6 Construction

Preface

This chapter has been updated to reflect the revised proposals which involve significantly less dredging and land reclamation in Broadwater Lake than the 2023 Scheme. The indicative programme for construction works has also been updated and further information provided on appropriate timing of works given the sensitivity of the Site. The following appendices have also been updated to reflect the revised proposals:

- Appendix 6.1: Outline Construction Environmental Management Plan (CEMP), including Annex 1: Detailed Construction Logistics Plan (CLP); and
- Appendix 6.2: Construction Phasing Drawings.

6.1 Introduction

6.1.1 This chapter describes the construction process including the enabling works, dredging, land reclamation, construction and demolition works and other key activities that will be undertaken prior to completion and operation of the Proposed Development. It also provides an indicative programme for the construction works and proposed phasing and timing.

6.1.2 This chapter has been prepared by Quod in conjunction with the Applicant and the project team. Information on enabling, demolition, in-lake and construction works may be subject to modification following appointment of a Principal Contractor(s). For this reason, the EIA is based on reasonable worst-case assumptions as set out in this chapter and the collective experience of the EIA consultant team with similar projects.

6.1.3 It should be noted that this is a descriptive chapter. Assessments of construction phase effects of the Proposed Development are provided in each technical chapter of this ES (i.e., Chapters 7 to 10). Each technical chapter also assesses the cumulative impacts of construction of the Proposed Development with other development schemes.

6.1.4 This chapter is supported by the following appendices:

- Appendix 6.1: Outline Construction Environmental Management Plan (CEMP), including Annex 1: Detailed Construction Logistics Plan (CLP); and
- Appendix 6.2: Construction Phasing Drawings.

6.2 Construction Programme and Timing

6.2.1 The timing and duration of construction work has been carefully considered due to the ecological sensitivity of the Site and its surrounds. Notably, important populations of wintering birds use Broadwater Lake from mid-October to mid-March and breeding birds between March to August.

6.2.2 A detailed construction programme will be developed with input from the project ecologist once a Principal Contractor is appointed based on the principles set out in Table 6.1.

Table 6.1: Timing of Works

Works	Principle
Demolition of existing Broadwater Sailing Club (BSC) buildings	September only
Vegetation clearance on the Peninsula	Outside the breeding bird season (September to end February)
All other works on land	All year-round, no timing restraints (may require breeding bird checks)
Works within Broadwater Lake (outside the Eastern Channel) including island removal and alteration.	September only
Vegetation clearance in the lake (Eastern Channel)	Outside the breeding bird season only (September to end February)
Eastern Channel – dredging	September only
East channel – initial land reclamation (works in and out of the water)	September – October. Water temperature to be above 10ºC to ensure eels active and can swim away from disturbance.
All other works in the Eastern Channel (on existing and reclaimed land)	No timing restraints

6.2.3 The indicative delivery programme for the Proposed Development is estimated to be approximately 16 months. Subject to planning permission and other consents / licences, enabling works are anticipated to commence in the second quarter ('Q2') of 2026 and with completion of works by the start of 2028 although this may be subject to change.

6.3 Indicative Construction Phasing

6.3.1 Indicative construction phasing drawings are presented in Appendix 6.2. Construction of the Proposed Development will indicatively be phased as follows:

Phase I - Pre-commencement Works:

- Installation of site compound and facilities
- Access Road improvements
- Creation of a visual screen across Broadwater Lake using submerged willow planters

Phase II - In-lake Works:

- Dredging
- Removal / reduction of islands
- Land reclamation

Phase III – Peninsula Works:

- Construction of building, structures and roads
- Landscaping

Phase IV:

- Post-construction ecological enhancements including floating reedbeds, tern rafts.
- Ecological reinstatement of BSC and relocation of pontoons

6.3.2 There is likely to be an overlap of some phases to ensure that works are carried out within the timing restrictions set out in Table 6.1.

6.4 Existing Uses

6.4.1 The BSC is expected to continue to operate at the lake throughout the majority of the construction period. Demolition of the existing BSC building will occur once the facility on the Peninsula is constructed and fit for use.

6.5 Description of Works

6.5.1 The following sections provide a description of the likely construction activities required to deliver the Proposed Development associated with enabling works, demolition and construction. As appropriate to each stage of the works, the Principal Contractor will be required to ensure the necessary consents and approvals have been obtained from the relevant authorities.

6.5.2 Some of the construction activities will need to be subject to environmental permits under The Environmental Permitting (England and Wales) Regulations 2016 ('EPR') such as the storage, treatment or re-use of waste for the purpose of land reclamation (e.g. dredging arisings) and piling / excavation in waste of landfill at the Peninsula. The relevant EPR schedules include EPR Schedule 9 – Waste operations and materials facilities (Waste Framework Directive), EPR Schedule 10 – Landfill (Landfill Directive), EPR Schedule 20 – Mining waste operations (Mining Waste Directive) and EPR Schedule 22 – Groundwater activities.

Enabling Works – Site Peninsula

Site Preparation

6.5.3 Pre-commencement surveys will be undertaken in line with recommendations presented within ES Chapter 7: Biodiversity, Chapter 8: Water Resources and Flood Risk and Chapter 9: Ground Conditions and Contamination. These will include:

- Ecological surveys as required by protected species licensing and as advised by the project ecologist;
- Pre-demolition health and safety and asbestos survey of remnant site buildings and structures – this will be undertaken on any structures that are to be removed to identify Asbestos Containing Materials (ACM) requiring regulated removal off-site by specialist licensed contractors;

- Further site investigation including boreholes where it is proposed to extend the Peninsula and construct buildings and other structures; and
- Water quality monitoring.

Fencing and Hoarding

6.5.4 The Site will be secured with hoarding erected at the entrance to the main construction area at the Peninsula from the Access Road. Appropriate fencing will be erected around the boundary of construction areas including the boundary of wet woodland on the Peninsula for safety and security, protecting the habitat from accidental damage. Temporary fencing or other suitable barriers would be installed to protect sensitive habitats and features. Permanent fencing will also be erected around areas of quicksand and other features within the Site for health and safety reasons as deemed appropriate. Any fencing will be sited to avoid tree root protection zones.

6.5.5 The woodland on the Peninsula will be protected from accidental damage during construction works through permanent fencing which will be installed at the start of construction works (see Figure 5.2). This would also serve to minimise noise and visual disturbance to breeding woodland birds, one of the special features of the SSSI. Further details are provided in Chapter 5: Description of the Development. Details of the design, installation methodology and timing of installation would be approved by LBH prior to commencement.

Construction Compound and Facilities

6.5.6 The main construction compound will be sited on the Peninsula (outwith Flood Zones 2 and 3) and secured by fencing. The main construction compound is likely to comprise:

- Compound security and visitors reception area;
- Main office and administration facilities including space for site inductions and briefings;
- Welfare facilities for the peak construction workforce, including first aid facilities;
- Material delivery, storage and handling area;
- Generator / electrical substation; and
- Secure enclosed and bunded fuel and chemical storage area with spill kits.

