Chesham Moor - Baseline report

Part A – Modular River Survey

Smarter Water Catchment Programme

July 2024

Working in partnership

Thames Water · The Rivers Trust · Chilterns Chalk Streams Project · Chilterns · Chiltern Society · Environment Agency · Affinity Water · Herts & Middlesex Wildlife Trust · Queen Mary University of London

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1 Introduction

This report contains a description of the baseline Modular River Survey (MoRPh) data captured by citizen scientists engaged on the River Chess at Chesham Moor located approximately 1km south east of the town centre of Chesham (Figure 1.1). This report will focus on the River Chess at the Chesham Moor site which runs south east within Chesham Moor park alongside Waterside road. The site is immediately downstream of a culverted section of the River Chess under Bois Moor Rd (Figure 2.1).

MoRPh is a bankside surveying technique developed by Queen Mary University of London that enables non-specialists to gather scientific data on the physical, ecological and hydrological condition of water bodies and adjacent land. Short lengths or 'subreaches' of the river are surveyed and the results are used to calculate 14 indices that represent physical habitat mosaics and human pressures. The surveys allow independent monitoring and evaluation of our river restoration projects. We can therefore be held to account if project goals are no longer being met, and can investigate and intervene if necessary, to ensure the long term-success of restoration work.

A programme of recruitment and training was started in early 2022, kindly funded by a grant from the Chess Smarter Water Catchments Programme. As of January 2024, our volunteers have undertaken 158 MoRPH surveys throughout the Chess catchment. This demonstrates a huge commitment from volunteers who have not only provided their time but have also co-ordinated to ensure surveys are completed, and demonstrated a great level of rigour to ensure the data gathered and uploaded is of the best quality possible.

Figure 1.1 General views of the baseline (pre-restoration conditions of the River Chess at the Chesham Moor site. Taken at subreach 6 (April 2023)

In this report, we summarise the findings of the pre-restoration (baseline) MoRPH surveys at the Chesham Moor site. We make comparisons with the online MoRPh database[1] which contains all the data collected by citizen scientists since the Modular River Survey began in 2016, and have filtered out the

[1] MoRPh Citizen Science Map, https://modularriversurvey.org/map/, accessed 12/02/24

surveys undertaken on chalk streams[2]. This is used to help us measure the current condition of the river in comparison to the wider River Chess catchment and other chalk streams across the UK.

We have summarised the baseline conditions of the Chesham Moor site because future river restoration works are planned for the River Chess catchment. To set river restoration objectives, it is necessary to understand the site, as the baseline conditions will help us decide which restoration activities are most suitable. In this report we also summarise the restoration activities that are planned for the Chesham Moor site and we link the activities to the baseline conditions gathered from the pre-restoration MoRPh surveys.

It is worth noting that the analysis within this report is based on the average values from the baseline citizen science MoRPh surveys. Therefore, we have not discussed the possible differences in the results due to surveys undertaken in multiple seasons.

2 What did we learn from the baseline MoRPH surveys?

2.1 Site overview

Baseline surveys were undertaken on seven subreaches[3] of the River Chess (Figure 2.1) at Chesham Moor in August and September 2022 and April and October 2023. As multiple surveys were undertaken, the data shows all of the results from all of the sites. The River Chess has been affected by centuries of historical modification, including canalisation and drainage for flood defence, farming and fishing pursuits, urban development and for industries such as milling.

At the Chesham Moor site, the channel was heavily modified and straightened, and sections of the channel were confined within hard concrete banks. At the upstream end of the site, the channel is constrained by a culvert which was causing the flow to back up and become stagnant. Along the site, there are areas of no riparian cover and areas where the riparian vegetation is heavily overgrown. The land use is primarily residential and recreational (green space) (Figure 1.1).

