Broads Forum
31 July 2014
Agenda Item No 12

Duck Broad Island Re-Creation Scheme – Environmental Monitoring

Report by Environment Officer

Summary: An area of reedswamp separating Heigham Sound from Duck Broad has eroded away since 1940s, Broads Authority have re-created this area as a solution to dredging disposal and BAP (Biodiveristy Action Plan) habitat re-creation. A rigorous water quality monitoring programme was adoped by the Authority for the life of the project. This found that the works had no detrimental impact on the water quality in this area. Monitoring of the establishment of wetland plants in the gabion baskets was carried out in order to progress from the trial 20m by 20m island to the full scale scheme, and is continuing on the full island re-creation scheme.

1 Introduction

1.1 Heigham Sound is situated in the Upper Thurne catchment to the south east of Hickling Broad. Heigham Sound is the waterbody between Deep Go Dyke, Meadow Dyke in the north and Candle Dyke to the south. The Sound has a navigable channel in its centre leading from Hickling Broad south towards the River Thurne. It is a component of The Upper Thurne Broads and Marshes SSSI, The Broads SAC, Broadland SPA and Broadland Ramsar sites highlighting its significance at a national as well as international level.

1.2 The planning application was to re-create an area of reedswamp which separated Duck Broad from Heigham Sound by using a retaining wall of gabion baskets and using the lagoons as a disposal area for sediment gained from dredging the navigation channel. Reedswamp is a BAP habitat and there are issues in this area with regression of reedswamp, so this project was considered to be of high value to this area.

1.3 A number of species as well as habitats could be impacted by the works. As part of the planning process a Habitat RegulationsAssessment was untaken by the Broads Authority to examine the potential impacts of the works on the interest features on the site. A rigorous water quality monitoring programme was put in place to record any changes in water quality during the works period.

2 Water Quality

2.1 Any detrimental impacts to the water quality could have a direct impact on fish populations and an indirect impact on the wildlife that relies on fish for food. There were concerns among stakeholders that the disturbance of sediment caused by dredging could lead to a release of nutrients which could adversely affect fish populations, and could increase the likelihood of a *Prymnesium parvum* [1] outbreak.

[1] Prymnesium parvum is a toxic algae which has been responsible historically for large fish kills in this area. At the top of the Thurne catchment, there is little flushing, which makes this area more susceptible to the algal effects

