.

4.2.1 More effective dredging means a greater improvement in compliance per m³ dredged. This can be achieved by dredging more closely to the specification envelope. Changing the compliance monitoring methodology and consequently changing the current priority matrix to focus on depth above compliance and volume per metre run rather than dredged volume will result in more effective dredging.

4.2.2 The measurement of compliance in each management unit should reflect the severity of any deviation from the specification envelope. For example, the average percentage of the envelope which is compliant, or the depth and quantity of sediment above compliance level that would need to be removed to achieve compliance. Such a measurement would then highlight the most severely affected areas.

4.3 Further improvement to dredging plant and methods will be essential if the Authority is to improve the accuracy of its dredging operations in a cost effective manner. For example, dredging more accurately with a conventional grab bucket often requires only part filling buckets and consequently reduced

efficiency due to the inverse ratio between sediment and water being removed per movement.

- 4.4 Smarter handling and re-use of dredged material is also essential as opportunities to deposit sediment onto bankside locations ('low fruits') are becoming fewer. Dredging costs increase dependant on the type of equipment used and the distance dredged material has to be moved for deposit or reuse. Over dredging also results in more frequent movement of material and consequently higher costs per project undertaken.

4.5 Dredged Material

Dredging operations cannot be undertaken without sites to deposit or reuse the dredged material. Opportunities to deposit sediment onto suitably located bankside locations (e.g. setback areas and embankments) are becoming fewer. The most pressing priority for the future is the need to establish strategic sites throughout the system for the deposit or re-use of sediment. Valuable work has been carried out through the Strategic Dredging Disposal Sites Project which has identified land throughout the Broads which is suitable for deposit. However, due to a combination of current land values and landowner attitude it has not been possible to purchase any land since the completion of stage 1 of the Project. Currently in some areas of the Broads it is possible to deposit sediment in BESL setback areas but in the long term there is still a need for the Authority to acquire strategic sites and officers consider that this should remain a high priority.

- 4.5.1 It is also essential that the Authority continue to work with landowners and partner organisations to identify, plan and manage other sediment reuse options in strategic areas. . Currently there is potential to work with BESL to use dredged material for bank crest raising purposes as the Broadland Flood Alleviation Project moves into its maintenance phase. Additionally the PRISMA projects have shown that new techniques to recreate bank edges are technically feasible, although more expensive so in view of the constraints, both practical and legislative, on sediment disposal it is considered that work should continue on the development and trialling of improved methods for the processing, treatment and reuse of dredged material in the Broads. Officers consider that this is essential if cost savings and efficiencies are to be delivered in the long term.

4.6 Source control

Officers also consider that the monitoring of sediment input from river banks should remain a high priority. Even though monitoring to date indicates that there are low levels of erosion in the majority of the area it would be sensible to continue to monitor erosion rates and bank conditions in order to identify vulnerable banks and prioritise potential erosion protection projects, which in themselves could provide a potential sediment reuse opportunity such as at Salhouse Spit.

4.7 Research/ Information management

Recent assessment of the hydrographic survey data available indicates that there are gaps in survey information and a need to update the existing

surveys, some of which were undertaken in 2009, in order to be able to more accurately assess sediment input rates and current compliance with the agreed waterways specifications. The Safety Management System sets out a policy for a rolling programme of surveying over a 5 year period, and it is suggested that the most cost effective way of achieving this would be to enter into a term contract with a contractor to undertake the survey work and data analysis as required.

- 4.8 The original assessment of the condition of the rivers and broads was undertaken by a complete hydrographic survey of the area in 2005. This survey has been used to provide a baseline against which to compare the results of more recent surveys undertaken after dredging operations have been carried out. Since 2011 the Authority has used a different contractor who specialises in hydrographic surveying techniques and uses a surveying methodology which provides more data for analysis. Recent post dredge surveys have been undertaken which provide data on the River Yare at Whitlingham and Thorpe, the River Waveney at Oulton Broad, the River Bure between Acle Bridge and Thurne Mouth, Thurne Mouth and Horning Church, Ranworth Dam, Malthouse Broad and South Walsham Fleet Dyke and the River Ant between Ludham Bridge and How Hill.
- 4.9 Initial analysis of these data indicates that the surveying method used by the contractor provides accurate information. Officers consider that developing a relationship with such a specialist hydrographic surveying contractor will provide better opportunities for interpretation of the data which will, in turn, allow for a more refined assessment to be made of the condition of the navigation area.
- 4.10 Further development of the GIS database on current and historic dredging is also considered to be important as this would enable a more accurate assessment of siltation rates and dredging return frequencies to individual management units to be undertaken and thus inform future dredging programmes.
- 4.11 A draft outline action plan is attached at Appendix 2 to this report. Further work is required to identify realistic timescales and costs of the proposed actions.