[2]Sites from the MoRPH database were filtered based on whether they were undertaken within 50m of a chalk stream (utilising: DEFRA Priority Habitat Chalk rivers and Streams, https://naturalengland-defra.opendata.arcgis.com/datasets/1bb8e710c8254e8fa33e95c7bc13229e, accessed 15/01/24)
[3] Subreaches are sections or 'reaches' of the river that have been divided up to undertake the survey following the standard MoRPH methodology

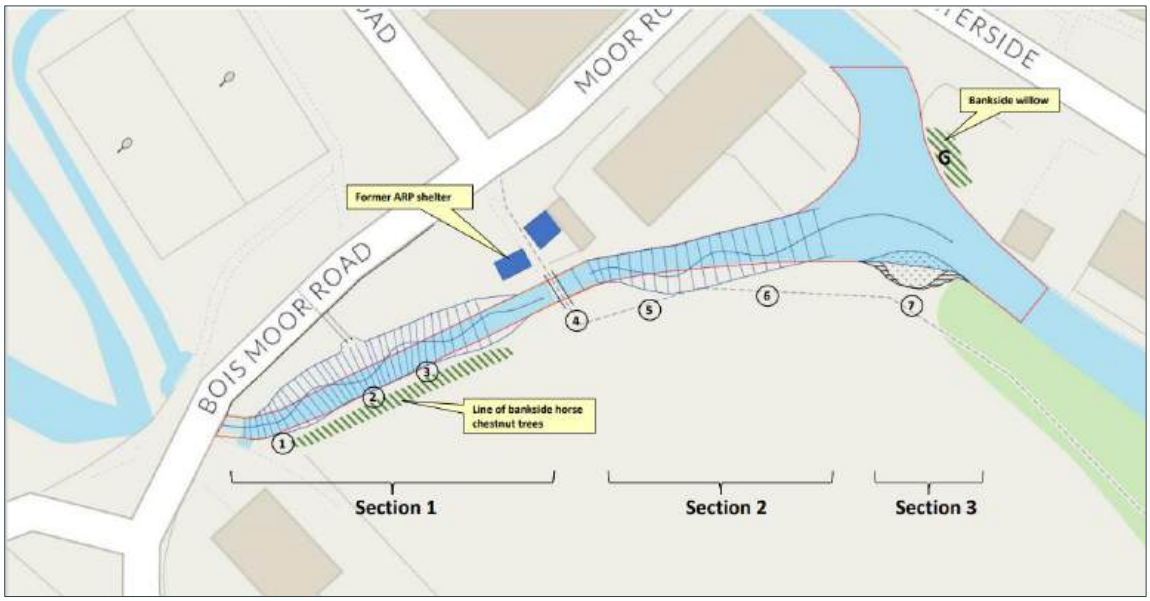


Figure 2.1 Map of the River Chess at the Chesham Moor site, showing the locations of the MoRPH subreaches (black circles 1-7) and the proposed new channel design split by sections 1, 2 & 3 of river restoration activities.

The Pre-Project MoRPH data (Figure 2.5 and Figure 2.6) shows the number of flow types (Index 1) were on average low (1-2) (Figure 2.2), about the same as the UK chalk Stream average, but well below what the river would naturally contain (pre-modification). Index 2 also illustrates that the highest energy flow types were smooth, rippled or unbroken standing waves.

Figure 2.2: Examples of the lack of flow diversity and the flow types smooth and rippled. Taken from Subreach 2 (left, October 2023) and Subreach 7 (right, October 2022).

At the majority of the seven subreaches, gravel-pebble was the coarsest bed material size covering the river bed. Silt was the next most common bed material size. The extent of bed siltation was very variable. The majority of subreaches either recorded very low (0-2), or high (7-8) extents of bed siltation. This likely reflects the overwide nature of the channel in some sections. However, this also relates to how the vegetation cover and flow conditions vary between surveys undertaken in different years and different seasons. Additionally, as the baseline surveys were taken over two different years, the knowledge and understanding of the citizen scientists may have improved over time with further training.