6.5.7 Small temporary secondary construction compounds may be required during works at the existing BSC site and for the Access Road improvement works. During enabling works, suitable facilities will be installed for construction site offices and welfare facilities. These will be in place until such a time as the Site accommodation units are installed and become functional. Portable welfare facilities will be installed on the hardstanding area on the Peninsula. Waste-water from welfare facilities would be disposed of appropriately off-site.

6.5.8 Parking for construction workers and visitors will be kept to a minimum. The Contractor will be required to encourage the construction workforce to vehicle share where possible to minimise traffic (as secured through the CLP).

6.5.9 Parking for construction vehicles will be located on the existing hardstanding as the most appropriate surface to support vehicle movement on the Site. No parking will be allowed on the Access Road.

Access Road

6.5.10 The Access Road will be used for construction access. The improvement works set out in Chapter 5: Description of the Development would mostly be undertaken during the enabling stage of the construction works due to its poor condition.

6.5.11 These works will involve the bell mouth junction with Moorhall Road up to the existing access to Broadwater Lake adjacent to the residential properties and will involve re-surfacing, street lighting and a dedicated pedestrian footway and access. Works would be undertaken to an adoptable standard.

6.5.12 To minimise disruption for existing businesses residents and BSC users sharing the Access Road, the works will be phased to ensure access is maintained. Some work may be required outside of the operational hours for the businesses GRS Bagging and Harleyford Aggregates. However, if this is the case, the Principal Contractor will be required to seek permission from LBH. Emergency access and access for HS2 and other users would be maintained at all times.

6.5.13 During this phase, construction materials will be delivered by rigid lorries, paving and roller HGVs will be required. No abnormal loads will be required.

In-Lake Works

6.5.14 The following section describes the works proposed within Broadwater Lake which are also illustrated in Figure 6.1.

6.5.15 Turbidity curtains or 'bubble curtains' would be used around areas of lake dredging / in-lake works to prevent dispersion of turbid water into adjacent parts of the lake. Turbidity within and outside of these features would be continuously monitored. Bubble curtains would only be removed when turbidity returns to levels (e.g., baseline turbidity) agreed with the EA and Natural England.

Dredging and Island Works

6.5.16 Dredging methods and a detailed method statement will be agreed with LBH, in consultation with Natural England and the Environment Agency, once a specialist dredging contractor has been appointed. The Applicant has held initial discussions with contractors to inform the methodology set out below.

6.5.17 The target dredging zones in the Eastern Channel, as shown on Figure 5.1 in Chapter 5: Description of Development, predominantly comprise compacted gravel with some areas being overlain by silt and some sand present within the gravel voids. Sediment sampling in the lake confirms the ready fluidisation of the finer particles when the cores were lifted, demonstrating that typically, dredging will lift gravels, leaving finer sediments behind.

6.5.18 Barges would enter and exit the lake from the shores of the Eastern Channel via a temporary slipway. It is anticipated that a long-reach excavator, on a barge, would be

manoeuvred into position on a suitably sized pontoon for both dredging and works to islands. The long-reach excavator will then proceed to dredge the gravels or island soils, lifting and removing from the water or islands, and place in a second receiving barge. The volume of dredged material is estimated to be approximately 7,094m^3.

6.5.19 Prior to deposition, excavation arisings would be screened and where required tested to inform suitability for re-use.

Land Reclamation / Beach Creation

6.5.20 A small area of land reclamation (c. 2,892m^2) is proposed on Peninsula. This would require approximately 7,965m^3 of material. The receiving barge from dredging / island removal works would transit across the Eastern Channel to the beach receptor site where the gravel can be unloaded by a second excavator which will likely also be placed on a pontoon and placed into position.

6.5.21 GPS controls on the excavator will ensure the sediment is placed in the correct location and minimise the wastage of gravel.

Pontoons and Slipways

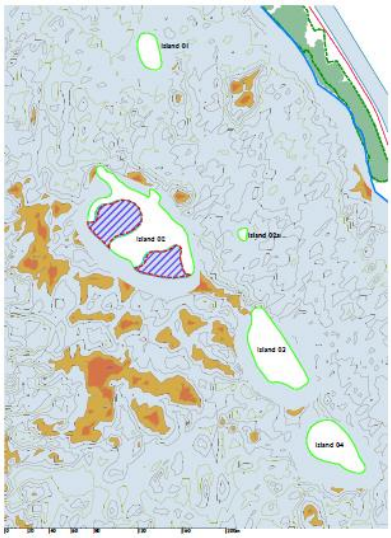
6.5.22 The pontoons will be prefabricated and will be fixed to hinged gangways that protrude from the reclaimed land. The pontoons will be floating structures avoiding the need for excavating and foundation work.

6.5.23 Two new slipways will be constructed from concrete adjacent to the reclaimed area to allow boats to be moved into and out of the water easily. Excavators will be used to form the desired profile of the ramp, assumed to be 1:10. The base of the slipway will be approximately 1.5m below the lowest recorded water level.

Floating Reedbeds and Tern Rafts

6.5.24 The floating reedbeds and tern rafts will be towed into position and fixed using anchors that will keep them in place.

Figure 6.1: In-Lake Works / Cut and Fill Analysis



Summary of Open Water Area and Volumes

CUT/DREDGING	Cut Material Volume (m^3)	Open Water Area (m^2 Increase)
Island 02	2,359m³	2,171m²
Island 06	2644m³	1,141m²
Island 07	649m³	296m²
Transit Channel	7,094m³	0m²
Total Cut	12,746m³	3,608m²

FILL	Fill Material Volume (m^3)	Open Water Area (m^2 loss)
Beach, Shelf & Buffer	7,965m³	2,892m²
Island 08 link buffer	325m³	0m²
Total Fill	8,290m³	2,892m²

Existing Open Water Area	639,654m²
Land Added	2,892m²
Land Removed	3,608m²
Proposed Open Water Area	640,370m²

Net Increase of Open Water	716m²

Lake bed level	Winter water depth	Summer water depth
36.5m	0.96m	0.64m
36.0m	1.46m	1.14m
35.5m	1.96m	1.64m
<35m	>2.46m	>2.14m

Note:

