South East Strategic Reservoir Option

Preliminary Environmental Information Report

Appendix 5.2 - Preliminary Hydrogeological Impact Assessment

Date: October 2025

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1 Introduction

1.1 Purpose of this report

1.1.1 This report presents a preliminary Hydrogeological Impact Assessment (HIA) of the baseline hydrogeological conditions and evaluates potential impacts on groundwater quantity (flows, levels) and quality due to the construction and operation of the proposed South East Strategic Reservoir Option (SESRO) Project (the Project).

1.1.2 This assessment of hydrogeological risks, based on desk study information and site-specific data:

- Identifies groundwater or groundwater dependent receptors (including surface water interactions) within the study area for the Project.
- Assesses qualitatively whether identified receptors are susceptible to changes in groundwater conditions.

1.1.3 The findings of this HIA inform the preliminary assessment of likely significant effects, which are detailed in the Preliminary Environmental Information (PEI) Report Chapter 5: Water environment, along with necessary mitigation measures.

1.1.4 A numerical groundwater model is currently being calibrated against site data to quantitatively support the assessment of impacts and further inform the design of the mitigation measures. Further details will be reported in the Environmental Statement (ES).

1.2 Scope of works

1.2.1 The agreed scope for the groundwater assessments is detailed in the PEI Report Chapter 5: Water environment.

1.2.2 For this report, the hydrogeological impact assessment has been subdivided as follows:

- Construction: Potential pre-mitigation impacts on Groundwater Levels and Flows
- Construction: Potential pre-mitigation impacts on Groundwater Quality
- Construction: Potential pre-mitigation impacts on Groundwater Dependent Terrestrial Ecosystems (GWDTEs)
- Operation: Potential pre-mitigation impacts on Groundwater Levels and Flows
- Operation: Potential pre-mitigation impacts on Groundwater Quality
- Operation: Potential pre-mitigation impacts on GWDTEs

1.2.3 Impacts as a result of existing contamination are detailed in the PEI Report Chapter 10: Geology and soils.

1.2.4 It is important to note that the impacts described within this section represent potential impacts in the absence of mitigation. The significance and extent of these impacts will be subject to detailed assessment and managed through the implementation of appropriate mitigation measures, monitoring, and design controls.

Construction: Potential pre-mitigation impacts on groundwater levels and flows

1.2.5 Construction activities have the potential to directly impact upon the groundwater levels and flows within bedrock and superficial geology, as a result of an altered drainage regime, physical barriers and dewatering.

1.2.6 Any temporary groundwater control within the superficial aquifers required for reservoir, watercourse, drainage and tunnel construction may cause drawdown of the local water table resulting in reduced groundwater levels, which could impact groundwater dependent receptors including watercourses, abstractions, springs or GWDTE within the extent of the drawdown (i.e. the zone of influence).

1.2.7 Any temporary groundwater control or consumptive abstractions within the bedrock required for reservoir or tunnel construction may cause drawdown of the local water table resulting in reduced groundwater levels, which could impact groundwater dependent receptors within the extent of the drawdown.

1.2.8 Construction of the reservoir, watercourses, drainage and tunnel may also result in impacts on groundwater recharge, storage, levels and flows (spatially and temporally) which could impact the aquifers and groundwater dependent receptors including watercourses, abstractions, springs or GWDTE. This includes potential mounding upgradient of structures, in the absence of mitigation.

Construction: Potential pre-mitigation impacts on quality

1.2.9 The utilisation of construction machinery has the potential to accidentally release lubricants, fuels and oils on to the ground. This could also be caused by spillage, leakage and in-wash from vehicle storage areas following rainfall, accidental release of foul waters (e.g. from welfare facilities) and construction materials such as concrete, grout and inert drilling fluids from tunnelling operations. These contaminants may enter aquifers through permeable soils, preferential pathways (natural or anthropogenic) or engineered drainage systems, potentially affecting abstractions, springs, and surface waterbodies via baseflow contributions. These risks are particularly relevant in areas with permeable geology and soils and shallow water tables; however, in parts of the site where low-permeability clays are present, these units act as aquicludes and may limit vertical migration of contaminants.

Construction: Potential pre-mitigation impacts on Groundwater Dependent Terrestrial Ecosystems

1.2.10 Any designated or non-designated GWDTEs may be susceptible to direct physical impacts as a result of construction activities, whilst indirect impacts may occur as a result of altered drainage/baseflow to GWDTEs.

Operation: Potential pre-mitigation impacts on groundwater levels and flows

1.2.11 Operational infrastructure has the potential to cause long-term changes to groundwater levels and flow patterns due to the presence of permanent below-ground structures, altered recharge conditions and physical barriers to flow.

1.2.12 Any waterbodies can act as a recharge source or barrier, depending on their design and lining, while tunnels, pipelines, and drainage systems can intercept or redirect groundwater, potentially altering flow directions and gradients. It is noted that the reservoir, and associated drainage, is being designed to mitigate any recharge or barrier impacts.

1.2.13 Without mitigation, changes to groundwater levels and flows may affect aquifers and hydraulically connected receptors, including watercourses, abstractions, springs, and GWDTEs. In the absence of mitigation, in some areas, mounding or drawdown may occur, with potential implications for groundwater flood risk or reduced baseflow, if not appropriately considered and mitigated. The scheme makes allowance for a drainage system to manage these risks appropriately.

Operation: Potential pre-mitigation impacts on groundwater quality

1.2.14 During operation, risks to groundwater quality may arise from leakage of pipelines, infiltration of contaminated runoff from roads or car parks, and seepage from infrastructure such as canals or battery storage systems. These contaminants may enter shallow aquifers through permeable soils or engineered drainage systems, potentially affecting abstractions, springs and surface waterbodies via baseflow contributions. Conversely, beneficial impacts to groundwater quality could occur due to changes of land-use.

Operation: Potential pre-mitigation impacts on Groundwater Dependent Terrestrial Ecosystems

1.2.15 Operational changes to groundwater levels or quality may indirectly affect GWDTEs by altering the hydrological regime that supports them as a result of altered drainage/baseflow to GWDTEs (both designated and non-designated sites).

2 Approach to assessment

2.1 Introduction

2.1.1 The National Policy Statement for Water Resources Infrastructure (NPSWRI) (Department for Environment, Food & Rural Affairs (Defra), 2023) requires infrastructure projects to undertake an assessment of the impacts of the Project on water resources and physical characteristics. There is no specific guidance in relation to assessing the impact of water infrastructure on the hydrogeological regime, therefore this preliminary HIA has been carried out in accordance with the Environment Agency (EA) technical guidance on 'Hydrogeological impact assessment for dewatering abstraction' (Environmental Agent, 2007), together with the Design Manual for Roads and Bridges (DMRB) LA 113 standard (Highways England, 2020) and relevant legislation and policy outlined in PEI Report Chapter 5: Water environment.

2.2 Study area

2.2.1 The study area for the assessment is defined using the 'source-pathway-receptor' principle. It includes the geographical extent of the draft Order limits and all known groundwater features within 1 km of these limits, such as underlying aquifers, Source Protection Zones (SPZs), mapped springs, groundwater abstractions, and designated GWDTEs. Additionally, the study area incorporates the previous scoping study area, bounded by the River Ock and the edge of the Chalk escarpment to the south, extending from Letcombe Brook in the west to Abingdon in the east, with a further 1 km buffer to ensure comprehensive coverage of potentially hydraulically connected receptors. The study area is shown in Figure 1: Hydrogeological study areas and topography.

2.3 HIA methodology

2.3.1 The HIA of the Project is carried out in accordance with the following technical guidance:

- EA 'Hydrogeological impact appraisal for dewatering abstractions' (Environmental Agent, 2007)
- DMRB standard LA 113 Appendix A (Highways England, 2020)

2.3.2 DMRB LA 113 Appendix A outlines a three stage process for assessing hydrogeological impacts:

- Step 1: Establish regional groundwater body status.
- Step 2: Develop a conceptual model for the surrounding area.
- Step 3: Based on the conceptual model, identify all potential features which are susceptible to groundwater level and flow impacts.

2.3.3 The EA guidance outlines a similar but more detailed 14 step process:

- Step 1: Establish the regional water resource status.
- Step 2: Develop a conceptual model for the abstraction and the surrounding area.
- Step 3: Identify all potential water features that are susceptible to flow impacts.
- Step 4: Apportion the likely flow impacts to the water features.
- Step 5: Allow for the mitigating effects of any discharges, to arrive at net flow impacts.

- Step 6: Assess the significance of the net flow impacts.
- Step 7: Define the search area for drawdown impacts.
- Step 8: Identify all features in the search area that could be impacted by drawdown.
- Step 9: For all these features, predict the likely drawdown impacts.
- Step 10: Allow for the effects of measures taken to mitigate the drawdown impacts.
- Step 11: Assess the significance of the net drawdown impacts.
- Step 12: Assess the water quality impacts.
- Step 13: If necessary, redesign the mitigation measures to reduce the impacts.
- Step 14: Develop a monitoring strategy.

2.3.4 The Preliminary HIA has qualitatively assessed impacts using the above fourteen step approach. For the ES, the assessment will be further supported by quantitative analysis of impacts (primarily from the 3D hydrogeological model).

2.3.5 The source-pathway-receptor model is applied to water features sensitive to groundwater level, flow and quality changes. In this context, sources include activities such as dewatering or spillages. The pathway is the hydraulic connection between the source and receptor, such as the aquifer that connects the two. The receptors are the groundwater bodies themselves, and/or groundwater dependent features such as public water supplies, springs, abstractions and GWDTE.

Tiered approach

2.3.6 The EA hydrogeological impact appraisal guidance recommends a tiered approach to the HIA, with the level of assessment matched to the risks associated with the decision being made.

2.3.7 The tiers can be broadly summarised as follows:

- Tier 1 (Basic) – conceptual models created based on published information or historical data. The conceptual model would typically be tested using lumped long-term average water balances and simple analytical equations, to arrive at a ‘best basic’ conceptual model.
- Tier 2 (intermediate) – conceptual models would be tested by more detailed data, such as time-variant heads and flows, and seasonal or sub-catchment water balances (semi-distributed). More detailed analytical solutions may be used (to investigate the impact of abstraction on river flows, for example), or two-dimensional steady-state groundwater models. Limited field investigations may be required to fill important gaps in the data. Tier 2 assessments are likely to focus on (and be limited to) specific areas of uncertainty that have been highlighted during Tier 1.
- Tier 3 (Detailed) - where the conceptual model represents a high degree of understanding of the hydrogeological and hydrological system and is likely to be tested using a spatially distributed and time-variant numerical groundwater model, calibrated and validated against historical data. This is likely to require the collection of data from a wide range of sources, including more field investigations.

2.3.8 It is noted that the guidance is aimed at those preparing supporting documentation for applications for transfer and full abstraction licences; at which stage there is a higher burden of evidence required.

2.3.9 For many construction activities associated with the Project, it is considered that the qualitative conceptualisation of the hydrogeology is sufficient to inform impacts, likely significant effects and mitigation measure requirements at the planning stage.

2.3.10 For activities that have the potential for higher magnitude impacts, such as construction of the reservoir, further quantitative assessment is considered beneficial to ensure that likely significant effects are accurately identified and mitigation measures incorporated.

2.3.11 As noted in 1.1.4, a numerical groundwater model is currently being calibrated against site data to quantitatively support the assessment of impacts and design measures.

2.3.12 A 3D groundwater model is currently being calibrated against site-specific data which will quantitatively inform the assessment and design of mitigation measures at ES stage; in particular the groundwater drain. Further details will be reported in the ES.

Groundwater Dependent Terrestrial Ecosystems

2.3.13 Location of GWDTEs have been identified by the EA for the second River Basin cycle of the Water Framework Directive[1] (Environmental Agent, 2024a), based on Sites of Special Scientific Interest (SSSI) outlines from Natural England, filtered to include only those sites with wetland vegetation communities listed in UK Technical Advisory Group paper 5 a-b (2004). Designated GWDTEs are shown in Figure 8: Hydrogeological designations and features. It is noted that other groundwater dependent habitats may be present within the zone of influence of the construction activities which are not included in the designated GWDTE dataset.

2.3.14 A review of other potential sites not designated as GWDTEs but with some dependence on groundwater, herein referred to as potential non-designated GWDTEs, will be undertaken for the ES stage, in consultation with the Project terrestrial and freshwater biodiversity specialists, informed by priority habitats, UK Habitat (UKHab) and National Vegetation Classification (NVC) survey data.

2.3.15 Assessment of impacts on GWDTE follows a five step, risk-based approach as per DMRB LA113 Appendix B:

- Step 1 – Identify potential linkages
- Step 2 – Assess GWDTE importance
- Step 3 – Assess potential impacts
- Step 4 – Establish risk to GWDTE
- Step 5 – Assessment outcomes and actions

2.3.16 To prevent potential duplication of likely significant effects, the potential effects on GWDTE from groundwater impacts will be reported in Chapter 7: Terrestrial ecology.

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[1] It is noted that Cycle 3 is the latest status classification, including for the quantitative GWDTE test and Chemical GWDTE test status elements. However, the designated GWDTEs dataset have been assessed by EA for the RBMP Cycle 2 dataset. No designated GWDTE locations dataset assessed for Cycle 3 is available.

2.4 Data sources

2.4.1 Section 4 of this report outlines the baseline and describes the existing condition of groundwater related features within the study area. A conceptual model based on the baseline understanding is then presented in Section 5.

2.4.2 The following sources of data and information were used to compile the baseline conditions:

- 1:10,000 British Geological Survey (BGS) Geological Map Sheets[2] (British Geological Survey, n.d.)
- British Geological Survey (BGS) geological mapping available via the online GeoIndex viewer (**Error! Reference source not found.**)
- DEFRA LIDAR data (Defra, 2022)
- DEFRA Magic Map (Defra, 2025)
- Environment Agency (EA) Abstraction Licensing Strategies (see Section 3)
- EA Catchment Data Explorer (Environmental Agent, 2025a)
- EA discharge consents data (Environmental Agent, 2025b)
- EA GWDTE data (Environmental Agent, 2024a)
- EA Hydrology Data Explorer (Environmental Agent, 2025c)
- EA request for information for licensed abstractions
- Groundsure Enviro and Geo Insight Report (Groundsure, 2025)
- Met Office HadUK Gridded climate data (Met Office, 2023)
- National River Flow Archive (NRFA) (UK Centre for Ecology and Hydrology, 2025)
- Project ground investigations (see Section 4.5)
- The BGS Lexicon of Named Rock Units (British Geological Survey (n.d.))
- The hydrogeological map of the Southwest Chilterns and Berkshire and Marlborough Down (Institute of Geological Sciences,1978)
- The physical properties of major aquifers in England and Wales. British Geological Survey Technical Report (Allen et al., 1997)
- The physical properties of major aquifers in England and Wales. British Geological Survey Technical Report (Jones et al., 2000)

2.5 Assumptions and limitations

2.5.1 The preliminary HIA has been collated based on a range of publicly available data, information provided by stakeholders and site investigation and survey data available at the time of writing.

2.5.2 Many of the publicly available datasets are at a regional scale, and as such there is a level of uncertainty associated with use of this data as they are unlikely to identify local hydrogeological and hydrological variations at a smaller scale. As an example, the geology within the study area has been assumed to be as shown on the geological maps available from the BGS which are at a minimum 1:10,000 scale, unless ground-truthed by ground investigation works.

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[2] Map sheets: SU38NE; SU38NW; SU39NE; SU39SE; SU39SW; SU48NE; SU48NW; SU49NE; SU49NW; SU49SE; SU49SW; SU58NW; SU59NE; SU59NW; SU59SE; SU59SW

2.5.3 Ground investigation works have been undertaken to inform the ground and groundwater conditions throughout the area of the Project. Groundwater level monitoring (Arcadis, 2024a and Arcadis, 2024b) began in May 2024 and is ongoing at the time of assessment. This preliminary HIA includes data analysed up to March 2025, with further analysis undertaken and presented in the ES.

2.5.4 It is acknowledged as a limitation that there may always be gaps in hydrogeological data where the information is not readily available, particularly with respect to more local receptors of lesser value. This may include the location of springs or unlicensed abstractions (less than 20m^3/day), which are not registered with local planning authorities or where land access has not been available at this stage. Due to unidentified receptors being of relatively low significance and with tertiary mitigation measures in place, these gaps are considered unlikely to result in the identification of additional likely significant effects.

2.5.5 It is assumed that abstractions located within the draft Order limits, but outside the reservoir footprint, will continue to operate as per the baseline and would not be physically removed or otherwise affected by the construction of the reservoir and associated infrastructure. This assumption does not apply to abstractions within the reservoir footprint.

2.5.6 It has been assumed that the section of Wilts and Berks Canal to be provided by the Project would be lined and as such there would be no infiltration or leakage impacts.

3 Regional water resource status

3.1.1 The proposed reservoir and western study area lie within the Kennet and Vale of White Horse Catchment Abstraction Management Strategy (CAMS) area (Environment Agency, 2007). To the east of the proposed reservoir and the eastern study area lies within the Thames Corridor CAMS area (Environment Agency, 2019b). CAMS areas are shown in Figure 2: Catchment abstraction management strategy areas. Given the critical environmental and hydrological importance of the River Thames, a bespoke licensing strategy has been developed specifically for this catchment. The key elements of this strategy are summarised below.

3.2 Thames bespoke licensing strategy

3.2.1 The Thames area has a bespoke licensing strategy that applies to the River Thames. The Lower River Thames is designated as 'water not available for licensing.' Any consumptive abstraction from its tributaries will decrease the flow in the Lower River Thames. The Kennet and Vale of White Horse catchment is a tributary of the Thames and as such the bespoke licensing strategy applies to both the Kennet and Vale of White Horse Abstraction Licensing Strategy (ALS) (Environment Agency, 2019a) and the Thames ALS (Environment Agency, 2019b).

3.2.2 The bespoke Thames licensing strategy applies to applications for the following licence types or variations to existing licences (Environment Agency, 2019b):

- Consumptive surface water abstractions
- Groundwater abstractions in direct hydraulic continuity with a river or water dependent habitat features.

3.2.3 The strategy adopts a ‘Hands off Flow’ (HoF) approach detailed within the Thames ALS (Environment Agency, 2019b).

3.2.4 Consumptive groundwater licences which do not have a direct impact upon river flow and will not contribute to the deterioration of groundwater quantitative status may be permitted but may be subject to restrictions. Applications for new non-consumptive abstraction licences or those with net environmental benefit may be permitted but may be subject to restrictions to protect local features and any bypassed reach.

3.3 Groundwater availability

3.3.1 Within the Kennet and Vale of White Horse CAMS area, the study area (Section 2.2) falls within the River Ock catchment. Water availability within the River Ock is assessed at the River Ock assessment point, which lies approximately 900 m to the east of the northern extent of draft Order limits. With the Thames bespoke licensing strategy applied there is water available at the River Ock assessment point at Q30, restricted water available at Q50 and water not available beyond this at Q70 and Q95 (Environment Agency, 2019a). Without the Thames bespoke licensing strategy applied, there is restricted water available at the River Ock assessment point at Q30 and water not available beyond this at Q50, Q70 and Q95 (Environment Agency, 2019a).

3.3.2 Within the Thames Corridor CAMS area, the study area falls within the catchment for the Days, lock and weir assessment point. With the Thames bespoke licensing strategy applied there is water available at the Days, lock and weir assessment point at Q30, restricted water available at Q50 and water not available beyond this at Q70 and Q95 (Environment Agency, 2019b). Without the Thames bespoke licensing strategy applied, there is restricted water available at the Days, lock and weir assessment point assessment point at Q30 and water not available beyond this at Q50, Q70 and Q95 (Environment Agency, 2019b).

