CD Ecology

In Partnership with Fixing and Linking Our Wetlands (FLOW) Project and CD Ecology

Slindon Village Pond

Pond condition assessments results and prioritised drainage and habitat improvement plan for Slindon Parish and South Downs National Park

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CD Ecology

December 2020

Slindon Village Pond, Slindon Parish
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Acknowledgements

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Acronyms and abbreviations

Name	Acronym
Area of Outstanding Natural Beauty	AONB
Bat Conservation Trust	BCT
West Sussex County Council Highways	WSCCH
Cabinet Office Briefing Room	COBR
Arun District Council	ADC
South Downs National Park	SDNP
Department for Environment, Food & Rural Affairs	DEFRA
Environment Agency	EA
Fixing and Linking our Wetlands	FLOW
Geographical Information System	GIS
Slindon Parish Council	SPC
National Trust	NT
Natural England	NE
Operation Watershed	OW
Sussex Biodiversity Records Centre	SxBRC
West Sussex County Council	WSCC
Principle Importance of the Natural Environment and Communities Act 2006	NERC

Executive Summary

The FLOW study of the Slindon Village Parish Pond system took 2 months to complete and used a scoring system to analyse the main attributes of the Pond. This included drainage, environmental and biodiversity aspects.

Most of the survey reference points were found to be in poor or moderate condition, and it was clear that 3 culverts leaving and entering the pond where blocked.

My current analysis suggests that most of the pond has a system of yearly management and the pond tended to have limited vegetation structure and diversity. However, Dormice use the adjacent wood, and all consideration must be taken into account under section 5 of the Wildlife and Countryside Act 1981 also designated under 2006 NERC Act Species of principle importance Natural Environment and Communities Act[1]. It's a criminal offence to damage dormice habitat and the removal of these species.

Opportunities were found for improvements in the water storage capacity, vegetation diversity and drainage of the pond systems during high rainfall events that would also provide better wetland habitat. Putting small interventions like this into the system could make a difference during high rainfall events by just holding back a higher percentage of the water and improving species diversity.

Four opportunities for drainage improvements can be seen in Figure 6.1 and three opportunities for environmental improvements, Figure 6.1 and beyond which range from improving vegetation diversity to hedge laying and lightly opening the pond.

The Parish and the SDNP have recently contacted ADC and WSCCH to identify and address the drainage problems on the adjacent road. Moreover, FLOW, SDNP and Slindon Parish identified the long-term asset this pond can bring to communities and the Environment

[1] Hazel dormice legislation - People's Trust for Endangered Species (ptes.org)

Contents

1. Background FLOW and CD Ecology

Christopher Drake has working on the Fixing and Linking Our Wetlands, FLOW Project for 3 years. FLOW is a Heritage Lottery Funded Project to carry out a complete condition assessment of all the wetlands on the Manhood Peninsula (MP), conduct biodiversity surveys of all the Parishes. FLOW has been acknowledged by WSCC and Chichester District Council (CDC)

CD ecology is working from the back of FLOW and this report uses a similar format to FLOW.

Figure 1: Study Project area

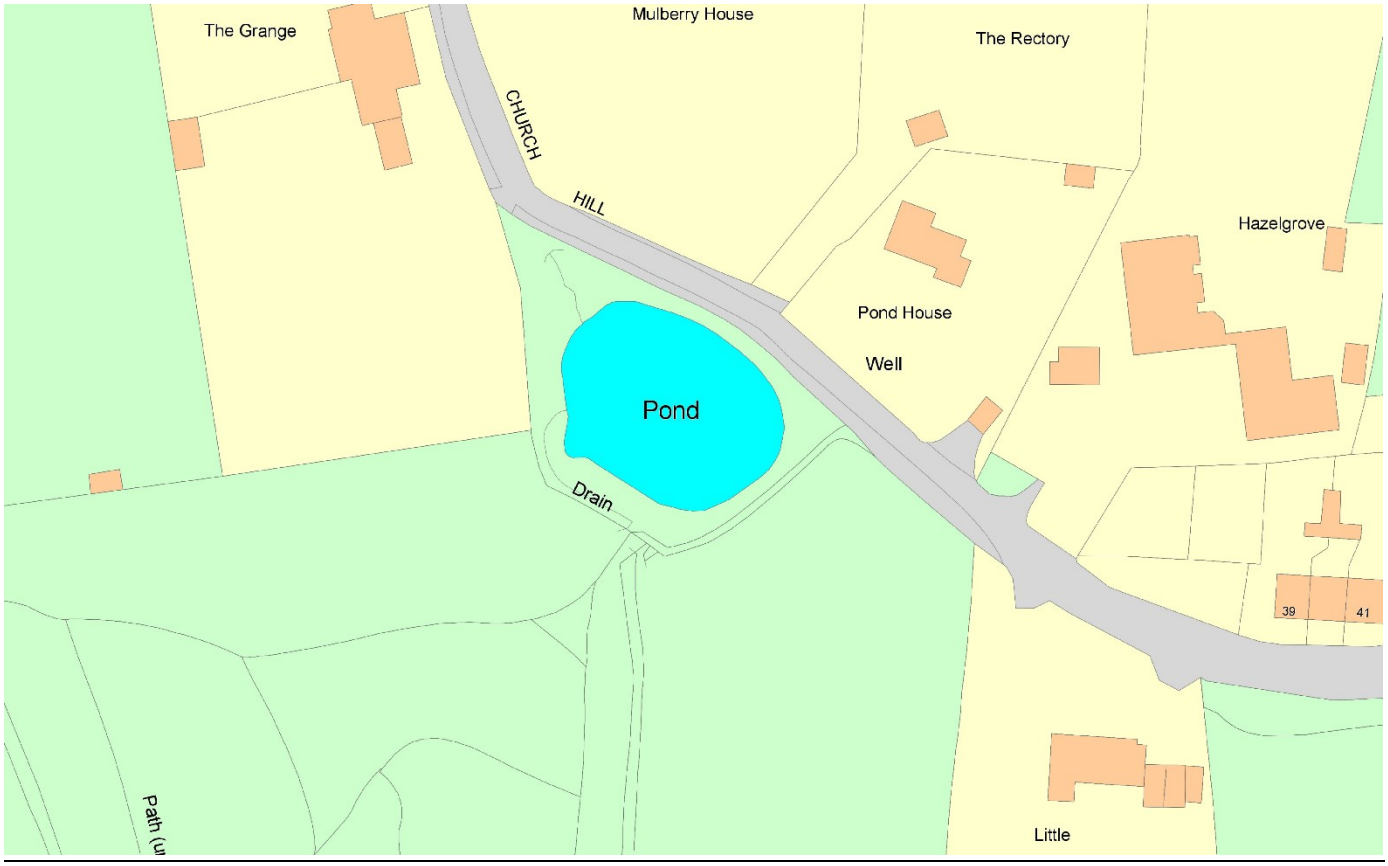


Figure 1 represents Slindon village pond, positioned next to National Trust Slindon Wood. The southern section of the pond is made up of broad leaved woodland and the eastern section represents open pasture and a managed hedge close to a path. The Northern section represents Church Hill Rd and one large Willow tree and the western section is a dry ditch entering the pond from the corner of Church Hill.