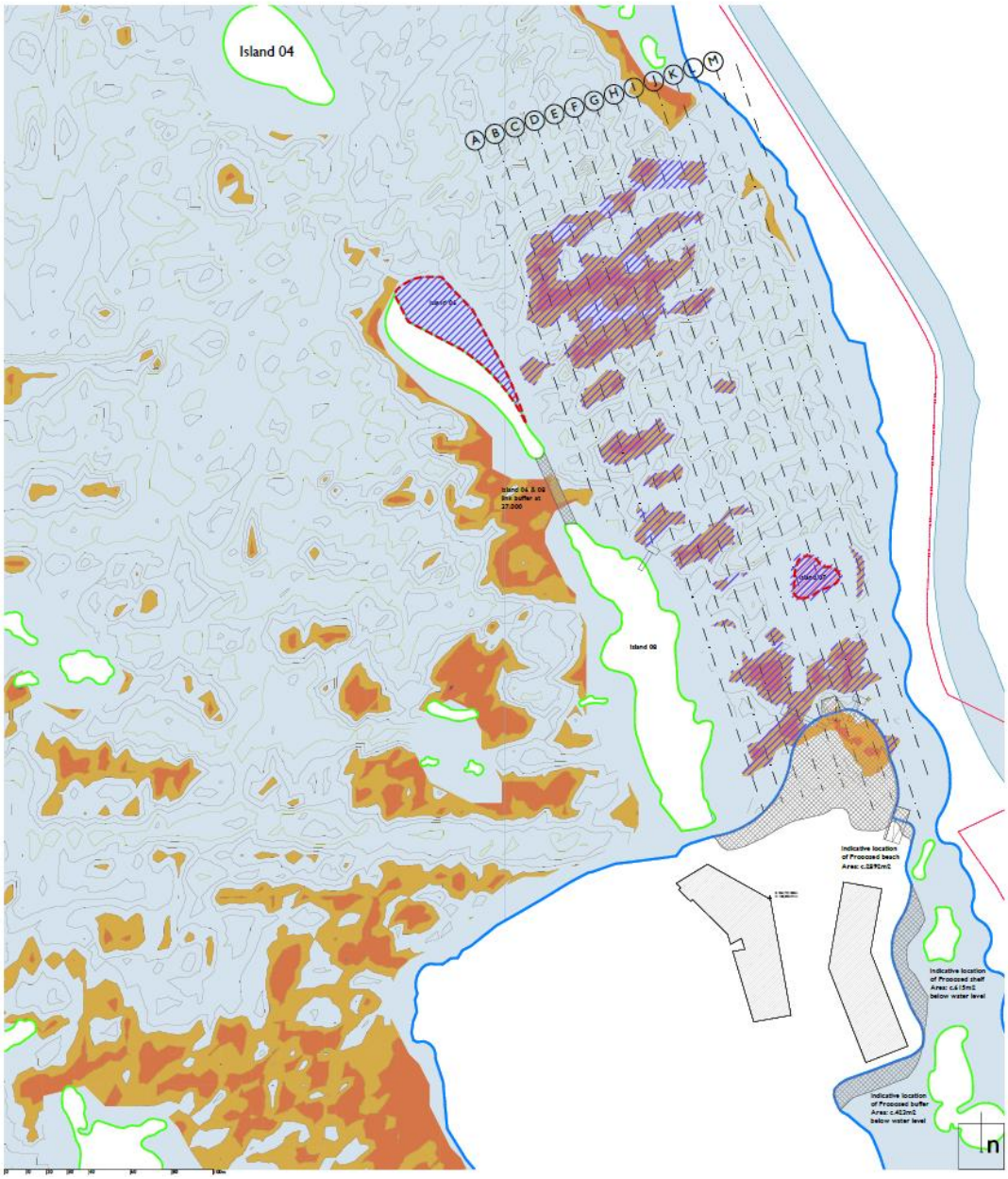
1. Calculations are based on an average winter/summer water level provided by the surveyor (refer dwg 32578BWLS-01-05)
2. Minimum 1.5m water depth is preferable for sailing and water activities to minimise algal blooms in summer
3. It was not possible to carry out a depth survey around the islands, but it is assumed that the water level is less than half a meter
4. Island 06 cut material identified as Giant Knotweed. Cut material to be disposed of safely using a suitably licensed landfill site or incineration facility.

Extent of dredging

Existing land mass to be removed

Note: Cut and fill exercise has been carried out using 3rd party data and calculations given are an approximate total.

Further detailed analysis for costing or construction should be carried out by a Qualified Civil Engineer.



Construction Works – Peninsula

6.5.25 The main works on the Peninsula will comprise installation of utilities, construction of the HWSFAC buildings and facilities, construction of car parking areas and internal access roads, landscape works and boundary treatments.

Utilities

6.5.26 Currently high voltage (HV) electrical intake to the Site crosses the Grand Union Canal on a utility's gantry from the Broadwater Lane substation at the western end of Broadwater Lane. This would be retained as the access route for the Proposed Development's electrical intake as it is the closest point of connection.

6.5.27 Horizontal Directional Drilling (HDD) methods will be used to provide conduits for utilities connections into and out of the Site. HDD is a trenchless method commonly used to install underground pipelines, cables, and conduits. It involves drilling a pilot hole along a predetermined path and then enlarging it to accommodate the desired pipe or cable, which is then pulled back through the enlarged hole. This technique minimises surface disruption, making it ideal for environmentally sensitive areas and waterways. The location of entry and exit pits and detailed method statements, including fluid break out plans, would be subject to agreement with LBH, the Canal and Rivers Trust and Natural England as appropriate.

6.5.28 An existing electrical transformer (500kVA) located on the Peninsula dates from the 1960s and would be replaced with a modern unit. Attached to the original electrical switchgear are a number of electrical capacitors, which are likely to include PCBs which is considered a hazardous material. These capacitors would therefore require disposal under the Hazardous Waste (England and Wales) Regulations 2005.

6.5.29 A water source heat pump would also be installed at the lake, as described in Chapter 5: Description of the Development. The details of heat pump would be subject to agreement with LBH, Natural England and the Environment Agency.

Groundworks

6.5.30 As part of the enabling works, it is proposed that surplus gravel in the north east corner of the Peninsula will be removed and repurposed within the Proposed Development. No areas of hardstanding will be removed to avoid risks of contamination to surface and groundwater (see Chapter 9: Ground Conditions and Contamination for further details). Figure 5.1 shows the area of gravel on the Peninsula to be removed.

Piling and Substructure

6.5.31 Building structures would only be constructed on the Peninsula. Buildings are sited on previously developed land as shown on Figure 5.3.

6.5.32 The Phase II Site Investigation (Appendix 9.3) has considered geotechnical design for the Proposed Development, including a general assessment of ground conditions, assessment of excavations and foundation solution assessment. The Site Investigation indicates that variably deep made and reworked ground overlying highly compressible alluvium, accompanied with shallow groundwater will be problematic for shallow foundation solutions.

6.5.33 Piling will be required for construction of the Main Building and the Equipment Store and Workshop. A Piling Risk Assessment will be undertaken due to the sensitivities of the Site and groundwater. It is expected that the new buildings will require a pile diameter of 450mm, installed to an approximate depth of 10m below ground. Continuous Flight Auger (CFA) piling methods are likely to be appropriate for use during the piling of building foundations to limit the potential for the mobilisation of shallow contamination within made ground soils into underlying natural strata and the groundwater. Shallow reinforced raft foundations may be appropriate considered for small, low-bearing structures.