3.4 Surface water availability

3.4.1 Water availability is the same for surface water and groundwater within both the Kennet and Vale of White Horse ALS and the Thames ALS (Environment Agency, 2019b).

4 Baseline information

4.1 Site location

4.1.1 The study area is described in Section 2.2 and shown in Figure 1: Hydrogeological study areas and topography. The study area encompasses or partly encompasses several towns and villages, including Abingdon, Wantage, Didcot, Harwell, Steventon, East Hendred and West Hagbourne. The land use within this area is predominantly agricultural, characterised by extensive farmland with small woodlands and hedgerows. Residential areas are primarily concentrated around the towns and villages.

4.1.2 The A34 runs through the eastern part of the study area. The area is served by several railway stations, including Didcot Parkway, from which railway lines extend along the south of the study area.

4.2 Topography

4.2.1 The topography of the study area is shown in Figure 1: Hydrogeological study areas and topography. The central area of the draft Order limits and within the proposed reservoir footprint is generally flat, ranging from 55 to 60 mAOD. Elevation increases towards the south, peaking at 144 mAOD in the south-west where the Chalk bedrock outcrops. It also rises slightly to about 70 mAOD in the northern part of the study area. In the west, it slopes down from approximately 80 mAOD near the A417 towards the east, reaching around 50 mAOD near the River Thames.

4.3 Surface water

4.3.1 Surface watercourses are shown in 696-ARB-XXXX-XXXX-MP-EN-000121. The baseline surface water environment of the study area can be characterised as follows:

- The study area includes several main rivers, including the River Thames, the River Ock, East Hanney Ditch, Cow Common Brook, Mere Dyke and Ginge Brook. There are also numerous ordinary watercourses, and several lakes and ponds also present.
- There are 15 WFD river water body catchments within or partly within the study area, outlined in Section 4.6.
- Watercourses within the study areas are generally extensively modified, many smaller watercourses have little to no flows during summer. Overall water quality is poor.
- Many of the watercourses are typical of a lowland system that is managed for agricultural purposes, resulting in a complex drainage system with many interconnected channels.
- Several designated and protected sites are present within the study areas, which are important for environmental or drinking water quality protection. There are licensed abstractions from surface water present within the Study area, some of which are for public water supply (shown in Figure 8: Hydrogeological designations and features).
- Agricultural land drains intersecting the proposed reservoir help to control the groundwater levels and reduce groundwater flooding during wet periods. However, ponding at the proposed reservoir is known to occur which may reflect limitations on

the capacity of the land drains and which may also be because of high groundwater levels limiting infiltration capacity to ground.

4.3.2 Preliminary groundwater modelling (Oxfordshire Wildlife and Landscape Study, 2025) indicates that watercourses in the study area, including the River Ock and River Thames, Ginge Brook, Letcombe Brook, Cow Common Brook and Portobello Ditch, interact with shallow groundwater and, in particular, gain water from superficial deposits. Although clay layers in thicker alluvial deposits may limit groundwater–surface water interactions in some areas. There may also be some loss from the superficial deposits into the Lower Greensand, dependent on the relative levels.

4.3.3 Groundwater baseflow contributions to watercourses across the study area is likely to be significantly variable along the reaches of each of the rivers due to differences in underlying geology and groundwater levels in the superficial aquifer. It is likely that the River Ock could have a greater groundwater baseflow contribution than other rivers due to artesian pressures in the underlying Corallian Limestone (the River Ock flows across these strata in some areas). Based on the observed range of groundwater levels, baseflow contribution is likely to be temporally variable (i.e. lower in summer due to aquifer water levels being below the base of the rivers/ditches). An estimate of the baseflow index (BFI) based on the Hydrology of Soil Types (HOST) (BFIHOST19) for nearby watercourses is available on the NRFA (UK Centre for Ecology and Hydrology, 2025b) and is summarised below:

- River Ock at Abingdon (Station number: 39081): 0.621
- Thames at Days Weir (Station number: 39002): 0.646

4.3.4 A BFI of approximately 0.6 indicates significant contribution from groundwater, highlighting a strong interaction between the two rivers and the groundwater. It is noted on the NRFA (UK Centre for Ecology and Hydrology, 2025b) that the River Ock's runoff is influenced by a number of groundwater abstractions and recharge sources, which may alter natural baseflow conditions. Additionally, runoff is augmented by sewage effluent inputs derived from outside the catchment, further modifying the hydrological regime and potentially masking natural groundwater contributions.

4.4 Published geology

Artificial geology

4.4.1 Mapped artificial geology is shown in Figure 4: Superficial and artificial geology.

4.4.2 Artificial geology present within the study area includes made ground and infilled ground.

4.4.3 Made Ground is an area where the pre-existing (natural or artificial) land surface has been altered in some way by human activity. Made Ground may be present in any areas which have undergone previous development or disturbance and, whilst the majority of the study area is agricultural land, made Ground may be present associated with this land use.

4.4.4 Infilled Ground refers to areas where voids such as former quarries, pits, or natural depressions have been filled with material, either natural or man-made. This material may include waste, rubble, or soil, and is typically deposited to restore ground levels or repurpose land for development or agriculture

4.4.5 Mapped areas of Artificial Ground across the study area include the following:

- A small area of made ground to the west of Willow Walk Nature Reserve in Wantage

- Made ground along East Hendred Brook to the north-west of East Hendred
- Made ground at Millenium Common and Appleford Sidings, west of Sutton Courteney
- Made Ground at Abingdon sewage works
- Made ground on the railway and historic railway sidings
- Made ground along the route of the old Wiltshire and Berkshire canal which runs across the study area
- Made ground embankments associated with the A34
- Made ground at Steventon Depot
- Infilled ground in agricultural fields to the north of Didcot
- Infilled Ground at Dorchester Lagoon and Queenford Lakes east of the River Thames

Superficial geology

4.4.6 Mapped superficial geology is shown in Figure 4: Superficial and artificial geology.

4.4.7 There are three main types of superficial deposits within the study area: River Terrace Deposits, Alluvium deposits and Head deposits.

4.4.8 The majority of the study area is covered by various sand and gravel members in the form of floodplain River Terrace Deposits. These comprise Northmoor Sand and Gravel Member Lower Facet, Northmoor Sand and Gravel Member Upper Facet, Summertown Radley Sand and Gravel Member and Wolvercote Sand and Gravel Member.

4.4.9 Alluvial deposits are found in the north-west and east as well as a small area in the centre of the study area. Small areas of alluvial are also located in the south and south-east of the study area. These deposits are associated with watercourses, namely Childrey Brook, Letcombe Brook, Cow Common Brook and Ginge Brook as well as the River Ock. Alluvium is made up of clay, silt, sand and gravel.

4.4.10 Head deposits can be found in the central, eastern and southern parts of the study area. Within the Head deposits there may be lenses of silt, clay, peat and other organic material.

4.4.11 Lithological descriptions of each of the superficial deposits is given in Table 1.

Table 1 Superficial geology

Superficial deposits		Lithological description (British Geological Survey (n.d.))
Alluvium		Homogeneous sandy, silty clay with rare fine to medium gravels of chalk and flint.
Head		Poorly sorted gravel, sand, silt and clay rock
River Terrace Deposits	Sand and gravel deposits (undifferentiated)	Sand and gravel with rare lenses of clay.
	Wolvercote sand and gravel member	Predominantly cold phase sands and gravels with Middle Jurassic limestone clasts that underlie the Wolvercote or Third Terrace of BGS maps.
	Northmoor sand and gravel member, upper facet	Cold phase sands and gravels with Middle Jurassic limestone clasts that underlie the Northmoor or First Terrace of BGS Map. Includes organic deposits and River Terrace Deposits.

Superficial deposits		Lithological description (British Geological Survey (n.d.))
	Summertown-Radley sand and gravel member	Predominantly cold phase sands and gravels with Middle Jurassic limestone clasts that underlie the Summertown-Radley or Second Terrace of BGS maps.
	Hanborough gravel member	Cold phase sands and gravels with Middle Jurassic limestone clasts that underlie the Hanborough or Fourth Terrace of BGS Maps, often decalcified.

Bedrock geology

4.4.12 Mapped bedrock geology is shown in Figure 5: Bedrock geology.

4.4.13 The bedrock geology of the study area comprises shallow dipping (1-2 degrees), marine sedimentary deposits from the Cretaceous and Jurassic period. The strata dip towards the south-east and therefore the age of the sub-cropping bedrock units decrease in age towards the south-east (Oxfordshire Wildlife and Landscape Study, 2025).

4.4.14 The Corallian Group is present in the north of the study area, comprising the Stanford Limestone Formation and Kingstone Sandstone Formation, along with a small section of the Hazelbury Bryan Formation (Sandstone).

4.4.15 The majority of the study area is underlain by Ampthill and Kimmeridge Clay Formation (herein referred to as the Kimmeridge Clay) in the form of Mudstone. A thin strip of Lower Greensand Group sandstone crosses the location of the proposed reservoir from south-west to east. The Gault Mudstone Formation is present across the south study area. The Kimmeridge Clay and Gault Mudstone Formations are fossil rich bedrock formations.

4.4.16 In the south of the study area the Upper Greensand Formation (Sandstone and Siltstone) and the West Melbury Marly Chalk Formation are present.

4.4.17 Lithological descriptions of each of the bedrock formations is given in Table 2.

4.4.18 There is no mapped faulting within the study area on the 1:50,000 scale geological maps. There are two small faults mapped near Steventon, south-east of the SESRO project shown on the 1:10,560 scale map (SU49SE) (British Geological Survey, n.d.). There is a small north-west to south-east trending fault located just south of Steventon, it displaces the base of the Upper Greensand by 25m. There is also a north-east to south-west trending fault, located just south of Milton displacing the base of the Upper Greensand by approximately 100m. Further unmapped minor faulting may be present in the study area.

4.4.19 Faulting can influence hydrogeology by acting either as a barrier to groundwater flow (due to fault gouge or low-permeability infill) or as a preferential pathway (where faults enhance permeability through fracturing). In the context of the SESRO project, no faulting is mapped beneath the proposed reservoir footprint, and the underlying Gault Clay and Kimmeridge Clay formations are low-permeability aquicludes, which further limit the likelihood of fault-related groundwater movement. While there is potential for unmapped minor faulting at depth within the bedrock, it is considered unlikely to have an impact on the groundwater environment.

Table 2 Bedrock geology

Parent group	Geological formation	Lithological description (British Geological Survey, n.d.)
Grey Chalk Subgroup	West Melbury Marly Chalk Formation	Buff, grey and off-white, soft, marly chalk and hard grey limestone arranged in couplets.
Selbourne Group	Upper Greensand	Very fine-grained sandstones and siltstones.
	Gault Formation	Over consolidated, fissured, silty, variably calcareous clay.
	Lower Greensand	Unconsolidated sands and weakly cemented sandstone.
Ancholme Group	Ampthill Clay Formation and Kimmeridge Clay Formation (Undifferentiated)	Kimmeridge Clay Formation: Mudstones with thin siltstone and cementstone beds; locally sands and silts. Ampthill Clay Formation: Mudstone with argillaceous limestone nodules; rhythmic alternations of dark grey mudstone; pale grey marls with cementstone.
Corallian Group	Stanford Formation	Shell detrital limestones, ooidal limestone, coralline limestone, fossiliferous marls, and interbedded limestone, marl and mudstone.
	Kingston Formation	Medium-grained quartzose sands with carbonate cemented beds; spiculitic sandstone, shelly and/or ooidal limestone, sandy or silty mudstone, and calcareous mudstone.
	Hazelbury Bryan Formation	Sand cemented into lenticular beds and doggers of calcareous sandstone to sandy limestone.

4.5 Ground investigation

4.5.1 The site has undergone numerous ground investigations. The following ground investigation records are available:

- Exploration Associates Ltd (1990) (Exploration Associated Ltd, 1992)
- Exploration Associates Ltd (1991/92) (Exploration Associated Ltd, 1992)
- Costain Geotechnical Services (1993/95) (UK Centre for Ecology and Hydrology, 2025a)
- Lankelma CPT Ltd (2002) (Lankelma Ltd, 2002)
- Soil Mechanics Phase 1 and Phase 2 (2002/03) (Thames Water Utilities Ltd ,1995 and Soil Mechanics Ltd, 2004)
- Norwest Holst Engineering Ltd Phase 1 and Phase 2 (2005/06) (Jacobs Ltd, 2006)
- Arcadis Phase 1, 2A and 2B (2024/25) (Allen et al., 1997, 3. Arcadis, 2024a and Arcadis, 2024b)

4.5.2 A summary of the of the geology within the proposed reservoir boundary based on the various ground investigations, is given below.

- Superficial deposits range from 0.3 to 4.75 m thickness and consist of River Terrace Deposits, Head deposits and Alluvium deposits. The thickness of these deposits is variable across the study area.

- The Kimmeridge Clay ranges from approximately 18 m thickness in the north where it is subcropping beneath superficial deposits to 42 m in the south, located below the Gault Clay and Lower Greensands.
- In the proposed reservoir area, the maximum thickness of the Lower Greensands is approximately 6 m in the southern part, while the Gault Clay reaches a maximum thickness of approximately 14 m in the south.

4.5.3 Ground investigation boreholes with groundwater level monitoring are shown in Figure 6: Groundwater monitoring locations (Groundwater level data is available from May 2024 and is ongoing, this report includes data analysed up to March 2025). There are also various historic borehole records across the study area available (British Geological Survey, n.d.).

4.6 Water Environment Regulations (WER)

4.6.1 Following the withdrawal of the UK from the European Union under the terms of the Floods and Water (Amendment etc.) (EU Exit) Regulations 2019, the Water Environment (Water Framework Directive (WFD)) (England and Wales) Regulations 2017 (WER, as amended) continue to transpose into English and Welsh law the Water Framework Directive (2000/60/EC of the European Parliament and of the Council of 23 October 2000).

4.6.2 The WER require the competent authorities in England and Wales to prevent deterioration and protect and enhance the status of aquatic ecosystems. This means that these authorities must ensure that new activities do not adversely impact upon the status of aquatic ecosystems, and that historical and ongoing activities that are already impacting it need to be addressed. The regulations apply to all bodies of water (groundwater and surface water), including those that are artificial.

4.6.3 The WER are discussed in more detail in PEI Report Appendix 5.1: WFD screening and scoping report. The study area falls within the Thames RBMP (Environment Agency, 2022). Below is a brief summary of the WFD status for the groundwater bodies and river water bodies located within the study area.

4.6.4 The proposed reservoir itself is underlain by the Gault Clay and Kimmeridge Clay which are not designated WFD groundwater bodies. Additionally, the superficial deposits present across the study area are not classified under the WFD, although they are assumed to be in hydraulic continuity with the underlying bedrock geology. Within the draft Order Limits, there are two WFD groundwater bodies present: the Shrivenham Corallian water body, which lies within the northern part of the draft Order Limits, and the Vale of White Horse Chalk water body, which just clips into the southern edge of the draft Order Limits, as shown on Figure 7: WFD groundwater bodies. A further seven WFD groundwater bodies are located along the River Thames in areas that could potentially experience changes as a result of the Project (potential impact to the River Thames downstream of the site to the tidal limit (at Teddington Weir). Details of each of these WFD groundwater bodies is detailed in Table 3 below.

Table 3 WFD groundwater bodies (Environment Agency, 2025a)

WFD Groundwater Body	Quantitative Status (Cycle 3)	Chemical Status (Cycle 3)	Overall Status (Cycle 3)	Location
Shrivenham Corallian (GB40602G600600)	Good	Good	Good	Partly within the northern extent of the draft Order limits
Vale of White Horse Chalk (GB40601G601000)	Good	Poor	Poor	Partly within the southern extent of the draft Order limits
Chiltern Chalk Scarp (GB40601G604100)	Good	Poor	Poor	Approximately 12km east of the draft Order limits
Berkshire Downs Chalk (GB40601G600900)	Poor	Poor	Poor	Approximately 13km south of the draft Order limits
South-West Chilterns Chalk (GB40601G601100)	Good	Good	Good	Approximately 21km south-east of the draft Order limits
Maidenhead Chalk (GB40601G602600)	Good	Poor	Poor	Approximately 33km south-east of the draft Order limits
Twyford Tertiaries (GB40602G602700)	Good	Good	Good	Approximately 36km south-east of the draft Order limits
Chobham Bagshot Beds (GB40602G601400)	Good	Poor	Poor	Approximately 40km south-east of the draft Order limits
Lower Thames Gravels (GB40603G000300)	Poor	Good	Poor	Approximately 47km south-east of the draft Order limits

4.6.5 The Project has the potential to impact up to 17 WFD surface water bodies (rivers), 14 of which are located within the study area, as shown on Figure 3: Surface water features. Details of each of these water bodies is detailed in Table 4 below.

Table 4 WFD river water bodies (Environment Agency, 2025a)

WFD River Water Body	2019 Ecological Status (Cycle 2)	2019 Chemical Status (Cycle 2)	2022 Ecological Status (Cycle 3)	2022 Chemical Status (Cycle 3)
Stutfield Brook (source to Ock) (GB106039023340)	Moderate	Fail	Moderate	Does not require assessment
Letcombe Brook (GB106039023350)	Poor	Fail	Poor	Does not require assessment
Cow Common Brook and Portobello Ditch (GB106039023360)	Poor	Fail		Does not require assessment
Childrey Brook and Woodhill Brooks (GB106039023370)	Moderate	Fail	Moderate	Does not require assessment
Childrey Brook and Norbrook at Common Barn (GB106039023380)	Poor	Fail	Poor	Does not require assessment
Ock (to Cherbury Brook) (GB106039023400)	Moderate	Fail	Moderate	Does not require assessment
Sandford Brook (source to Ock) (GB106039023410)	Poor	Fail		Does not require assessment
Frilford and Marcham Brook (GB106039023420)	Moderate	Fail	Moderate	Does not require assessment
Ock and tributaries (Land Brook confluence to Thames) (GB106039023430)	Poor	Fail	Poor	Does not require assessment
Moor Ditch and Ladygrove Ditch (GB106039023630)	Poor	Fail	Poor	Does not require assessment
Ginge Brook and Mill Brook (GB106039023660)	Moderate	Fail	Moderate	Does not require assessment
Thames (Evenlode to Thame) (GB106039030334)	Moderate	Fail	Poor	Does not require assessment
Thames Wallingford to Caversham (GB106039030331)	Moderate	Fail	Moderate	Does not require assessment

WFD River Water Body	2019 Ecological Status (Cycle 2)	2019 Chemical Status (Cycle 2)	2022 Ecological Status (Cycle 3)	2022 Chemical Status (Cycle 3)
Mill Brook and Bradfords Brook system, Wallingford (GB106039023600)	Moderate	Fail	Moderate	Does not require assessment
Thames (Egham to Teddington) (GB106039023232)	Poor	Fail	Poor	Does not require assessment
Thames (Reading to Cookham) (GB106039023233)	Moderate	Fail	Moderate	Does not require assessment
Thames Wallingford to Caversham (GB106039030331)	Moderate	Fail	Moderate	Does not require assessment

4.7 Aquifer classifications

4.7.1 Aquifers within the study area of have been classified by the EA based on their importance (in terms of utilisation as a resource but also their role in supporting surface water flows and wetland ecosystems). Aquifer classifications are as follows (Environment Agency, 2024b):

- **Principal aquifers** are strategically important rock units that have high permeability and water storage capacity. Principal aquifers provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands.
- **Secondary A aquifers** comprise permeable layers that can support local water supplies, and may form an important source of base flow to rivers
- **Secondary B aquifers** are mainly lower permeability layers that may store and yield limited amounts of groundwater through characteristics like thin cracks (called fissures) and openings or eroded layers
- **Secondary undifferentiated** are aquifers where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type. These have only a minor value.
- **Unproductive strata** are largely unable to provide usable water supplies and are unlikely to have surface water and wetland ecosystems dependent on them

4.7.2 Superficial aquifer deposits overlie the bedrock sequence across most of the hydrogeological study area. Their distribution and type are shown in Table 1 and Figure 4: Superficial and artificial geology and their aquifer classification is shown in Table 5. They consist mostly of River Terrace Deposits and Alluvium and are highly variable in thickness and lithology.

