

**Construction, Maintenance and Environment Work Programme
Progress Update**

Report by Head of Construction, Maintenance and Environment

Summary: This report sets out the progress made in the delivery of the 2015/16 Construction, Maintenance and Environment Section work programme.

Members' views in regards to Section 5 and questions regarding the Construction, Maintenance or Environmental works programme are welcomed.

1 Construction Programme Update 2015/16

- 1.1 The progress of the Construction and Maintenance Work Programme is described in this report. As previously reported verbally to members, a further detailed breakdown shows that up to the end of January 2016, 44,545m³ of sediment has been removed from the Rivers and Broads, and the details of quantities and costs achieved so far are set out in Appendix 1. This represents 89% of the programmed target of at least 50,000m³.
- 1.2 The priority dredging at Hickling Broad has been progressing well, after water temperatures finally dipped below 8 degrees in late November. The area which has been focussed on is at the top end of the Broad, opposite the Sailing Club, Pleasure Boat Inn, Whispering Reeds Boatyard and the parish staithe. The dredged material has been taken down the broad and used to top-up the previously constructed lagoons at Duck Island. Whilst this has been progressing a contractor has been used to install geo-textile fabric (nicospan) along eroded areas of Hill Common, as part of our erosion protection trial. At the start of February, when higher water levels allowed, these areas were started to fill with dredged material from the channel. Throughout the project water quality and temperature have been diligently monitored as well as taking frequent Pymnesium samples for counting. All aspects have remained within predetermined parameters. We are on schedule to complete the project at the end of February.
- 1.3 The second dredging crew has been working on the Middle Bure at Acle. The dredging has been going well with the crew concentrating on sediment removal from the long bend just downstream of Acle Bridge. The set-back area at Acle Bridge has now been filled, so an area just downstream from the Bridge is being utilised to allow this dredging section to be completed.
- 1.4 Through January the Fen Excavator has been carrying out contract work for Suffolk Wildlife Trust at Oulton Broad, with the Fen Harvester also being on

site to carry out the programmed reed cut. The team have also been scrub clearing at Fleggburgh Common and Oulton Marshes. From here the equipment was moved to Irstead to carry out ditch works at How Hill before being mobilized to Blofield. The 2015/16 Fen programme will be completed soon with the last site being at South Walsham. The Fen excavator is then cleaned down, serviced and redeployed to the Construction Team on dredging offloading.

2 Maintenance Programme Update 2015/16

- 2.1 At this time of year the Maintenance Teams are fully engaged in carrying out conservation tasks, reactive navigational tasks and routine maintenance, below is a selection of works:
- 2.2 In preparation for a 3,000m³ dredge of Lime Kiln Dyke the trees and scrub that have grown up along the edge of this dyke has needed clearing. This work was started in December and has had a dedicated resource working on it throughout January. It is due for completion in February, with the dredging works programmed in for January 2017. In combination with tree clearance works undertaken with volunteers, contractors and Ranger staff over 4km of riverbank on the River Ant has been cleared.
- 2.3 The boardwalk at Barton has had issue with the timber surface becoming slippery, with leaf litter and moss's growing between the grooves, this situation has been exacerbated with the mild wet weather. Recent advice from the chemical company that supplied the tanalisation treatment, suggests that pressure washing the timber severely reduces the life span of the treatment, therefore we have installed chicken wire across the deck to reduce the slipperiness of the surface. This has been quite a lengthy task on a 600m boardwalk.
- 2.4 In preparation for the new season starting the Tourist Information Centres get a refresh and the maintenance crews have completed these at Toad Hole and Hoveton.
- 2.5 The winter months are a good opportunity for riverside tree and scrub to be managed and a maintenance crew have been hard at work at Horning, clearing riverside vegetation. This work was carried out just upstream of Blackhorse Broad and we were acting as a contractor on behalf of the land owner.
- 2.6 Other works over the period have included re-timbering at Coltishall 24hr Mooring, stump treatment and clearance of arisings at How Hill, tree work at the edge of Whitlingham Park, new Kissing Gates at Valentines Meadow as well as vegetation management at Island Cottage.

