# Teddington Direct River Abstraction

## Preliminary Environmental Information Report

## Chapter 10 – Ground Conditions and Contaminated Land

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# Table of Contents

**10. Ground Conditions and Contaminated Land ..... 1**
10.1 Introduction ..... 1
10.2 Legislation, policy and guidance ..... 1
10.3 Consultation, engagement and scoping ..... 6
10.4 Embedded design (primary) mitigation and standard good practice (tertiary) ... 13
10.5 Assessment methodology ..... 15
10.6 Study area ..... 23
10.7 Baseline conditions ..... 23
10.8 Preliminary assessment of likely significant effects ..... 43
10.9 Additional (secondary) mitigation and enhancement measures ..... 55
10.10 Summary of Residual Likely Significant Effects ..... 56
10.11 Next steps ..... 56
10.12 References ..... 57

# List of Tables

Table 10.1 Key policy from the NPS for Water Resources Infrastructure .....3
Table 10.2 Key scoping opinion comments for ground conditions and contaminated land..6
Table 10.3 Summary of the scope for ground conditions and contaminated land .....11
Table 10.4 Value and sensitivity criteria definition .....17
Table 10.5 Determining the value/sensitivity of receptors.....17
Table 10.6 Determining the magnitude of impact .....19
Table 10.7 Table of significance .....22
Table 10.8 Geology of the shafts, conveyance tunnel route and surrounding areas .....24
Table 10.9 Anthropogenic material recorded within Made Ground.....26
Table 10.10 Summary of Category 2 pollution incidents within 250m of the draft Order limits .....29
Table 10.11 Summary of main water and water bodies on-site and the study area.....30
Table 10.12 Landfills and waste sites within 250m of the draft Order limits.....31
Table 10.13 BGS estimated urban soil chemistry .....33
Table 10.14 Summary of historical OS mapping.....35
Table 10.15 Current potentially contaminative land uses in and within 250m of the draft Order limits .....40
Table 10.16 Preliminary assessment of likely significant effects during construction .....45
Table 10.17 Preliminary assessment of likely significant effects during construction .....47
Table 10.18 Preliminary assessment of likely significant effects during construction .....49
Table 10.19 Preliminary assessment of likely significant effects during construction .....51
Table 10.20 Preliminary assessment of likely significant effects during construction .....54
Table 10.21 Summary of residual likely significant effects for ground conditions and contaminated land .....56

# List of Plates

Plate 10.1 Superficial and artificial deposits in the vicinity of the Project .....24
Plate 10.2 Conveyance route geological long-section .....27

# 10. Ground Conditions and Contaminated Land

## 10.1 Introduction

10.1.1 This chapter of the Preliminary Environmental Information (PEI) Report outlines the preliminary assessment of the Environmental Impact Assessment (EIA) in relation to effects from contamination on human health, surface water and groundwater, and ground stability both within the Teddington Direct River Abstraction (TDRA) Project (hereafter referred to as 'the Project') sites (shaft and infrastructure locations) and on adjacent and nearby sites. This chapter should be read in conjunction with the description of the Project as presented in Chapter 2: Project Description. This chapter is supported by the following Volume 2 PEI Report Figures:

a. Figure 10.1: Superficial and artificial deposits in the vicinity of the Project

b. Figure 10.2: Historical landfill and waste sites in the vicinity of the Project

c. Figure 10.3: Ground investigation (GI) borehole location plan

10.1.2 This chapter is supported by the following Volume 3 PEI Report Appendix:

a. Appendix 10.1: London Water Recycling SRO – TDRA Phase 1 Ground Investigation Interim Factual Report (GI Interim Factual Report)

10.1.3 Ground conditions and contaminated land effects interact with various other environmental aspects, and these issues have been addressed in the following chapters:

a. Potential effects on water resources (surface water and groundwater) and from flooding are assessed in Chapter 5: Water Resources and Flood Risk.

b. Potential effects on aquatic or hydrologically connected protected sites and aquatic ecology are assessed in Chapter 6: Aquatic Ecology.

c. Potential effects from construction waste generation and management are discussed in Chapter 11: Materials and Waste.

d. Potential effects of noise and vibration from tunnelling operations and earthworks are discussed in Chapter 14: Noise and Vibration.

## 10.2 Legislation, policy and guidance

10.2.1 This section examines key legislation, policy frameworks and guidance relevant to geology and contaminated land, emphasising alignment with the National Policy Statement for Water Resources Infrastructure (NPS) (Department for Environment, Food and Rural Affairs (Defra), 2023), the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2024), regional and local plans.

10.2.2 Collectively they aim to protect human health and the environment from contamination.

10.2.3 A summary of national legislation and policy is provided in Appendix 1.1: National Planning Policy and Legislation.

## Legislation

10.2.4 Part 2A of the Environmental Protection Act 1990 (the contaminated Land Regime) provides a risk-based approach to the identification and remediation of land where contamination poses an unacceptable risk to human health or to the environment; essentially, it provides a mechanism to address legacy land contamination issues by requiring parties to clean up polluted sites.

10.2.5 The Contaminated Land (England) Regulations 2006 make provision for the identification and remediation of contaminated land under Part 2A of the Environmental Protection Act 1990. They identify categories of sites ('special sites'), including land, which are contaminated by radioactive substances in, on or under that land. In relation to such special sites the Environment Agency is to be the enforcing authority.

10.2.6 The Contaminated Land (England) Amendment Regulations 2012 amend the Contaminated Land (England) Regulations 2006 as follows: Regulation 3 (pollution of controlled waters) to protect controlled waters from being affected by land contamination by applying environmental objectives on controlled water waterbodies.