6.5.34 Details of piling will be provided at subsequent stages of detailed design.

6.5.35 During piling operations, the use of reliable monitoring and data recording systems is fundamental and shall be in place. Following piling operations, the contractor shall conduct regular inspections and load tests on the piles to verify their integrity and load-bearing capacity which will then be confirmed by the structural engineer.

Construction of Buildings

6.5.36 All the buildings on-site will have a ground floor concrete slab. The first-floor slab of the main building will be a reinforced concrete hollow core slab which will be confirmed during the next stages of detailed design.

6.5.37 The buildings will be a typical traditional construction of brick and block cavity external walls and internal solid blockwork load bearing walls and timber framed pitched roofs.

6.6 Demolition

6.6.1 BSC currently operate from a single-storey club house, associated boat storage area, parking area, storage containers and pontoons on the northern shore of Broadwater Lake. The existing single storey BSC club house (approximately 150 sqm) associated storage containers, tarmac and hardstanding will be demolished and removed from the Site.

6.6.2 Three existing pontoons used by the existing BSC facilities will be relocated and repurposed as floating habitats in the north west of the lake. The one remaining slipway will be retained for emergency access. This work would be undertaken once the Proposed Development is built and available for use.

6.6.3 No works will be required within 8m of the top of the bank of the adjacent River Colne.

6.7 Landscape and Ecological Proposals

6.7.1 Pre-commencement ecological works will include installation of the submerged willow planters to provide visual screening and create the Wildlife Refuge Zone in the south western part of the lake.

6.7.2 All remaining landscaping and ecological enhancements as described in Section 5.7 of Chapter 5: Description of the Development will occur towards the end of the construction phase. HGV movements are expected to be minimal during this phase.

6.8 Materials and Waste

Demolition

6.8.1 Where feasible, materials generated through the demolition of BSC would be re-used for the construction works. Re-use of such materials would be subject to testing and dependent on it meeting relevant geotechnical specification requirements and being inert. Re-use of material reduces deliveries to the Site and the amount of waste for disposal.

Construction

6.8.2 Waste produced during all demolition and construction activities on-site will be subject to the 'Duty of Care' under the Environmental Protection Act 1990[1]. It will be the joint responsibility between the Principal Contractor and the Applicant to ensure that waste produced on-site is disposed of in accordance with legislation. A Site Waste Management Plan (SWMP) will be prepared prior to commencement of works on-site as secured by the Outline CEMP (Appendix 6.1). The SWMP will specify the procedures by which waste will be managed during the demolition and construction stage. The Principal Contractor would be required to prepare and implement the SWMP. The SWMP will identify the types and quantities of waste that would be produced throughout the demolition and construction of the Proposed Development and would identify management options for each type of waste, paying attention to the waste hierarchy.

6.8.3 Table 6.2 provides indicative construction waste volumes based on the proposed building area schedule.

Table 6.2: Indicative Construction Waste Volumes

Waste Type	Percentage	Indicative Amount (tonnes)	Indicative Amount (m^3)
Bricks	5%	24.4	47.3
Tiles and Ceramics	5%	24.4	47.3
Concrete	11%	53.7	104.0
Inter Material	16%	78.1	151.3
Insulation Materials	2%	9.8	18.9
Metals	1%	4.9	9.5
Packaging Materials	10%	48.8	94.5
Plasterboard / Gypsum	10%	48.8	94.5
Plastic	5%	24.4	47.3
Timber	15%	73.2	141.8

Waste Type	Percentage	Indicative Amount (tonnes)	Indicative Amount (m^3)
Floor Coverings	0%	0.0	0.0
Electrical and Electronic Equipment	1%	4.9	9.5
Furniture	0%	0.0	0.0
Canteen / Office/ Ad-hoc Waste	5%	24.4	47.3
Liquids	1%	4.9	9.5
Oils	0%	0.0	0.0
Hazardous Waste	1%	4.9	9.5
Mixed Construction and / or Demolition Waste	0%	0.0	0.0
Total	**100%**	**488**	**945**

6.8.4 There will be no import of fill materials to facilitate the land reclamation or island formation. As shown on Figure 6.1 indicative cut and fill volumes are as follows:

- Cut Material:
  - Lake dredging in Eastern Channel – 7,094m^3;
  - Loss and alternation of islands – 5,652m^3;
  - Total = 12,746m^3
- **Fill Material (Land reclamation):** 8,290m^3
- **Materials Balance**: Surplus 4,456m^3

6.8.5 Cut material from dredging and island alteration would be used for land-reclamation on Site subject to screening and testing. The surplus cut material will be re-used within the Site for construction, such as sub-base material, creation of gravel beaches and other construction works subject to screening, testing and its suitability.

6.8.6 Contractors will be required to operate in accordance with measures set out in the Outline CEMP and will be required to investigate opportunities to minimise and reduce waste generation in line with the Government aim of working towards eliminating all avoidable waste by 2050 through:

- Agreements with material suppliers to reduce the amount of packaging or to participate in a packaging take-back scheme;

- Implementation of a 'just-in-time' material delivery system to avoid materials being stockpiled, which increases the risk of their damage and disposal as waste;
- Use of standard size components in design detailing to eliminate risk at source where possible to do so;
- Attention to material quantity requirements to avoid over-ordering and generation of waste materials;
- Re-use of materials wherever feasible, e.g. re-use of excavated soil for landscaping;
- Segregation of waste at source where practical;
- Re-use and recycling of materials off-site, where feasible, and where re-use on-site is not practical (e.g., through use of an off-site waste segregation facility and re-sale for direct re-use or re-processing);
- Use of colour coded and signposted skips to reduce risk of cross contamination and covered to prevent dust and debris blowing around the Site, these will be cleared on a regular basis; and
- No burning of wastes or unwanted materials on-site.

6.8.7 Contractors will be required to carry out works in a way that, as far as is reasonably practicable, minimises the amount of waste to be disposed of by landfill. Any waste arisings from the Site will be transported and disposed of in accordance with relevant legislation, including the following:

- The Environmental Permitting (England and Wales) Regulations 2016[2] (as amended)[3];
- The Hazardous Waste (England and Wales) Regulations 2005[4];
- The Waste (England and Wales) (Amendment) Regulations 2011[5] (as amended)[6];
- The Waste Management (England and Wales) (Amendment) Regulations 2006[7]; and
- Clean Neighbourhoods and Environment Act 2005[8].

6.8.8 Suitable soils and other materials would be stored and re-used on-site as far as practicable.

6.8.9 Hazardous waste will be kept separately from other wastes and in appropriate containers and Duty of Care will be ensured for the transfer and removal of all site wastes. Further details are provided in Appendix 6.1: Outline CEMP which accompanies the planning application.

