**Broads Forum**
25 April 2013
Agenda Item No 8

# A Future Strategy for Dredging

Report by the Rivers Engineer and
Head of Construction and Maintenance

**Summary:** This report considers a future strategy for dredging and the opportunities for a significant increase in output. The Forum's views are sought on the options for the future and how they might be delivered alongside other priorities.

## 1 Background

1.1 Over the last ten years the Authority's approach to managing the dredging of the rivers and connected and isolated broads has been transformed. In 2006 an holistic approach was developed in the Sediment Management Strategy and in 2007 the means for its delivery was enhanced through the acquisition of the plant and staff from May Gurney. That second major change was made possible by a loan from the Public Works Loans Board to purchase the Thorpe Dockyard and the two newer mud wherries and the initial higher revenue costs were met from the additional National Park Grant awarded to the Authority.

1.2 Tolls have had to rise above inflation to meet the higher level of activity. The investments this last year in a new workshop, a new mud wherry and the Spirit of Breydon Launch are projected to reduce navigation reserves below the minimum of 10% of expenditure in the short term. However, if boat numbers continue to hold up the outlook for the new Broads Plan period starting in 2016 means that further investment in dredging equipment to increase output could be considered. Now is therefore a good time to review the approach taken to dredging.

## 2 Current Approach and Constraints

2.1 With the exception of two relatively new mud wherries most of the plant passed over by May Gurney was old and appropriate for only a traditional grab and sling approach. Since 2007, through the good work of the fitters, the plant has been maintained using a make-do and mend approach. This has been supplemented by judicious purchases of second-hand replacement cranes, a tug and new unifloats which have enabled the Authority to significantly increase the amount of mud dredged from the navigation area to approximately 50,000 $m^3$ per annum. The Authority has committed to maintaining this target as set out in the strategic objective NA1.1 of the 2011 Broads Plan. However, given that it is estimated that a maximum of 24,300 $m^3$ is entering the system every year the net reduction in the backlog could be in the order of 25,700 $m^3$ per annum (50,000 – 24,300 $m^3$), and with the

outstanding amount required to meet the agreed standards at 1,475,463 $m^3$, then, at the current rate, it will take 57 years to bring the whole area up to standard the Authority has set. Were 100,000$m^3$ removed per year, this could be significantly reduced to 20 years.

2.2 The constraints on the present operation are:

- The number of specialist staff, Rivers Engineer and Environment officers available to carry out the project preparation (design, health and safety and constructional management etc.), obtain the necessary permissions and consents for the disposal site and developing the restoration plan for the disposal site
- The number of technicians available to operate the equipment
- The amount, type and reliability of the operational plant
- The availability of suitable sites for the disposal of the sediment
- Times when dredging cannot be undertaken to minimise impact on the holiday industry or the special environment of the Broads

The available budget is an underlying constraint for most of the above. However, the benefits of the current system are that the Authority has a range of equipment of different sizes and specifications, suitable for dredging the variety of sediment types and coping with the various physical restrictions in the Broads (air draft, small dykes, wide open water bodies) and additionally by operating in house, has a high degree of flexibility in responding to changing needs/ circumstances and can achieve very low unit costs.

2.3 In 2011/12 the Broads Authority dredged 47,000 $m^3$ from navigation area and in 2012/13 the Broads Authority has dredged a total of 48,432 $m^3$. Dredging in both 2011/12 and 2012/13 has involved deposit of the sediment into a mixture of setback areas and more complex projects, for example construction of the basket lagoons at Duck Broad and use of geotextile tubes at Salhouse Broad which has impacted on the volume achievable given the time involved in establishing the perimeters. The detailed breakdown of the costs and operations technicians' time invested to achieve these dredge volumes is given in the Construction and Maintenance progress report.

2.4 Table 1 shows a breakdown for the total dredging costs between staff and equipment, which demonstrates that staff costs account for just under half of the total cost.

| Total Dredging Costs for the target volume of 50,000m3 | | |
|---|---|---|
| 2012/13 Dredging and support staff Costs | £623,832.00 | *Includes operatives & two Fitters & percentage of Engineering staff* |
| Vessel & Equipment Costs for dredging 2012/13 | £300,000.00 | *Maintenance, purchase of spares, repairs and certifications* |
| Dredging projects costs (not including staff) 2012/13 inc | £416.256.00 | *Includes licences, surveys, contractors, materials, fuel,* |

| | | |
|---|---|---|
| Prisma expenditure | | *consents and mitigation costs* |
| TOTAL | **£1,340,088.00** | |