1.2 Ponds and Biodiversity

Ponds provide food and shelter for many different species, Bats, Reptiles, Fish, Invertebrates, Birds and insects. Different types of ponds support different invertebrates. Varied marginal vegetation Maintain a varied structure and mixture of plant species in the marginal vegetation to increase the range of places available for invertebrates to shelter and breed in. Avoid introducing any non-native species. Trees and shrubs Ideally, any overhanging vegetation should be on the northern margin and no more than 25% of the pond edge should be shaded, although shaded woodland ponds can provide special habitats for some rare invertebrates. Leave a buffer zone of unfertilised rough tussocky grass at least 10m wide around any pond in improved grassland or arable fields to protect it from spray drift or fertiliser inputs. Poached ground Allow livestock some access to pond margins to create areas of poached ground and bare mud that are important for invertebrates such as craneflies. Submerged vegetation Leave plentiful submerged vegetation for aquatic invertebrates and for species such as dragonflies and some hoverflies that lay their eggs on aquatic vegetation and whose larvae live in the water[2]

1.3 Drainage

Well maintained ditches, ponds and rifes allow water to be stored or flow away to the sea, reducing the risk of flooding and providing a stable and important home to many species, including the fast-declining water vole (Strachan 2011).

Unfortunately, budget strains within the Environment Agency mean the local parish has to take responsibility now rests with riparian owners who may require encouragement, information and support to identify and tackle what needs doing. The dissolution of the local Internal Drainage Boards (IDBs) and Districts (IDDs) by DEFRA means that they are stepping

[2] buglife ponds & ditches A4 4pp.indd

back from much of the management of ditches and waterways that they have traditionally carried out and, again, riparian owners will have to take over.

CD Ecology and recommendations supported from FLOW. Community engagement is key a recommendation, advising riparian owners and identifying areas for improvement and managing will enhance biodiversity and manage flood risk. The recommendations were as follows:

The ongoing management and investment should be based around four key themes:

- *the importance of land drainage consents to prevent culverting or infilling of watercourses where it will increase flood risk;*
- *the need to control runoff from new developments;*
- *the requirement to continue maintaining watercourses, culverts and highway drainage on a cyclical basis,*

The objective is to ensure that the drainage system is managed and maintained on a proactive, cyclical basis to ensure it is functioning as intended. This can be achieved through an annual walkover survey of the critical drainage routes to identify their condition, maintenance requirements and any land drainage consent issues. This should take place in late autumn to allow vegetation die back following the summer, but also to identify any remedial measures before the wet winter months when the possibility of flooding can primarily affect the village'

Hedges are another important habitat as they are abundant but undermanaged and overlooked and often originally relic pieces of woodland, they act as important green infrastructure. The two combined offer good wildlife corridors and connect the designated areas of National Trust Slindon and the outlying Southdowns National Park. Hedgerows, whether related to ditches or not, can be targeted for improvement to combat soil erosion and reduce surface water movement across agricultural land which is an important factor in overall water management.

Slindon Parish Council have received funding from West Sussex Operation Water Shed Funds to carry out the Drainage and Biodiversity Project. The project aims to gain a working understanding of the ditch and pond drainage system by assessing the condition of the ditches/pond which form it. An action plan of suggested improvement work will be produced, focusing on improving biodiversity. Some of the work outlined may be carried out as part of the FLOW project. In addition to the main focus on the wetland network, the report will look at other important habitats across the site including hedgerows and Woodland.

The area offers a discrete opportunity for demonstrating the importance of the Lawton Report (2010) suggestions and thus would contribute to enhancing not only the habitats and their

associated species but would increase resilience in the face of climate change and provide an example for others to follow[3]

2.0 History of Slindon Village Pond

Today, Slindon village pond is recognised as a conservation area and for the most part, the space is a functional - village pond/recreational space. Anglers fish the pond and people come to absorb this historical feature. The site itself, boarders Slindon Manor Wood of which the National Trust own. Part of the pond catchment features extend down into the wood with culverts and ditches.

The pond itself is as old as the village and was used in the 1700-1800 as horse and carriage washing facilities. Moreover, “the pond was first registered as a town or village green on 17 May 1967” Due to the close pond proximity to the road, the pond was partly owned by West Sussex County Council. As a result, the register entry was amended in December 1971 to exclude a width of highway verge on the west side of the carriageway leading from St Mary’s Church, Slindon to Elm Cottage, Slindon but the rest of the pond and surround was still registered as a town or village green[4].

Around 1897 a special Parish Council meeting approved the works and have the pond cleaned. Additionally, there was also works to strengthen the road foundations around the road section of the pond. The cost of this is thought to be of £4.10.0 and in 1905 the Rural District Council advised that a noxious smell could only be eliminated through cleaning at a cost of £16. Between 1948 and 1950 the County Council stepped in to clean the pond as it was identified as a useful purpose in drawing storm water off the roads. In 1980 the parish council was given a grant application from Arun District Council’s Lotteries. This was used to strengthen the banks and again in 2000 a local volunteer group secured funding as part of a millennium project.

[3] Thomson Ecology Handbook: Making Space for Nature - The Lawton Report (2010)
[4] Facilities and Services | Slindon Parish Council

3. Methodology

3.1 Access and initial information

Slindon Village Pond was easy to access, with 10m access from the road there was no issues accessing this site. At the time of visit, it was safer to access the pond in areas where vegetation was less thick. I chose 6 reference points for surveying, these points where equally positioned around the pond. This enables us to get a balanced set of reference points at equal distance around the perimeter of the pond.

3.2 Ditch and pond surveys

A Ditch Condition Assessment sheet (Appendix I, section 12) was developed to capture a wide range of information on the ditches and ponds surveyed. These surveys have been designed to give a rapid assessment of a wide range of information including the physical attributes of each Pond (bank profile, Sediment depth, water availability, storage capacity, % Open Water, Rotational Management, Aquatic Plants, Shading, Drainage Issues, Connectivity etc), the emergent and bankside vegetation structure, historical and current management observations and surrounding land use. In addition, information on sediment depth was taken at various positions into the centre of the pond. This was to measure the variant sediment depth into the middle of the pond. This report also investigated the drainage ditches entering and leaving the pond.

Moreover, for example…. The scores are in Appendix I, section 12. Banks Slope is out of 2 and so on…….

The information gathered was ‘scored’ to enable comparisons between sample reference points. This has been tried and tested with the FLOW project. In order to produce maps of the results a traffic light system was developed with red as “poor”, amber as “moderate” and green as “good”. However, it should be noted that this scoring system is relative and as such does not imply an overall status but rather the specific ditch/pond condition

Water Availability – At the point of survey each assessment is based upon water available and marked out of 2. Does it dry out? Unsure or always wet.

Pond Width – The distance from top of bank gradient to top of bank gradient on the opposite side. <0.5m = 0, 0.6m-1m = 1, 1.1m-2m = 2, 2.1m-4m = 3 and >4=4. All scores are marked out of 4

Pond Depth -The distance from the top of the bank gradient to the top of the water. This allows us to look at the ditch/pond capacity. <0.5m = 0, 0.6m-1m = 1, 1.1m-2m = 2, >2= 3

Banks Slope – A bank slope under 30 degrees will score 0. A bank slope between 30 and 60 degrees = 2 if on both sides. 1 = one side of the bank.

Bank structure - Is it concreate or soil? Soil = 1 out of 1 and concreate = 0 out of 1.

Buffer Width – From the top of the bank gradient to a land use feature. This can be a footpath or a ploughed field. Bigger the buffer strip higher the score.

Buffer Quality – Bare managed ground = 0 and diverse vegetation = 1.

Bank erosion – Any sign of bank erosion = 0

Litter – 1-2 items of litter = 1 and abundant = 0

Turbidity – Is the water clear or opaque. Clear water scores higher.

Algal Bloom – Water with lots of algae = 0 and water with no algae = 1

Pollution – Does the water looked polluted? Oil on the surface ect..

Trees, Bushes, Riparian forbs, sedges, rushes, reeds and long grass – all score higher for avaibility.

Open Water – area of open water is a higher score for water not chocked with vegetation.