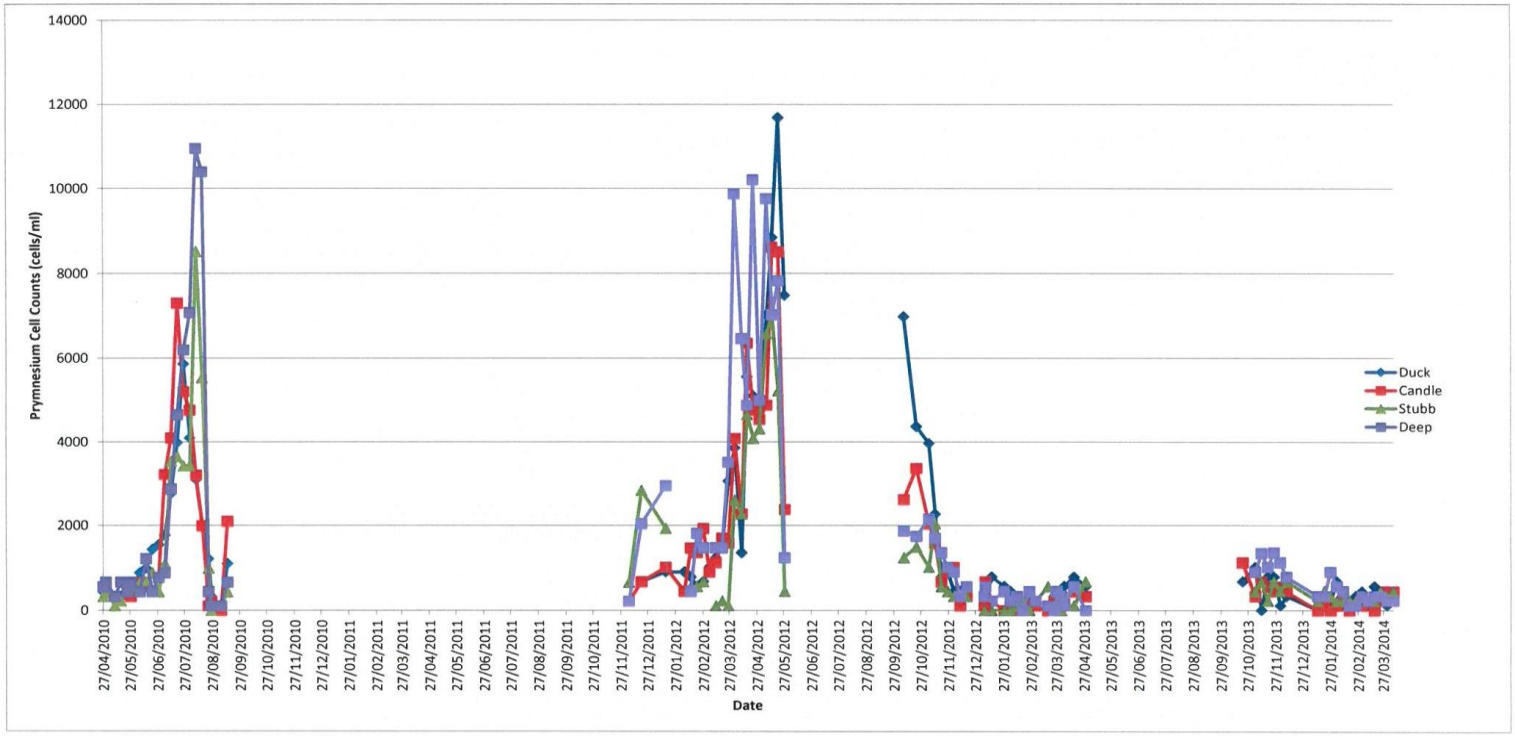

Figure 1 – *Prymnesium parvum* cell counts for the entire recording period

2.2 It was therefore critical that water quality was monitored before, during and after the works to give early warning of potential problems.

2.3 A variety of water quality parameters ,see Appendix 1, were measured at the works site (Duck Broad) and three control sites, two upstream (at Stubb Mill and Deep Waters) and one downstream of the works area (in Candle Dyke) for the entire works period.

2.4 In 2010 constructions works were carried out in the summer months, but to reduce the risk of a *Prymnesium parvum* outbreak, subsequent construction and dredging work was all moved to the winter period in subsequent years.

2.5 The graph in Figure 1 shows the *Prymnesium parvum* cell counts for the entire recording period from April 2010 to March 2014. The gaps in the graph are when there was no monitoring between work periods.

2.6 The results show that the cell counts are generally lower than 2,000 cells/ml apart from on two occasions in August 2010 and April 2012 when they peaked over 10,000 cells/ml. Environment Agency guidance suggests that the risk associated with a prymnesium bloom is increased when the cell counts increase above 10,000 cells/ml. There was a Prymnesium bloom resulting in minor fish kills in the west of Hickling Broad in April 2012, where the cell counts went above 21,000. However the cell counts in the Heigham Sound area peaked at just over 10,000 cells/ml, suggesting the source of the bloom was in the west of Hickling. The bloom in Hickling was thought to be related to weather conditions of a dry early spring, with low water levels.

2.7 No detrimental impacts to water quality occurred as result of the works. Infact there has been an improvement in water quality in Duck Broad, which has become less turbid since the retaining wall was built. It is thought this is due to a reduction in the fetch of the wind sweeping across the broad. This is demonstrated by a reduction in suspended solids recorded in Duck Broad during the project period, see Figure 2.

3 Wetland Plants

3.1 The gabion baskets making up the retaining wall of the structure were planted with a mixture of Reed, *Phragmites australis*, and Reedmace, *Typha angustifolia*. These plants were propagated from seed collected in the surrounding reedbeds.

3.2 Initially the trial 20m by 20m island was planted with a known quantity of plants, which were monitored for the 12 months following planting for health, vigour and general condition of the plants. The plants were monitored monthly and the number of plants present in each basket were counted and their condition assessed as Good, Moderate or Poor. An overall success rate was given to each basket based on these two factors.

3.3 The success rate was calculated as High for all baskets bar one which was calculated as Medium. The retaining wall was densely vegetated with

intermittent vegetation colonising in the backfill area, as shown in the Figure 3 which was taken 12 months after planting.