5 Waterway Specification Compliance Reporting

- 5.1 The Waterway Specifications set out in the SMS were reviewed in the 2010/11 Action Plan to ensure consistency across the system. Compliance monitoring over the period of the original SMS 5 year Action Plan was carried out on the basis of assessing cross sections taken at regular intervals in each management unit and calculating the proportion of cross sections which achieved the required width and depth below mean low water level. So in a river reach of 1km where cross sections were taken at 100m centres, if 6 of the 10 cross sections achieved the required specification the compliance in that reach would be deemed to be 60%. Undertaking this process over the entire navigation area was then used to prioritise annual dredging

programmes through tabulation of the data and producing a compliance map for the whole system using Autocad software.

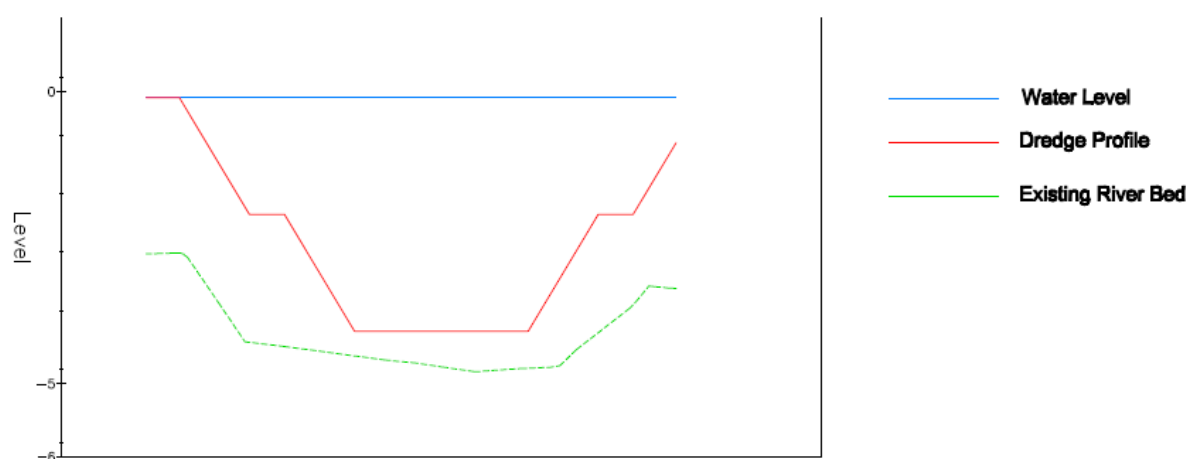
- 5.2 Table 3 below sets out the current assessment of compliance with the agreed Waterways Specification taking account of the most recent hydrographic survey information described in paragraph 4.5. Appendix 3 shows this information in map format.

Table 3

Compliance category (%age)	Length (m) 2008	Length (m) 2009	Length (m) 2012	%age river length 2008	%age river length 2009	%age 2012	Direction of travel
0	32,145	19,937	15,405	13%	8%	7%	↓
1-20	37,451	27,045	17,855	15%	11%	8%	↓
21-49	30,700	42,130	39,000	13%	18%	17%	↓
50-74	35,933	29,575	45,365	15%	13%	19%	↑
75-90	57,353	62,939	44,022	23%	27%	19%	↓
91-100	36,079	41,344	65,822	15%	18%	26%	↑
No data	14,847	13,254	8,757	6%	5%	4%	↓
Total	244,508	236,226	236,226	100%	100%	100%	