3 Environment Team Programme Update 2015/16

- 3.1 A major piece of work that the Environment Design Team is involved with is the Hickling Enhancement project (seen section 5 of this report) as well as the environmental monitoring required for the existing dredging project. The team have been involved in ground investigations, assessing different construction materials as well as potential locations for erosion protection. They have also been developing the permits and permission required to place sediment onto agricultural land. This has been ongoing as well as the water monitoring data that is required on a weekly and daily basis at Hickling.
- 3.2 Works have been ongoing at Mutford Lock, with repairs being made to the hydraulic systems, Penstocks and the gate values. The works have been carried out with a combination of contract divers and Operation Technicians.
- 3.3 The bio-manipulation ring structure at Ranworth Broad has been assessed and reviewed and the top cages are to be removed by Operation Technicians in March. Norfolk Wildlife Trust will be funding the planning application to retain the structure once the current five year planning consent expires. The barrier across the dyke at Coltishall Common, which was installed to prevent water fern spreading from the ditch system has been removed as the water fern is not currently present, and the Common Trustees are carrying out regular maintenance work to keep it under control.
- 3.4 As part of the group working to better understand Prymnesium some of the Environment Design Team Officers attended a meeting at the John Innes Centre to contribute to work being carried by the UEA, John Innes and Broads Authority. This algae is continuing to reveal more unknowns the more it is studied and this is firing up the scientists with UEA and John Innes putting a great deal of resource into the study. We are developing and using information from this group to better mitigate against the harmful effects from this algae whilst we work and plan to work at Hickling Broad.

4 Fitters

- 4.1 A large part of the Fitters programme was occupied in the run up to Hickling dredging as the equipment needed mobilising onto the broad. This entailed linkflotes being disassembled pushed through Potter Heigham Bridge and reassembled the other side, the concrete pump, hopper system and safety rails all had to be erected and positioned. The same had to be carried out for the dredging rig, with added complication of the moon pool needing to be fabricated. This was completed with the Fitters and Construction Teams working together.
- 4.2 The Launch refit has continued with the penultimate Motor Launch to be refitted, the Martin Broom, currently in the workshop. This will be completed in two weeks' time and then the Spirit of Breydon will arrive at Griffin Lane to be serviced.

- 4.3 The Fitter team has been busy undertaking small repairs to plant and equipment as well as continuing to keep the remaining older plant serviceable. Running repairs to the wherries John Fox & Tony Hewett have been completed. At this time of year the Trip Boats are also being made ready for the start of the season and both the Electric Eel & Ra are at the Dockyard receiving attention.

5 Hickling Enhancement project 2016/17

- 5.1 The Broads Authority has identified as a strategic objective for 2015/16 to *'Develop a long-term approach for the management of Hickling Broad, building on scientific evidence from the Broads Lake Review. In the short term, progress development of a number of smaller projects to meet immediate concerns'*.

The adopted vision for the enhancement works in Hickling Broad focusses on:

- Protection of refuge areas in quiet bays and sheltered areas which provide conditions for water plants to flourish and habitat for fish and birds
 - Maintenance of the marked channel to meet Waterway Specification
 - Beneficial re-use of dredged material, being used to restore eroded reed swamp, construct lake side bank protection and regularly topping up bank restoration and island areas, as well as being spread to local arable land
 - Regular monitoring to continue, to build understanding of the lake and to help shape its future management
- 5.2 The scope of enhancement works that could be delivered in Hickling Broad are wide and varied both in terms of the actual type of practical works and the benefits that will be accrued. The lake edge enhancement options are largely engineering solutions that aim to promote the natural ecological functioning at the lake edge. Recent research within the Lakes BESS Project in the Broads (<https://lakebess.wordpress.com>) highlights the value to biodiversity of a gradual transition from the marginal reed swamp with a mix of emergent and submerged water plants extending out into the open water. It is this habitat type that has been degraded across the Upper Thurne, with the loss of an important structural component for wetland biodiversity.
- 5.3 The options that look to rebuild eroded reedbed out into previous reed dominated areas also need to maintain a soft transition between reed and open water, without import of significant foreign materials, legacy issues and on-going maintenance. Where sediment removal from the marked channel can be re-used in these lake edge enhancement areas, then these opportunities should be taken.
- 5.4 Potential options for the locations of reedbed expansion, bankside protection and refuge creation have been presented previously to the Authority following consultation with a wide range of stakeholders. Refinement and subsequent consultation on these outline plans have been through several iterations with the landowners, Norfolk Wildlife Trust, and with the wider stakeholders through the Upper Thurne Working Group. One of the principles agreed for

the works was to develop the project in a phased manner, taking a precautionary approach to ensure that techniques are successful in small trials before adopting for a large area.

- 5.5 The design options currently being evaluated and costed for each location includes techniques already trialled in the Broads, such as protective silt curtains, Nicospan™ geotextile fencing, geo-tubes such as at Salhouse, and gabion baskets such as at Duck Broad.
- 5.6 All of these options can be used with dredged sediment to compliment the design and provide conditions in which reed and swamp vegetation can establish and expand out into the open water.
- 5.7 Novel techniques, or at least untested in the Broads, include the *baggerbuffer* silt curtain, which incorporates a heavy geo-tube anchoring system; *frond mattresses* simulate submerged plant growth and encourage sediment deposition; *geo-cell grids*, which retain sediment in a honeycomb lattice; and *tyre mattresses*, which retain sediment and provide a robust submerged retaining wall. The latter two options, geo-cell grid and tyre mattresses can be designed in such a way to create shallow reef or island type structures, which can be vegetated and create sheltered conditions behind.