6.9 Construction Plant and Equipment

6.9.1 An indicative list of large plant and equipment that are likely to be used at various phases of construction shown in Table 6.3.

Table 6.3: Indicative Plant and Equipment

Plant and Equipment	Stage of Works					
	Enabling Works – Site Preparation	Enabling Works – Access Road	Enabling Works – In-Lake Works	Construction - Main Works and Peninsula	Demolition	Landscape and Ecological Enhancements
360^0 Excavator	✔	✔	✔	✔	✔	✗
Long Reach Excavator	✗	✗	✔	✗	✗	✗
Mobile Crane	✗	✗	✗	✔	✗	✗
Breaker	✗	✗	✗	✔	✔	✗
Compressor & Air Tools	✗	✗	✗	✔	✗	✔
Drills / Cutters	✔	✔	✗	✔	✔	✔
Compacter / Roller	✔	✔	✗	✔	✗	✗
Piling Rigs	✗	✗	✗	✔	✗	✗
Concrete Pumps	✗	✗	✔	✔	✗	✗
Scaffolding	✗	✗	✗	✔	✗	✔
Forklift Truck	✗	✗	✔	✔	✗	✗
Mechanical Road Sweeper	✔	✗	✗	✗	✗	✗
Lorries, HGVS and Vans	✔	✔	✔	✔	✔	✔
Ready mix concrete trucks	✔	✔	✔	✔	✗	✗
Floating Barge	✗	✗	✔	✗	✗	✗
Vibrofloat	✗	✗	✗	✔	✗	✗

6.10 Hours of Work

6.10.1 It is anticipated that the core working hours for the construction stage will be as follows:

- 07:00 – 18:00 weekdays;
- 07:00 – 13:00 Saturday; and
- No working on Sundays or Bank Holidays and the preceding Saturday and Sunday.

6.10.2 In line with LBH Guidance[9], construction work which gives rise to noise that is audible at the construction area boundary will be restricted to

- 08:00 – 16:00 weekdays; and

- 08:00 – 13:00 Saturday.

6.10.3 Approval from LBH will be required for works that need to be undertaken outside of these hours.

6.11 Construction Traffic

General Management

6.11.1 A CLP has been prepared to accompany the planning application (Annex 1 to Appendix 6.1: Outline CEMP). The CLP includes measures designed to:

- Optimise the efficient delivery and collection of goods and materials to the Site;
- Lower traffic emissions by timing construction vehicle movements in off-peak hours where possible and avoiding congested routes;
- Enhance safety – improved vehicle and road user safety, especially along the Site access road;
- Reduce congestion – reduced trips overall to the Site; and
- Minimise disturbance to ecological receptors within the Site caused by construction.

6.11.2 To support these objectives, the Applicant has committed to:

- Promote smarter operations that reduce the amount of vehicle trips required to the Site (i.e., bringing multiple building materials from one supplier);
- Use Fleet Operative Recognition Scheme[1] accredited vehicles;
- Scheduling of deliveries out of network peak hours where possible (i.e. 08:00-09:00 and 17:00-18:00); and
- Avoiding all HGV movements through Harefield Village.

6.11.3 Further information on the principles of construction traffic management included in the CLP is provided below.

Construction Vehicle Routing and Deliveries

6.11.4 Figure 6.2 shows the local HGV construction traffic routing to the Site which is included in the CLP and would be secured by planning condition. HGVs will be required to approach the Site from Denham via the M25, M40, A40 or the A412. Once on the A412, HGVs will be required to turn then east onto Moorfield Road, continuing onto Moorhall Road. HGVs will then turn left onto the Access Road proceeding to the main Site entrance. Suppliers will be made aware that these routes are required to be followed at all times unless agreed or alternate diversions are in place.

6.11.5 During enabling works, a small number of construction vehicles will be required to travel to Mayling Transport Yard, 50m to the east of the Site via Broadwater Lane, for the installation

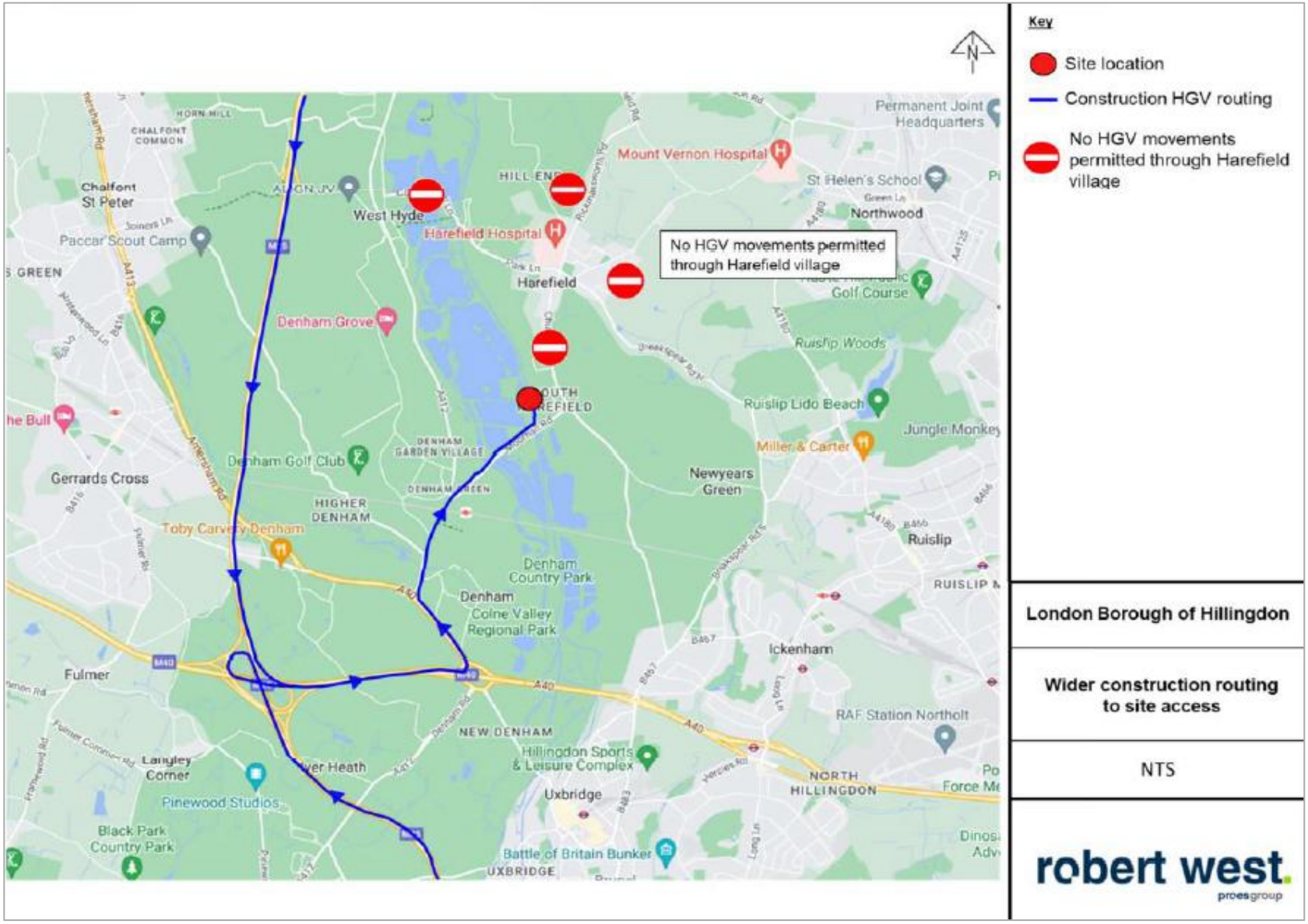
[1] The Fleet Operator Recognition Scheme (FORS) is a voluntary accreditation scheme for fleet operators which aims to raise the level of quality within fleet operations, and to demonstrate which operators are achieving exemplary levels of best practice in safety, efficiency, and environmental protection.