4.7.3 The permeable and water-bearing Alluvium, River Terrace Deposits are designated as Secondary A aquifers while the Head deposits are categorised as Secondary (undifferentiated) aquifers. These can generally be classified as minor aquifers with a shallow near-surface water table that interacts with the numerous streams and drains in the area and support small scale local water supply.

Table 5 Superficial aquifer classificaion

Superficial deposit	Aquifer classification
Alluvium	Secondary A
River Terrace Deposits	Secondary A
Head	Secondary (undifferentiated)

4.7.4 Bedrock aquifers within the study area are shown in Table 2 and Figure 5: Bedrock geology and their aquifer classification is shown in Table 6. The Gault Formation and Ampthill Clay and Kimmeridge Clay undifferentiated formation are classified as unproductive and act as aquitards in the study area. The Corallian Group and Lower Greensand are classified as Secondary A aquifers, while the Upper Greensand and Chalk in the south are classified as principal aquifers.

Table 6 Bedrock aquifer classificaion

Parent group	Geological formation	Aquifer classification
Grey Chalk Subgroup	West Melbury Marly Chalk Formation	Principal
Selbourne Group	Upper Greensand	Principal
	Gault Formation	Unproductive
	Lower Greensand	Secondary A
Ancholme Group	Kimmeridge Clay Formation	Unproductive
Corallian Group	Stanford Formation	Secondary A
	Kingston Formation	Secondary A
	Hazelbury Bryan Formation	Secondary A

4.8 Hydrogeology

Superficial aquifer properties and groundwater flow

4.8.1 Flow through the superficial deposit aquifers is by intergranular flow where the permeability will support it. Groundwater flow through the superficial deposits will be locally variable and limited to more permeable zones. Groundwater flow in the superficial deposits generally follows the topography, flowing from south to north-east, with local flow patterns likely influenced by numerous surface watercourses.

4.8.2 Due to their permeability, the Alluvium and River Terrace Deposits are anticipated to be in continuity with associated surface watercourses and underlying geology. Head deposits are likely to be more variable and heterogeneous.

4.8.3 During the various ground investigation phases outlined in Section 4.5, hydraulic testing was conducted to determine hydraulic properties of the superficial aquifers. Results from this hydraulic testing has been analysed up to March 2025 and includes data from nine boreholes within the Alluvium deposits and one borehole within the River Terrace Deposits. Particle Size Distribution (PSD) Curves were also analysed for the ground investigation boreholes.

4.8.4 The hydraulic conductivity values for the Alluvium at the site vary significantly across different boreholes, indicating a range of permeability within the deposits. The median hydraulic conductivity value within the Alluvium deposits is 6.18×10^{-6} m/s, indicating low permeability and typically indicative of fine sands and silty sands (Environment Agency, 2024a). However, the hydraulic conductivity values range from 2.43×10^{-9} m/s to 1.15×10^{-3} m/s, indicating variability of hydraulic conductivity with areas of much lower permeability which may act as barriers to groundwater flow. This variability in hydraulic conductivity can influence groundwater flow patterns, recharge rates, and contaminant transport within the superficial aquifers. PSD curves for alluvium deposits show around 50% sand and silt, and 20-30% clay, suggesting a loamy sand or sandy loam texture with minor coarse fragments.

4.8.5 The hydraulic conductivity value derived from a falling head test within the River Terrace Deposits is 7.4×10^{-5} m/s. This is within the range expected of sand and gravel mixtures and indicates a medium permeability (CIRIA, 2024). However, this result is based on only one test and may not be representative of the overall hydraulic properties of these deposits. PSD curves were produced across various ground investigation boreholes within the River Terrace Deposits. PSD curve analysis indicates that the River Terrace Deposit samples generally exhibit a loamy sand to sandy loam texture, with approximately 50 to 75% of the samples falling within the Silt and Sand ranges, and clay content ranging from 5 to 30%. There is significant variability among the River Terrace Deposit samples. Both fine (silt/clay) and coarse (gravel) fractions were identified within these samples.

4.8.6 Although no hydraulic testing has been conducted on the head deposits, PSD curves indicate a higher proportion of fine materials within these deposits. The clay content ranges from 30% to 70%, while sand and silt constitute between 30% to 60% of the sample. Some samples also contain minor coarse fragments.

Bedrock aquifer properties and groundwater flow

4.8.7 A summary of the hydraulic testing of the bedrock geology from the ground investigation starting in May 2024 (see Section 4.5) is shown in Table 7.

Table 7 Aquifer hydraulic properties

Strata	No. of boreholes tested (May 2024 to Feb 2025)	Hydraulic conductivity (m/s)		
		Lower quartile	Median	Upper quartile
Gault Clay	10	1.69×10^{-9}	5.98×10^{-9}	1.03×10^{-8}
Lower Greensands	29	1.46×10^{-8}	1.24×10^{-7}	6.40×10^{-6}
Kimmeridge Clay	45	9.08×10^{-10}	2.37×10^{-9}	4.20×10^{-8}
Corallian Group	13	2.57×10^{-9}	2.17×10^{-7}	1.66×10^{-5}

4.8.8 No hydraulic testing has been conducted within the Chalk and Upper Greensand formation. The Chalk and Upper Greensand form the escarpment to the south of the study area. The hydrogeological map of the Southwest Chilterns and Berkshire and Marlborough Down (Institute of Geological Sciences, 1978) is the most relevant hydrogeological map for the study area, which shows groundwater flow within the Chalk and Upper Greensand to generally follow topography from the higher elevations of the escarpment in the north and west toward the lower-lying areas in the south and east, outside the study area. The chalk provides baseflow to a series of springs, as outlined in Section 4.11, and may also drive flow downwards through the Gault Clay to the underlying Lower Greensand and Corallian Group (ESI, 2005a).

4.8.9 The Gault Clay is a low permeability formation with low hydraulic conductivity, ranging from $2.00\text{x}10^{-11}$ m/s to $4.64\text{x}10^{-7}$ m/s, there are unlikely to be significant direct inflows. The vertical hydraulic conductivity of the Gault controls the rate of vertical flow from the Chalk/Upper Greensand to the underlying Lower Greensand (ESI, 2005a).

4.8.10 The Lower Greensand Formation is a significant aquifer in the Thames Basin, particularly south of the London anticline in the Weald Basin. The median hydraulic conductivity of the Lower Greensands is $1.24\text{x}10^{-7}$ m/s, with an inter-quartile range of $1.46\text{x}10^{-9}$ to $6.40\text{x}10^{-6}$ m/s, indicating high variability, this may be due to the occurrence of clay within the Lower Greensand. For comparison, hydraulic conductivity measurements of cores from the Lower Greensand of the Weald District are also given in Allen et al (1997) (Defra, 2023). The median value given is 6.1×10^{-6} m/s, with an interquartile range of 2.4×10^{-6} to 5.3×10^{-5} m/s.

4.8.11 The median hydraulic conductivity of the Kimmeridge Clay is $2.37\text{x}10^{-9}$ m/s, with an inter-quartile range of $9.08\text{x}10^{-10}$ to $4.20\text{x}10^{-8}$ m/s, indicating low hydraulic conductivity. However, areas of high hydraulic conductivity may occur within the thin limestone horizons in the clay. Inflows via the limestones are likely to be small (they are <1 m thick) (ESI, 2005a).

4.8.12 The topmost limestone and sandstone beds of the Corallian Group are very permeable and form the dominant aquifer in the study area (ESI, 2005a). The underlying West Walton Beds are predominantly clayey and so are assumed to form the base of the aquifer (ESI, 2005a). The median hydraulic conductivity of the Corallian Group is $2.17\text{x}10^{-7}$ m/s, with an inter-quartile range of $2.57\text{x}10^{-9}$ to $1.66\text{x}10^{-6}$ m/s, indicating high variability. The aquifer is partially displaced by a fault in the upper part of the Ock catchment. The hydrogeological map of the Southwest Chilterns and Berkshire and Marlborough Down (Institute of Geological Sciences, 1978) shows groundwater within the Corallian Group is shown to be flowing to the south-east, an approximate groundwater level within the Corallian Group is shown to be at 40 mAOD within the site.

Rainfall and recharge

4.8.13 The closest rain gauges to the study area are Abingdon rain gauge located in the north-east of the study area and Stanford rain gauge, located 1km north-west of the study area (Environment Agency, 2025c). The locations of these rain gauges are shown on Figure 3: Surface water features. Rainfall data has also been analysed using the Met Office HadUK 5 km^2 Gridded dataset (Met Office, 2023). Average rainfall data is summarised in Table 8.

4.8.14 Averages across the three data sources are relatively similar. February to April are generally the lowest rainfall months with average rainfall ranging from 39mm to 43mm.

Whereas October to December are generally the highest rainfall months with average rainfall ranging from 54mm to 66mm. Annual average rainfall at all three sources is very similar between 601mm to 605mm.

Table 8 Average rainfall at proximal rain gauges and HadUk

	Average rainfall (mm)		
	Abingdon rain gauge	Stanford rain gauge	HadUK 5 km^2 gridded dataset
Period	Jan 1994 - Apr 2025	Jan 1994 - Dec 2024	Jan 1960 - Dec 2023
January	55.7	53.1	54.3
February	43.1	40.0	39.1
March	40.0	40.5	42.9
April	41.1	43.2	42.2
May	48.7	51.9	51.0
June	43.1	43.1	49.1
July	43.8	46.9	43.3
August	51.3	52.0	50.2
September	50.6	56.3	49.4
October	65.7	64.4	61.9
November	65.0	60.5	61.2
December	54.6	54.2	60.1
Annual	605.4	601.5	604.6

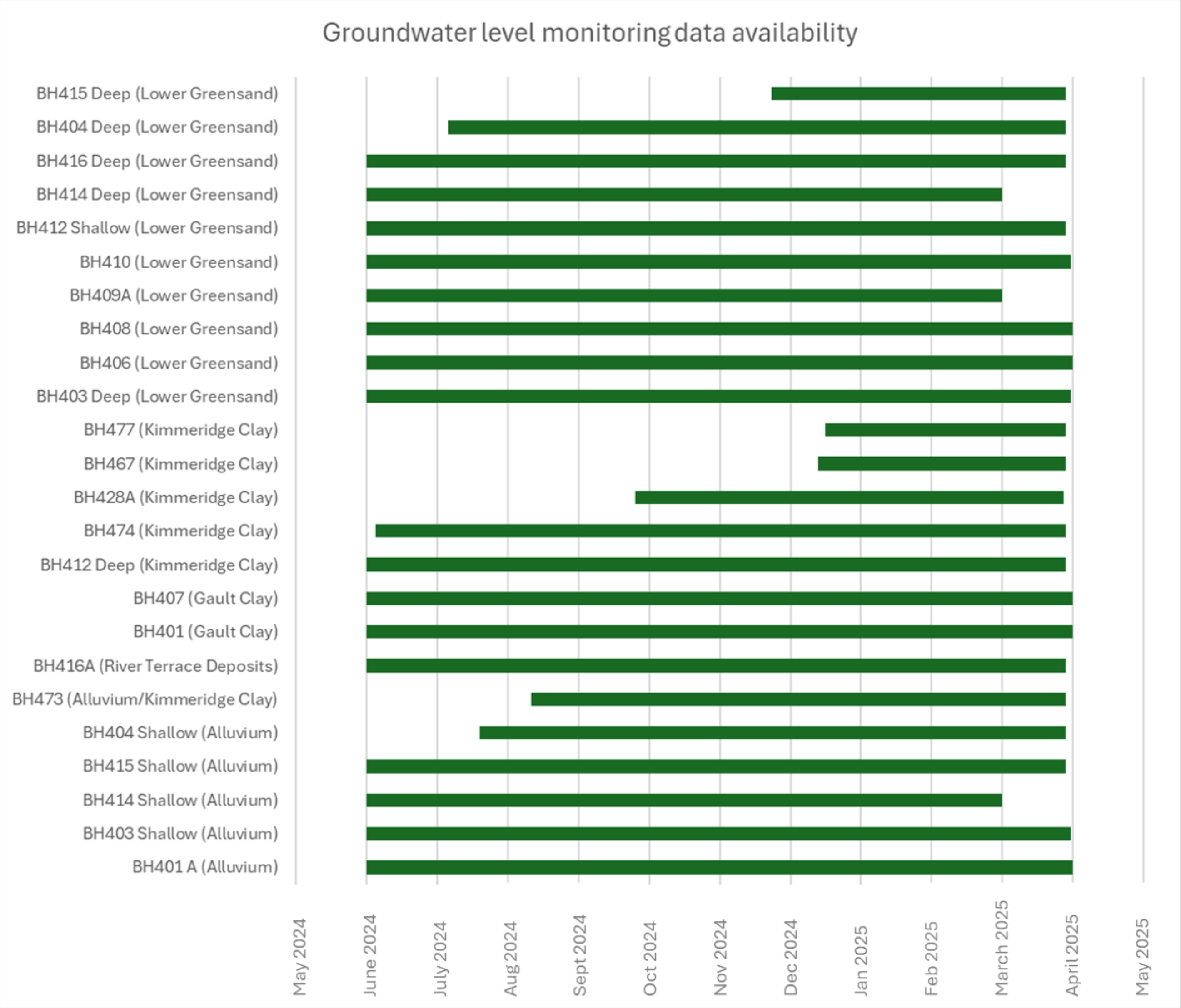
4.8.15 The primary source of recharge to the bedrock within the study area is the Corallian Group. Recharge to the Corallian Group, within the north of the study area, is relatively unimpeded due to the absence of superficial cover. Additionally, at the western end of the Ock catchment, the Lower Greensand lies unconformably and directly on top of the Corallian Group, allowing direct recharge in this area (ESI, 2005a). Minor recharge to the Lower Greensands aquifer is also likely where it outcrops within the central study area. Recharge to the Chalk and Upper Greensands is expected to occur in the southern part of the study area, where superficial cover is limited. The Gault Clay and Kimmeridge Clay are considered aquicludes, with negligible expected recharge.

4.8.16 Recharge is likely within the superficial deposits, particularly the River Terrace Deposits, which exhibit high permeability. The UK Centre for Ecology and Hydrology's eFLAG gridded dataset (UK Centre for Ecology and Hydrology, 2025a) analyses factors such as precipitation, evapotranspiration, runoff, and existing soil moisture deficit (SMD) to calculate potential recharge on a 2 km² grid across Great Britain for specific aquifers, including the Thames Gravels Water Body. The Thames Gravels Water Body serves as an analogous aquifer to the River Terrace Deposits within the study area. From 1989 to 2018, median potential monthly recharge to the Thames Gravels Water Body ranged from 1mm in June or July to 26mm in December, with a median annual total of 115mm. Equivalent data for the Alluvium or Head deposits within the study area is unavailable. Due to their lower permeability, recharge within the Alluvium and Head deposits is anticipated to be less than that of the River Terrace Deposits. Recharge within the Head deposits are expected to be low due to their variability and heterogeneity.

Groundwater levels

4.8.17 Groundwater level monitoring has been undertaken as part of the 2024 ground investigation (Arcadis, 2024a and Arcadis, 2024b). Groundwater level data is available from May 2024, and monitoring is ongoing with additional monitoring planned. This report includes data analysed up to March 2025, with further analysis to be presented in the ES. The availability of groundwater level monitoring data across the monitoring period is shown in Plate 1. Additionally, historic groundwater monitoring data is available from the EA (Environment Agency, 2025c). The groundwater level monitoring borehole locations are shown in Figure 6: Groundwater monitoring locations.

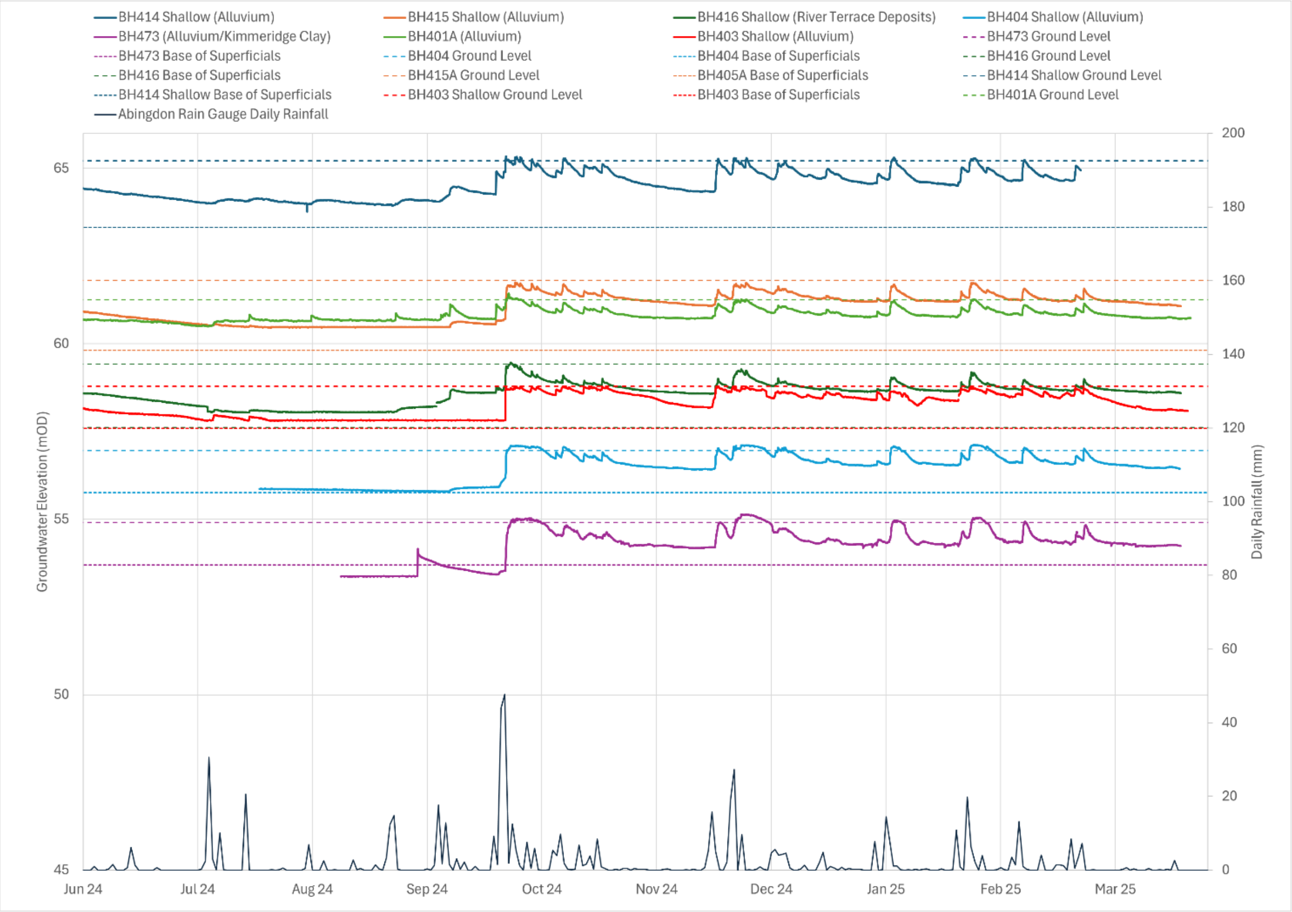
Plate 1 Groundwater level monitoring data availability



Superficial deposits

4.8.18 Groundwater level monitoring within the superficial deposits is shown in Plate 2. Groundwater levels within the superficial deposits range from 53 to 66 mAOD, and between 0 to 1.5 mbgl (metres below ground level) with levels generally between 0.2 and 1.1 mbgl. These levels suggest that the Rivers Ock and Thames may be gaining water from groundwater locally, although clay layers in thicker alluvial deposits may limit groundwater – surface water interactions in some areas. The other watercourses on site (e.g. East Hanney Ditch, Cow Common Brook, Mere Dyke) are likely in continuity with the superficial deposits. Plate 2 also shows daily rainfall at Abingdon rain gauge and the ground level and base of the superficials within the boreholes. Generally, the superficial groundwater levels show a seasonal response, with the lowest groundwater levels in summer (July and August) and groundwater levels rising through October, November, and December. Groundwater levels within the superficial deposits are responsive to rainfall as shown by the large rainfall event in September 2024 and subsequent rise of groundwater levels across all monitoring boreholes. Additionally, water levels reached ground level in several of the boreholes, highlighting the risks of groundwater flooding. Further information on groundwater flooding will be included in the Flood Risk Assessment (FRA) within the ES.