Aquatic Vegetation – in- channel vegetation scores 0 when its > 60%

Non Aquatic – in channel non aquatic vegetation scores 0 when its > 60%

Rotational Management – Both sides of the bank managed together = 0 and one side of the bank managed at different times = 1

Shading – If the water course is completely shaded then this = 0

Sediment Depth = >25cm = 0 and < than 5cm = 2

Invasive Species = any invasive like Japanese Knotweed = 0

All data was compiled into Microsoft Excel Spreadsheets before being used to create maps of the parish using Geographical Information System (GIS), specifically, QGIS (Wein 2.14.13. 2017).

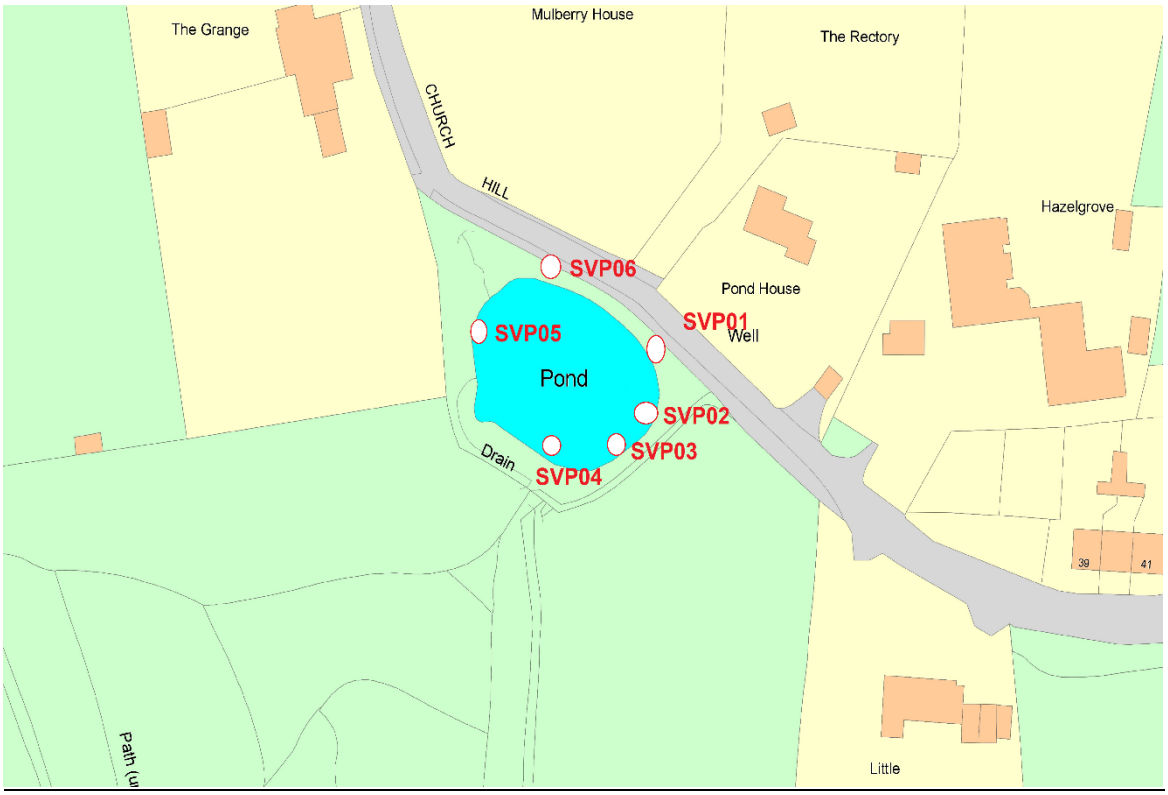
3.3 Sources of information

South Downs National Park provided an Ordnance Survey License to enable mapping of results along with a number of local, relevant GIS layers. West Sussex Highways Authority granted access to GIS information regarding the local area (utility locations, agricultural land grading information, hedgerow information and other historical information) and allowed these to be printed. Further GIS based information has been obtained from the Open Access, Environment Agency website. NE data sets were also used to look at designated area boundaries, key species locations, habitat mapping and which farms are in stewardship.

4. Results

Six Survey reference points visited around the village pond. The table below summarises the survey statistics from the ditch condition assessments (see Appendix 1 for ditch condition assessment form used).

Figure 2: Surveyed locations Village Pond



4.1 Survey Refence Point SVP01 (Grid Ref SU96240818)

Water Availability 2/2

Pond Width 4/4

Pond Depth 1/3

Distance from Shore	5m from shore/2ft water	10m from shore/3ft water	15m from shore/4ft water
Silt Depth	0 m	0.2m deep	0.5m deep
Sediment type	Gravel	Gravel/Silt	Silt

Banks Slope 0/2

Bank Structure 1/1

Bankside buffer width 3/4

Bankside buffer quality 1/1

Bankside erosion 1/2

Litter 1/2

Water Quality – Turbidity 1/2

Water Quality – Algal Bloom 1/2

Water Quality – Pollution 1/1

Trees	1/2
Bushes	0/2
Riparian forbs	0/2
Sedges	2/2
Rushes	2/2
Reeds	2/2
Long Grass	1/2

Open Water (>60%)	2/2
Aquatic Plants 41%-60%	1/2
Non Aquatic 1-40%	2/2

Rotational Management both sides together/different timings	0/1
Shading (water >80% shaded = 0 40%-80%=1 <40% = 2	2/2
Invasive Species	1/1
Total Score	**33**

Drainage Issues = No

Connectivity = No

4.2 Survey Refence Point SVP02 (Grid Ref SU96220816)

Water Availability 2/2

Pond Width 4/4

Pond Depth 1/3

Distance from Shore	5m from shore/3ft water	10m from shore/4ft water	15m from shore / 5ft water
Silt Depth	0 m	0.5m deep	0.7m deep
Sediment type	Gravel	Gravel/Silt	Silt

Banks Slope 0/2

Bank Structure 1/1

Bankside buffer width 1/4

Bankside buffer quality 0/1

Bankside erosion 1/2

Litter 2/2

Water Quality – Turbidity 0/2

Water Quality – Algal Bloom 2/2

Water Quality – Pollution 1/1

Trees	0/2
Bushes	0/2
Riparian forbs	0/2
Sedges	1/2
Rushes	1/2
Reeds	1/2
Long Grass	1/2

Open Water (>60%)	2/2
Aquatic Plants 41%-60%	0/2
Non Aquatic 1-40%	1/2

Rotational Management both sides together/different timings	0/1
Shading (water >80% shaded = 0 40%-80%=1 <40% = 2	1/2
Invasive Species	1/1
Total Score	**24**

Drainage Issues = No

Connectivity = No

4.3 Survey Refence Point SVP03 (Grid Ref SU96220816)

Water Availability 2/2

Pond Width 4/4

Pond Depth 2/3

Distance from Shore	5m from shore/3ft water	10m from shore/4ft water	15m from shore / 5ft water
Silt Depth	0.6 m	1.0 m deep	1.0m deep
Sediment type	Gravel/silt	Silt	Silt

Banks Slope 0/2

Bank Structure 1/1

Bankside buffer width 1/4

Bankside buffer quality 1/1

Bankside erosion 1/1

Litter 2/2

Water Quality – Turbidity 0/2

Water Quality – Algal Bloom 2/2

Water Quality – Pollution 2/1

Trees	2/2
Bushes	2/2
Riparian forbs	0/2
Sedges	1/2
Rushes	1/2
Reeds	1/2
Long Grass	1/2

Open Water (>60%)	2/2
Aquatic Plants 41%-60%	0/2
Non Aquatic 1-40%	0/2

Rotational Management both sides together/different timings	1/1
Shading (water >80% shaded = 0 40%-80%=1 <40% = 2	0/2
Invasive Species	1/1
Total Score	**30**

Drainage Issues = Yes (0.1m outlet culvert blocked at the time of survey)