of utilities. Construction vehicles required to travel to Mayling Transport Yard will be notified ahead of departure and will be checked in at this location.

6.11.6 Light Goods Vehicles (LGVs) and cars will utilise the local highway network and are not restricted to permitted routes.

6.11.7 Access for all users will be strictly controlled and fencing or hoarding will be erected to prevent unauthorised access. Anglers, BSC users, HS2 operatives and other users by agreement would be allowed access towards the end of construction period.

Figure 6.2: Local Construction HGV Routing



Construction Vehicle Management

6.11.8 The labour force will be encouraged to use public transport and other sustainable modes. Secure cycle parking for contractors and visitors will be provided on-site. On-site parking will be provided to eliminate contractor parking on the local highway network and Access Road. Secure cycle parking will be provided for contractors and visitors.

6.11.9 The Principal Contractor and sub-contractors will ensure a commitment to careful management of Site deliveries and collections by scheduling them in a manner that consciously avoids, where possible, the most congested times of the day.

6.11.10 A delivery management system will be used to control the volume of deliveries to the Site. This system will work by defining the number of resources the Site has and thus can service in 30 minutes intervals. It then limits the number of delivery bookings per half-hour to this defined capacity.

6.11.11 All construction vehicles will load / unload within the Site boundary and perform turning manoeuvres within the Site, preventing these movements on the local highway network or the Access Road. Local traffic management measures for Site access will be agreed with LBH prior to construction commencing.

Other Measures

6.11.12 Section 5.0 of the CLP provides further detail on other measures to reduce construction traffic and associated effects which would be explored by the Applicant, including use of holding areas, Grand Union Canal, collaboration with other sites in the area, and use of a Travel Plan.

Construction Vehicle Movements

6.11.13 The following construction vehicles are expected to travel to / from the Site: articulated lorries, rigid lorries, mobile crane, barges, excavators and large tippers. The largest vehicle expected to travel to / from the Site is a 16.5m articulated lorry. A swept path analysis has been undertaken and is presented within the CLP.

6.11.14 Section 6.0 of the CLP provides predicted levels of construction traffic. The estimated numbers and types of vehicles have been projected for the busiest periods during the enabling works and construction programme to allow for an assessment of a reasonable ‘worst case’ scenario. This has been informed by estimates of materials and construction waste. The final estimates of vehicle movements will be confirmed by the contractor and included in a revised CLP which would be submitted to LBH for approval.

6.11.15 A total of 672 HGVs are estimated to be required throughout the construction phase. A peak of 97 monthly HGV trips are expected during the in-lake works.

6.11.16 In addition to HGV trips, LGV (light vans) and car trips to the Site are expected daily throughout construction by contractors and visitors. During the peak of construction activity, up to 30 van and car trips are expected daily. Outside of the peak construction period there is likely to be between 15-20 van and car trips daily.

6.12 Construction Environmental Management

Construction Environmental Management Plan (CEMP)

6.12.1 The Applicant has committed to implementing a CEMP(s) during all enabling works, in-lake works, demolition and construction activities. An Outline CEMP is provided as Appendix 6.1 which sets out the strategy, standards, control measures and monitoring procedures that will be implemented to manage and mitigate any adverse environmental effects of the construction process, including mitigation measures defined by the ES.

6.12.2 A detailed CEMP (or CEMPs) would be developed in accordance with the Outline CEMP in consultation with key stakeholders including LBH, Natural England and Environment Agency as appropriate. The nature of the detailed CEMPs and the works they cover will be dependent on the nature of the contracts and roles and responsibilities of contractors.

Considerate Constructors Scheme

6.12.3 The Site will be registered with the Considerate Constructors Scheme[10]. This scheme ensures that contractors carry out their operations in a safe and considerate manner with due regard to passing pedestrians, road users and surrounding properties.

Stakeholder Engagement

6.12.4 As stated above, the LBH, the Environment Agency and Natural England will be engaged with in the development of detailed CEMP(s) and construction method statements as appropriate.

6.12.5 The Principal Contractor will commit to appointing a community liaison manager, who will be the first line of response to resolve issues of concern or complaints. Site boards outlining information on the scheme and forthcoming works will be available at the entrance to the Site. Site contact numbers will be displayed as appropriate, along with the complaint's procedure.

6.12.6 The Applicant and Principal Contractor will share information about the construction programme with relevant stakeholders and the public as appropriate.

6.12.7 Residents and other interested parties (including local businesses, HS2, BSC, the Canal and Rivers Trust, and regulatory bodies) will be kept informed any works occurring as relevant to their property and operating interests and will be provided with liaison manager contact information.

Environmental Mitigation Measures

6.12.8 This section provides a summary of key measures which are secured through the Outline CEMP (Appendix 6.1).

Lighting

6.12.9 The Site must be provided with suitable and sufficient lighting, which must be, so far as is reasonably practicable, by natural light. This relates to both the construction site as well as the approach and traffic route to the working area.

6.12.10 Site lighting during the construction phase will be designed to comply with the latest Institution of Lighting Engineers' guidance notes for the reduction of light pollution and the provisions of BS 5489, Code of Practice for the Design of Road Lighting[11], where applicable.

6.12.11 Restriction of lighting to dusk and dawn in late autumn – winter.

6.12.12 In determining temporary construction lighting arrangements for the Site, due consideration will be given by the Principal Contractor to residents with lighting directed away from adjacent residential properties.

6.12.13 Construction lighting will be designed to avoid disturbance to foraging and commuting bats in accordance with good practice. Works will be undertaken during daylight hours only and there will be no lighting at night during the construction phase.