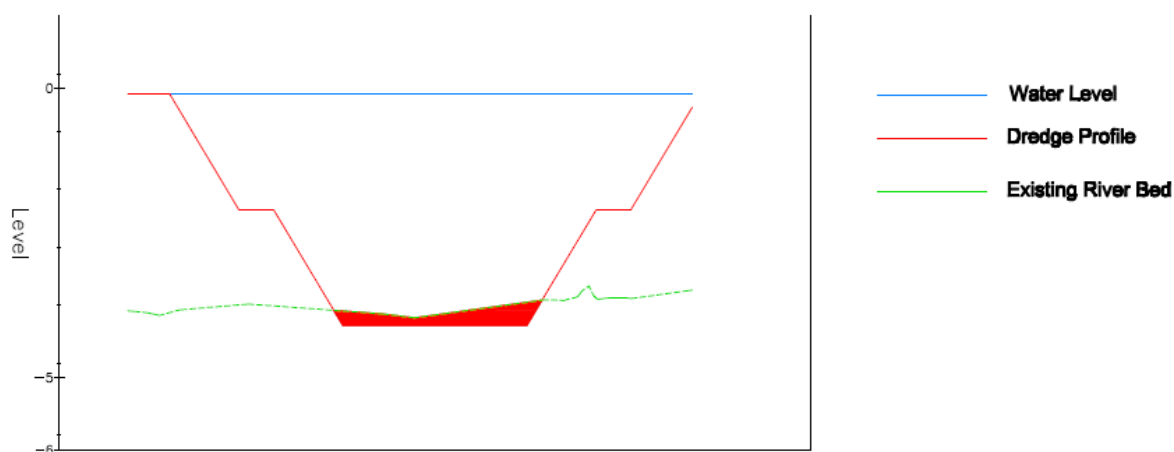
- 5.3 When reviewing these data against recent hydrographic surveys officers have concluded that this process is both overly complicated and moreover, does not provide the most accurate assessment of bed levels over each management unit. Assessing cross sections taken at intervals of 100 or 200m does not allow for detailed analysis of the entire bed area between cross sections. Additionally cross sections can show non-compliance either because a small proportion of the width is above the required dredge profile or there is a very thin layer of sediment, perhaps 100mm, across the entire width of the cross section above dredge profile which would be difficult to dredge without over dredging below the required profile. Figures 1 and 2 illustrate compliant and non-compliant cross sections.

Figure 1



Compliant river section

Figure 2



Non compliant river section

5.4 Members have previously indicated that consideration should be given to using alternative methodologies to assess compliance and thus inform the annual dredging programme. Officers have therefore considered this issue and this report seeks members' views on a proposed alternative method of assessing compliance.

6 Proposed Alternative Compliance assessment Methodology

6.1 Officers consider that more detailed assessment of the hydrographic survey data available should be carried out in order to determine the percentage of the bed area of each management unit, in plan view, which is non compliant rather than using the cross section analysis method. This can be easily mapped using the existing software. Following this assessment, it should be

possible to quantify the volume of sediment per linear metre which needs to be dredged in order to achieve the required specification. More sophisticated analysis of the hydrographic survey data would also allow for an assessment to be made of the average depth of sediment in each unit above dredge profile. This would in turn allow for an assessment to be made as to whether the programming of dredging operations would be cost effective in individual management units.

- 6.2 In future officers therefore to propose to report on percentage compliance based on a plan view assessment of the total bed area of each management unit coupled with the percentage of the management unit that would be economic to dredge. Dredging prioritisation would then take place based on a more detailed assessment of the non-compliant areas in each management unit which would identify which areas would be economic to dredge. Officers propose to use a trigger level of 300mm cut depth or 10% or more of the total area of the waterway specification envelope in non compliant areas being above compliance level to identify priority sites.
- 6.3 This assessment would then be used to inform the annual dredging programme, which is currently being reviewed, and report to members on compliance across the navigation area by presenting the information in map and table format. The Navigation Committee has also suggested that performance against the compliance criteria should be used as the public indicator, rather than using a volume of dredged material, which is less easy for users to visualise.