Connectivity = 1

4.4 Survey Reference Point SVP04 (Grid Ref SU96240817)

Water Availability 2/2

Pond Width 4/4

Pond Depth 1/3

Distance from Shore	5m from shore/3ft water	10m from shore/4ft water	15m from shore / 5ft water
Silt Depth	0.3 m	0.5 m deep	1.0m deep
Sediment type	Gravel/silt	Silt	Silt

Banks Slope 1/2

Bank Structure 1/2

Bankside buffer width 4/4

Bankside buffer quality 1/1

Bankside erosion 1/1

Litter 2/2

Water Quality – Turbidity 0/2

Water Quality – Algal Bloom 2/2

Water Quality – Pollution 2/1

Trees	2/2
Bushes	2/2
Riparian forbs	0/2
Sedges	0/2
Rushes	0/2
Reeds	0/2
Long Grass	1/2

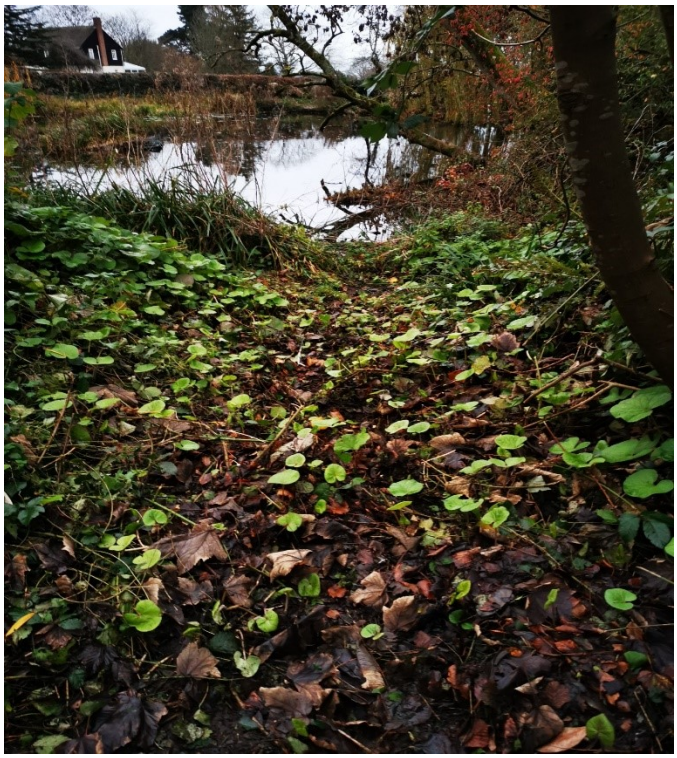
Open Water (>60%)	2/2
Aquatic Plants 41%-60%	0/2
Non Aquatic 1-40%	0/2

Rotational Management both sides together/different timings	1/1
Shading (water >80% shaded = 0 40%-80%=1 <40% = 2	0/2
Invasive Species	1/1
Total Score	**30**

Drainage Issues = No

Connectivity = 0

4.5 Survey Reference Point SVP05 (Grid Ref SU96200820)



Pond Width 4/4

Pond Depth 1/3

Distance from Shore	5m from shore/3ft water	10m from shore/4ft water	15m from shore / 5ft water
Silt Depth	0.5 m	0.75 m deep	1.0m deep
Sediment type	Gravel/silt	Silt	Silt

Banks Slope 1/2

Bank Structure 1/2

Bankside buffer width 4/4

Bankside buffer quality 1/1

Bankside erosion 1/1

Litter 0/2

Total 6

Water Quality – Turbidity 0/2

Water Quality – Algal Bloom 2/2

Water Quality – Pollution 2/1

Trees	1/2
Bushes	1/2
Riparian forbs	0/2
Sedges	1/2
Rushes	1/2
Reeds	1/2
Long Grass	1/2 Total 6

Open Water (>60%)	2/2
Aquatic Plants 41%-60%	1/2
Non Aquatic 1-40%	1/2 Total 4

Rotational Management both sides together/different timings	1/1
Shading (water >80% shaded = 0 40%-80%=1 <40% = 2	1/2
Invasive Species	1/1
	Total 3

Drainage Issues = Yes (Culvert from the west under the road was blocked at the time of survey)

Connectivity = 1

4.6 Survey Reference Point SVP06 (Grid Ref SU96430820)

Pond Width 4/4

Pond Depth 2/3

Distance from Shore	5m from shore/3ft water	10m from shore/5ft water	15m from shore / 5ft water
Silt Depth	0.2 m	0.5 m deep	1.0m deep
Sediment type	Gravel/silt	Silt	Silt

Banks Slope 1/2

Bank Structure 1/2

Bankside buffer width 4/4

Bankside buffer quality 0/1

Bankside erosion 1/1

Litter 2/2

Water Quality – Turbidity 0/2

Water Quality – Algal Bloom 2/2

Water Quality – Pollution 2/1

Trees	1/2
Bushes	0/2
Riparian forbs	0/2
Sedges	1/2
Rushes	0/2
Reeds	0/2
Long Grass	0/2

Open Water (>60%)	2/2
Aquatic Plants 41%-60%	0/2
Non Aquatic 1-40%	0/2

Rotational Management both sides together/different timings	1/1
Shading (water >80% shaded = 0 40%-80%=1 <40% = 2	1/2
Invasive Species	1/1

Drainage Issues = Yes (Culvert from under the road was blocked at the time of survey)

Connectivity = 1

5.0 Discussion

5.1 Condition of the Pond and Connecting Ditches using the FLOW scoring system

Using the scoring system, we were able to see which areas had high scores and were considered in good condition, and those with low scores and possible problems. Some of the arising problems were Drainage, Plant diversity and Sediment.

5.11 Surveying the Ditches

As well as conducting 6 surveys around the perimeter of the pond, Christopher also conducted 3 additional ditch surveys illustrated on map ref 7.2 below. The results are as follows:

Ditch Survey Refence Point SVP03 (Grid Ref SU96220816) blocked culvert leaving the pond. At the time of survey Christopher checked the pipe and it was blocked.

Ditch Width 0/4 (<0.5m = 0)

Ditch Depth 0/3 (<0.5m = 0)

Sediment Depth 0/2 (>25cm = 0)

Water Availability 0/2 (0 = Dries Out)

Banks Slope 0/2 (neither banks slope between 30 and 60 degrees)

Bank Structure 1/1 (earth = 1)

Buffer Width 3/4 (1.2m – 4m = 3)

Buffer Quality 1/1 (Diverse shrub/Tree community = 1)

Bank Erosion 1/1 (No erosion = 1)

Litter 1/2 (Litter present = 1)

	B1= North/East Bank	B2 = South/West Bank
Trees	2/2 (>50% = 2)	2/2 (>50% = 2)
Bushes	2/2	2/2
Riparian forbs	0/2 (absent = 0)	0/2 (absent =0)
Sedges	0/2	0/2
Rushes	0/2	0/2
Reeds	0/2	0/2
Long Grass	0/2 Total 4	0/2 Total 4

Rotational Management both sides together/different timings	0/1 (Both Sides Managed together = 0
Shading (water >80% shaded = 0 40%-80%=1 <40% = 2	0/2 (Water >80% shade = 0)
Invasive Species	1/1 (None present = 1)
	Total 1

Total Overall Score	16
0 – 45 = Very Poor, 45-55 = Average, 55 – 65 = Good	Shade, aquatic vegetation, ditch depth and width all will benefit from improvement.

Ditch Survey Reference Point SVP05 (Grid Ref SU96200820) blocked culvert entering the pond. The 0.25m pipe was blocked.