Plate 2 Groundwater level monitoring within the superficial deposits



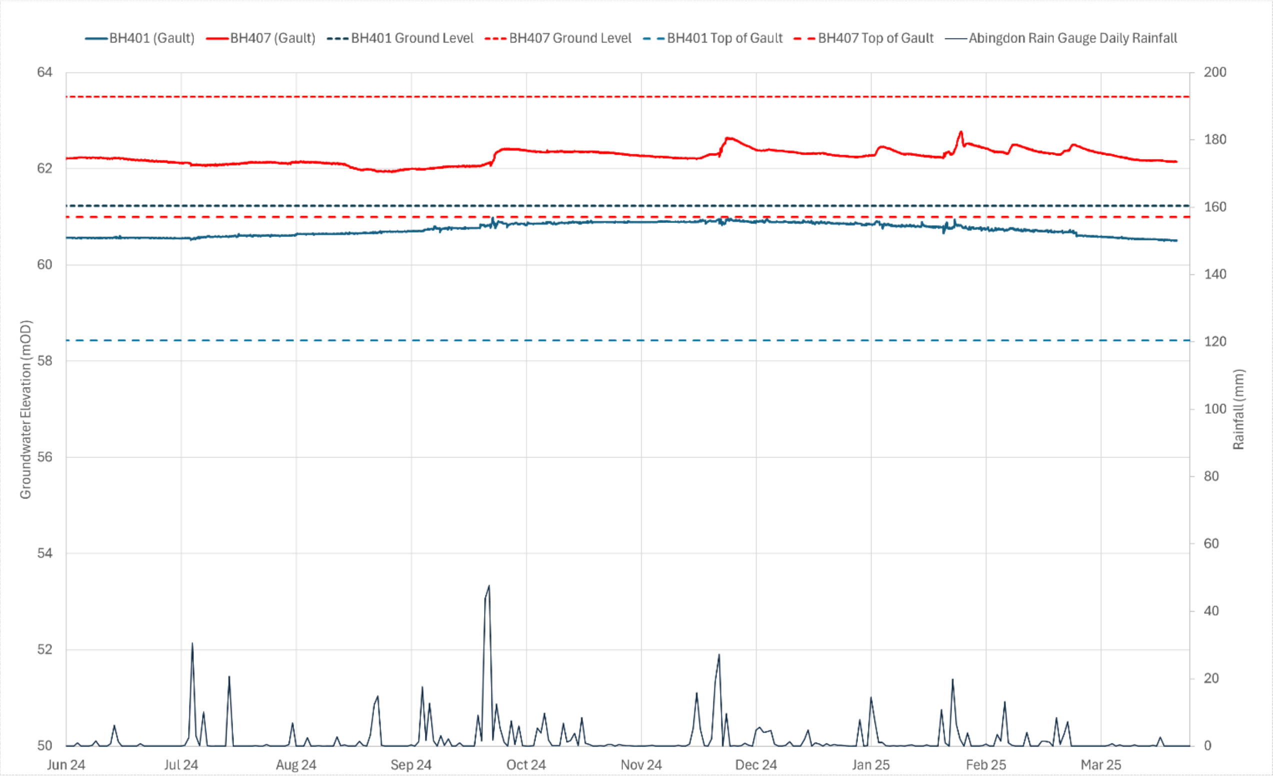
Gault Clay

4.8.19 Groundwater level monitoring within the Gault Clay is shown in Plate 3. Groundwater levels across the monitoring period varied by 0.05 m in BH401 and 0.13 m in BH407. The data indicates slight seasonal fluctuations, with levels during October to January being slightly higher than those observed in June and July. It is important to note that a full year of monitoring has not yet been completed.

4.8.20 The piezometric head in both boreholes is above the top of the Gault Clay, indicating confining pressures. Borehole BH407 appears to be more responsive to rainfall compared to BH401, likely due to a thinner overlying clay cover at BH407.

4.8.21 The limited groundwater level variation observed in BH401 and BH407, combined with the consistent exceedance of the formation top by piezometric heads, indicates that the Gault Clay functions as a confined aquitard with low permeability.

Plate 3 Groundwater level monitoring within the Gault Clay



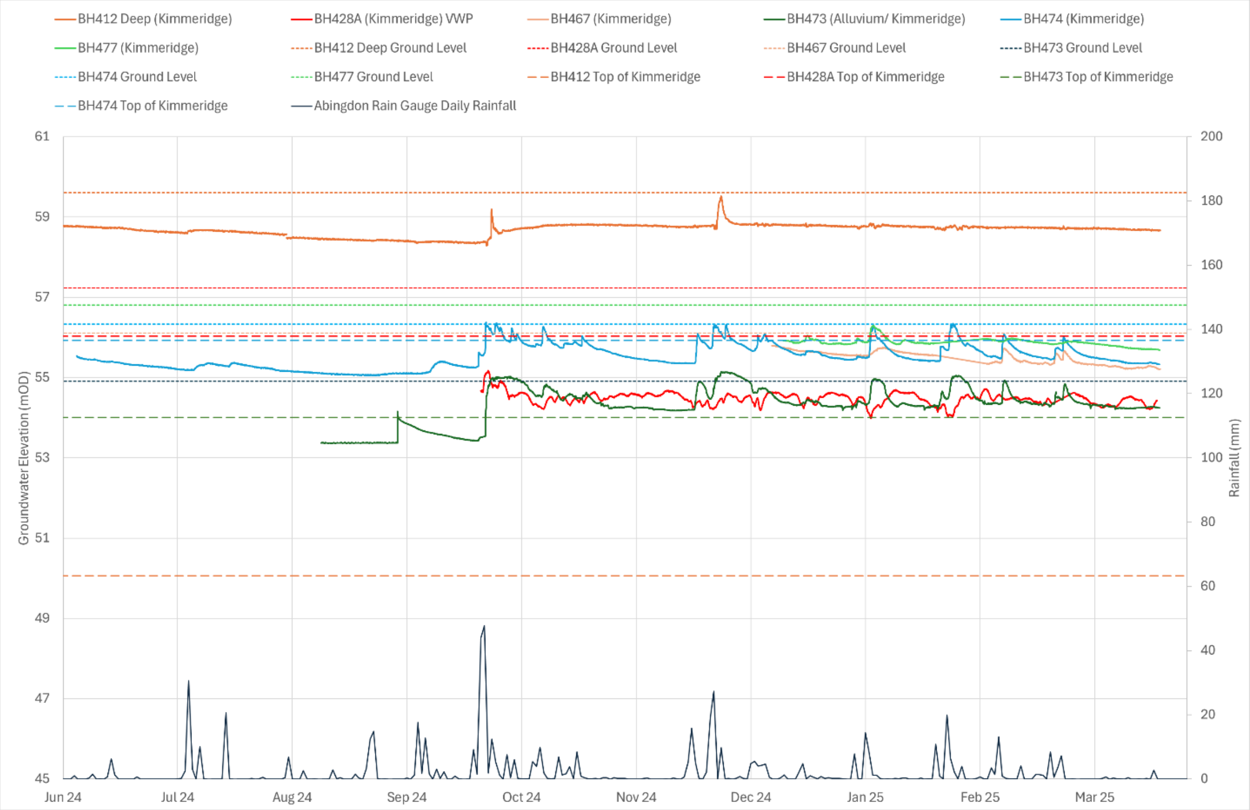
Kimmeridge Clay

4.8.22 Groundwater level monitoring within the Kimmeridge Clay is shown in Plate 4. The monitoring data indicates minor seasonal fluctuations. Levels are generally higher between October and January compared to those recorded in June and July. It is important to note that the monitoring period does not yet cover a complete hydrological year. During the observed period, groundwater levels in boreholes BH474 and BH473 fluctuated by approximately 1.5 metres. In contrast, variations in the remaining boreholes were more limited, ranging from approximately 1.0 metre to 0.5 metres. BH474 and BH473 are equipped with shallower monitoring installations and have less overlying clay, making them more responsive to rainfall. However, some degree of rainfall response is evident across all monitored boreholes.

4.8.23 The piezometric head in BH474 and BH473 regularly exceed the top of the Kimmeridge Clay, indicating confining pressures. A similar trend is observed in BH467, where the piezometric head remains above the formation top throughout the monitoring period. In contrast the piezometric head in BH428A remains below the formation top across the monitoring period. Levels for the top of the Kimmeridge Clay are not yet available in BH467 and BH477.

4.8.24 The observed groundwater level variations and piezometric head data suggest that the Kimmeridge Clay generally behaves as a low-permeability, confined aquitard, with localised variability in hydraulic response.

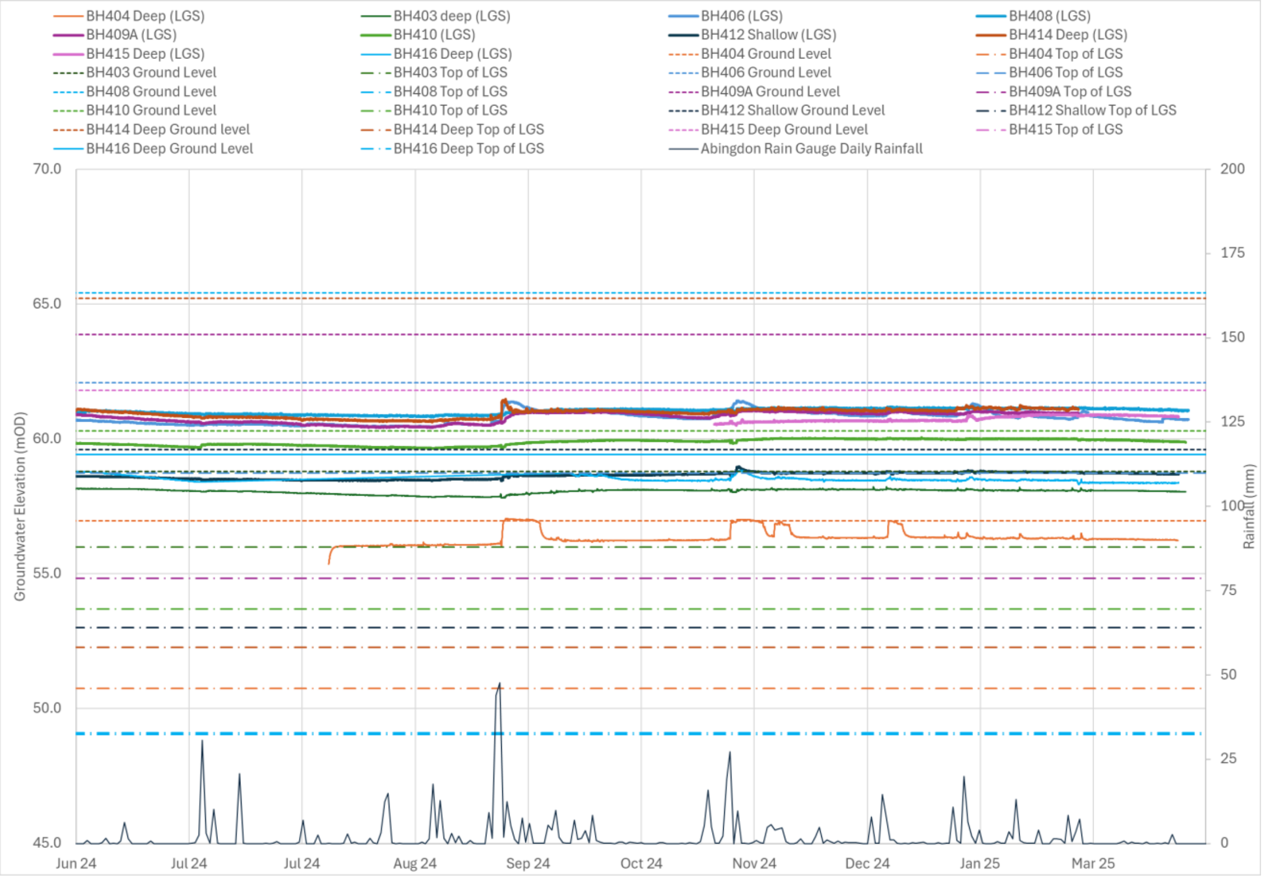
Plate 4 Groundwater level monitoring within the Kimmeridge Clay



Lower Greensands

4.8.25 Groundwater level monitoring within the Lower Greensand is shown in Plate 5. Groundwater elevations across the monitored boreholes range from approximately 56 to 61 mAOD (0 to 5 mbgl). Within individual boreholes groundwater levels fluctuated by approximately 0.5 to 1 m, with clear seasonal trends and short-term fluctuations of corresponding to rainfall events. The data shows that groundwater levels generally decline through the summer months and begin to recover from October onwards, consistent with seasonal recharge patterns. Notably, sharp rises in groundwater levels following significant rainfall events (such as those observed in September and January) demonstrate the aquifer’s high responsiveness to recharge. Following recharge, groundwater may discharge to nearby surface water features as baseflow, contribute to lateral flow within the aquifer, or be retained within the aquifer.

Plate 5 Groundwater level monitoring within the Lower Greensands



Corallian Group

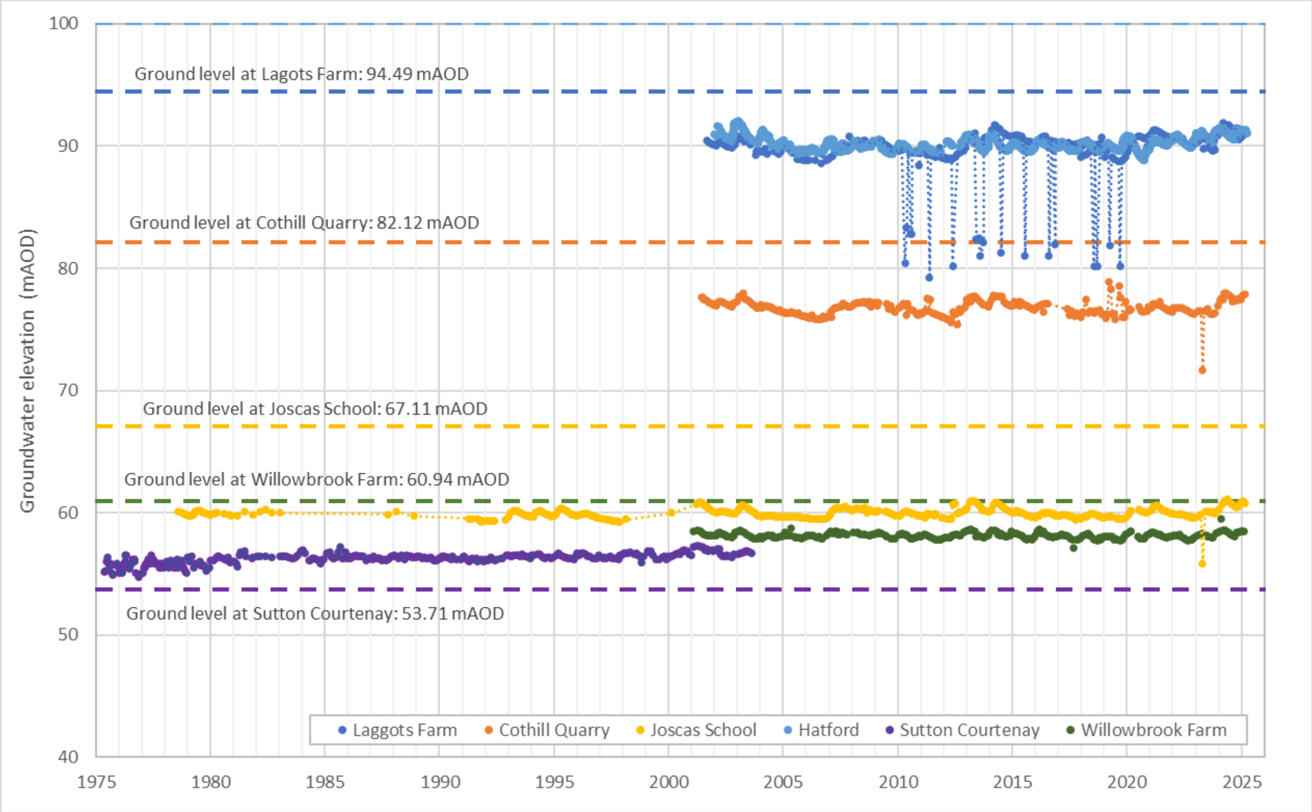
4.8.26 Groundwater level data for the Corallian Group is currently derived from long-term EA monitoring boreholes, shown in Figure 6: Groundwater monitoring locations. These records are being supplemented by site-specific monitoring as part of the ongoing ground investigation, with results to be reported in the ES.

4.8.27 There are six local boreholes monitoring groundwater levels within the Corallian Group, groundwater level monitoring within these boreholes is shown in Plate 6. Two of these boreholes, Willowbrook Farm and Sutton Courtenay, monitor the Corallian Group where it is confined under the Kimmeridge Clay and, in the case of Sutton Courtenay, also under the Gault Clay. The remaining four boreholes monitor the Corallian Group further north, where it is at outcrop.

4.8.28 Groundwater levels within the Corallian Group range from 0 to 10 mbgl. The boreholes monitoring within the Corallian Group generally show relatively stable long-term groundwater levels with seasonal fluctuations of around 1 to 3 m. The boreholes monitoring the Corallian Group at outcrop (Cothill Quarry, Hatford, Joscas School, and Loggots Farm) show more pronounced seasonal fluctuations, likely due to their responsiveness to seasonal rainfall.

4.8.29 Additionally, it is noted that the monitoring at Sutton Courtenay indicates artesian pressures within the confined Corallian Group, with groundwater levels consistently measured above the ground level at the site.