The frequency distributions illustrate the low physical habitat complexity of the site due to the low channel physical habitat (Index 8) and riparian physical habitat (Index 10). Similarly, there was little

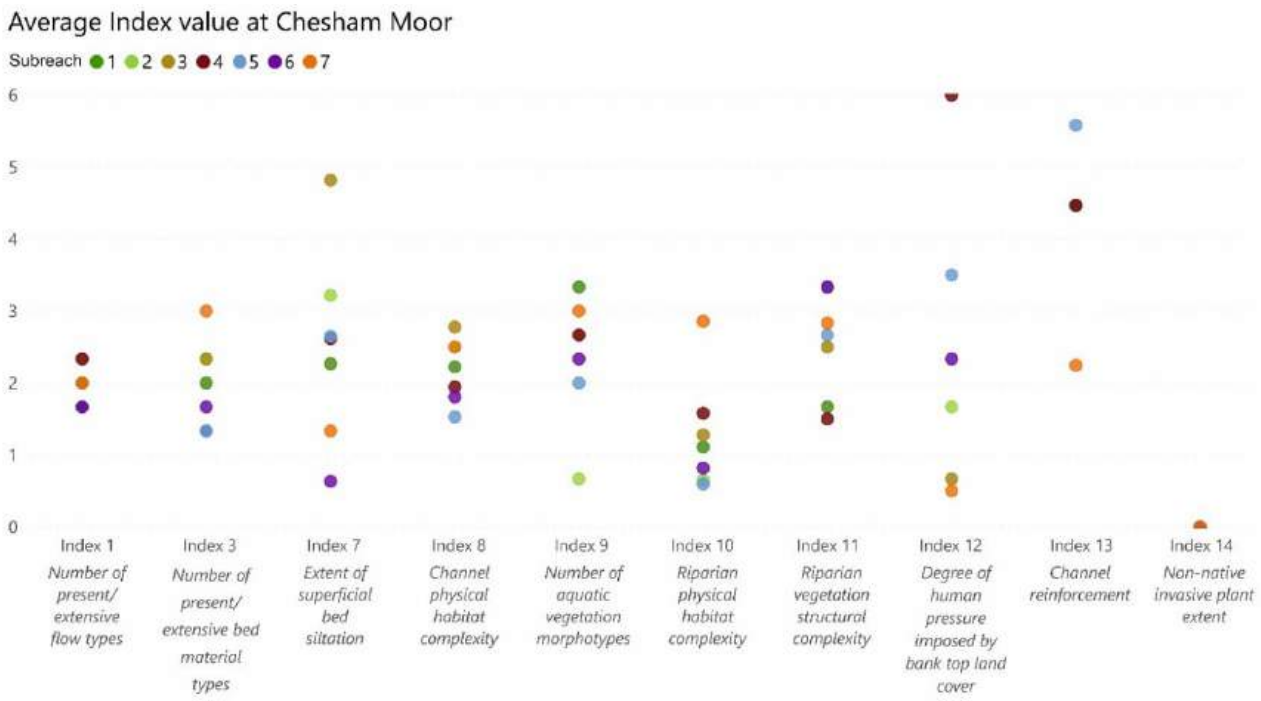
diversity in the aquatic vegetation morphotypes[4] (Index 9) and riparian vegetation structure (Index 11) across the site which demonstrates the low complexity of the aquatic and riparian vegetation. This was likely to be reflecting the variability of the riparian vegetation which was very sparse at some subreaches and overgrown at other subreaches, causing extensive channel shading (Figure 2.3). The bank top along the subreach is managed to restrict growth of vegetation, which is likely to be preventing the long-term regrowth of long grass, shrubs and small trees. This is likely the reason for the low complexity of riparian vegetation recorded.