Table 1 Material and installation costs for available edge protection options (Based on known costs, unless otherwise stated, does not include any provision for sediment backfill behind the structure)

Edge protection type	Materials only cost (per linear metre)	Typical contractor installation cost (per linear metre)	Authority installation cost (per linear metre)
Silt curtain	£65	£50	£5
Nicospan	£22	£105	£35
Geo-tube	£140	£500 (estimate)	£245
Frond mattress	£220	£80	£15
Gabion baskets	130	£400 (estimate)	£125

- 5.8 Following on-site investigations by the Environment and Design Team, better understanding of the substrate, ground bearing capacity and water depths have now been developed, as well as considering the fish spawning potential of the Broad shore. This has enabled further design feasibility work to be undertaken, and has identified two areas as most suitable in year one to start enhancement works (see Appendix 2).
- Area D - a 260 metre stretch of eroded reed bed on the eastern side of the North Bay, south of The Studio. The reed edge in this area, of around 6,000 m² has regressed since 1946 and shows signs of deterioration with steeply eroded edges to the exposed root zone. The clay substrate is close to the surface of the sediment with very little overlying sediment in which reed and/or water plants can establish good rooting attachments.

- Area I - on west side of the broad known as Churchill's Bay. A substantial area of reed swamp, around 10,500 m², been lost from this area since 1946. The edge of the reed growth is eroded with exposed root zones and little outward growth of reed into the open water. Again the underlying clay in this area is close to the surface, with a layer of recent sediment, mainly comprised of decaying reed and vegetative matter. The sediment is black and anoxic, supporting only a relatively small amount of water plants, including spiked water milfoil and some stoneworts.

5.9 Both sites are suitable for options that enhance reed bed area. They can receive some dredged sediment in the design and have firm clay beds that will enable construction of a low key, inexpensive retaining edge for the new reed bed area. If budget or time constraints allowed only one site to be worked on, the Site I, Churchill's Bay, would be the priority.

5.10 Adoption of these techniques also enables beneficial reuse of dredged material, which is a key aspect of the vision. However, given the constraints on backfilling these areas at the edge of the Broad, where shallow water prevents the Broads Authority excavator to get close enough to offload, additional resources are also required which could include a hired in concrete pump and screener. Alternatively use of contractors to mud pump to deliver the dredgings directly could be an option, although this would be experimental as Nicospan has not previously been used to retain mud pumped material with higher water content.

Edge habitat enhancement	Option A	Option B	Option C
	Nicospan edge to create new reed swamp habitat	Silt curtain, with partial backfill to create graded edge	Geotubes to create new reed swamp habitat
Priority 1 Area I - Churchill's Bay	200 m frontage, 6,000 m ³ capacity	200 m frontage, 3,000 m ³ capacity	200 m frontage, 6,000 m ³ capacity
Revenue cost - Contractor installation and backfilling with mud pump	98,000	62,000	228,000
Revenue budget cost – Authority installation and backfilling with concrete pump (Total project cost inc staff and plant costs)	26,000 (124,000)	23,500 (78,500)	49,000 (166,000)
Comments	Maximum disposal capacity within BA cash budget, tested technique with concrete pump but not mud	Reduced disposal capacity, within BA cash budget, both untested techniques	Exceeds budget availability, and over engineered for the location, tested technique.

	pump		
Priority 2 Area D – east side of north bay	260 m frontage, 5,000 m ³ capacity	260 m frontage, 2,500 m ³ capacity	260 m frontage, 5,000 m ³ capacity
Revenue cost - Contractor installation and backfilling with mudpump	79,900	61,900	135,000
Revenue budget cost – Authority installation and backfilling with concrete pump (Total project cost)	9,500 (119,600)	20,500 (71,300)	40,000 205,100
Comments	Maximum disposal capacity within BA cash budget, tested technique with concrete pump but not mud pump	Reduced disposal capacity, within BA cash budget, both untested techniques	Exceeds budget availability, and over engineered for the location, tested technique.

- 5.11 An alternative option for the beneficial reuse of sediment in bank protection areas is land spreading for agricultural benefit. Discussions with local landowners and the Environment Agency are on-going to identify potential land-spreading for agricultural benefit projects for sediment mud-pumped from the marked channel. Given the relatively high salt content of the water and sediment in Hickling Broad, the process of Environmental Permitting and demonstrating agricultural benefit are more complex than in other mud-pumping projects the Authority has led in recent years. Project development is on-going and regular updates will be provided through the next six months.