6.12.14 No security lighting will be installed as the Site can be secured through its existing gates and through presence of security personnel. Lighting of site compounds, although temporary, will be designed in accordance with best practice guidance. It will be bespoke, low level, shielded and directional with LED and warm colour temperatures. Site compounds will be enclosed by visual screening.

6.12.15 Details of construction lighting would be agreed and controlled through the detailed CEMP(s).

Ecology and Arboriculture

6.12.16 The timing of certain activities will be restricted through the Outline CEMP in line with the principles set out in Table 6.1 to minimise disturbance effects during the construction stage. This, and the avoidance of habitats, forms the most effective method of mitigating effects.

6.12.17 To minimise noise, vibration and visual disturbance effects to the birds using the refuge area during construction, appropriate fencing will be erected around the boundary of construction areas. Temporary fencing or other suitable barriers would be installed to protect sensitive habitats and features.

6.12.18 As set out in paragraph 6.5.5, a visual and acoustic screen will be installed prior to the commencement of the bird breeding season and construction works around the woodland, slightly inset behind the tree line. To minimise disturbance effects, the main construction compound will be sited away from sensitive habitats including the lake shoreline, lagoon and woodland as far as practicable. Acoustic barriers will be placed around noise and vibration generating plant as appropriate.

6.12.19 Works (including surveys and monitoring visits) will be undertaken in accordance with a biosecurity risk assessment and safe system of work. The risk assessment and safe system of work will take into account species-specific guidelines for management and control of INNS produced by the Non-Native Species Secretariat (NNSS) and Natural England. Protected species checks prior to commencement of works and mitigation measures and licensing to ensure compliance with legislation as appropriate.

6.12.20 Measures to protect trees would be implemented in line with recommendations included in the Arboricultural Impact Assessment (Appendix 10.6). A detailed Arboricultural Method Statement (AMS) will be compiled, detailing the exact location and nature of protective

fencing, tree pruning, signage, timings and methods of works and other protection measures. All site operatives will be made aware of the nature of the protection detailed in the AMS and it will remain in place throughout construction.

Dust and Other Emissions

6.12.21 Standard mitigation measures are secured through the Outline CEMP which will ensure dust effects are not significant on human or ecological receptors. These measures are informed by a construction dust assessment, included within an Air Quality Assessment and are based on industry best practice guidance These measures relate to site management, preparing and maintaining the Site, operating vehicle / machinery, sustainable travel, demolition, waste management, operations, earthworks and construction.

6.12.22 Wherever possible, risks of dust will be minimised at source such as through the covering of stockpiles, working methods, wheel washing and good plant and vehicle maintenance. All vehicles leaving the Site will be checked prior to alighting onto Moorhall Road ensuring no debris is taken off-site. Wheel washing facilities will be available for use before construction vehicles leave the construction area.

6.12.23 In line with the GLA's Control of Dust and Emissions from Construction and Demolition during Construction and Demolition Supplementary Planning Guidance (SPG) (GLA, 2014)[12], Non-Road Mobile Machinery (NRMM) will be expected to comply with emissions standards.

Noise and Vibration

6.12.24 Potential sources of noise and vibration during the construction phase will include (but not restricted to) plant and usage of heavy machinery, piling activities, and vehicle movements. A construction noise and vibration assessment has been undertaken, and a Noise Assessment accompanies the planning application. Activities that produce the greatest noise levels include access road improvements, in-lake works, and demolition of the BSC building. A worst-case assessment has been undertaken with activities such as road construction assessed at locations nearest to the on-site residential NSRs.

6.12.25 Mitigation measures during the construction stage specified within the Noise Assessment are included in the Outline CEMP. The Principal Contractor will be required to implement best practicable means on-site to minimise adverse noise and vibration impacts on nearby sensitive receptors and ecological receptors from construction activities.

Ground Conditions and Soil Resources

6.12.26 All areas of existing hardstanding will remain in-situ to act as a low permeability cover layer over landfilled areas of the Peninsula.

6.12.27 The Outline CEMP includes the following measures which would be implemented to mitigate the potential risks posed to human health, groundwater, surface water, built environment and ecology:

- General good construction working practices would be implemented such as dust suppression, including potentially contaminated dusts, (damping down), perimeter fencing around excavations, covering stockpiled materials;

- Appropriate stockpile segregation, locations and containment measures would be implemented to minimise the exposure of surface water and groundwater from potentially impacted runoff;
- A discovery strategy for managing and dealing with unexpected / unforeseen contamination that may be encountered during construction phase works. This may require additional site investigation, sampling risk assessment and remediation to ensure the protection of the identified receptors;
- All construction workers will be required to wear Personal Protective Equipment (PPE) such as gloves, goggles and face mask (where appropriate) to prevent dermal contact, inhalation or ingestion. Appropriate site hygiene facilities will be put in place and the presence of contaminants, and the associated risks will be explained to ground workers before they begin work;
- Fuel storage on-site will be carried out under best practice, i.e. integrally bunded containers. Plant refuelling would be carried out using best practice techniques and any spills to be controlled with spill kit. Fuel storage should, where possible, be located sufficiently away from any surface water features, ditches and drains which may provide a preferential pathway for migration of leaks / spills;
- Management of water that collects on-site or within excavations will be implemented;
- An appropriate management plan for polluting substances that are being brought on Site and used as part of the construction process will be implemented. This is to include any site won materials (Broadwater Lake sediment) that are proposed to be re-used in land reclamation;
- An appropriate management plan for sediments in surface water runoff generated in construction area and laydowns will be implemented;
- An appropriate management plan of accidental leakage and / or spillage incidents of oils / hazardous substances will be implemented; and
- Incorporation of hydrocarbon interceptors into the Site drainage system at high-risk areas, such as parking, unloading and refuelling areas, to remove hydrocarbons and oils from surface water prior to discharge will be implemented.

Water Environment and Flood Risk

6.12.28 Details of water environment mitigation measures are specified below:

Surface Water / Groundwater

- Adherence to the measures included in the Outline CEMP and all guidance from statutory consultees, appropriate training for all workforce, including specialised toolbox talks where necessary, ongoing monitoring and management from suitably experienced Environmental Clerk of Works;
- Use of self-bunded refuelling facilities (or sufficient secondary containment with impermeable base and sides), provision of spill kits, well maintained / certificated plant and equipment, use of biodiesel only;
- Self-bunded facility for the storage of and chemicals / potentially contaminative materials being used during construction, including paints, lubricants, solvents etc. No on-site mixing of concrete, no vehicle washing on-site (apart from self-contained

wheel washes if required). No discharge of construction runoff will be allowed into the lake or groundwater (e.g. via soakaways);