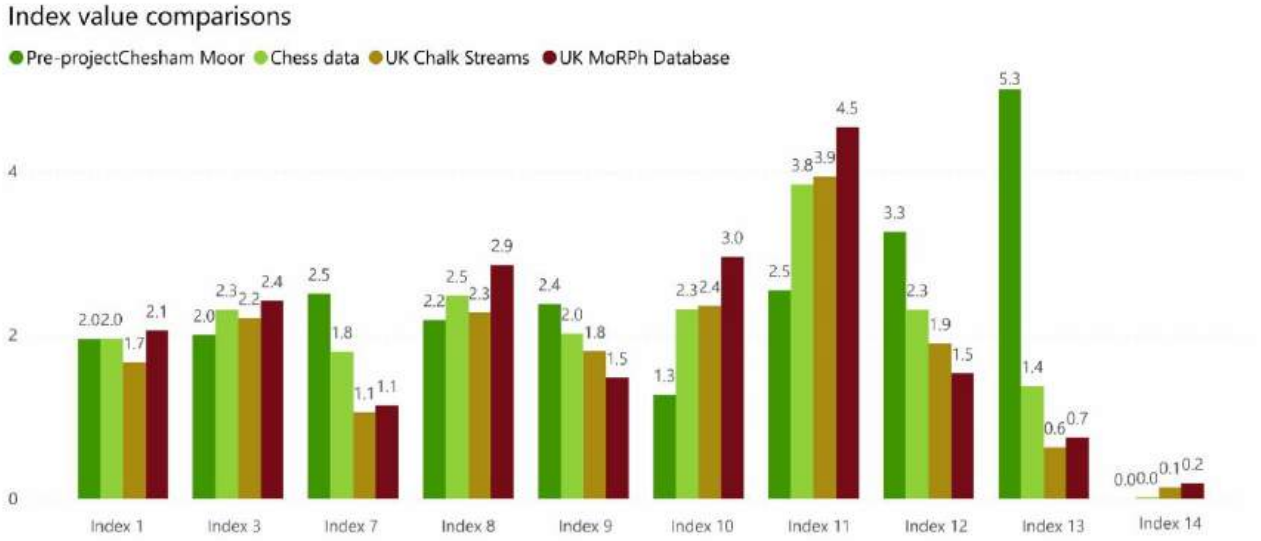
Figure 2.3: Evidence of the variability of riparian vegetation as it was very sparse at some subreaches (left taken at Subreach 1, April 2023) and overgrown at other subreaches (photo in Figure 2.2, right taken at Subreach 7, October 2022).

Human pressure and channel reinforcement was identified at the majority of the subreaches. This was linked closely to the road culvert at the upstream end of the site (Subreach 1), the concrete channel banks and concrete footbridge (Figure 2.4). Additionally, human pressure on the bank top is visible by the limited riparian vegetation diversity, which is likely due to maintenance preventing long grass, shrubs and trees from establishing. No non-native plant species were recorded at any of the subreaches.

Figure 2.4: Photos of human pressure at the site. Upstream culvert taken at Subreach 1 (left, October 2023), and concrete lined channel banks taken at Subreach 4 (right, October 2023).

[4] Organisms that share particular physical characteristics (size, height etc.)





Dataset	Index 1	Index 3	Index 7	Index 8	Index 9	Index 10	Index 11	Index 12	Index 13	Index 14
Pre-project Chesham Moor	1.95	2.00	2.50	2.18	2.38	1.27	2.55	3.26	5.27	0.00
Chess data	1.96	2.31	1.80	2.48	2.02	2.32	3.84	2.31	1.38	0.00
UK MoRPh Database	2.05	2.42	1.14	2.86	1.48	2.95	4.54	1.53	0.75	0.19
UK Chalk Streams	1.67	2.21	1.05	2.27	1.80	2.35	3.93	1.90	0.63	0.14
Total	**1.91**	**2.23**	**1.62**	**2.45**	**1.92**	**2.22**	**3.72**	**2.25**	**2.01**	**0.08**

Figure 2.5 Summary of the pre-restoration (baseline) averages of the MoRPh indexes[5] per subreach from the Chesham Moor site. Also shown are index value comparisons for all MoRPh surveys on the River Chess (light green), UK average chalk stream values (brown), and average values for all rivers within the Citizen Science MoRPH database (red).