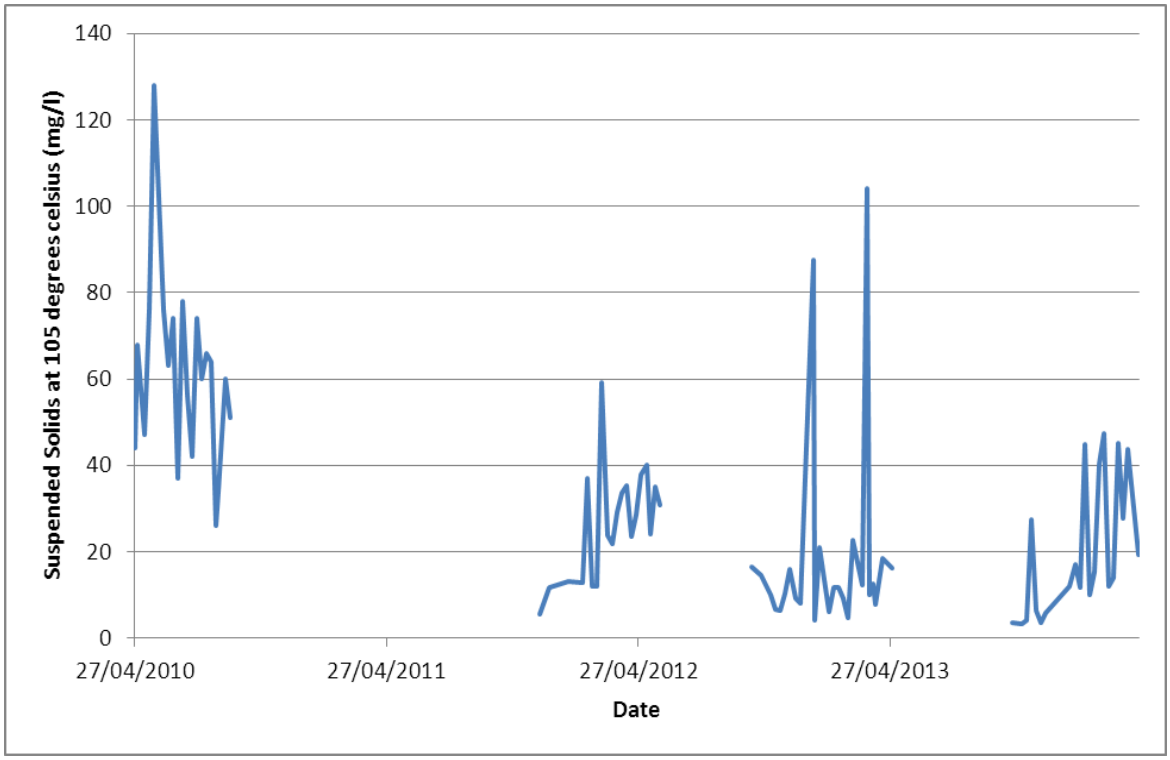

Figure 2 – Suspended Solids in Duck Broad for the entire recording period

Figure 3. Trial area 12 months after reed planting

3.4 Due to the successful establishment of planting on the trial island, the planting density was reduced for the full island re-creation scheme. This was planted in late summer 2012. During a hard winter in 2012-3, prolonged easterly

winds washed sediment out from the baskets on the Duck Broad side of the structure. A dry summer followed in 2013 with low water levels and the plants were struggling to grow.

3.5 The monitoring approach was modified to reflect the much larger area of the full scheme. A quick regime was introduced for each basket to state whether there was 75% or more vegetation on the baskets, and whether 75% or more of the vegetation was healthy. This was carried out on the perimeter wall as access to the middle cross walls was not possible. The count in June 2014 revealed only 23% of the baskets to be well vegetated and healthy. Re-planting of the Duck Broad side of the island is occurring in July 2014.

3.6 Some reed rhizome, sourced from the River Thurne, has also been placed in the lagoon areas to assist in the establishment of reedswamp.

3.7 The gabions will continue to be monitored until the majority of baskets are well vegetated. The lagoon areas will be monitored until reedswamp establishes.

4 The Future

4.1 The scale and frequency of water quality monitoring undertaken for this project is unprecedented in the Broads. Although the monitoring was costly in terms of time and money, the data is now being used more widely. The Environment Agency is working closely with an algal specialist to further understand how *Prymnesium parvum* behaves in the Upper Thurne. Although it was unfortunate in ecological terms that there was a *Prymnesium parvum* bloom during the works period, the data collected at this time is invaluable in looking for trends in datasets so that predictions can be made in the future of when a bloom may occur.

Background papers:	None
Author:	Sally McColl
Date of report:	8 July 2014
Broads Plan Objectives:	NA1
Appendices:	APPENDIX 1 – Suite of Water Quality Parameters Monitored

.

Appendix 1 – Suite of Water Quality Parameters Monitored

Chemical Analysis – monitored weekly (laboratory analysis)

Ammoniacal Nitrogen filtered as N (mg/l)
Nitrite, Filtered as N (mg/l)
Nitrogen: Total oxidised filtered as N (mg/l)
Orthophosphate filtered as P (mg/l)
Silicate filtered as SiO_2 (mg/l)
Phosphorous: Total as P (mg/l)
Chlorophyll (ug/l)
Solids suspended at 105°C (mg/l)

- **Ecological Analysis – monitored weekly by Dr Fran Green**

Prymnesium parvum (cells/ml)
List of diatom species

- **Water quality indicators – monitored weekly in the field by BA staff**

Water depth (cm)
Secchi depth (cm)
pH
Water temperature (°C)
Conductivity (us/cm)
Dissolved oxygen (mg/l)
Visual check for dead or distressed fish

- **Water quality indicators – monitored every 30 minutes on a remote data logger located in Heigham Sound 2011-2013**

Temperature (°C)
pH
Conductivity (us/cm)
Chlorophyll (ug/l)
Turbidity (NTU)

- **Water quality indicators – monitored every 30 minutes on a remote data logger located in Heigham Sound 2013-2014**

Temperature (°C)
pH
Conductivity (us/cm)
Turbidity (NTU)
Nitrate (mg/l)
Ammonia (mg/l)
Dissolved oxygen (%)