Ditch Width 0/4 (<0.5m = 0)

Ditch Depth 0/3 (<0.5m = 0)

Sediment Depth 0/2 (>25cm = 0)

Water Availability 0/2 (0 = Dries Out)

Banks Slope 0/2 (neither banks slope between 30 and 60 degrees)

Bank Structure 1/1 (earth = 1)

Buffer Width 3/4 (1.2m – 4m = 3)

Buffer Quality 1/1 (Diverse sedge community = 1)

Bank Erosion 1/1 (No erosion = 1)

Litter 1/2 (Litter present = 1)

	B1= North/East Bank	B2 = South/West Bank
Trees	0/2 (Absent = 0)	1/2 (Present 1-50% = 1)
Bushes	0/2	1/2
Riparian forbs	1/2 (Some water Mint present 1-50% = 1)	1/2 (Some Water Mint present 1-50% = 1)
Sedges	2/2 (Abundant >50% = 2)	2/2 (Abundant >50% = 2)
Rushes	1/2 (Present 1-50)	1/2 (Present 1-50)
Reeds	0/2	0/2
Long Grass	2/2	2/2

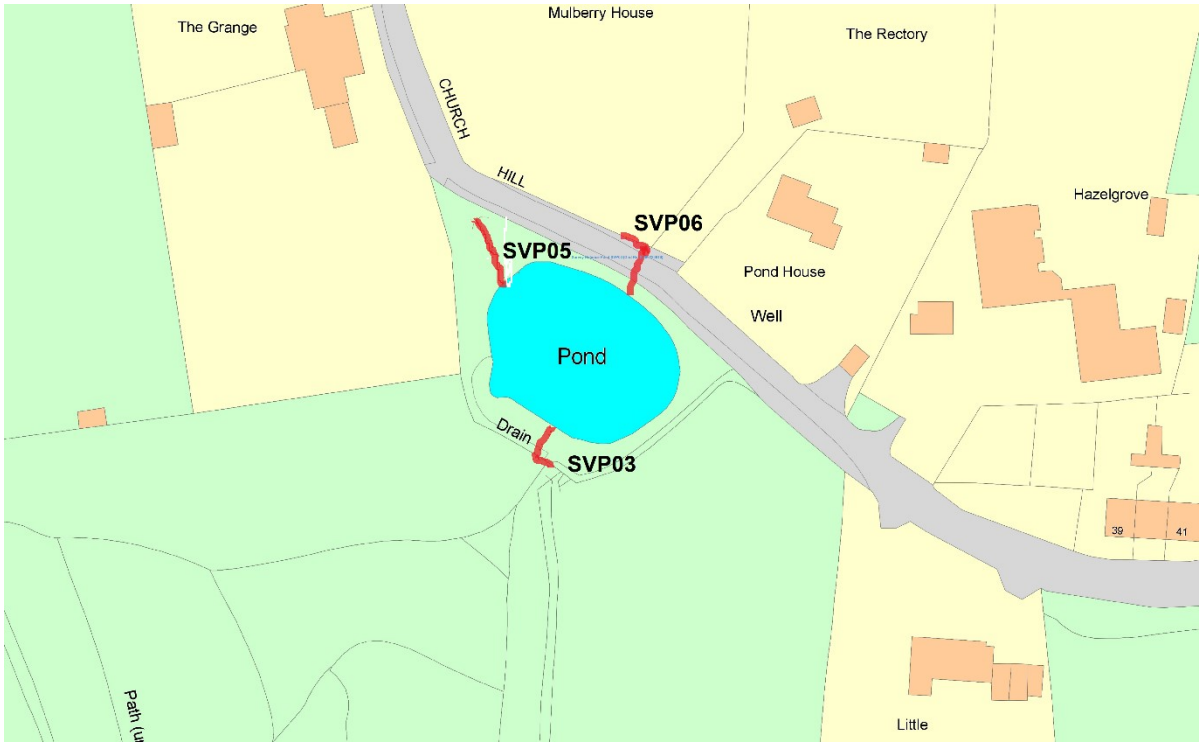
Rotational Management both sides together/different timings	0/1 (Both Sides Managed together = 0
Shading (water >80% shaded = 0 40%-80%=1 <40% = 2	1/2 (Water40%-80% shade = 1)
Invasive Species	1/1 (None present = 1)

Total Overall Score	22
0 – 45 = Very Poor, 45-55 = Average, 55 – 65 = Good	Aquatic vegetation, ditch depth and width all will benefit from improvement.

Survey Reference Point SVP06 (Grid Ref SU96430820) blocked culvert under the road. Christopher assessed the culvert with a stick. A camera will need to be used to find the blockage.

The Drainage Map reference 7.2 illustrates 3 red lines as problem areas.

5.2 Drainage Reference Map



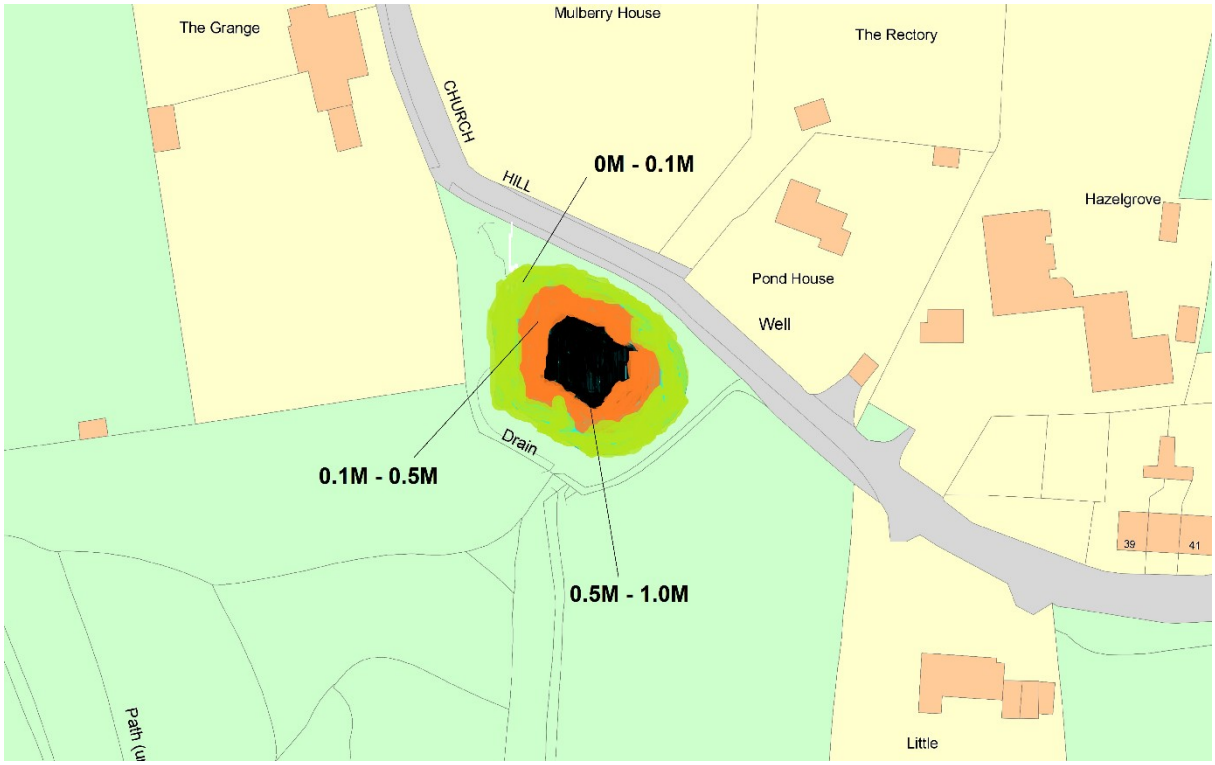
5.3 Sediment and Water Depth

During the survey, Christopher recorded gravel and silt making up the topography of the pond. All six reference points have 3 depth reference points on each survey. The silt is predominately dark organic matter which has washed down from nearby areas.