- Cut-off ditches and / or geotextile silt-fences will be installed around excavations, exposed ground and stockpiles to prevent the uncontrolled release of sediments from the Site;
- Advanced provision of suitable operational SuDS measures that will also serve to treat suitable runoff during the construction period (that will include an agreed form of hydrocarbon interception, sediment detention and therefore phosphate capture, and wetland vegetation suitable for managing nitrogen nutrients (e.g. through the very shallow scraping of clean surface material (without disturbing any underlying potential / known waste), lining with impermeable clay layer, clean cover layer and pre-planted native wetland plant coir blankets (vegetation from a local provenance source and agreed with Natural England) to create shallow wetland features (that will be maintained);
- Sediment traps on all surface water drains in the surrounding region;
- Silty water abstracted during excavations will be discharged to settlement tanks or siltbusters as appropriate. Only clean run-off will be permitted to discharge to ground or to the lake via the pre-installed SuDS features. A temporary discharge consent will be agreed with EA prior to the commencement of works, if necessary;
- Provision of a suitable facility to contain / remove and potential contaminated liquids, storage of materials and equipment at least 10m from the lake margin and 50m from any boreholes and in Flood Zone 1 and away from highlighted groundwater flood risk areas, protect any stockpiles so that materials are not blown or washed away, no use of herbicides or pesticides;
- The detailed CEMP will set out specific measures in relation to spillage prevention and response. This will be disseminated to relevant site employees and associated training and equipment provided. On-site provisions will be made to contain a serious spill or leak through the use of spill kits, booms, bunding and absorbent material, alongside appropriate monitoring;
- Contaminated soil will be identified by ground investigation prior to construction and either treated on-site and reused or removed and disposed of off-site by a licensed waste disposal operator at a correctly licensed waste depot. Contaminated water will be removed from the Site by tanker and disposed of at a suitably licensed location;
- Implementation in accordance with all legal and permitting requirements including Environmental Permit and Flood Risk Activity Permit for works within 8m of the River Colne (this is limited to the demolition of the existing BSC Club House and habitat enhancements in this northern area of the lake shore.);
- No excavation of any areas associated with former regulated or potential unregulated waste activities. No removal of any concrete cover over these locations. Provision of a suitably designed / specified impermeable barrier over these areas (e.g., clay) and appropriate overlying clean cover to prevent new pathways to terrestrial areas including connected groundwater;
- Advanced construction and use of SuDS features to support the management of construction surface water runoff and discharge to Broadwater Lake only when at an acceptable water quality standard;

- Method Statement for dredging / re-use of sediment in SSSIs. This is likely to comprise the use of long-reach excavators on pontoons and use of barges to extract / move and deposit dredged sediment from donor to pre-established receptor sites which will minimise the amount of lake-bed disturbance, water quality deterioration and duration of works (method statements will be provided once a contractor has been appointed);
- GPS and CAD controlled dredging and land forming activities. This will prevent over-deepening / unnecessary excavation and therefore prevent any new pathways between lakebed dredging and groundwater from forming (also as this is believed to be already in hydrological continuity);
- Use of turbidity curtains or bubble curtains around each area of lake dredging / in-lake works to prevent dispersion of turbid water into adjacent parts of the lake. Turbidity within and outside of these features would be continuously monitored. They would only be removed when turbidity returns to levels (e.g., baseline turbidity) agreed with the EA and Natural England; and
- Monitoring and reporting of the success of these measures and interactive feedback to management regime. Implementation in accordance with all legal and permitting requirements.

Flood Risk

- The Principal Contractor will be required to sign up to the Environment Agency's Floodline warning service for works within areas at risk of flooding;
- A suitable flood safe egress route will be agreed in advance and Flood Evacuation Plan will be implemented in good time;
- No compounds / excavated / dredged material or vehicles or materials will be stored in Flood Zones 2 or 3; and
- No works will occur within 8m of the River Colne unless authorised under a Flood Risk Activity Permit (FRAP) from the EA. This is limited to the demolition of the existing BSC clubhouse and habitat enhancements in this northern area of the lake shore.

Landscape and Visual

6.12.29 Temporary landscape and visual impacts from construction activities within the Site will be managed through good housekeeping measures. External scaffolding, hoarding and protective sheets used during construction would be designed to minimise visual impacts. Temporary hoarding on the north facing elevations of the main building and around working areas of the Site will be a recessive green or camouflage so as not to draw attention from visual receptors on raised ground to the north east of the Site.

6.12.30 Temporary lighting would be designed to avoid light spill and visual intrusion for adjacent residential properties and recreational users of the Grand Union Canal (see Lighting section).

Cultural Heritage

6.12.31 An Archaeological Desk Based Assessment accompanies the planning application. Historic environment record data indicates that no designated heritage assets are recorded as being

on-site. The eastern portion of the Site is located within the Colne Valley Archaeological Priority Area (APA).

6.12.32 The presence of alluvial deposits in borehole logs from site investigation undertaken at the Site indicates that there may be some non-designated geo-archaeological assets present which could be impacted by the Proposed Development. Archaeological recording is expected to be secured through a suitably worded planning condition.

6.13 Monitoring

6.13.1 A programme of environmental monitoring will be implemented, before and during construction of the Proposed Development to provide a baseline position and monitor the efficacy of measures to protect ecological features and water resources in particular. If monitoring indicates an issue or that mitigation is not effective, the activities or working methods would be reviewed by the Contractor (in consultation with stakeholders as appropriate) and appropriate action taken should this be necessary. Monitoring is also proposed to demonstrate the effectiveness of the embedded mitigation measures and residual effects. Further details of monitoring are provided in Chapter 7: Biodiversity and Chapter 8: Water Resources and Flood Risk.

References

[1] Her Majesty's Stationary Office (1990). *The Environmental Protection Act 1990*.
[2] Her Majesty's Stationary Office (2016). *The Environmental Permitting (England and Wales) Regulations 2016.*
[3] Her Majesty's Stationary Office (2018). *The Environmental Permitting (England and Wales) (Amendment) Regulations 2018.*
[4] Her Majesty's Stationary Office (2005). *The Hazardous Waste (England and Wales) Regulations 2005.*
[5] Her Majesty's Stationary Office (2011). *The Waste (England and Wales) Regulations 2011.*
[6] Her Majesty's Stationary Office (2014). *The Waste (England and Wales) (Amendment) Regulations 2014.*
[7] Her Majesty's Stationary Office (2006). *The Waste Management (England and Wales) Regulations 2006.*
[8] Her Majesty's Stationary Office (2005). *Clean Neighbourhoods and Environment Act 2005.*
[9] London Borough of Hillingdon. Available at: https://www.hillingdon.gov.uk/article/5157/Commercial-industrial-and-construction-noise#:~:text=Monday%20to%20Friday%2C%208am%20to%206pm
[10] Considerate Constructors Scheme. Available at: https://www.ccscheme.org.uk/
[11] British Standards Institution (2003), BS 5489-1:2003 Code of practice for the design of road lighting. Lighting of roads and public amenity areas.
[12] Greater London Authority (2014), Construction and Demolition during Construction and Demolition Supplementary Planning Guidance.