[5] Indexes 2,4,5,6, are excluded from these plots as they are not numbers between 0 and 10.

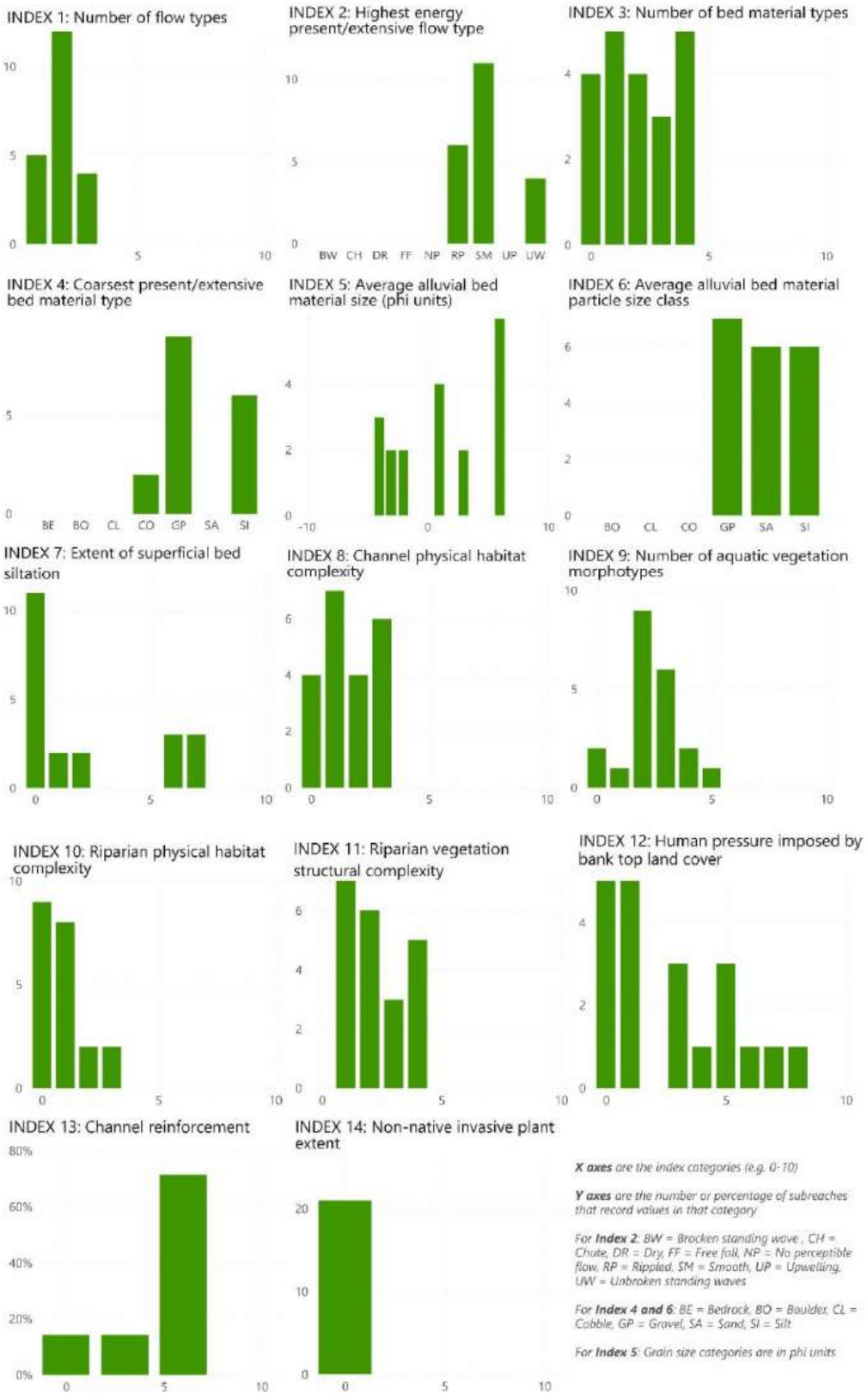


Figure 2.6 Frequency distributions of MoRPh Index values 1-11 for the pre-restoration (baseline) surveys of the Chesham Moor site.