Sediment map 7.31 illustrates the depth of sediment in the pond. The survey identified deep sediment in the middle of the pond and a hard gravel bottom around the perimeter.

The pond stays wet year-round and makes this a suitable water tanking pond. Shallow bays and deep pools allows the temperature and oxygen levels to fluctuate through the year.

5.31 Sediment/Water Reference Map



0m – 0.1m Sediment depth = 2/2 0.5m – 1.0m Water Depth = 2/2

0.1m – 0.5m Sediment depth = 1/2 1.0m - 1.5m Water Depth = 2/2

0.5m – 1.0m Sediment depth = 0/2 1.5m – 2.0m Water Depth = 2/2

5.4 Plant Diversity

Six sample points were taken to measure plant diversity. Plant diversity has been broken into two categories, Environment and Bankside Vegetation. Map illustration 5.41 identifies the current habitat features around the pond. 100% of the marginal plants are in the sunny sections of the pond and no marginal vegetation was present under the canopy. Moreover, 10% Reed, 65% sedge, 25% Rush and very little Riparian vegetation present around the sunnier sections. A small amount of Water Mint (Mentha aquatica) was found near SVP05.

Rose bay Willow Herb (*Epilobium angustifolium*) was present near SVP05 which is a good pollinator. Overall SVP05 scored well for plant diversity.

Trees and shrubs make up most of the vegetation cover along the southern section of the pond. Moreover, the dense tree cover creates shade across 60% of the pond. Moreover, there is good mix of trees species along the southern section of the pond. Ash, Spindle, Hazel, Willow, Sycamore and Hawthorn. These trees support a few species including bats, pollinating insects and birds. Adjacent Slindon Manor Estate has a thriving Dormice population[5] "*Slindon has a thriving population of dormice in the beautiful woodland"* Although Dormice are present in the adjacent wood, we must assume dormice are using some of the tree species next to Slindon Village Pond.

SVP05, SVP06 and SVP03 seemed to represent better biodiversity value overall. The main reason is a good mix of habitat features, like trees, shrubs, marginal wetland plants. These survey points would have scored higher if the drainage inlets/outlets were more functional.

However, there was no in-channel marginal riparian recorded and this primarily down to the abundance of invasive Carp. In Channel Riparian plants are important pollinators for many insects and food plants aquatic invertebrates[6].

[5] Our work at Slindon | National Trust
[6] buglife ponds & ditches A4 4pp.indd

5.41 Current habitat features present

Marginal Vegetation (Reed, Sedge and Rush

Woodland mix (Hazel, Spindle, Sycamore, Ash, Willow and Hawthorn)

6.0 Pond and Ditch Opportunities for Improvement

- 6.1Biodiversity General Improvements Wetland

The pond contains a water depth of 0.3m year-round the edges and deep water in the middle. This marginal depth is a great opportunity to plant better riparian pollinators around the permitter. Extending the flowering period around the pond will allow more insects to breed and make the pond more attractive. Moreover, more insects will attract more birds, bats and invertebrates. The riparian pollinators also provide food for our long-suffering Water Vole population[i] One of the key species to attract in a pond is the water vole (Arvicola amphibius), the fastest declining mammal in England, (Strachan et al. 2011), and it lives in the linked-up waterways of the MP and is considered a regionally important population. Water voles have specific habitat requirements that include all year-round availability of water and good vegetation coverage on soft earthy banks with a wide range of plant species. These needs do not sound onerous, but water voles do not hibernate, spending much of the winter in their burrows with cached food, but they prefer undisturbed vegetation on the banks all year round for cover and quite steady levels of water.

Recommended Wetland Plants Species for Biodiversity Improvements

- ***Lythrum salicaria***, or purple loosestrife
- *Caltha palustris* or Marsh Marigold
- *Menyanthes trifoliata* or Bog Bean
- Water Mint or *Mentha aquatica*
- Common Reed or *Phragmites Australis*
- Yellow Flag Iris or *Pseudacorus*
- Pendulous Sedge or *Carex pendula*

- **6.11** Trees and Shade

During the survey Christopher recorded the abundance of tree cover and shade creation around the pond. Whilst the Northern and Eastern sides of the pond scored well, the Southern section has a low shade score. This is really about biodiversity balance, a study was conducted at several ponds in Norfolk. They found Macrophyte diversity was significantly lower in unmanaged/shady ponds compared with ponds managed in 2004–2006 and 2007–2009. In addition, with the exception of Mollusca, invertebrate diversity was significantly lower in the unmanaged/shady ponds compared with all the managed ponds. A tendency was evident for diversity to peak 3–5 years after management and for a subsequent decline in diversity (significant for macrophytes). No distinctive species assemblages were associated with the different pond successional stages, although several species were confined to individual ponds. Although many species were absent from the non-managed/shady ponds, especially in the macrophytes and Coleoptera, few species were unique to these ponds.[ii]

Generally, the pond shade cover is 60-70% cover over the pond. Along with the invasive Carp population and poor channel vegetation, the pond contains very little macrophytes. Both shade, fish and a lack of oxygen all relates to a poor macrophytes population. Thinning out 10% crown cover, planting in-channel vegetation and removal of Carp in the pond will improve macrophytes population and therefore improve oxygen levels in the pond. Please read Slindon Village Pond Bat Report for tree cutting

- 6.12 Drainage

The pond has 3 drainage inlet/outlet pipes, all recognised as blocked and not functional. Moreover, the two ditches, one inlet and one outlet were recorded as poor. This is primarily related to poor water storage capacity in the ditches. The ditches are less than 0.5m deep and less than 1 meter wide. Therefore, digging the ditches to 3-4m deep will improve the tanking capacity and manage excess water. Additionally, creating 45 degree bank angles will prevent soil slipping into the ditch. Vegetation will be planted after the work has finished and this will improve drainage and biodiversity. Please read the table 6.2 for detailed reference points.

- 6.13 Buffer strip Biodiversity

During the survey bankside vegetation was also recorded, generally the results are based upon the abundance of cover type. For example, SVP02, SVP03, SVP04 all contain lots of tree cover but no other vegetation type. None of these reference points contain riparian, grasses, Sedges, Reeds and Rushes. This is primary down to the abundance of shade cover over these reference survey points. Moreover, SVP01 and SVP02 has plenty of Grasses, Sedges and Reeds but not enough tree cover. Additionally, Wildflower strips and native flowering trees will also improve biodiversity and a recommended list is detailed below. Please read the table 8.2 for detailed reference points

- 6.14 Wildflowers

Barren Strawberry

Knapweed

Basil
Birds Foot Trefoil
Common Catsear
Dropwort
Field Woodrush
Lady's Bedstraw
Marjoram
Oxeye Daisy
Rough Hawkbit
Selfheal
Wild Clary
Yarrow
Betony
Cow Parsley
Foxglove
Fragrant Agrimony
Greater Burnet Saxifrage
Hedge Bedstraw
Lesser Celandine
Remote Sedge
Sanicle
Stinking Iris
Wild Strawberry

Agrimony
Basil
Birds Foot Trefoil
Common Catsear
Dropwort
Field Woodrush
Lady's Bedstraw

Marjoram
Oxeye Daisy
Rough Hawkbit
Selfheal
Wild Clary

Native Poppy

Corn Flower
Yarrow
Yellow Pimpernel

- 6.15 Native Flowering Trees

Spindle *Euonymus europaeus*

Common Alder *Alnus glutinosa*
Alder Buckthorn *Frangula alnus*
Cherry Plum *Prunus Cerasifera*

Hazel ***(Corylus)***

Wild Cherry *Prunus avium*
Crab Apple *Malus sylvestris*
Malus domestica Discovery Apple
Malus domestica James Grieve Apple