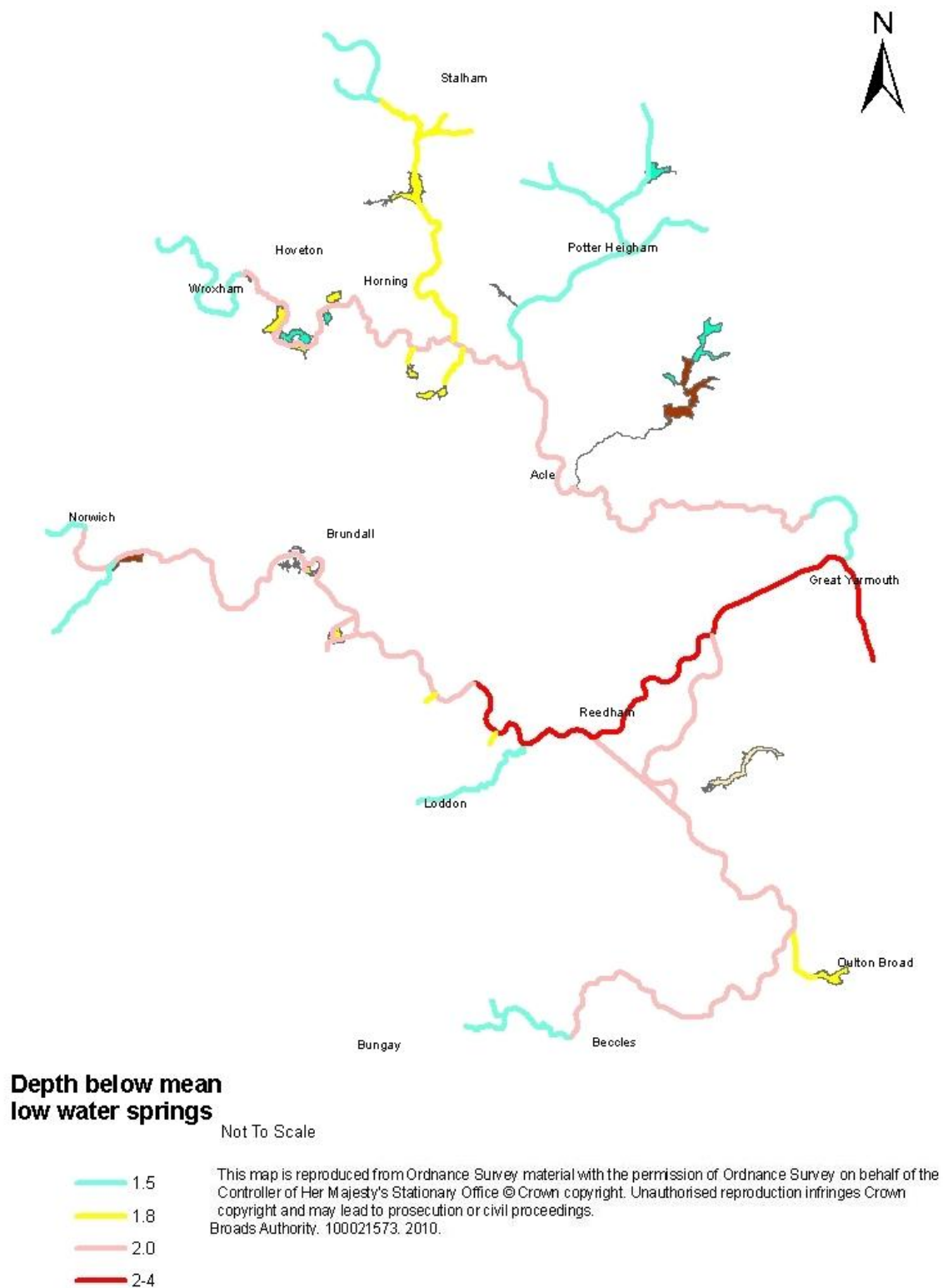
7 Conclusions

- 7.1 This report outlines officers' views on the issues that should be prioritised in the review of the SMS and its Action Plan and proposes a new methodology for assessing and reporting on compliance and programming future dredging operations. Members' views are sought on the content of the report.

Background papers:	Nil
Author:	Adrian Clarke/Tom Hunter
Date of report:	4 January 2013
Broads Plan Objectives:	NA1
Appendices:	APPENDIX 1 - Waterway Specifications 2010/11 Update APPENDIX 2 - Draft SMS Action Plan 2013 APPENDIX 3 - Waterway Specification compliance map

APPENDIX 1

Figure 1



Draft SMS Action Plan 2013/14

Theme	Project	Action
Maintenance dredging	Annual navigation dredging programme 2013	Maintenance dredging is an ongoing high priority 50,000m³ programmed for 2013/14 Draft prioritised sites list includes: Lower Bure River Waveney (Aldeby to Beccles) River Chet (subject to BESL works) River Ant (How Hill to Barton Broad) Heigham Sound/Upper Thurne Upton Dyke Acle Dyke Hardley Dyke
Maintenance dredging	Planning future dredging programmes	Review of Waterway Specification compliance monitoring and prioritisation process.
Strategic disposal sites	Use of setback areas for disposal	Continued liaison with BESL to ensure best use of BFAP setback areas for sediment reuse in rond creation
Strategic disposal sites	Strategic disposal sites project	Prioritisation of further site investigation on potential strategic disposal sites for the future.
Strategic disposal sites	Trialling of improved methods of reuse of sediment	Prioritisation of the development and trialling of improved methods for the processing, treatment and reuse of dredged material in the Broads.
Source control	Decrease sediment input from river banks	Continued erosion monitoring through BESL project with additional BA surveys to determine where erosion control measures should be prioritised.
Research	Assess environmental impact of delivery of the	Prioritisation of further site specific assessments for

	SMS.	protected areas.
Research/information management	Hydrographic surveying	Investigate term contract with a hydrographic surveying contractor to undertake survey work and data analysis as required.
Research/information management	Historic dredging database	Develop GIS database on current and historic dredging to enable a more accurate assessment of siltation rates and dredging return frequencies to individual management units to be undertaken and thus inform future dredging programmes.

APPENDIX 3