2.2 Channel bed siltation

A detailed breakdown of bed siltation along the channel within the site is shown in

Figure 2.7 (Index 7) illustrates the extent of silt of the channel bed recorded by the trained citizen science surveyors. UK chalk streams are expected to have relatively low levels of silt across the channel bed as a high proportion of the flow is groundwater fed[6]. Within the site, the extent of bed siltation recorded varied extensively and there was a higher extent of bed siltation at the upstream end of the site. Subreach 3 recorded the average highest extent of bed siltation and Subreach 6 had the owest average extent of bed siltation. This is likely related to the overwide channel conditions at the upstream end of the site and the increase in-channel vegetation obscuring the channel bed towards the downstream end of the site (Figure 2.8).

Figure 2.7: Index 7 at each subreach.

Figure 2.8: Evidence of overwide conditions taken at Subreach 2 (left, October 2023) and dense in-channel vegetation obscuring the channel bed taken at Subreach 6 (right, August 2022).

2.3 Riparian margin

A detailed breakdown of the riparian habitat along the channel within the site is shown in Figure 2.9. Index 10 and 11 illustrate the physical habitat complexity of the riparian margins and the complexity of the riparian vegetation. Along the site, there was a high level of variability of the riparian vegetation which was very sparse at some subreaches and overgrown at other subreaches, causing extensive channel shading. Subreach 7 displayed the highest amount of physical habitat complexity and vegetation complexity, as shown in Figure 2.3.

[6] Beth Mondon et al., 'The Sedimentology of Gravel Beds in Groundwater-Dominated Chalk Streams: Implications for Sediment Modelling and Management', River Research and Applications, 2024).

