Recommendations for the future management of Adderbury Lakes, Adderbury Undertaken by Windrush AEC Ltd, on behalf of Adderbury Parish Council and Lakes Management Committee

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1.0 Introduction

Adderbury Parish Council (APC) have engaged Windrush AEC Ltd to produce outline recommendations for the future management of Adderbury Lakes, Adderbury, with particular reference to water quality and aquatic ecology.

This report is based on a site visit undertaken on 2 December 2019, in the company of Rick Atkinson and Nigel Claxton

2.0 Key issues

A number of key issues affecting the lakes were identified during the site visit. These included:

- Poor water quality. A fish mortality had recently taken place in the top lake
- Over-vigorous growth of aquatic plants, including filamentous algae and floating duck-weed
- The build-up of fine sediment in the lake

3.0 Possible causes of key issues

3.1 Poor water quality

Nutrient sources

The growth of algae and rooted plants in the lake is largely controlled by the amount of nutrient (phosphorus and nitrate) present. Phosphorus is generally the limiting element and thus controlling any excessive input of this into the lake is vital. Sources of phosphorus include agricultural run-off and generally most importantly, sewage effluent.

Discussions with Rick and Nigel confirmed that there have been spills of sewage effluent from Thames Water (TW) assets that have entered the lake. The source of the effluent is believed to be one or more drain covers within the footpath upstream of the lakes. These surcharged during periods of heavy rain, causing effluent (presumably untreated) to enter the lake. This has apparently occurred on more than one occasion, with TW forced to send staff to clean up the spillage.

Despite the clean-up operation, it will be inevitable that a considerable amount of nutrients, particularly phosphorus will have entered the lake system. In addition, the suggestion was made that the large property on the western side of the lake has a septic tank system that may allow nutrients to drain downslope within local groundwater, ultimately entering the lake.

Figure 1: Footpath above the lake which is the origin of past sewage spills

Figure 2: Site of possible sewage system discharge on the west side of the lake

3.2 Over-vigorous growth of aquatic plants

The abundance of submerged plants is a result of high nutrient input to the lakes. The uptake of nutrients by rooted plants is generally a preferable ecological state than the alternative, algal dominated system. However, the rooted plants produce some challenges to the recreational management of the lakes; boating is difficult, and there have been complaints that the lake is becoming 'choked' with weeds. The latter issue is compounded by the fact that some of the submerged plants present are non-native invasive species with the ability to dominate a water body.

In addition to the rooted plants there is a significant growth of filamentous algae, and an abundance of surface growing duckweed.

Recent attempts to reduce the amount of weed present have focused on removal by physical means. The recent fish mortality occurred rapidly following dragging of the lake. Investigation by the Environment Agency was inconclusive but did suggest a likely link to an eco-toxin present in the decaying sediment. This type of fish mortality is not unknown, with a large scale example occurring in the recent past on the Kennet and Avon Canal at Hungerford.

3.3 Sediment build up

The main source of sediment is probably erosion from arable farmland and the footpath/road network upstream of the lakes. Fine sediment enters the streams feeding the lakes via preferential flow pathways (roads and footpaths). It is then deposited in the lakes as the water velocity decreases. Sediment is not only damaging in its own right but also carries with it chemically and physically bound nutrients which promote excessive plant growth.

Leaf fall from the surrounding deciduous trees is also a significant contributor to the overall sediment burden.

The de-silting work recently carried out re-located much of the fine sediment from the lake bed to the margins, where it was contained within Nicospan barriers. Some of the nutrients were thus effectively 'locked up' and made un-available. However, a significant percentage will have re-cycled back into the lake as soluble ortho-phosphate, available for uptake by plants and algae.

4.0 Recommendations

- **Reduce nutrient entering the lake**

TW should be contacted to seek assurance that the operational issues that result in sewage spillages entering the lakes will be addressed. Not only is sewage damaging to the ecology of the water via possible de-oxygenation and elevation of nutrient levels, they can also be directly harmful to human health; sewage contains a range of potentially dangerous pathogens. TW may also be able to provide funding for a community project such as that at Adderbury lakes. Projects that enhance biodiversity, education and community engagement are favoured by TW. The community contact at TW is Rosemary Waugh rosemary.waugh@thameswater.co.uk

It would also be prudent to further investigate the potential for effluent to enter the lake from the private house sewage system on the west side of the lake. If the large concrete tank

observed is in fact a septic tank then this may have the potential to discharge nutrients downslope into the lake.

Wildfowl numbers in the lake should also be minimised. Whilst feeding ducks is satisfying and enjoyable for many people, it serves to increase nutrient loading via breakdown of waste food and bird faeces. Ideally, no supportive feeding would take place, helping to keep wildfowl numbers at a low level.

- **Reduce sediment entering the lake**

If possible, the agricultural interests upstream should be contacted with a view to addressing any significant areas of sediment run-off into the streams entering the lakes. Assistance could possibly be provided by the Environment Agency under Catchment Sensitive Farming initiatives. Contact them via Robert Iles Robert.Iles@environment-agency.gov.uk

There are two silt traps upstream of the lake. If funds allow, these should be de-silted to optimise the capture of sediment and associated nutrients. Oxfordshire County Council may be able to assist, as much of the local input of sediment is via run-off from the footpath under their control.

Once sediment laden material has entered the lake system, it is important to tie it up in a way that least damaged the lake. The small area of sedge and reeds developing downstream of the lake inflow should therefore be encouraged; removing the growing plants will be counterproductive.

Fig 3. Reedbed at the entry to the lake should be allowed to develop

A further reduction in leaf litter can be made by carefully reducing the canopy of the surrounding trees. Subject to overall aesthetics and conservation considerations, reduction of

the canopy by selective trimming, coppicing or felling of trees will reduce leaf fall into the lake. It should however be understood that reducing the canopy will also reduce shading which will of course promote submerged weed growth. A balance between these two conflicting issues must therefore be struck

- **Reduce the abundance of submerged weed growth**

Physical removal of weed is an option for its control. However it is labour intensive and disposal of weed near to the bank will result in nutrients from rotting plants re-entering the lake. There is also a continued risk of fish mortality from unknown eco-toxins following disturbance.

Increasing shade in the water body will help to limit submerged weed growth. Planting large, well grown clumps of water lily will increase shade locally. Protecting the newly introduced plants from wildfowl damage is important to ensure successful establishment.

A final option is to utilise fish as means to bio-manipulate the lakes' ecology. Put simply, a high density of fish such as carp can be used to disturb the lakes' substrate, mobilising nutrients and sediment, and uprooting plants. This will increase algal growth and water turbidity to the detriment of the rooted plants that will then decline. A stocking density of around 250kg/ha common carp would be a good starting point.

If this policy is to be followed, it is recommended that the upper lake is left with a limited fish population, with abundant weed growth acting as a nutrient and sediment sink. The lower lake would then be stocked with carp to create a more algal dominated, turbid water system.

Note that any stocking of either lake requires the written consent of the Environment Agency.