Plate 6 Groundwater level monitoring within the Corallian Group

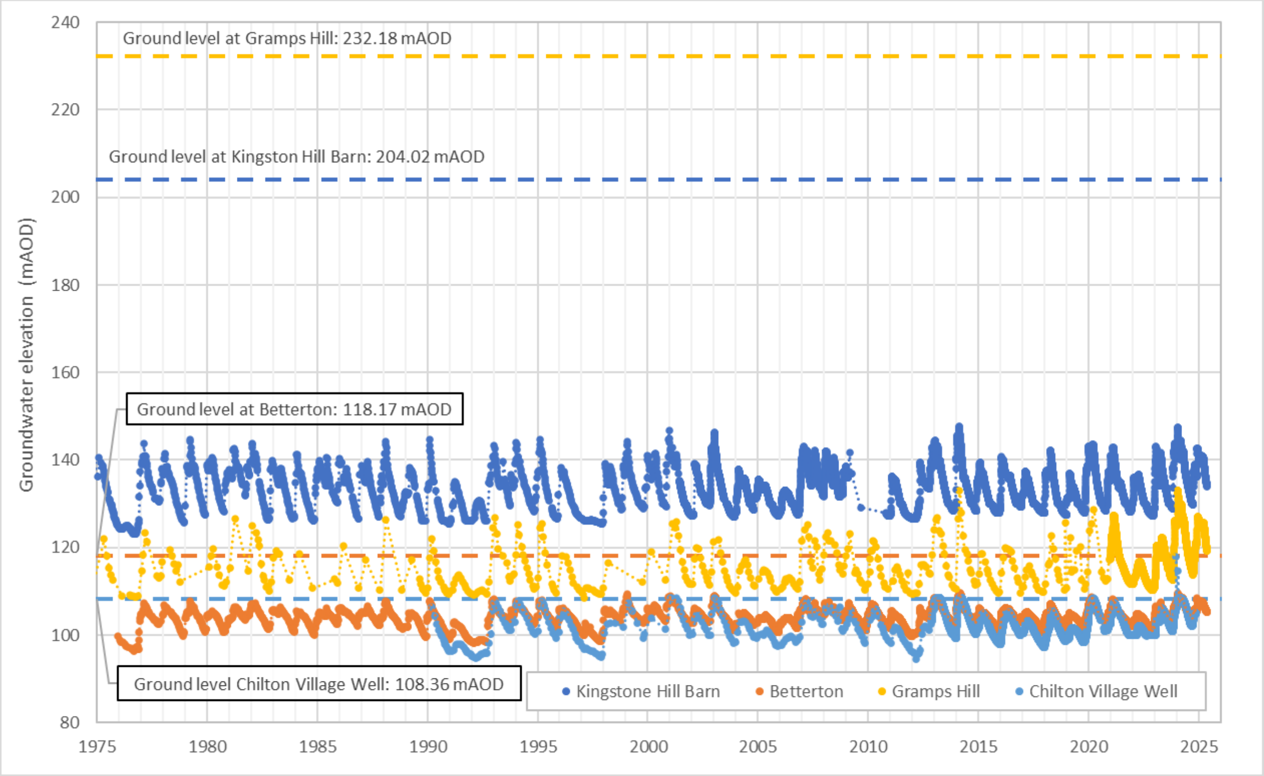


Chalk

4.8.30 Groundwater level data for the Chalk is currently derived from long-term EA monitoring boreholes, shown in Figure 6: Groundwater monitoring locations. These records are being supplemented by site-specific monitoring as part of the ongoing ground investigation, with results to be reported in the ES.

4.8.31 There are four local boreholes monitoring groundwater levels within the Chalk, as shown in Plate 7. Groundwater levels in the chalk range from approximately 95 to 145 mAOD, and 0 to 12mbgl. The data from these boreholes indicate stable long-term groundwater level trends. All four boreholes exhibit noticeable seasonal fluctuations ranging from approximately 5 to 15 m. The monitoring locations in the west, specifically Gramps Hill and Kingston Hill Barn, show greater seasonal fluctuations compared to the eastern locations. Notably, Chilton Village Well occasionally reaches groundwater levels above ground level, indicating occasional artesian pressures.

Plate 7 Groundwater level monitoring within the Chalk



Groundwater quality

4.8.32 The 2005 ESI Interpretation of Groundwater Chemistry report (ESI, 2005b) provides a detailed interpretation of groundwater chemistry in the Ock catchment area, focusing on the proposed reservoir. The groundwater chemistry of the Corallian Group shows a range of water types from calcium bicarbonate to sodium chloride/sulphate. The unconfined aquifer is dominated by calcium bicarbonate, while the confined aquifer exhibits a transition to more saline conditions. The groundwater chemistry of the Corallian Group shows a range of water types from calcium bicarbonate to sodium chloride/sulphate. The unconfined aquifer is dominated by calcium bicarbonate, while the confined aquifer exhibits a transition to more saline conditions. The Kimmeridge Clay and Oxford Clay show variations in salinity and ion concentrations with depth and location, with high total dissolved solids and dominant sulphate concentrations. The groundwater within the superficial deposits is dominated by calcium bicarbonate, with variations in ion concentrations influenced by proximity to watercourses. The groundwater and pore water concentrations were also compared with drinking water standards. The analysis revealed that certain species, such as sulphide, silver, nitrite, chloride, and sodium, may exceed the standards in specific locations within the Corallian Group.

4.8.33 Groundwater quality is discussed further in Chapter 10: Geology and soils.

4.9 Environmentally designated sites

4.9.1 A small section in the south-western part of the study area falls within Source Protection Zone 1 (SPZ1). This SPZ is linked to the Wantage supply in the Chalk aquifer, situated approximately 4km south-west of the draft Order limits, as illustrated on Figure 8:

Hydrogeological designations and features. No additional SPZs are present within the study area.

4.9.2 There is one Drinking Water Safeguard Zone (DWSZ) for groundwater within the study area which is based on the SPZ. Two further DWSZs are located adjacent to the River Thames in the Thames (Reading to Cookham) and Thames (Cookham to Egham) catchments (Figure 8: Hydrogeological designations and features).

4.9.3 The entirety of the study area lies within a Nitrate Vulnerable Zone (Figure 8: Hydrogeological designations and features).

4.9.4 EA data shows three designated GWDTEs within the study area:

- Barrow Farm Fen (SSSI), approximately 500m north of the draft Order limits
- Frilford Heath, Ponds and Fens (SSSI), approximately 200m north of the draft Order limits
- Little Wittenham (SSSI), approximately 7km east of the draft Order limits.

4.9.5 Designated GWDTEs are shown on Figure 8: Hydrogeological designations and features.

4.9.6 A review of potential non-designated GWDTE will be included in the ES, in consultation with the Applicant's terrestrial and freshwater biodiversity team, informed by available priority habitat, UKHab and NVC survey data.

4.10 Water resources

Abstractions

4.10.1 Licensed abstractions and impoundments are shown on Figure 8: Hydrogeological designations and features.

4.10.2 There are a total of 32 licensed abstractions (13 groundwater and 19 surface water) located within or partly within the study area and one licensed impoundment, along Moor Ditch.

4.10.3 There are 25 point abstractions within the study area. One of the abstractions is used for water supply and energy production and located on the River Thames, 17 are agricultural abstractions, four are industrial abstractions and the remaining are used for energy production or amenity purposes. Two of the 25 point abstractions within the study area are also within the draft Order limits, both are groundwater abstractions. One is located approximately 1.1km north-west of the proposed reservoir footprint and abstracts from the Corallian Group. The other is located approximately 2.7km north-east of the proposed reservoir footprint, and abstracts from the River Terrace Deposits. Table 9 shows the distribution and type of abstractions within the study area.

Table 9 Point abstraction types and spatial distributions within study area

	Surface Water	Groundwater			Total
		Corallian Group	Lower Greensands	River Terrace Deposits	
Inside draft Order limits	0	1	0	1	**2**

Outside draft Order limits	15	3	1	4	23
Total	**15**	**4**	**1**	**5**	**25**

4.10.4 There are four reach surface water abstractions located within, or partly within, the study area. Of which three are used for spray irrigation and one for hydroelectric power. One of these reach abstractions is located along the River Ock near Garford and located partly within the draft Order limits.

4.10.5 There are three area abstractions within the study area, one of which is located partly within the draft Order limits, south of Caldecott. All three area abstractions within the study area are dewatering abstractions within the River Terrace Deposits for industrial use.

4.10.6 There is one impoundment within the study area on Moor Ditch, located approximately 3km east of the draft Order limits.

Private water supplies

4.10.7 Private water supply data has been requested from the local authorities (Vale of White Horse council and South Oxfordshire council) but not yet been received. This data will be analysed at ES stage.

4.10.8 A spring, located about 600m south of the draft Order limits in the Upper Greensand formation, is noted on the BGS hydrogeological map (Institute of Geological Sciences, 1978) as being used for water supply, shown in Figure 8: Hydrogeological designations and features.

Discharges

4.10.9 61 active consented discharges have been identified from EA data within the study area, shown on Figure 8: Hydrogeological designations and features. The receiving environment classifications of these discharges are summarised below:

- 46 discharge to freshwater rivers
- 12 discharge into land / infiltration systems
- Two discharge to grass plots / irrigation areas
- One discharge into groundwater via a borehole

4.10.10 These include discharges associated with domestic effluent, waste-water treatment works (WwTW), and trade effluent.

4.10.11 16 of these discharges are located within the draft Order limits, all of which are discharges to freshwater rivers. Including three trade discharges and 13 sewage discharges (of which 11 are operated by Thames Water).

4.11 Water features

4.11.1 A number of springs are located within the study area. These include:

- The BGS hydrogeological map (Institute of Geological Sciences, 1978) shows a spring line, about 3km south of the draft Order limits, including three mapped springs within the study area underlain by the Upper Greensands which feed several minor watercourses, as shown on Figure 8: Hydrogeological designations and features. One of these springs, located about 600m south of the draft Order limits, is noted on the hydrogeological map as being used for water supply (see Section 4.10.8).

- A spring located approximately 0.5km to the north-east of the draft Order limits, underlain by the Corallian Group, is also identified on the BGS hydrogeological map (Institute of Geological Sciences, 1978) and shown on Figure 8: Hydrogeological designations and features. This likely feeds a tributary of the River Ock.
- Marcham Salt Water Spring Local Wildlife Site (LWS) is located approximately 1km north of the proposed reservoir embankments at Marcham Mill (north of the River Ock) underlain by the Corallian Group. It is one of the few inland salt springs in the UK that support salt-tolerant (halophytic) plant species typically found in coastal environments. The site is particularly important for its population of Wild Celery (*Apium graveolens*) (Soil Mechanics Ltd, 2002).

4.11.2 Further walkover surveys to identify features such as abstractions and springs will be undertaken and reported on in the ES.

4.12 Other features susceptible to drawdown impacts

4.12.1 South Oxfordshire Crematorium is located approximately 500m to the north-west of the proposed reservoir and has been identified as a potential site that may be impacted by drawdown. Bedrock geology underlying the crematorium is the Corallian Group. There are no mapped superficial deposits underlying crematorium within the BGS 1:50k superficial mapping (British Geological Survey, n.d.), however on a more local scale superficial deposits may be present.

4.12.2 Within the draft Order limits, there are two scheduled monument sites: Site SE of Noah's Ark Inn, Frilford, and Sutton Wick settlement site. These buried archaeological sites may be susceptible to drawdown.

4.12.3 Collaboration with the Applicant’s heritage team is ongoing to identify any heritage sites that may be susceptible to drawdown impacts and these will be assessed in the ES.

4.13 Groundwater flooding

4.13.1 The susceptibility to groundwater flooding within the study area is shown in Figure 9: Groundwater flooding susceptibility. Groundwater flooding is generally caused by rising groundwater levels in permeable strata.

4.13.2 Within the draft Order limits, several areas are identified as having a potential for groundwater flooding to occur at surface level. These are primarily located in the central and southern portions of the draft Order limits, including areas adjacent to Cow Common Brook and extending toward the southwest boundary. These areas are predominantly underlain by permeable superficial deposits, such as River Terrace Deposits and Alluvium. Additionally, areas with potential for groundwater flooding of property situated below ground level are present within the draft Order limits, particularly around Drayton. Areas with limited potential for groundwater flooding to occur include those underlain by the Lower Greensand, Corallian Group, Upper Greensand, and Chalk formations. n locations within the draft Order limits where superficial deposits are absent and the underlying Kimmeridge Clay or Gault Clay is at outcrop, groundwater flooding is not considered a risk.

4.13.3 Groundwater flood risk will be discussed further as part of the FRA in the ES.

5 Conceptualisation

5.1.1 Based on the baseline understanding of the study area as outlined in Section 4. Table 10 summarises the hydrogeological conceptualisation of the study area. A conceptual cross section of the study area is also shown in Plate 8 and Plate 9.

Table 10 Conceptual model

Model Element	Study area description
Surface topography	The topography of the study area is mostly flat in the central region (55–60 mAOD), where the proposed reservoir is located. Elevation increases to the south, reaching 144 mAOD in the south-west due to Chalk bedrock. The north rises slightly to about 70 mAOD, while the west slopes down from 80 mAOD near the A417 to around 50 mAOD near the River Thames in the east.
WFD groundwater catchment	The proposed reservoir itself is underlain by Clay and not designated as a WFD groundwater bodies. Additionally, the superficial deposits present across the study area are not classified under the WFD There are two WFD groundwater bodies within the draft Order Limits, the Shrivenham Corallian water body in the north and the Vale of White Horse Chalk water body in the south. A further seven WFD groundwater bodies are located along the River Thames in areas that could potentially experience changes as a result of the Project.
Main groundwater bodies	There are three main types of superficial deposits within the study area: River Terrace Deposits, Alluvium deposits and Head deposits. The Alluvium deposits, designated as Secondary A aquifers, are primarily located along watercourses within the central and eastern parts of the study area. The River Terrace Deposits, also classified as Secondary A aquifers, are found throughout the study area. The Head deposits, designated as Secondary (undifferentiated) aquifers, are more widespread across the southern and western parts of the study area. The Corallian Group is the dominant aquifer in the area, outcropping to the north of the study area, designated as a Secondary A aquifer. The Gault Clay and Kimmeridge Clay underlying the proposed reservoir act as low permeability aquicludes, designated as unproductive. A thin strip of Lower Greensand formation also underlies the proposed reservoir, the Lower Greensand is a significant and variable aquifer, with potential clay layers, designated as a Secondary A aquifer. The Chalk and Upper Greensand outcrop to the south of the study area and are designated as Principal aquifers.
Groundwater flow direction	Groundwater flow through the superficial deposits will be locally variable and limited to more permeable zones.

Model Element	Study area description
	Groundwater flow in the Alluvium and River Terrace deposits generally mirrors the topography, flowing from south to north-east, with local flow patterns influenced by numerous surface watercourses. Groundwater flow in the Head deposits is more restricted and variable due to the higher clay content and heterogeneity. Where permeable zones exist, flow is likely to be shallow and slow, generally following topography. Groundwater flow within the Corallian Group is generally south-east. Groundwater within the Chalk and Upper Greensands flows from the higher elevations of the escarpment in the north and west toward the lower-lying areas south of the study area. Minimal groundwater flow is anticipated with the low-permeability Gault Clay and Kimmeridge Clay.
Approximate groundwater level	Superficial groundwater levels range from 53 to 66 mAOD and are typically shallow (0–1.5 mbgl), showing clear seasonal fluctuations and responsiveness to rainfall, with occasional artesian conditions. The Gault Clay and Kimmeridge clay show limited groundwater level variation with piezometric heads consistently above the formation top, suggesting confined conditions. Groundwater levels within the Lower Greensands levels range from approximately 56 to 61 mAOD (0 to 5 mbgl) with groundwater fluctuations of up to 1m in response to rainfall. The Corallian Group shows groundwater levels between 0 and 10 mbgl, with seasonal variations of 1 to 3 m. No groundwater monitoring has been undertaken within the Chalk or Upper Greensands as part of the SESRO project however EA groundwater monitoring shows the Chalk formation has groundwater levels ranging from 95 to 145 mAOD.
Regional faults	No significant regional faults identified.
Surface water bodies	The main surface water bodies present are the River Thames, the River Ock, East Hanney Ditch, Cow Common Brook, Mere Dyke and Ginge Brook. There are also numerous main rivers, ordinary watercourses, and several lakes and ponds also present. The Project has the potential to impact up to 17 WFD surface water bodies (rivers), 14 of which are located within the study area
Groundwater Abstractions Licences	There are 32 licensed abstractions located within or partly within the study area and one licensed impoundment. One of which is a water supply abstraction located on the River Thames. Of the 32 abstractions, 2 are located within the draft Order limits and are groundwater point abstractions, abstracting from the Corallian Group and the River Terrace Deposits.
SPZs	A small section in the south-western part of the study area falls within an SPZ1, linked to the Wantage supply in the Chalk aquifer, located approximately 4km south-west of the draft Order limits.

Model Element	Study area description
Groundwater - surface water Interactions (GWSWI)	EA data shows three designated GWDTEs within the study area: Barrow Farm Fen (SSSI); Frilford Heath, Ponds and Fens (SSSI) and Little Wittenham (SSSI). The Chalk and Upper Greensand formations are known to contribute baseflow to springs, there are three mapped springs located to the south of the study area. There is a further mapped spring located in the north of the study area, on the Corallian Group. Additionally, Marcham Salt Water Spring LWS is located approximately 1km north of the proposed reservoir embankments at Marcham Mill.
Recharge	Recharge to the bedrock aquifers in the study area primarily occurs in the north of the study area where the Corallian Group is at outcrop. In the western Ock catchment, the Lower Greensand directly overlies the Corallian Group, enabling direct recharge in that area Recharge to the Chalk and Upper Greensand occurs mainly in the southern area, where superficial cover is limited. Within the superficial deposits, recharge is most significant in the River Terrace Deposits due to their high permeability. Recharge is also likely to occur through the Alluvium deposits. Recharge in the Head deposits is expected to be lower.