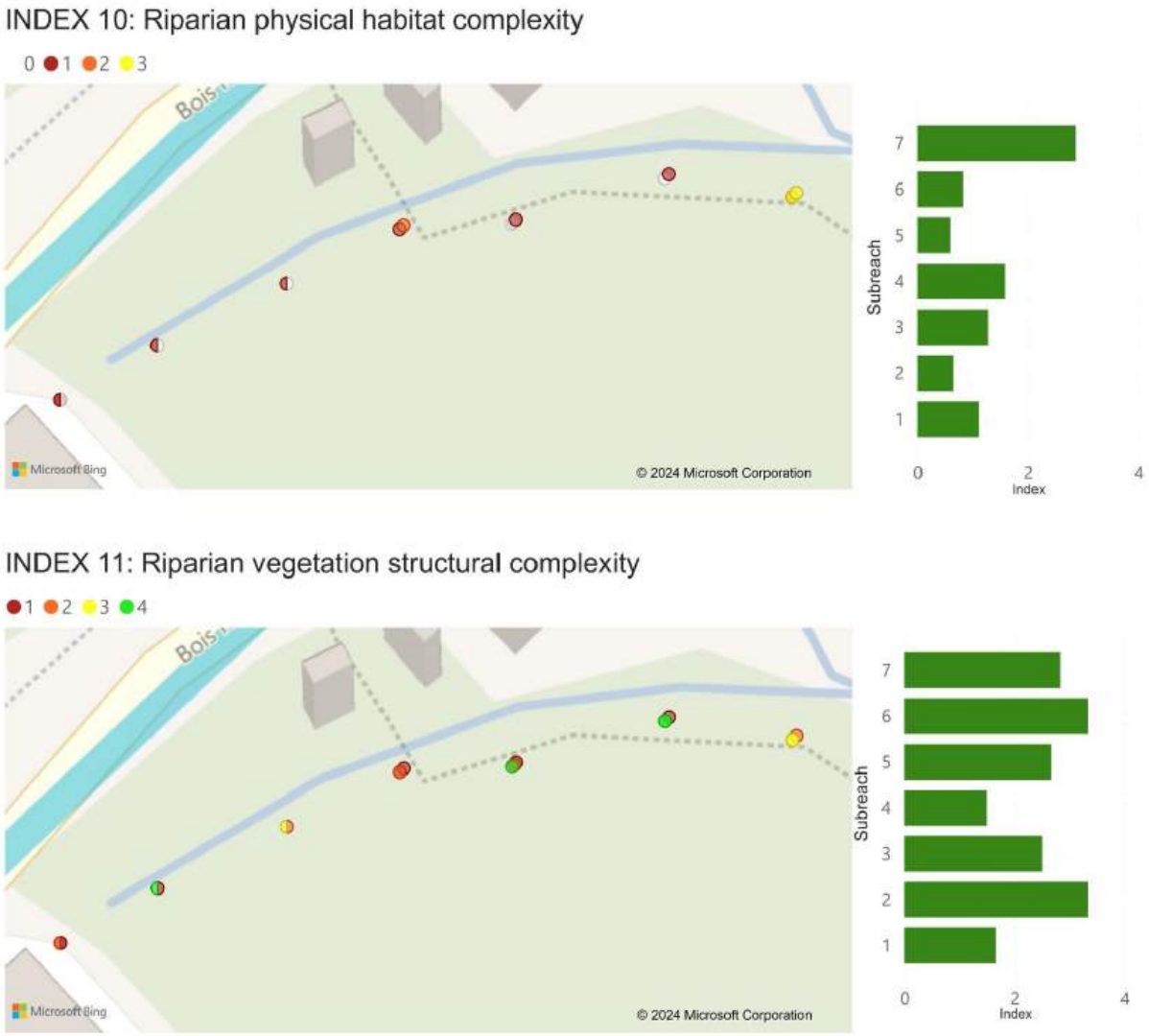


Figure 2.9: Index 10 and Index 11 at each subreach.

3 What restoration works are proposed for the site?

As outlined above, the river channel at the Chesham Moor site has been heavily modified due to the urban setting.

A detailed restoration plan has been prepared by the Chiltern Society and the Chilterns Conservation Board[7]. This project has been so far funded by the government's Green Recovery Challenge fund, a scheme to help nature recovery and tackle climate change, the project aims to combine practical restoration and enhancement with education and engagement. Going forward, the project will be funded by Affinity Water.

The aims of our restoration project are to reverse the detrimental effects of past physical alterations to the channel and so restore a more diverse and naturally functioning river. This will allow the chalk stream to have a more natural flow and for there to be a better relationship between it and the surrounding landscape. Our restoration works plan to remove the concrete walls and widen the main channel to

[7] Chalk Stream restoration work at Chesham Moor – A proposal to reinstate the natural banks along a 200m section of the River Chess side channel downstream from Bois Moor Road.

approximately 7m at its maximum. This will provide a more natural gradient of the bank slope as well as space within the bed for a channel with features of traditional chalk streams.

The design of the channel is two-stage; first stage is narrowing the channel to help focus lower flows and minimise sedimentation which reduces the need for maintenance, provides spawning sites for fish and encourages growth of vegetation in the channel; The second stage involves vegetated shelves being used to allow the channel to accommodate larger flows without flooding.

Our restoration works will be carried out in three sections (Figure 2.1):

- SECTION 1: The channel will be pushed to the left to help protect the existing trees and new reed beds will help reduce pollution from entering the channel from the roadside gulleys.
- SECTION 2: Downstream of the footbridge the channel will encroach into the field on the right bank in order to protect the residential garden boundaries.
- SECTION 3: A gravel 'beach' will be created to help reduce the risk of erosion and provide safer access for people to visit the site.