2.5 As previously agreed through setting the Construction and Maintenance annual work programme, practical work is programmed to achieve a division of operational staff time according to the sources of funding so that 60% is spent on navigation, 20% on National Park recreational projects and 20% on conservation. Dredging is given the greatest amount of time in the navigation allocation, with other time spent on different navigational work (e.g. mooring maintenance, navigation markers, pontoons and vegetation management). There is scope for shifting this balance to increase time spent on dredging but if so would require a greater allocation of navigation budget for these works to allow the Authority to make greater use of contractors, and could not be safely curtailed because of the high level of other maintenance work required.

| | days | % |
|---|---|---|
| Dredging | 1906 | 37 |
| Moorings & Pontoons | 589 | 11 |
| Navigation Works | 429 | 8 |
| Navigation corporate share | 508 | 10 |
| Recreation (inc. corp. share) | 915 | 18 |
| Conservation (inc. corp. share) | 775 | 15 |

*Table 2: Operations staff time 2012/13 (based on data up to February 2013) Corporate share: equipment/ depot maintenance, staff training, annual leave*

## 3 Routes to a Significant Increase in Dredging Capacity

3.1 If the Authority wanted to double its dredging capacity to 100,000 metres$^3$ per annum it would need to overcome some of the constraints listed above. The role of the specialist staff is crucial and is a limiting factor in any increase in dredging capacity. Project preparation is delivered by the Environment and Design Team which comprises one engineer and 3.4 (FTE) environment officers. Their role in designing the scheme and obtaining the necessary permissions and consents are central to the delivery of a successful programme.

3.2 The number of staff involved in the on-site operations (currently 23.6 full time equivalents) depends on the plant used but again if the traditional operation is maintained then crudely the number of person days would need to double if the output was to double. This is not the case if a very different set of techniques is employed.

3.3 In terms of plant the Authority has explored different techniques. Increasingly long reach 360 degree excavators are being used in preference to the crane and clam shell, particularly for offloading. The excavators are much more reliable and more precise in their operation. They are also more flexible and can be used for a variety of tasks in a range of different conditions and can reduce the need for restoration works to the disposal areas by shaping as well as placing the material.

3.4 Water injection dredging has been tested in the lower reaches of the river Bure where the tide runs strongly but was found not to be particularly effective with the fine suspended sediment returning on the subsequent tides.

3.5 Pump dredging has been used in variety of localities, the large scale project at Barton Broad, a range of smaller isolated broads, for example Upton Little Broad, the western arm of Ormesby Broad and most recently at Heigham Sound. The main issue with this technique has been the huge of volume of water to sediment that is moved and the need to create large bunds to contain the material. The recent testing of geotextile bags at Upton Little Broad and at Salhouse has shown that there is an alternative and more cost effective approach. The Authority mud pump is ideally suitable for small sites with loose sediment, and mud pumping in navigable areas can be problematic due to the need for anchors and guide wires to operate, as well as the delivery pipe being present in the navigation area.

3.6 The execution of effective dredging projects is heavily reliant on identifying and acquiring suitable sites to deposit the material. The Strategic Dredging Disposal Strategy shows that if the Authority is to tackle the highest priority areas a great deal of project preparation is required to identify sites for the deposit of sediment. Many of these sites may also not be immediately adjacent to the navigation requiring significant work to design practically and economically feasible dredging methods.

3.7 In addition to simply depositing sediment as part of navigational dredging, it is increasingly important for a project to have multiple benefits in order to reach advantageous agreements with stakeholders without having to pay out significant sums of money. Such benefits can include reedbed creation, flood defence benefits, agricultural conditioner and land raising. Our work with the PRISMA project has assisted with this element.

## 4 Options for the Future

4.1 Three options have been considered: maintain the status quo, increase of 20% to 60,000 metres$^3$ and a doubling of output to 100,000 metres$^3$.

4.2 ***Option 1***
Maintain the status quo of 50,000m$^3$ pa would require a continued budget investment of approximately £1,200,000 based on 2012/13 without the Prisma contribution for disposal construction projects.

4.3 ***Option2***
Based on the use of current operational staff and equipment, increasing the annual dredge volume to 60,000m$^3$ would require a commitment of 48% of operational staff time on dredging projects. This would result in a very significant reduction in staff time available to undertake practical work on moorings, navigation marking etc. with serious implications for the safety of the public. Therefore to maintain the current level of work on maintaining moorings signage, trees etc would likely require the Authority to contract/

employ an equivalent of a fulltime 6 person team. Based on the average cost of an Operations Technician this would amount to approximately an extra £110,000.00 per annum. In addition, the maintenance of existing wherries and cranes will require increased fitter time and cost resulting from increased wear and tear and an assumed 20% increased budget for running costs, which totals a further £60,000 and the contribution to reserves for the renewal of equipment would also have to be maintained at £60,000p.a. Therefore the total additional cost for increasing the annual dredge volume to 60,000$m^3$ would be approximately £230,000, equivalent to a tolls increase of 8.5% above inflation.