Plate 8 North – South conceptual cross section

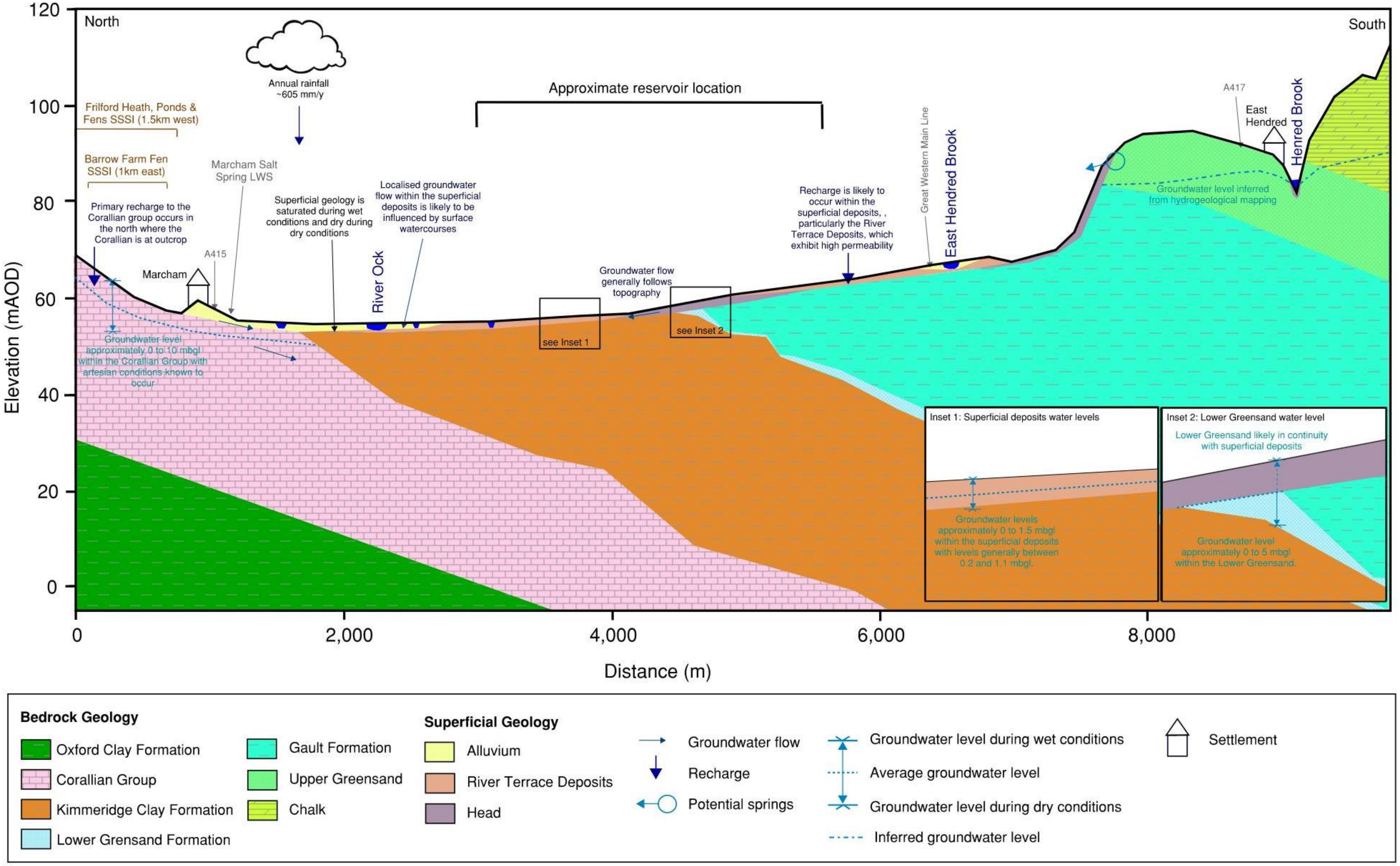
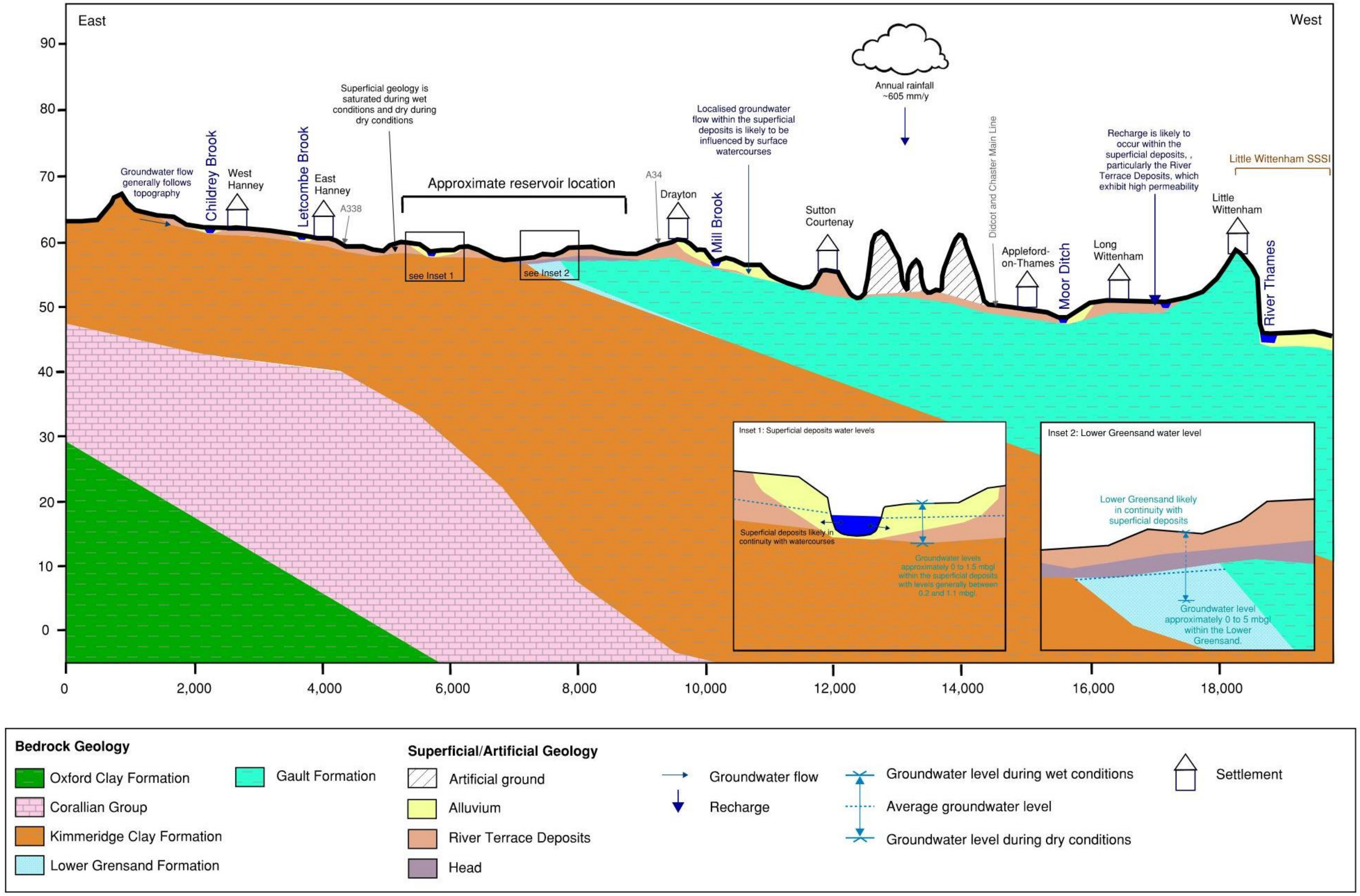


Plate 9 East - West conceptual cross section



6 Assessment of impacts

6.1 Introduction

6.1.1 This section assesses the potential hydrogeological impacts of the Project during both construction and operation phases on groundwater dependent receptors without mitigation measures in place. The findings subsequently inform the mitigation measure requirements on a precautionary basis, as detailed in Section 7.

6.2 Impacts of the Project

Construction

Impacts on groundwater levels and flows

6.2.1 Construction activities associated with SESRO have the potential to alter groundwater levels and flows through activities including dewatering, excavation, temporary abstraction, emplacement and piling. These changes may affect both superficial and bedrock aquifers, as well as dependent receptors such as springs, GWDTEs, and private water supplies.

6.2.2 Key sources of impact during construction include:

- Dewatering may be required to maintain dry working conditions, potentially lowering groundwater levels in the surrounding area.
- Physical barriers such as embankments and underground structures, which may impede or redirect groundwater flow; primarily the reservoir emplacement.
- Excavation, piling and trenching, particularly in permeable superficial deposits, which may disrupt shallow groundwater flow paths.
- Tunnel boring for conveyance infrastructure may intercept groundwater, causing localised drawdown and diversion of flow paths.
- Temporary hardstanding and drainage infrastructure, which may reduce infiltration and alter recharge patterns.
- Removal of receptors within footprint.
- Consumptive abstractions for construction water supply (such as dust suppression).

6.2.3 Changes in groundwater levels and flows within permeable aquifers can influence connected receptors through established hydraulic pathways. Where aquifers are linked to surface watercourses, springs, abstractions, or GWDTEs, alterations in flow direction or reductions in groundwater levels may lead to decreased baseflow or reduced water availability. The extent of these effects depends on the strength of the hydraulic connection and the scale of change.

6.2.4 Receptors potentially affected by changes in groundwater levels and flows include:

- Aquifers: Both superficial and bedrock aquifers within the development footprint and hydraulically connected aquifers.
- Licensed abstractions and private water supplies from hydraulically connected units (or that are directly impacted within Order limits).

- Surface watercourses: Baseflow contributions to the River Thames, River Ock, and other minor watercourses may be reduced.
- Hydraulically connected springs.
- GWDTEs: Hydraulically connected designated sites as well as potential non-designated GWDTEs.
- Other features susceptible to drawdown impacts
- Sensitive anthropogenic sites (such as burials or saturated historical sites)

Impacts on groundwater quality

6.2.5 Groundwater quality may be compromised during construction due to accidental releases of contaminants, mobilisation of sediments, and infiltration of leachate from construction materials. These risks are particularly relevant in areas with permeable soils and shallow water tables. However, in parts of the site where low-permeability clays such as the Gault Clay and Kimmeridge Clay are present, these units act as aquicludes and limit vertical migration of contaminants.

6.2.6 Potential sources of contamination include:

- Fuel and chemical spills from construction plant and storage areas.
- Leachate from concrete, asphalt, and other construction materials.
- Sediment-laden runoff from exposed soils and stockpiles.
- Accidental discharge of wastewater or contaminated stormwater.

6.2.7 Potential pathways of groundwater contamination include:

- Infiltration through permeable soils and superficial deposits (e.g., Alluvium, River Terrace Deposits).
- Preferential pathways created by excavation and piling.
- Direct discharge into aquifers during dewatering or tunnelling.
- Groundwater flow between different strata.
- Baseflow contribution of impacted groundwater to surface waterbodies

6.2.8 Receptors at risk of groundwater contamination include:

- Superficial aquifers
- Direct impacts to bedrock aquifers where construction activities occur within the aquifer, and indirect impacts to hydraulically connected aquifers.
- Licensed abstractions and private water supplies from hydraulically connected units.
- Hydraulically connected GWDTEs and springs which are sensitive to changes in water chemistry.
- Surface waterbodies via baseflow contribution.

Impacts on GWDTE

6.2.9 GWDTEs rely on relatively stable groundwater baseflow contributions and water quality. Construction activities may indirectly affect these habitats through drawdown or contamination.

6.2.10 Potential impacts for GWDTEs include:

- Dewatering, abstraction and excavation reducing groundwater levels.
- Contaminant migration from spills or leachate.

6.2.11 Alterations to groundwater levels or quality may impact GWDTEs if occurring within hydraulically connected aquifers supplying baseflow to GWDTEs.

6.2.12 Three designated GWDTEs are present within the study area. Barrow Farm Fen SSSI and Frilford Heath, Ponds and Fens SSSI are located north of the draft Order limits and therefore hydraulically upgradient of the Project. Little Wittenham SSSI is located approximately 7km from the draft Order limits, thereby having minimal hydraulic connectivity with the project. As a result, no impacts are expected within the designated GWDTEs and they have been excluded from the impact assessment. However, potential non-designated GWDTEs that may be at risk, may be identified through ecological surveys and have been incorporated as potential susceptible receptors.

Operation

Impacts on groundwater levels and flows

6.2.13 During the operational phase, permanent infrastructure associated with SESRO may result in long-term changes to groundwater levels and flow regimes. These changes may arise from physical barriers to flow, altered recharge patterns, and changes in hydraulic gradients due to the presence of large-scale engineered structures such as the reservoir, tunnels, and drainage systems.

6.2.14 Key sources of operational impacts on groundwater levels and flows include:

- Reservoir footprint: The reservoir may act as a recharge source or barrier depending on its lining and base conditions. It may also alter the regional groundwater flow direction and cross-aquifer leakage due to altered stresses/pressures.
- Permanent conveyance tunnels and pipelines: These may act as preferential pathways or barriers, depending on construction methods and backfilling materials.
- Pumping stations and underground structures: These may permanently intersect aquifers, altering local flow patterns.
- Landscaping (including hardstanding areas) and drainage infrastructure: Engineered drains may intercept shallow groundwater, redirecting flow and potentially lowering water tables. Infiltration and recharge patterns may be altered
- Canal infrastructure: Lined canals may raise local groundwater levels (through mounding), while leakage could create new recharge zones.
- Other features susceptible to drawdown impacts

6.2.15 Changes in groundwater levels and flows within permeable aquifers can influence connected receptors through established hydraulic pathways. Where aquifers are linked to surface watercourses, springs, abstractions, or GWDTEs, alterations in flow direction or reductions in groundwater levels may lead to decreased baseflow or reduced water availability. The extent of these effects depends on the strength of the hydraulic connection and the scale of change.

6.2.16 Receptors potentially affected by changes in groundwater levels and flows include:

- Aquifers: Both superficial and bedrock aquifers within the development footprint and hydraulically connected aquifers.
- Licensed abstractions and private water supplies from hydraulically connected units.
- Surface watercourses: Baseflow contributions to the River Thames, River Ock, and other minor watercourses may be reduced.

- Hydraulically connected springs.
- GWDTEs: Hydraulically connected designated sites as well as potential non-designated GWDTEs.

Impacts on groundwater quality

6.2.17 Operational activities may introduce new, long-term risks to groundwater quality through leakage, runoff, and accidental discharges. These risks are particularly relevant where infrastructure intersects permeable aquifers or where contaminants may infiltrate through unsealed surfaces.

6.2.18 Potential sources of contamination include:

- Pipeline leakage
- Runoff from highways and car parks
- Canal seepage
- Battery storage and renewable energy infrastructure
- Drainage systems, may convey contaminated surface water into shallow aquifers

6.2.19 Potential pathways of groundwater contamination include:

- Infiltration through permeable soils and superficial deposits (e.g., Alluvium, River Terrace Deposits).
- Preferential pathways created by construction or natural fractures
- Engineered drainage systems
- Groundwater flow between different strata.
- Baseflow contribution of impacted groundwater to surface waterbodies

6.2.20 Receptors at risk of groundwater contamination include:

- Superficial aquifers
- Direct impacts to bedrock aquifers where construction activities occur within the aquifer, and indirect impacts to hydraulically connected bedrock aquifers.
- Licensed abstractions and private water supplies from hydraulically connected units.
- Hydraulically connected GWDTEs and springs which are sensitive to changes in water chemistry.
- Surface waterbodies via baseflow contribution.

Impacts on GWDTE

6.2.21 GWDTEs rely on stable groundwater levels and water quality. Operational infrastructure may alter the hydrological regime supporting these ecosystems, potentially leading to habitat degradation or loss.

6.2.22 Potential impacts for GWDTEs include:

- Altered groundwater levels: Due to interception, drainage, or recharge changes.
- Contaminant migration: From operational discharges or infrastructure leakage.

6.2.23 Alterations to groundwater levels or quality may impact GWDTEs if occurring within hydraulically connected aquifers supplying baseflow to GWDTEs.

6.2.24 Three designated GWDTEs are present within the study area. Barrow Farm Fen SSSI and Frilford Heath, Ponds and Fens SSSI are located north of the draft Order limits and therefore hydraulically upgradient of the SESRO project. Little Wittenham SSSI is located approximately 7km from the SESRO project's draft Order limits, thereby having minimal hydraulic connectivity with the Project. As a result, no impacts are expected within the designated GWDTEs and they have been excluded from the impact assessment. However, potential non-designated GWDTEs that may be at risk, may be identified through ecological surveys and have been incorporated as potential susceptible receptors.

6.3 Summary of receptors susceptible to impacts

6.3.1 Based on the potential impacts identified above, a summary of impacts as a result of different Project Elements is given in Annex 1.

6.3.2 Table 11 outlines the receptors considered susceptible to potential impacts. Where receptors are scoped in (i.e. considered hydraulically connected to the SESRO project activities), this has informed the control measures. Receptors are shown in the following figures:

- Figure 3: Surface water features
- Figure 4: Superficial and artificial geology
- Figure 5: Bedrock geology
- Figure 7: WFD groundwater bodies
- Figure 8: Hydrogeological designations and features

Table 11 Summary of receptors susceptible to impacts

Receptor		Construction			Operation			Justification
		Scoped In	Groundwater levels and flows impact	Groundwater quality impact	Scoped In	Groundwater levels and flows impact	Groundwater quality impact	
WFD Groundwater body	Shrivenham Corallian (GB40602G600600)	In	✓	✓	In	✓	✓	Potential for direct impacts to groundwater levels or flows Potential for direct impacts to groundwater quality
	Vale of White Horse Chalk (GB40601G601000)	In	✓	✓	In	✓	✓	Potential for direct impacts to groundwater levels or flows Potential for direct impacts to groundwater quality
	Chiltern Chalk Scarp (GB40601G604100)	Out			Out			No impacts anticipated due to spatial separation from the SESRO project and limited hydrogeological connectivity
	Berkshire Downs Chalk (GB40601G600900)	Out			Out			No impacts anticipated due to spatial separation from the SESRO project and limited hydrogeological connectivity
	South-West Chilterns Chalk (GB40601G601100)	Out			Out			No impacts anticipated due to spatial separation from the SESRO project and limited hydrogeological connectivity
	Maidenhead Chalk (GB40601G602600)	Out			Out			No impacts anticipated due to spatial separation from the SESRO project and limited hydrogeological connectivity
	Twyford Tertiaries (GB40602G602700)	Out			Out			No impacts anticipated due to spatial separation from the SESRO project and limited hydrogeological connectivity
	Lower Thames Gravels (GB40603G000300)	Out			Out			No impacts anticipated due to spatial separation from the SESRO project and limited hydrogeological connectivity
	Chobham Bagshot Beds (GB40602G601400)	Out			Out			No impacts anticipated due to spatial separation from the SESRO project and limited hydrogeological connectivity
Superficial aquifers	Alluvium	In	✓	✓	In	✓	✓	Potential for direct impacts to groundwater levels or flows Potential for direct impacts to groundwater quality
	River Terrace Deposits	In	✓	✓	In	✓	✓	Potential for direct impacts to groundwater levels or flows Potential for direct impacts to groundwater quality
	Head	In	✓	✓	In	✓	✓	Potential for direct impacts to groundwater levels or flows Potential for direct impacts to groundwater quality
Bedrock aquifers	West Melbury Marly Chalk Formation	Out			Out			Negligible impacts anticipated as located south of the draft Order limits (except a very small area of above ground works at Rowstock associated with highway works) and dips away from the site (to the south-east). As a result, impacts are considered to be negligible.
	Upper Greensand	In	✓	✓	In	✓	✓	Potential for direct impacts to groundwater levels or flows Potential for direct impacts to groundwater quality
	Gault Formation	In	✓	✓	In	✓	✓	Potential for direct impacts to groundwater levels or flows Potential for direct impacts to groundwater quality
	Lower Greensand	In	✓	✓	In	✓	✓	Potential for direct impacts to groundwater levels or flows Potential for direct impacts to groundwater quality
	Kimmeridge Clay Formation	In	✓	✓	In	✓	✓	Potential for direct impacts to groundwater levels or flows Potential for direct impacts to groundwater quality

Receptor		Construction			Operation			Justification
		Scoped In	Groundwater levels and flows impact	Groundwater quality impact	Scoped In	Groundwater levels and flows impact	Groundwater quality impact	
	Corallian Group	In	✓	✓	In	✓	✓	Potential for direct impacts to groundwater levels or flows Potential for direct impacts to groundwater quality
Surface watercourses	Stutfield Brook (source to Ock) and tributaries	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels Potential for indirect impacts to water quality through baseflow contribution
	Letcombe Brook and tributaries	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels Potential for indirect impacts to water quality through baseflow contribution
	Cow Common Brook and Portobello Ditch and tributaries	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels Potential for indirect impacts to water quality through baseflow contribution Potential for direct impacts from watercourse diversion and subsequent changes in groundwater surface water interaction
	Childrey Brook and Woodhill Brooks	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels Potential for indirect impacts to water quality through baseflow contribution
	Childrey Brook and Norbrook at Common Barn and tributaries	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels Potential for indirect impacts to water quality through baseflow contribution Potential for direct impacts from watercourse diversion and subsequent changes in groundwater surface water interaction
	Ock (to Cherbury Brook) and tributaries	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels Potential for indirect impacts to water quality through baseflow contribution
	Sandford Brook (source to Ock) and tributaries	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels Potential for indirect impacts to water quality through baseflow contribution
	Frilford and Marcham Brook and tributaries	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels Potential for indirect impacts to water quality through baseflow contribution
	Ock and tributaries (Land Brook confluence to Thames)	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels Potential for indirect impacts to water quality through baseflow contribution