Once our restoration project has been undertaken, we would expect to see future improvements in many of the indices as the system adjusts following restoration work. In future post-restoration MoRPh surveys this will include:

- Improvements in the number of flow types (flow diversity) due to the two-stage channel design that will accommodate low and higher flows.
- An increase in the number of aquatic vegetation morphotypes[4] due to the more natural in-channel habitat created by the two-stage channel design.
- Improvements in the riparian vegetation habitat complexity through removal of concrete bank, providing soft bank for vegetation development. Alongside increased maintenance of overgrown riparian vegetation and a reduction in management of riparian grass allowing vegetation to increase in diversity.

The table below (Table 3.1) describes our restoration activities proposed at each subreach within the three sections.

Table 3.1: Details of the proposed restoration work within each section and sub-reach of the River Chess at the Chesham Moor site.

Section	Subreach	Restoration works
1	1	• Upstream limit of concrete bank removal and bank reprofiling. • Develop channel sinuosity through narrowing. • To improve the flow diversity, aquatic vegetation and reduce siltation.
	2	• Concrete bank removal. • Create a reed bed where two road outfalls discharge. • Develop channel sinuosity through narrowing. • To improve the flow diversity, aquatic vegetation and reduce siltation.
	3	• Concrete bank removal. • One tree removal to increase light levels in the channel. • Develop channel sinuosity through narrowing. • To improve the flow diversity, aquatic vegetation and reduce siltation.
2	4	• New replacement footbridge, wider for better accessibility.
	5	• Move the channel into the field on the right bank to protect the residential gardens. • Improve maintenance to reduce overgrown riparian vegetation. • Improve light levels in the channel and riparian vegetation diversity.
	6	• Move the channel into the field on the right bank to protect the residential gardens. • Narrow the channel and introduce maintenance to manage marginal vegetation. • To improve the flow diversity, aquatic vegetation and reduce siltation
3	7	• Create a gravel 'beach' to reduce erosion during high flows and provide safe access for visitors. • To improve the flow diversity, aquatic vegetation and riparian vegetation diversity.

4 Conclusions

MoRPH surveys of the River Chess at the Chesham Moor site have enabled us to understand the pre-restoration (baseline) conditions. From this, we can make the following conclusions:

- The site has relatively poor in-channel and riparian habitats that includes a lack of flow diversity and riparian vegetation diversity.
- The poor condition of the site is attributed to the extensive historic human modifications including concrete channel banks, channel straightening and over-widening, urban land use and lack of riparian vegetation maintenance.
- Restoration works have been planned for the site based on the baseline conditions and aim to restore a more diverse and naturally functioning river.
- The restoration works include creating a two-stage channel to focus low flows and accommodate flooding while improving sedimentation. The works involve removing parts of the concrete banks and improving management of the riparian vegetation (introducing maintenance of overgrown vegetation and a reduction in grass cutting to allow grass and shrubs to grow).
- Once complete, in future post-restoration MoRPh surveys, we would expect to see improvements in many of the indices as the system adjusts following restoration work. Including increases in the number of flow types and aquatic vegetation morphotypes[4]. Alongside, higher riparian and in-channel physical habitat and structural complexity.

MoRPh citizen science surveys are a great technique for non-specialists to gather scientific evidence on the conditions of waterbodies. They are also a valuable way for the community to feel more engaged with their local river. We hope that these surveys have enabled volunteers to explore unfamiliar parts of the River Chess and appreciate it in a new way and are excited to see the results of future surveys.

MANY THANKS FOR ALL THE EFFORT WITH SURVEYING AND WE HOPE YOU'VE ENJOYED OUR REPORT. WE WOULD LOVE TO HEAR ANY FEEDBACK AT CHESSCS@CHILTERNS.ORG.UK

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