6.2 id numbers & location	Issues / opportunities	Proposed improvement
SVP01 **Grid Ref SU96240818**	Lack in-channel Vegetation. Silt is deep in the middle of the pond. Remove silt from the centre of the pond.	Plant new marginal pollinators along the edge and into the water channel. Plant one or two pollinating trees 2-3m from the pond edge. Use the silt from the pond and create small soil raised areas. Sow wildflower seeds after works.
SVP02 **Grid Ref SU96220816)**	Lack of in-channel Vegetation, Silt is deep in the middle of the pond. Remove silt form the centre of the pond. Hedge along the path is over managed and is cut to regular and prevents future flowering.	Plant new marginal pollinators along the edge and into the water channel. Plant one or two Pollinating Trees 1-2m from the edge. Improve the over managed hedge along the path. This hedge can be hedge layed and plant new species between existing trees to improve biodiversity. Use the silt from the pond and create small soil raised areas. Sow wildflower seeds after works. Moreover plant native bulbs to improve
SVP03 **Grid Ref SU96220816**	Ditch does not tank any water. No bank Side Vegetation lots of shade. Dig ditch 2m-3m deep to improve storage capacity. Crown lift trees around the ditch to improve sunlight	Plant new marginal pollinators along the edge and into the water channel. Crown lift trees over the pond and improve light entering the water. Hedge lay some of the smaller trees along the path perimeter. This will improve hedge thickness, allow more light onto the water, and provide a thick cover for nesting birds. Sow Native blue bells and wood anomies around the woodland area. Create log piles around the woodland perimeter, this will improve the habitat for newts.
SVP04 **Grid Ref SU96240817**	.Lack of in-channel Vegetation, Silt is deep in the middle of the pond. Remove silt form the centre of the pond. Crown lift some of the trees and allow more light onto the water.	Plant new marginal pollinators along the edge and into the water channel. Crown lift trees over the pond and improve light entering the water. Hedge lay and plant some of the smaller trees along the path perimeter. This will improve hedge thickness, allow more light onto the water, and provide a thick cover for nesting birds/Dormice corridors. Sow Native blue bells and wood anomies around the woodland area. Create log piles around the woodland perimeter, this will improve the habitat for newts. Put up bird boxes and bat.

SVP05 **Grid Ref SU96200820**	.Lack of in-channel Vegetation, Silt is deep in the middle of the pond. Remove silt form the centre of the pond. Dig the ditch 3m – 4m and repair the culverts. Create 45 degree angles on the banks to prevent soil spill.	Dig the ditch and remove the silt from the pond. Plant bankside vegetation with riparian plants and wildflower seeds. Use the slit to create small mounds and sow with wildflower seeds. Plant a mix of pollinating trees as described in 8.15. This will improve biodiversity.
SVP06 **Grid Ref SU96430820**	+++	New culvert, plant Phragmites near the culvert. This will collect some of the silt and reduce the phosphate and slow the rate of silt deposition.

7.0 Other environmental Issues found

Due to the abundance of fish, the clarity of the water was opaque on all surveys. Carp are bottom feeders and consume many invertrabrates. Colored (Opaque) water prevents light entering the bottom of the pond. This also prevents aquatic vegetation from growing on the bottom.

7.1 Water Quality

The EU Water Framework Directive was adopted by the UK in Dec 2000 and it covers water quality in river catchments, in groundwater and aquifers, the abstraction of water, and runoff from all sources and pollution types.

While we did not analyse the water quality in Slindon, but we are aware of the symptoms of runoff, particularly of nitrates and phosphates, and where possible we noted their source. Most arable farms use nitrates based fertilisers intensely and there is no organic farming in the Parish. The ditches, where they have a good margin and a range of riparian vegetation on the banks, even small relic reedbeds can utilise this nitrate runoff and ‘mop it up’ before it gets passed on through the water course. If the nitrates stay in the water this can lead to eutrophication and significant algal growth which uses up all the oxygen in the water. This effectively kills all other species so that no invertebrates or other aquatic plants can survive and so the water way loses its biodiversity. Even ditches with vegetated margins can become covered in algae and blanket weed as field drains bypass this vegetated fringe and deliver water directly into the ditch.

Blanket weed, and algae were seen in many ditches and, as this was not a specific item to note on our original ditch condition assessment form, we did not map it.

Nitrate and Phosphate analysis

Over the course of the FLOW project University students carry out individual pieces of research and a Masters student, Claire Lipop, from the University of Oxford spent the 2017 summer assessing water vole habitat across the MP, (C. Lipop 2017). She looked at ponds and waterways, their vegetation structure, water levels and some water quality issues. During her analysis she checked the phosphate and nitrate levels of these areas and 5 sites were in the Parish of Earnley.

Nitrate levels: of the 5 sites looked at for nitrate levels, 2 were free of nitrate pollution, 2 showed slight levels, and 1 had significant levels of nitrates in the water. The factor here seemed to be the size of the waterway/pond and the larger the channel/wetland, the higher the nitrate levels. This may be due to the fact that the larger waterways get the water from other sites and, so they receive runoff from many farmer's fields and it has had a cumulative effect. One of the sites to higher levels of nitrates was the new Earnley Flood Channel and it may be that the vegetation in this channel is not yet colonized enough to help absorb these nitrates. This channel was not planted up and over time it is slowly developing riparian vegetation that can help to combat the pollution.

Phosphate levels: of the 5 sites studied only 2 of the sites showed significant phosphate levels, both connected - Bookers Lane ditch and, again, the Eranley Flood channel. Both receive water from the north of the Earnley Parish, and also part of East Wittering and Bracklesham Parish. This is a large catchment with arable farming and the ditches will have picked up the phosphate through runoff. By not overmanaging these ditches and allowing the vegetation to grow on the banks and in the water, it may help to combat the effects of the high phosphate levels.

8.0 Timescales

Work must be planned to fit in with the boundaries set by the wildlife and Countryside Act 1981, amended 2006, so that the birds/Dormice breeding and nesting season is avoided and also the water vole breeding season. This begins at the end of February and runs to the end of July, and during that time no removal of tree or hedgerow vegetation can take place, or ditches that may contain water voles (unless they are checked and voles absent or removed with a NE license).

Work may be best carried out between the end of July and the end of October, before the ground is too wet for heavy vehicles, and when the ditches are dry and do not have water voles in them – subject to checking. Where ditches have no records of water vole activity (can be checked via the Sussex Biodiversity records Centre http://sxbrc.org.uk/). Advice should be sought from the EA's Biodiversity Department (lead agency for water vole conservation) before carrying out any work on or around water vole habitat and Natural England (www.gov.uk/guidance/water-voles-protection-surveys-and-licences). Water voles can breed as late as October, dependant on the weather and therefore surveys must take place before any work is proposed. It may be that mitigation will be necessary.

The presence of ground nesting and wading birds would need to be considered during the winter months but the work recommended in this report does not affect their habitat directly but may take place adjacent to farmland and indirectly disturb them.

9.0 Management priorities

Ditch Management

Many long term drainage and habitat issues can be solved with sympathetic monitoring and maintenance actions. Capital works can be paid for with grants or carried out by local councils but unless the work is followed up with regular management this money will have to be spent again 5 years or so down the line for the work to be repeated.

Ditches need to be managed carefully for drainage purposes and so that they function as good wetland for wildlife. This does not have to be mutually exclusive and by sympathetically cutting vegetation on the banks of ditches, not totally removing it, this provides better erosion resistance, which in the long term can affect the carrying capacity of ditches.