Receptor		Construction			Operation			Justification
		Scoped In	Groundwater levels and flows impact	Groundwater quality impact	Scoped In	Groundwater levels and flows impact	Groundwater quality impact	
	Moor Ditch and Ladygrove Ditch and tributaries	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels Potential for indirect impacts to water quality through baseflow contribution
	Ginge Brook and Mill Brook and tributaries	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels Potential for indirect impacts to water quality through baseflow contribution
	Thames (Evenlode to Thame) and tributaries	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels Potential for indirect impacts to water quality through baseflow contribution
	Eastern Watercourse Diversion (flows from the existing Steventon Ditch West, Orchard Farm Ditch, Mere Dyke East and Mere Dyke West and tributaries south of the reservoir)	In	✓	✓	In	✓	✓	Potential for direct impacts from watercourse diversion and subsequent changes in groundwater surface water interaction
	Western Watercourse Diversion (flows from the existing Common Brook, East Hanney Ditch and Portobello Ditch)	In	✓	✓	In	✓	✓	Potential for direct impacts from watercourse diversion and subsequent changes in groundwater surface water interaction
	Mill Brook and Bradfords Brook system, Wallingford and tributaries	Out			Out			No anticipated impact as watercourse and its catchment outside of draft Order limits
	Thames Wallingford to Caversham and tributaries	Out			Out			No anticipated impact as watercourse and its catchment outside of draft Order limits
	Thames (Egham to Teddington)	Out			Out			No anticipated impact as watercourse and its catchment outside of draft Order limits
	Thames (Reading to Cookham)	Out			Out			No anticipated impact as watercourse and its catchment outside of draft Order limits
	Thames Wallingford to Caversham	Out			Out			No anticipated impact as watercourse and its catchment outside of draft Order limits
Abstractions	River Gravels industrial groundwater abstraction (TH/039/0018/012) – within draft Order limits	In	✓	✓	In	✓	✓	Potential for direct impacts to groundwater levels or flows Potential for direct impacts to groundwater quality
	Corallian Group agricultural groundwater abstraction (TH/039/0017/001/R01) – within draft Order limits	In	✓	✓	In	✓	✓	Potential for direct impacts to groundwater levels or flows Potential for direct impacts to groundwater quality

Receptor		Construction			Operation			Justification
		Scoped In	Groundwater levels and flows impact	Groundwater quality impact	Scoped In	Groundwater levels and flows impact	Groundwater quality impact	
	River Ock reach abstraction (28/39/17/0027) – partly within draft Order limits	In	✓	✓	In	✓	✓	Potential for reduction in baseflow from reduction in groundwater levels Potential for impacts to water quality through baseflow contribution
	Abingdon area abstraction (TH/039/0018/011) – partly within draft Order limits	In	✓	✓	In	✓	✓	Potential for direct impacts to groundwater levels or flows Potential for direct impacts to groundwater quality
	Area abstractions outside draft Order limits	In	✓	✓	In	✓	✓	Potential for direct impacts to groundwater levels or flows Potential for direct impacts to groundwater quality
	Surface water abstractions outside draft Order limits: 28/39/17/0143; 28/39/17/0146; 28/39/18/0019; TH/039/0017/005; 28/39/17/0152; 28/39/18/0059; TH/039/0015/006	In	✓	✓	In	✓	✓	Potential for reduction in baseflow from reduction in groundwater levels Potential for impacts to water quality through baseflow contribution
	Groundwater point River Terrace abstractions outside draft Order limits: 28/39/18/0055; 28/39/18/0009; TH/039/0018/003	In	✓	✓	In	✓	✓	Potential for direct impacts to groundwater levels or flows Potential for direct impacts to groundwater quality
	River Thames reach abstraction outside draft Order limits (TH/039/0015/003)	In	✓	✓	In	✓	✓	Potential for reduction in baseflow from reduction in groundwater levels Potential for impacts to water quality through baseflow contribution
	Reach abstractions along Frilford Brook (28/39/17/0113) and Moor Ditch tributary (28/39/18/0073) outside draft Order limits	Out			Out			No impacts anticipated as hydraulically upgradient from the SESRO project
	Groundwater abstractions east of Didcot and Chester Line (28/39/18/0068 (River Gravels); 28/39/15/0026/1 (Lower Greensand); 28/39/15/0029/R01 (Corallian Group))	Out			Out			No impacts anticipated due to spatial separation from the SESRO project and limited hydrogeological connectivity
	Groundwater abstractions within the Corallian Group north of the draft Order limits (TH/039/0017/002/R01; TH/039/0017/003/R01)	Out			Out			No impacts anticipated as hydraulically upgradient from the SESRO project
	Surface water abstractions south of the draft Order limits (28/39/17/0023; 28/39/18/0084)	Out			Out			No impacts anticipated as hydraulically upgradient from the SESRO project
	Surface water abstractions north of the River Ock (28/39/17/0122; 28/39/17/0125; 28/39/17/0005; 28/39/17/0115)	Out			Out			No impacts anticipated as hydraulically upgradient from the SESRO project

Receptor		Construction			Operation			Justification
		Scoped In	Groundwater levels and flows impact	Groundwater quality impact	Scoped In	Groundwater levels and flows impact	Groundwater quality impact	
	River Ock surface water abstraction west of the draft Order limits (28/39/17/0054)	Out			Out			No impacts anticipated as hydraulically upgradient from the SESRO project
Mapped water supply spring (see 4.10.8)		In	✓	✓	In	✓	✓	Hydraulically upgradient of the SESRO project, scoped in precautionarily due to its labelled use as a water supply source
Milton Impoundment		Out			Out			No impacts anticipated as outside draft Order limits and likely to be hydraulically disconnected
Discharges	Thames Water sewage discharge to freshwater river (CAWM.0345)	In	✓	✓	Out			Potential for direct impacts or reduction in baseflow from reduction in groundwater levels during construction. This is situated within the proposed reservoir footprint; therefore, it is assumed that the discharge consent will be revoked before the operational stage.
	Sewage discharge to freshwater river (CAWM.0557)	In	✓	✓	Out			Potential for direct impacts or reduction in baseflow from reduction in groundwater levels during construction. This is situated within the proposed reservoir footprint; therefore, it is assumed that the discharge consent will be revoked before the operational stage.
	Thames Water sewage discharge to freshwater river (CAWM.0382)	In	✓	✓	Out			Potential for direct impacts or reduction in baseflow from reduction in groundwater levels during construction. This is situated within the proposed reservoir footprint; therefore, it is assumed that the discharge consent will be revoked before the operational stage.
	Thames Water sewage discharge to freshwater river (CAWM.0380)	In	✓	✓	Out			Potential for direct impacts or reduction in baseflow from reduction in groundwater levels during construction. This is situated within the proposed reservoir footprint; therefore, it is assumed that the discharge consent will be revoked before the operational stage.
	Thames Water sewage discharge to freshwater river (CAWM.0381)	In	✓	✓	Out			Potential for direct impacts or reduction in baseflow from reduction in groundwater levels during construction. This is situated within the proposed reservoir footprint; therefore, it is assumed that the discharge consent will be revoked before the operational stage.
	Sewage discharge to freshwater river (EPRTB3094RX)	In	✓		In	✓		Potential for direct impacts or reduction in baseflow from reduction in groundwater levels.
	Thames Water sewage discharge to freshwater river (CTCR.1804)	In	✓		In	✓		Potential for direct impacts or reduction in baseflow from reduction in groundwater levels.
	Thames Water sewage discharge to freshwater river (CTCR.1804)	In	✓		In	✓		Potential for direct impacts or reduction in baseflow from reduction in groundwater levels.
	Thames Water sewage discharge to freshwater river (CNTD.0053)	In	✓		In	✓		Potential for direct impacts or reduction in baseflow from reduction in groundwater levels.

Receptor		Construction			Operation			Justification
		Scoped In	Groundwater levels and flows impact	Groundwater quality impact	Scoped In	Groundwater levels and flows impact	Groundwater quality impact	
	Thames Water sewage discharge to freshwater river (CNTD.0030)	In	✓		In	✓		Potential for direct impacts or reduction in baseflow from reduction in groundwater levels.
	Thames Water sewage discharge to freshwater river (CNTD.0030)	In	✓		In	✓		Potential for direct impacts or reduction in baseflow from reduction in groundwater levels.
	Thames Water sewage discharge to freshwater river (TEMP.2989)	In	✓		In	✓		Potential for direct impacts or reduction in baseflow from reduction in groundwater levels.
	Thames Water sewage discharge to freshwater river (CTCR.1804)	In	✓		In	✓		Potential for direct impacts or reduction in baseflow from reduction in groundwater levels.
	Trade discharge to freshwater river (EPREB3990AK)	In	✓		In	✓		Potential for direct impacts or reduction in baseflow from reduction in groundwater levels.
	Trade discharge to freshwater river (CAWM.1151)	In	✓		In	✓		Potential for direct impacts or reduction in baseflow from reduction in groundwater levels.
	Trade discharge to freshwater river (EPREB3990AK)	In	✓		In	✓		Potential for direct impacts or reduction in baseflow from reduction in groundwater levels.
	Discharges outside the draft Order limits	Out			Out			Negligible indirect impacts anticipated as likely to be hydraulically disconnected
Springs	Upper Greensand Springs	Out			Out			No impacts anticipated as located hydraulically upgradient from SESRO project Note: one mapped water supply spring scoped in above
	Corallian Group Spring	Out			Out			No impacts anticipated as located hydraulically upgradient from SESRO project
	Marcham Salt Water Spring LWS	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels or quality
GWDTE (designated)	Little Wittenham (SSSI)	Out			Out			No impacts anticipated as situated approximately 7km from the draft Order limits and limited hydraulic connectivity.
	Barrow Farm Fen (SSSI)	Out			Out			No impacts anticipated as located hydraulically upgradient from SESRO project.
	Frilford Heath, Ponds and Fens (SSSI)	Out			Out			No impacts anticipated as located hydraulically upgradient from SESRO project.
Other features	South Oxfordshire Crematorium	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels or quality
	Site SE of Noah's Ark Inn, Frilford	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels or quality
	Sutton Wick settlement site	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels or quality
	Potential anthropogenic features e.g. water dependent heritage sites	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels or quality
Potential GWDTE (non-designated)		In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels or quality

Receptor	Construction			Operation			Justification
	Scoped In	Groundwater levels and flows impact	Groundwater quality impact	Scoped In	Groundwater levels and flows impact	Groundwater quality impact	
Potential Springs (unmapped)	In	✓	✓	In	✓	✓	Potential for direct impacts or reduction in baseflow from reduction in groundwater levels or quality
Potential Private Water Supplies (unmapped)	In	✓	✓	In	✓	✓	Potential for direct impacts or derogation of supply from reduced groundwater levels or quality

7 Control measures

7.1 Introduction

7.1.1 Based on the conceptualisation, receptors susceptible to groundwater flow, potential drawdown or quality impacts have been identified. This section outlines a selection of the key embedded and tertiary control measures included within the design or management plans to eliminate or reduce the potential impacts from different project activities or elements.

7.2 Construction

7.2.1 Key construction activity embedded and tertiary control measures to eliminate or reduce impacts are outlined in Table 12 and the commitments register.

Table 12 Construction mitigation measures

Activity	Mitigation
All activities within Order Limits	• Best practice pollution prevention and control measures • Implementation of water monitoring plan • Receptor specific risk assessments for GWDTEs, springs, abstractions, discharges and anthropogenic receptors within the draft Order limits or within the zone of influence of construction activities (as informed by groundwater modelling or monitoring)
Construction Dewatering	• Undertaken in line with appropriate abstraction licences and discharge permits • Abstractions for dewatering to generally be non-consumptive, with water returned back to the water environment, where possible.
Temporary abstractions for water supply	• If utilised, to be undertaken in line with appropriate abstraction licence and discharge permitting regulations, including provision of appropriate supporting information on hydrogeological impacts.
Emplacement of physical barriers	• Drainage measures to maintain, as closely as feasible, the baseline hydrogeological behavior, and mitigate mounding.
Excavation, piling and trenching	• Foundation Works Risk Assessment (Risk assessment to identify and propose measures to mitigate groundwater and environmental risks from foundation construction activities)
Permanent conveyance tunnels/pipelines	• Tunnelling methodology that excludes groundwater in more permeable strata • Breakout management plan
Emplacement of temporary hardstanding and drainage infrastructure	• Drainage design to follow SuDS principals to manage runoff at greenfield rates and appropriately capture silts/contaminated runoff.

Activity	Mitigation
Removal of receptors within footprint	- Avoidance through embedded design - Secondary mitigation likely when unavoidable

7.2.2 Key operational activity embedded and tertiary control measures to eliminate or reduce impacts are outlined in

Table 13 Operational mitigation measures

Activity	Mitigation
All activities within Order limits	- Implementation of water monitoring plan - Receptor specific risk assessments for GWDTEs, springs, abstractions, discharges and anthropogenic receptors within the draft Order limits or within the zone of influence of operational activities (as informed by the groundwater modelling or observational monitoring)
Reservoir emplacement	- Groundwater drain designed to prevent upstream mounding (groundwater flooding), or downstream surface water flooding and erosion
Permanent conveyance tunnels/pipelines	- Tunnel waterproofing design - Pipeline backfill designed to mimic local hydrogeology. Where risk of preferential pathway, clay stanks to be implemented. - Pipelines/tunnels designed to minimise leakage for design life. - Leakage detection measures.
Pumping stations and underground structures	- Drainage designed to prevent upstream mounding (groundwater flooding), or downstream surface water flooding and erosion - Foundation Works Risk Assessment
Watercourse diversions and drainage infrastructure	- Lining of watercourses - Drainage design to follow SuDS principals to manage runoff at greenfield rates and appropriately capture silts/contaminated runoff.
Canal infrastructure	- Canal lined to prevent infiltration/leakage
Runoff from highways/car parks	- Drainage design to follow SuDS principals to manage runoff at greenfield rates and appropriately capture silts/contaminated runoff.
Renewable energy infrastructure including battery storage	- Drainage design to include containment, where risk of pollution from firewater. - Battery Fire Safety Management Plan (a strategy outlining measures to prevent, detect, and respond to fire risks associated with battery systems, including drainage and run off design for any firewater)

8 Monitoring and reporting plan

8.1 Monitoring plan

8.1.1 Due to the inherent uncertainties and limitations in hydrogeological conceptualisation, monitoring plays a critical role in the verification of impacts and mitigation strategy.

8.1.2 A water monitoring plan will be in place during construction. This will be developed in consultation with key stakeholders.

9 Hydrogeological impact magnitude

9.1 Hydrogeological impact magnitude

9.1.1 To inform the assessment reported in Chapter 5: Water environment and based on the impact assessment and identified control measures outlined above, the anticipated hydrogeological magnitude of impact is summarised in Table 14 below.

Table 14 Hydrogeological impact preliminary magnitude

Receptor		Receptor sensitivity	Control Measures	Impact Magnitude	Justification
WFD Groundwater body	Shrivenham Corallian (GB40602G600600)	Very High	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact anticipated and very low risk of pollution to groundwater
	Vale of White Horse Chalk (GB40601G601000)	Very High	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact anticipated and very low risk of pollution to groundwater
Superficial aquifers	Alluvium	High	As per Table 12 and Table 13; primarily the groundwater drain	Construction – Moderate Operation - Negligible	Construction - Partial loss or change to an aquifer Operation - No measurable impact anticipated and very low risk of pollution to groundwater
	River Terrace Deposits	High	As per Table 12 and Table 13	Construction – Moderate Operation - Negligible	Construction - Partial loss or change to an aquifer Operation - No measurable impact anticipated and very low risk of pollution to groundwater
	Head	High	As per Table 12 and Table 13	Construction - Moderate Operation - Negligible	Construction - Partial loss or change to an aquifer Operation - No measurable impact anticipated and very low risk of pollution to groundwater
Bedrock aquifers	Upper Greensand	Very High	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact anticipated and very low risk of pollution to groundwater

Receptor		Receptor sensitivity	Control Measures	Impact Magnitude	Justification
	Gault Formation	High	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact anticipated and very low risk of pollution to groundwater
	Lower Greensand	High	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact anticipated and very low risk of pollution to groundwater
	Kimmeridge Clay Formation	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact anticipated and very low risk of pollution to groundwater
	Corallian Group	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact anticipated and very low risk of pollution to groundwater
Surface watercourses	Stutfield Brook (source to Ock) and tributaries	Moderate (Levels and flows) Low (Quality)	As per Table 12 and Table 13	Construction - Negligible Operation – Negligible	No measurable impact anticipated on the integrity of the water environment
	Letcombe Brook and tributaries	High (Levels and flows) High (Quality)	As per Table 12 and Table 13	Construction - Negligible Operation – Negligible	No measurable impact anticipated on the integrity of the water environment
	Cow Common Brook and Portobello Ditch and tributaries	High (Levels and flows) Moderate (Quality)	As per Table 12 and Table 13	Construction - Negligible	No measurable impact anticipated on the integrity of the water environment

Receptor		Receptor sensitivity	Control Measures	Impact Magnitude	Justification
				Operation – Negligible	
	Childrey Brook and Woodhill Brooks	High (Levels and flows) Moderate (Quality)	As per Table 12 and Table 13	Construction - Negligible Operation – Negligible	No measurable impact anticipated on the integrity of the water environment
	Childrey Brook and Norbrook at Common Barn and tributaries	High (Levels and flows) Moderate (Quality)	As per Table 12 and Table 13	Construction - Negligible Operation – Negligible	No measurable impact anticipated on the integrity of the water environment
	Ock (to Cherbury Brook) and tributaries	High (Levels and flows) Moderate (Quality)	As per Table 12 and Table 13	Construction - Negligible Operation – Negligible	No measurable impact anticipated on the integrity of the water environment
	Sandford Brook (source to Ock) and tributaries	Very High (Levels and flows) Very High (Quality)	As per Table 12 and Table 13	Construction - Negligible Operation – Negligible	No measurable impact anticipated on the integrity of the water environment
	Frilford and Marcham Brook and tributaries	High (Levels and flows) High (Quality)	As per Table 12 and Table 13	Construction - Negligible Operation – Negligible	No measurable impact anticipated on the integrity of the water environment
	Ock and tributaries (Land Brook confluence to Thames)	High (Levels and flows)	As per Table 12 and Table 13	Construction - Negligible	No measurable impact anticipated on the integrity of the water environment

Receptor		Receptor sensitivity	Control Measures	Impact Magnitude	Justification
		Moderate (Quality)		Operation – Negligible	
	Moor Ditch and Ladygrove Ditch and tributaries	High (Levels and flows) Moderate (Quality)	As per Table 12 and Table 13	Construction - Negligible Operation – Negligible	No measurable impact anticipated on the integrity of the water environment
	Ginge Brook and Mill Brook and tributaries	High (Levels and flows) Moderate (Quality)	As per Table 12 and Table 13	Construction - Negligible Operation – Negligible	No measurable impact anticipated on the integrity of the water environment
	No measurable impact anticipated on the integrity of the water environment Thames (Evenlode to Thame) and tributaries	Very High (Levels and flows) Very High (Quality)	As per Table 12 and Table 13	Construction - Negligible Operation – Negligible	No measurable impact anticipated on the integrity of the water environment
	Eastern Watercourse Diversion (flows from the existing Steventon Ditch West, Orchard Farm Ditch, Mere Dyke East and Mere Dyke West and tributaries south of the proposed reservoir)	High (Levels and flows) High (Quality)	As per Table 12 and Table 13	Construction - Negligible Operation – Negligible	No measurable impact anticipated on the integrity of the water environment
	Western Watercourse Diversion (flows from the existing Common	High (Levels and flows)	As per Table 12 and Table 13	Construction - Negligible	No measurable impact anticipated on the integrity of the water environment