4.4 ***Option 3***

Achieving a target of 100,000$m^3$ would require greater investment in project preparation as identified above, as identifying and gaining permissions for enough sites in the right locations to economically accommodate twice the capacity of dredged sediment will be a significant undertaking. Capacity would therefore have to be increased by a further engineer and environment officer at a cost £50,000. Extra capacity would also needs to be achieved in the programme by additional staff, approximately 8 additional technicians would be required at a cost £168,000.

4.5 To deliver the projects required to achieve a target of 100,000$m^3$ the Authority would rely more critically on greater utilisation of existing plant and also require additional items. The table below outlines the existing and likely additional plant required and the estimated purchase costs.

*Table 3 Additional equipment required to deliver 100,000$m^3$ of sediment removal*

| Plant | Existing required for 50,000 $m^3$ | Estimated required for 100,000$m^3$ | Additional cost for 100,000$m^3$ | Comments and Indicative costs for equipment needed. |
|---|---|---|---|---|
| Grab crane | 4 | 4 | Nil, but increased maintenance required, and shorter renewal period | Heavy reliance on maintaining existing. The price of sourcing used Grabs ranges from £10,000 - £50,000 |
| 360 excavator | 3 | 5 | £180,000 | To deliver dredging and restoration work. New Long Reach 360 Cost £90,000 |
| Wherry | 7 | 7 | Nil, but increased maintenance required, and shorter renewal | Replacement of at least 2 existing required with heavy reliance on maintaining some existing. Cost of new wherries is circa |

| | | | | |
|---|---|---|---|---|
| | | | period | £100,000 each |
| Uniflotes | 27 | 36 | £90,000 | Required for additional excavators or concrete pumps. Replacement costs are £10,000 per flote. |
| Concrete pump | 0 | 1 | £30,000 | Could be hired. Purchases are available, circa £30,000 |
| Cutter suction dredger | 0 | 1 | | Could be contracted. Used units become available, circa £300,000 |
| Total | | | **£300,000** | |

Therefore an additional annual budget of approximately £518,000 for increased staff and plant running costs would be required, as well as a further £300,000 of initial investment to increase the plant. This is equivalent to a tolls increase of 19% plus a one off further increase of 11% for the capital investment.

## 5 Alternative Options

5.1 An alternative to increasing the in house capacity would be to outsourcing a significant amount of the required dredging volume to specialist contractors. This would require an increased dredging budget to cover expenditure, which is likely to be in the region of £20 per cubic metre (depending on the site and method of sediment deposit). Therefore to increase the volume to 60,000$m^3$ would require an additional £200,000 budget, or to increase to 100,000$m^3$ would require an additional £1,000,000. The use of contractors to increase dredge volumes will still require significant investment in project preparation. In comparison, in 2006, British Waterways quoted an average of £40/$m^3$ for their national dredging framework contract (although this did include a proportion of heavily contaminated material).

5.2 Using cutter suction dredgers is generally less labour intensive at point of use but disposal site preparation will still be required, possible construction of bund walls to retain material, monitoring of the pipework and dealing with obstructions/ blockages etc and restoration of sites. It is also an expensive piece of equipment to invest in. The cost of a new cutter suction dredger and associated pipework is likely to be in excess of £450,000. Used equipment is sometimes available, although the most recent example was still on the market for £250,000. If this is to be considered further work will need to be done to look at the Authority's specific requirements and the range of the Broads navigation sites within which such equipment could be practically used, as well as the outputs which are achievable in order to develop a business case for any purchase.

## 6 Conclusions

6.1 The Authority has the plant and operational staff to sustain the current annual target volume of 50,000$m^3$, allowing for the other main tasks and duties to be carried out However, to do this in an effective manner is challenging and requires a focus beyond volume. 50,000$m^3$ of well managed dredging will provide significant improvements to navigation. However to achieve and sustain this, significant work is required to acquire sites to accommodate the sediment and prepare economically and environmentally feasible projects in the highest priority areas.

6.2 A 20% increase in dredged volume to 60,000$m^3$ is possible with the present staffing levels but additional budget and resources would be essential to ensure that the Authority was completing the critical safety maintenance of moorings and other navigational structures and would also require further increased investment in project preparation. Given the current economic climate the Forum's views are sought as to whether a significant tolls increase is achievable at this time.

6.3 Increasing the dredge volume to 100,000$m^3$ with current plant and staff is not possible bearing in mind existing Authority staff time commitments, but could be achieved with significant investment in additional staff, new and highly reliable plant and equipment would be needed and a larger team locating disposal sites, designing and planning dredging projects would be essential. Given the success of the Prisma project in terms of both constructing new disposal opportunities and providing inward investment for plant and facilities a funding application could be developed to seek to the necessary capital as a legacy project of Prisma.

6.4 Members' views are sought on the options as set out in Section 4, and comments are welcomed on the relative priority of dredging alongside other navigation responsibilities.

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| Appendices: | None |