Where hedges are associated with a ditch it is common for the field side only to be managed and this allows the ditch to recover quickly and continue to offer wildlife habitat. Trees next to ditches should still be lightly managed and some left alone. Consideration should be made for the Hazel Dormice nearby. Dormice forage on nectar on many trees and require trees producing flowers and seeds. Hard tree management reduces their survival rates and any cutting should be reduced to one or two trees every 3/4 years[7]. Some light in a ditch is better than no light and cutting back to prevent shading of the water but all debris should be removed or it will block up the ditch, prevent water flow and potentially cause problems.

Refer to EA document '*delivering consistent standards for sustainable asset management*' Version 3 March 2012 for different cutting regimes that takes wildlife and water heights and conditions into consideration.

The debris from vegetation cuts around ditches, and hedge management, should be removed from site and not left in the ditch. This will only cause problems. Any silt removed from the ditch channel, where possible, should be left on the bank for 48 hours, to allow invertebrates to re-colonise the water, but should then be removed. Putting nitrogen rich sediment on the edge of the bank will cause some of the loose material to fall back in to the water if it rains, negating the work done, and it will produce a flush of nettles and reduce biodiversity along this edge. Where possible, time the work with ploughing of the field, and with an EA D1 exemption certificate, this nitrogen rich material can be spread across the field.

[7] EN DORMOUSE HANDBOOK (4663) (ptes.org)

Ensure that no manure or silage is stored on ditch margins but kept away from waterways so that the nutrient rich runoff cannot pollute the water.

The wider the margin between the ditch and / or hedge, and the farmed land, the more wildlife potential the network will have, especially if it is not mowed more than twice a year and the debris removed. This could provide pollen rich and wild flower areas for invertebrates and birds to use.

10 Sources of future help

Funding - grants

For the larger physical works to be carried out, landowners who have the equipment will be encouraged to do this work where possible. However, it may be that contractors or vehicles can be hired in to do the work but the issue of spoil removal will also need to be considered.

West Sussex County Council Operation Watershed fund - this has been supplied by central government for the use by local flood groups and organisations in the County for flood relief work and applications and information about the grants are available at https://www.westsussex.gov.uk/leisure-recreation-and-community/supporting-local-communities/operation-watershed/

Countryside Stewardship, managed by Natural England, can be considered in some cases with Mid-Tier and Capital Grants for wetland creation and improvement work:

Other grants that could be applied for.

Chichester District Council Communities Fund – looking at parishes south of Chichester and one of their priorities is to improve the wildlife value of the area – any wetland or hedgerow improvement could fall into this category. http://www.chichester.gov.uk/article/24324/Funding-opportunities

Heritage Lottery Fund – through the FLOW project – some monies maybe found to finance works but in-kind contributions would be sought from landowners and farmers to maximise the benefits.

There may also be **biodiversity grants** available from private companies Biffa, Viridor and Veolia, and plastic bag and other smaller grants that can be applied for from a range of supermarkets and retailers.

ii Labour – volunteer led work

Use local volunteers across the SDNP to manage wetland and other habitat sites. Their knowledge and experience can be utilised to get working parties going and to lead improvement work.

Vegetation clearance work will need to be carried out on a rotational basis. The initial work, on overgrown ditches will be time and labour intensive but in future years this should be easier as only one years' worth of growth is tackled. A regular programme of works in each Parish, focussing on those particularly important ditches is the key, and making it a fun team building community experience that involved everyone will encourage continual participation.

work and volunteers can add value by providing refreshments, helping to do surveys, draw maps etc.

11. References

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14. Appendices

i. Ditch Condition Assessment Form (FLOW)

Ditch Assessment – Score Sheet

Survey Information					
Location		Survey Ref.		Grid ref.	
Recorder		Date		Rainfall	
Water present	Y/N	Depth (m)		Flow	

Attribute	Scoring criteria	Score
Water availability	Dries out = 0; unsure = 1; always wet = 2	/2
Ditch profile		
Ditch width	<0.5m = 0; 0.6m-1m = 1; 1.1m-2m = 2; 2.1m-4m = 3; >4m = 4	/4
Ditch depth	<0.5m = 0; 0.6m-1m = 1; 1.1m-2m = 2; >2m = 3	/3
Banks slope	neither bank slope between 30° and 60° = 0; one side only = 1; both sides = 2	/2
Bank structure	Concrete = 0; gravel/sand/earth etc. = 1	/1
	Total	/10
Environment		
B1* Buffer width	0m = 0; 0.1m – 1m = 1; 1.1m – 2m = 2; 2.1m – 4m = 3; > 4m = 4	/4
B2 Buffer width		/4
B1 Disturbance	High = 0; medium = 1; low = 2; none = 3	/3
B2 Disturbance		/3
B1 Bank erosion	Medium/high = 0; none/low = 1	/1
B2 Bank erosion		/1
Litter	Abundant = 0; present (1-2 items) = 1; absent = 2	/2
	Total	/18

Bankside vegetation					
B1 Trees	/2	B2 Trees	/2	Absent = 0 Present = 1 Abundant/dominant =2	
B1 Bushes	/2	B2 Bushes	/2		
B1 Riparian forbs	/2	B2 Riparian forbs	/2		
B1 Sedges	/2	B2 Sedges	/2		
B1 Rushes	/2	B2 Rushes	/2		
B1 Reeds	/2	B2 Reeds	/2		
B1 Long grass	/2	B2 Long grass	/2		
Total	/14	Total	/14	Total	/28

Emergent vegetation		
Open water	<40% = 0; 41%-60% = 1; >60% = 2; (if dry enter NA)	/2
Channel vegetation	>61% = 0; 41%-60% = 1; 1-40% = 2; (if none enter NA)	/2
	Total	/4
Management		
Rotation	Both sides managed together = 0; different timings/types = 1	/1
Shading	Watercourse >80% shaded by vegetation =0; 40%-80% = 1; <40% = 2	/2
Sediment depth	>0.25m = 0; 0.1m-0.25m = 1; <0.1=2	/2
Cutting	Insensitive = 0; unknown/unsure = 1; sensitive = 2	/2
Invasive species	Any non-native invasive sp. = 0 (record info in sketch); none present = 1	/1
	Total	/8

	Overall score:	/70
	<20 = red 21-40 = amber >40 = green	
Modifier	If score category does not reflect the ditch surveyed justify the new score category below	

*B1 = north or east bank of ditch, B2 = south or west bank of ditch

Additional ditch information					
Drainage issues	Previous flood events in vicinity				Yes / No
Connectivity	Number of adjoining ditches (if culverted more than 10m = no connection) **Include ditches at either end of surveyed section**				
Adjacent land use	B1	Arable Pasture Residential Garden Road Commercial Other ……	B2	Arable Pasture Residential Garden Road Commercial Other ……	
Hedgerow present	B1	Yes / In-part / No	B2	Yes / In-part / No	
Hedgerow survey	B1	Yes / No	B2	Yes / No	

Pipes/culverts in ditch section		
Please record the location and condition of any pipes the ditch flows through, including at the start and end of the surveyed section.		
Ref. number (please label on map)	Condition description e.g. clear / blocked / collapsed / unknown	Approximate size
1		
2		
3		
4		
5		

Additional comments	
e.g. any recent disturbances, blockages, information received from local people, concerns about invasive species, nature of any pollution, etc. Include a diagram if necessary	

Annotate the survey map with the following information:

- Direction of flow where evident
- The location of any pipes/culverts with the reference number used on this form
- The location of any points of note e.g. sewage locations, blockages, invasive species, water vole signs etc.
- Mark any areas of flooding or very wet ground
- The location of any ash trees

Photo taken? Yes / No

[i] Species – Water Vole – The Mammal Society

[ii] **The role of pond management for biodiversity conservation in an agricultural landscape.** The role of pond management for biodiversity conservation in an agricultural landscape - Sayer - 2012 - Aquatic Conservation: Marine and Freshwater Ecosystems - Wiley Online Library