Receptor		Receptor sensitivity	Control Measures	Impact Magnitude	Justification
	Brook, East Hanney Ditch and Portobello Ditch)	Moderate (Quality)		Operation - Negligible	
Abstractions	River Gravels industrial groundwater abstraction (TH/039/0018/012) within draft Order limits	Moderate	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the abstraction anticipated
	Corallian Group agricultural groundwater abstraction within draft Order limits (TH/039/0017/001/R01)	Moderate	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the abstraction anticipated
	River Ock reach abstraction (28/39/17/0027) partly within draft Order limits	Moderate	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the abstraction anticipated
	Abingdon area abstraction (TH/039/0018/011) partly within draft Order limits	Moderate	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the abstraction anticipated
	Area abstractions outside draft Order limits	Moderate	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the abstraction anticipated
	Surface water abstractions outside draft Order limits:	Moderate	As per Table 12 and Table 13	Construction - Negligible	No measurable impact on the abstraction anticipated

Receptor		Receptor sensitivity	Control Measures	Impact Magnitude	Justification
	28/39/17/0143; 28/39/17/0146; 28/39/18/0019; TH/039/0017/005; 28/39/17/0152; TH/039/0015/006			Operation - Negligible	
	Surface water abstraction outside draft Order limits used for potable water supply: 28/39/18/0059	High	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the abstraction anticipated
	Groundwater point River Terrace abstractions outside draft Order limits: 28/39/18/0055; 28/39/18/0009; TH/039/0018/003	Moderate	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the abstraction anticipated
	River Thames reach abstraction outside draft Order limits (TH/039/0015/003)	Moderate	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the abstraction anticipated
Mapped water supply spring		High	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact anticipated
Discharges	Discharges outside the draft Order limits	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated

Receptor		Receptor sensitivity	Control Measures	Impact Magnitude	Justification
	Thames Water sewage discharge to freshwater river (CAWM.0345)	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated
	Sewage discharge to freshwater river (CAWM.0557)	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated
	Sewage discharge to freshwater river (EPRTB3094RX)	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated
	Thames Water sewage discharge to freshwater river (CAWM.0382)	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated
	Thames Water sewage discharge to freshwater river (CAWM.0380)	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated
	Thames Water sewage discharge to freshwater river (CAWM.0381)	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated
	Thames Water sewage discharge to freshwater river (CTCR.1804)	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated

Receptor		Receptor sensitivity	Control Measures	Impact Magnitude	Justification
	Thames Water sewage discharge to freshwater river (CTCR.1804)	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated
	Thames Water sewage discharge to freshwater river (CNTD.0053)	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated
	Thames Water sewage discharge to freshwater river (CNTD.0030)	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated
	Thames Water sewage discharge to freshwater river (CNTD.0030)	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated
	Thames Water sewage discharge to freshwater river (TEMP.2989)	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated
	Thames Water sewage discharge to freshwater river (CTCR.1804)	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated
	Trade discharge to freshwater river (EPREB3990AK)	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated

Receptor		Receptor sensitivity	Control Measures	Impact Magnitude	Justification
	Trade discharge to freshwater river (CAWM.1151)	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated
	Trade discharge to freshwater river (EPREB3990AK)	Low	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the discharge anticipated
Springs	Marcham Salt Water Spring LWS	Moderate	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the integrity of the water environment anticipated
Other features	South Oxfordshire Crematorium	High	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact anticipated
	Site SE of Noah's Ark Inn, Frilford	High	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact anticipated
	Sutton Wick settlement site	High	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact anticipated
	Potential anthropogenic features	High	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact anticipated

Receptor	Receptor sensitivity	Control Measures	Impact Magnitude	Justification
Potential GWDTE (non-designated)	Very High	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact on the integrity of the water environment anticipated
Potential Springs (unmapped)	High	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact anticipated
Potential Private Water Supplies (unmapped)	High	As per Table 12 and Table 13	Construction - Negligible Operation - Negligible	No measurable impact anticipated

10 Conclusions

10.1.1 The hydrogeological baseline has been collated based on publicly available data, information provided by stakeholders, site surveys and ground investigation data.

10.1.2 Based on the baseline collated to date, a qualitative HIA has been undertaken of the construction and operational impacts to receptors within the study area. This assessment, utilising the source-pathway-receptor conceptualisation, has identified receptors potentially susceptible to impacts and receptors that can be descoped from further assessment due to limited hydraulic continuity.

10.1.3 The findings of the preliminary HIA have informed the embedded design and standard good practice mitigation measures identified to date.

10.1.4 The assessment findings and control measures have subsequently informed the preliminary magnitudes of impacts and likely significant effects reported in PEI Report Chapter 5: Water environment.

10.1.5 At the PEI Report stage, receptors that may potentially be susceptible to hydrogeological significant effects include the Alluvium, Head and River Terrace Deposit superficial aquifers (that will be extensively modified during construction by the reservoir emplacement and drainage measures).

10.1.6 As the design develops, groundwater modelling is progressed and further baseline data is obtained, the assessment will be updated. However, the assessment to date is considered sufficient to inform the receptors susceptible to potential likely significant effects.

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Annex 1 Summary of impacts from project components

Table 15 Summary of impacts from project components

Element	Potential impacts	Susceptible receptors
All Project Components	Construction – Potential for contamination of groundwater quality due to fuel spills or leachate from materials (e.g. asphalt, concrete) Potential for runoff of sediment during construction, impacting groundwater quality Potential indirect effects on GWDTEs from altered groundwater quality, levels and flows. Contamination risks during decommissioning Operation – Potential indirect effects on GWDTEs from altered groundwater quality, levels and flows.	Underlying superficial and bedrock aquifers Underlying connected WFD groundwater bodies Dependent groundwater abstractions (licensed and private). Surface watercourses and any associated surface water discharges, abstractions. Potential dependent GWDTEs. Hydraulically connected springs. Other features potentially susceptible to drawdown.
Reservoir (including embankment and directly associated infrastructure, such as pipes in the base)	Construction – Construction dewatering and embankment loading may alter shallow groundwater flow and levels. Operation – Long-term changes in flow direction or groundwater levels due to reservoir footprint, drainage and potential recharge impacts.	Underlying bedrock (Gault Formation, Lower Greensand, Kimmeridge Clay Formation) and superficial aquifers and any dependent receptors Surface watercourses within draft Order limits Discharges (CAWM.0345; CTCR.1804; CAWM.0557; EPREB3990AK; CAWM.1151; EPREB3990AK; CAWM.0382; CTCR.1804; CAWM.0380; CAWM.0381; CNTD.0053; EPRTB3094RX; CNTD.0030; TEMP.2989) Area abstractions River Gravels industrial groundwater abstraction (TH/039/0018/012) – within draft Order limits Corallian Group agricultural groundwater abstraction (TH/039/0017/001/R01) – within draft Order limits River Ock reach abstraction (28/39/17/0027) – partly within draft Order limits

Element	Potential impacts	Susceptible receptors
		Surface water abstractions outside draft Order limits: 28/39/17/0143; 28/39/17/0146; 28/39/18/0019; TH/039/0017/005; 28/39/17/0152; 28/39/18/0059; TH/039/0015/006 Groundwater point River Terrace abstractions outside draft Order limits: 28/39/18/0055; 28/39/18/0009; TH/039/0018/003 River Thames reach abstraction outside draft Order limits (TH/039/0015/003) Potential Private Water Supplies (unmapped) Potential dependent GWDTEs. Hydraulically connected springs. Other features potentially susceptible to drawdown.
Pumping Station	Construction – Excavation and piling may intersect shallow aquifers, impacting groundwater levels and flows. Construction dewatering may impact groundwater levels and flows. Shallow excavations/ trenching for potential pipelines may alter groundwater levels and flow. Operation – Permanent underground piling and structures may intersect shallow aquifers, impacting groundwater levels and flows.	Underlying Kimmeridge Clay Formation and superficial aquifers. Cow Common Brook and Portobello Ditch and tributaries Childrey Brook and Woodhill Brooks Ock and tributaries (Land Brook confluence to Thames) Thames (Evenlode to Thame) and tributaries Eastern Watercourse Diversion River Gravels industrial groundwater abstraction (TH/039/0018/012) – within draft Order limits Abingdon area abstraction (TH/039/0018/011) – partly within draft Order limits Discharges (CTCR.1804; EPREB3990AK) Potential Private Water Supplies (unmapped) Potential dependent GWDTEs. Hydraulically connected springs.

Element	Potential impacts	Susceptible receptors
		Other features potentially susceptible to drawdown.
River tunnel and shafts	Construction – Tunnelling may intercept groundwater, causing drawdown and flow diversion. Operation – Permanent conveyance tunnel structure may intersect shallow aquifers, impacting groundwater flow and levels.	Underlying Kimmeridge Clay Formation and superficial aquifers Cow Common Brook and Portobello Ditch and tributaries Childrey Brook and Woodhill Brooks Ock and tributaries (Land Brook confluence to Thames) Thames (Evenlode to Thame) and tributaries Eastern Watercourse Diversion River Gravels industrial groundwater abstraction (TH/039/0018/012) – within draft Order limits Abingdon area abstraction (TH/039/0018/011) – partly within draft Order limits Discharges (EPREB3990AK; CTCR.1804) Potential Private Water Supplies (unmapped) Potential dependent GWDTEs. Hydraulically connected springs. Other features potentially susceptible to drawdown
Thames Water to Southern Water (T2ST) Water Treatment Works (WTW)	Construction – Shallow excavations/ trenching and construction dewatering for potential pipelines may alter groundwater levels and flow. Excavation and piling for pumping station infrastructure may intersect shallow aquifers, impacting groundwater levels and flows. Construction dewatering may impact groundwater levels and flows.	Underlying bedrock (Gault Formation, Lower Greensand, Kimmeridge Clay Formation) and superficial aquifers and any dependent receptors Surface watercourses within the pipeline route and dependent receptors

Element	Potential impacts	Susceptible receptors
	Operation – Permanent pipelines may intersect shallow aquifers altering groundwater levels and flows. Potential leakage of foul water from the T2ST may impact groundwater quality in shallow aquifers that intersect the pipeline.	
Farmoor Transfer	Construction – Shallow excavations/ trenching and construction dewatering for potential pipelines may alter groundwater levels and flow. Excavation and piling for pumping station infrastructure may intersect shallow aquifers, impacting groundwater levels and flows. Construction dewatering may impact groundwater levels and flows. Operation – Permanent pipelines may intersect shallow aquifers altering groundwater levels and flows.	Underlying Kimmeridge Clay Formation and superficial aquifers Cow Common Brook and Portobello Ditch and tributaries Childrey Brook and Woodhill Brooks Ock and tributaries (Land Brook confluence to Thames) Thames (Evenlode to Thame) and tributaries Sandford Brook (source to Ock) and tributaries Eastern Watercourse Diversion Discharges (CTCR.1804; CAWM.0557; EPREB3990AK; CAWM.1151) Potential Private Water Supplies (unmapped) Potential dependent GWDTEs. Hydraulically connected springs. Other features potentially susceptible to drawdown
Access roads and highways improvements	Construction - Shallow excavations/ trenching may impact groundwater levels and flows in shallow aquifers. Operation- Runoff may carry hydrocarbons, sediments, and de-icing salts into shallow aquifers.	Underlying bedrock (Upper Greensand, Gault Formation, Lower Greensand, Kimmeridge Clay Formation, Corallian Group) and superficial aquifers and any dependent receptors Surface watercourses within draft Order limits and any associated surface water discharges and abstractions. Shrivenham Corallian WFD groundwater body (GB40602G600600)

Element	Potential impacts	Susceptible receptors
	SuDs based drainage solutions may impact flow pathways and recharge into shallow aquifers.	Vale of White Horse Chalk WFD groundwater body (GB40601G601000) Potential dependent GWDTEs. Hydraulically connected springs. Other features potentially susceptible to drawdown
Wilts and Berks Canal	Construction - Excavations/ trenching may impact groundwater levels and flows in shallow aquifers. Construction dewatering may impact groundwater levels and flows. Operation - Canal lining and water retention may locally raise groundwater levels, potential for seepage. Risk of contamination from canal water if leaks occur.	Underlying bedrock (Gault Formation, Lower Greensand, Kimmeridge Clay Formation) and superficial aquifers Cow Common Brook and Portobello Ditch and tributaries Childrey Brook and Woodhill Brooks Thames (Evenlode to Thame) and tributaries Childrey Brook and Norbrook at Common Barn and tributaries Eastern Watercourse Diversion Western Watercourse Diversion River Gravels industrial groundwater abstraction (TH/039/0018/012) – within draft Order limits Abingdon area abstraction (TH/039/0018/011) – partly within draft Order limits Discharges (CAWM.0345; CAWM.0557; EPREB3990AK; CAWM.0382; CTCR.1804; CAWM.0380; CAWM.0381) Potential Private Water Supplies (unmapped) Potential dependent GWDTEs. Hydraulically connected springs. Other features potentially susceptible to drawdown
Recreational lakes	Construction –	Underlying Kimmeridge Clay Formation and superficial aquifers.

Element	Potential impacts	Susceptible receptors
	Construction dewatering and excavation may alter shallow groundwater flow and levels. Earthworks may temporarily alter surface and shallow subsurface flow paths, potentially affecting recharge zones or increasing runoff. Operation – Long-term changes in flow direction or groundwater levels and potential recharge impacts. Changes in groundwater levels due to the lake may affect baseflow contributions to nearby watercourses or springs. Nutrient loading (e.g. from recreational use, runoff, or wildlife) could degrade groundwater quality.	Cow Common Brook and Portobello Ditch and tributaries Childrey Brook and Woodhill Brooks Ock and tributaries (Land Brook confluence to Thames) Thames (Evenlode to Thame) and tributaries Eastern Watercourse Diversion River Gravels industrial groundwater abstraction (TH/039/0018/012) – within draft Order limits Abingdon area abstraction (TH/039/0018/011) – partly within draft Order limits Discharges (CTCR.1804; EPREB3990AK) Private water supply P271-10/00010 Potential dependent GWDTEs. Hydraulically connected springs. Other features potentially susceptible to drawdown.
Active travel routes, additional footpaths and non-motorised vehicles (NMU) provision	Construction – Minor changes to shallow groundwater flow from path construction Operation – No direct impact expected.	Underlying superficial aquifers and any dependent receptors Surface watercourses within the route and dependent receptors
Car Parks	Construction – Shallow excavations may impact groundwater levels and flows in shallow aquifers. Operation –	Underlying bedrock (Gault Formation, Lower Greensand, Kimmeridge Clay Formation) and superficial aquifers and any dependent receptors Surface watercourses and any associated surface water discharges and abstractions.

Element	Potential impacts	Susceptible receptors
	Impermeable surfaces may reduce recharge and alter runoff patterns. Risk of hydrocarbon and heavy metal contamination to groundwater from vehicles	
Site wide drainage including the groundwater drain	Construction - Shallow excavations may impact groundwater levels and flows in shallow aquifers. Construction dewatering may impact groundwater levels and flows. Operation – Engineered drainage including the groundwater drain will intercept or redirect shallow groundwater, impacting groundwater levels and flows. Permanent underground groundwater drain structure may impact groundwater levels and flows within the superficial deposits and underlying clay.	Underlying bedrock (Gault Formation, Lower Greensand, Kimmeridge Clay Formation) and superficial aquifers and any dependent receptors Surface watercourses and any associated surface water discharges and abstractions.
Eastern and Western Watercourse Diversions	Construction – Excavations/ trenching may impact groundwater levels and flows in shallow aquifers. Construction dewatering may impact groundwater levels and flows. Operation – Diversions may change surface-groundwater interactions; potential for altered recharge/discharge zones and subsequent impact on groundwater levels and flows.	Underlying bedrock (Gault Formation, Lower Greensand, Kimmeridge Clay Formation) and superficial aquifers and any dependent receptors Cow Common Brook and Portobello Ditch and tributaries Childrey Brook and Woodhill Brooks Thames (Evenlode to Thame) and tributaries Childrey Brook and Norbrook at Common Barn and tributaries Eastern Watercourse Diversion Western Watercourse Diversion Discharges (CAWM.0345; CAWM.0557; CAWM.0382; CAWM.0380; CAWM.0381)

Element	Potential impacts	Susceptible receptors
		Potential Private Water Supplies (unmapped) Potential dependent GWDTEs. Hydraulically connected springs. Other features potentially susceptible to drawdown
River Thames flood compensation (eastern bank)	Construction – Excavations may impact groundwater levels and flows in shallow aquifers. Construction dewatering may impact groundwater levels and flows. Operation – May locally raise groundwater levels or alter flow paths. Potential for mobilisation of contaminants in saturated soils, affecting groundwater quality.	Underlying Kimmeridge Clay Formation and superficial aquifers. Thames (Evenlode to Thame) and tributaries Reach abstraction (TH/039/0015/003) River Thames surface water absractions (28/39/18/0019; 28/39/18/0059; TH/039/0015/006) River Gravels industrial groundwater abstraction (TH/039/0018/012) – within draft Order limits Abingdon area abstraction (TH/039/0018/011) – partly within draft Order limits Discharge CTCR.1804 Potential Private Water Supplies (unmapped) Potential dependent GWDTEs. Hydraulically connected springs. Other features potentially susceptible to drawdown
Site-wide utilities diversions and new supplies	Construction – Trenching and installation may locally disrupt shallow groundwater levels and flow. Operation – Permanent underground structures may locally impact groundwater flow pathways in shallow aquifers. Potential leakage of foul may impact groundwater quality in shallow aquifers that intersect the pipeline.	Underlying bedrock and superficial aquifers and any dependent receptors

Element	Potential impacts	Susceptible receptors
Renewable Energy Assets	Construction - Excavations for potential ground mounted solar may impact groundwater levels and flows in shallow aquifers. Operation – Floating solar may reduce evaporation. Infrastructure may influence local recharge dynamics. Potential for groundwater contamination from battery electrolyte leaks or firewater runoff.	Underlying bedrock (Gault Formation, Lower Greensand, Kimmeridge Clay Formation, Corallian Group) and superficial aquifers and any dependent receptors Shrivenham Corallian WFD groundwater body (GB40602G600600) Vale of White Horse Chalk WFD groundwater body (GB40601G601000) Watercourses and any associated surface water discharges and abstractions.
Planting and new green open space	Construction – Excavations/ landscaping may impact groundwater levels and flows in shallow aquifers Operation – Landscaping and habitat creation may alter recharge and shallow flow patterns. Creation of wetland habitats may influence groundwater recharge.	Underlying bedrock (Gault Formation, Lower Greensand, Kimmeridge Clay Formation) and superficial aquifers and any dependent receptors Surface watercourses and any associated surface water discharges and abstractions.

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Annex 2 Figures

Figure 1: Hydrogeological study areas and topography

Figure 2: Catchment abstraction management strategy areas

Figure 3: Surface water features

Figure 4: Superficial and artificial geology

Figure 5: Bedrock geology

Figure 6: Groundwater monitoring locations

Figure 7: WFD groundwater bodies

Figure 8: Hydrogeological designations and features

Figure 9: Groundwater flooding susceptibility

Thames Water

It's everyone's water