Table 2 Materials costs for mud pumping and habitat enhancement options in year 1

Channel mud pumping	£
Site set up costs (Environmental Permit application; planning consent; agronomy services)	9,500
Annual site costs (landowner payments; Environmental Permits)	3,500
Monitoring (water quality analysis; Prymnesium counts)	5,000
Earthworks	5,000
Mud pumping contractors – this amount of budget would be able to deliver roughly 700 m ³ . Priority in the north part of the broad would be in the marked channel south of the sailing club.	7,000
	£30,000

- 5.12 The draft budget allocation provided for delivery of this vision in 2016/17 is £60,000, subject to Broads Authority approval and a forward budget allocation as per 2016/17 is planned within the Financial Strategy to 2018/19. Given the multiple benefits predicted to arise from the enhancement works, it has been agreed that costs are to be funded equally between the National Park and navigation revenue budgets.
- 5.13 From the costed options presented in the tables above, the most favourable range of works that deliver the vision and are affordable from revenue budgets are:

Item	Year 1 2016/17	Year 2 2017/18	Year 3 2018/19
Install Nicospan Area I, and dredge/ backfill with concrete pump (3,000m3)	£26,000		
Silt curtain trials Area D plus other	£20,500		
Land spreading lagoon permitting and set up costs	£9,500		
Lagoon construction and site costs		£13,500	
Mud pumping contract to top up Area I (3,000m3) and pump to land (1,000m3)		£40,000	
Area D backfilling			£25,000
Mud pumping to land OR			£35,000
MultIPLE bid match funding			£35,000
Contingency sum	£4,000	£6,500	
Total	£60,000	£60,000	£60,000

- 5.14 Officers are still working on a revised bid for European funds, and have been advised that the timetable for successful bid would mean a start in Jan 2018. Therefore funds in Year 3 may be required as match for this project, which would be aiming to deliver the heavier engineering aspects required for works in deeper water or where island construction is the preferred solution.
- 5.15 Members views are sought on these proposals.

Background papers: Nil

Author: Rob Rogers/Dan Hoare/ Trudi Wakelin
Date of report: 9 February 2016

Broads Plan ref: NA1.1

Appendices: APPENDIX 1 – Dredging Programme 2015/16
APPENDIX 2 – map

Dredging Progress 2015/16 (April 2015 to end January 2016)

APPENDIX 1

Project Title	Project Element	Active BA dredging weeks Completed (to end Jan/Planned)	Volume Removed m ³		Annual project cost	Actual project cost ¹ (Apr-Jan)
			Planned	Actual	Planned	Actual
River Ant	Irstead to Barton Broad	3/4	1,500	1,030	£24,340	£18,520
<i>Completed mid May 2015</i>						
River Chet	Pye's Mill to Loddon Basin	7/4	1,000	2,900	£10,810	£18,910
<i>Completed mid May 2015. Additional volume near Loddon Basin removed</i>						
Upper Bure	Coltishall Lock	5/8	2,000	900	£29,570	£33,520
<i>Total sediment removed 1,600 m³ over 2014/15 and 2015/16 years. Sediment spread for agricultural benefit in Oct 2015</i>						
Upton Dyke	Restoration work on setback filled in 2014/15	NA	NA	NA	£7,000	£560
<i>Completed at end of May 2015 using staff rather than contractors.</i>						
Mid Bure	Thurne Mouth to Horning Hall	19/12	8,000	12,500	£80,070	£112,790
<i>Filling setback areas upstream of Ant Mouth. Autumn phase completed. Returning after Hickling dredging complete.</i>						
Mid Bure	Thurne bank rond restoration	NA	NA	NA	£10,550	£10,340
<i>Re-profiling rond upstream of Thurne White Mill completed September 2015 with BA plant</i>						
Oulton Broad	Oulton Broad	12/14	10,000	10,170	£73,090	£69,080
<i>Completed 24 August 2015.</i>						
Mid Bure	Acle to Stokesby	10/10	7,000	9,020	£56,150	£66,680
<i>Acle Bridge Stores setback filled. Dredge area has been extended to fill these setback areas. Expected completion end March.</i>						
Lower Yare	Seven Mile House to Berney Arms	9/10	5,000	5,500	£50,330	£49,100
<i>Completed.</i>						
Upper Bure	Belaugh to Coltishall	Contractors	1,500	185	£28,000	£19,740
<i>Anchor Street site completed Oct 2015. Only one bank stabilisation site of the original three could be carried out in 2015/16.</i>						

APPENDIX 2

Map showing favoured areas for reedbed enhancement