10.2.7 The Water Act 2003 makes provision with respect to the management and conservation of water resources in England and Wales. It aims at the sustainable use of water resources, the protection of water consumer interests and the strengthening of competition in the field of water services, and the promotion of water conservation. Section 86 amends the Environmental Protection Act 1990, specifically Part 2A, to include provisions for preventing the pollution of controlled waters by contaminated land.

10.2.8 Section 161B of the Water Resources Act 1991 (as amended) specifically addresses contaminated land is section 161B. This section provides the Environment Agency with the authority to serve works notices requiring the remediation of contaminated land that affects controlled waters.

10.2.9 The Environmental Damage (Prevention and Remediation) Regulations 2015 apply to contaminated land with regard to the prevention and remedying of pollution of land and water. The Regulations also provide detail with respect to other matters of enforcement and define offences.

10.2.10 The Construction (Design and Management) Regulations 2015 aim to improve health and safety in construction by defining roles and responsibilities. Key stakeholders include clients, designers, principal designers, principal contractors, contractors and workers. The regulations emphasise communication, cooperation and coordination to ensure a safe working environment.

10.2.11 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 aim to protect and enhance water quality, ensure sustainable water use, reduce pollution, and enhance aquatic ecosystems. This EU Directive was transposed into law in England and Wales as the Water Environment (Water Framework Directive) Regulations 2017, herein referred to as the WFD Regulations. More information has been provided in Chapter 5: Water Resources and Flood Risk.

## National policy

### National Policy Statement for Water Resources Infrastructure 2023

10.2.12 Key policy relevant to water resources infrastructure and flood risk is set out in the NPS (Defra, 2023), and requirements for ground conditions and contaminated land are provided in Table 10.1.

Table 10.1 Key policy from the NPS for Water Resources Infrastructure

| Paragraph(s) | Requirement for the Applicant | How the Project addressed this |
|---|---|---|
| 4.10.4 | Development of land will affect soil resources, including physical loss of and damage to soil resources, through land contamination and structural damage. Indirect impacts may also arise from changes in the local water regime, organic matter content, soil biodiversity and soil process. | Desk-based information has been gathered from various sources to develop the baseline conditions for soil and land contamination; refer to Section 10.7. A programme of GI is underway for the Project to provide data on the ground conditions, including potential contamination, at the construction sites and along the conveyance route. The results of the GI will be included in the Environmental Statement (ES). |
| 4.10.5 | For developments on previously developed land, the Applicant should ensure that they have considered the risk posed by land contamination. Risks would require consideration in accordance with the contaminated land statutory guidance as a minimum. The guidance is published under Part 2A of the Environmental Protection Act 1990 and provides detail on when land may be designated as contaminated by the Environment Agency. | Potential impacts from existing contamination have been assessed in accordance with statutory guidance and best practice. This includes development of a conceptual site model and assessment of available contamination data. These will be developed following completion of the ongoing GI. Refer to the geology and preliminary conceptual site model sections of Section 10.7. |
| 4.10.15 | Where required, a preliminary assessment of ground instability should be carried out at the earliest possible stage. The Applicant should | A programme of GI is underway for the Project to provide data on the ground conditions. The risk of collapsible ground, embankment |

| Paragraph(s) | Requirement for the Applicant | How the Project addressed this |
|---|---|---|
| | ensure that any necessary investigations are undertaken to ascertain that the site is and will remain stable, or can be made so, as part of the development. The site needs to be assessed in context of surrounding areas where subsidence, landslides and land compression could threaten the development during its anticipated life or damage neighbouring land or property. This could be in the form of a land stability or slope stability risk assessment report. | stability and subsidence from tunnelling and shaft construction, will be assessed in geotechnical and tunnelling reports following completion of the GI. The results of these assessments will be summarised within the ES. |
| 4.10.17 | The Applicant can minimise the direct effects of a project on the existing use of the proposed site, or proposed uses near the site, by the application of good design principles, including the layout of the project and the protection of soils during construction. | Soil management and protection measures will be captured in the ES in the Code of Construction Practice (CoCP). Refer to Section 10.4. |

### National Planning Policy Framework 2024

10.2.13 Paragraph 196 of the NPPF sets out that:

*'Planning policies and decisions should ensure that:*

*(a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);*

*(b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and*

*(c) adequate site investigation information, prepared by a competent person, is available to inform these assessments.'*

10.2.14 Paragraph 197 of the NPPF sets out that:

*'Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.'*

10.2.15 In relation to the NPPF, this chapter considers the aspects related to land contamination. Land stability issues, such as subsidence, embankment stability and risk of encountering collapsible ground, will be investigated and assessed as part of the ongoing GI for the Project. It is anticipated that any potential issues or risks related to the stability of land and property will be mitigated by

design alterations (primary mitigation). The findings and conclusions on land stability from the ground engineering reports produced following the ongoing GI will, however, be summarised in the ES.

## Regional and local policy

10.2.16 In addition to the national policy set out above, the Project must also have regard to relevant regional and local plans and policy.

10.2.17 The London Plan 2021, Policy G9 (Geodiversity) (Greater London Authority, 2021) states that development proposals should:

*'1) make a positive contribution to the protection and enhancement of geodiversity*

*2) protect Regionally Important Geological Sites (RIGS)*

*3) give Locally Important Geological Sites (LIGS) the level of protection commensurate with their importance.'*

10.2.18 The London Borough of Richmond upon Thames (LBR) Local Plan 2018, Policy LP 10 (Local Environmental Impacts, Pollution and Land Contamination) (Land Contamination Section F) (LBR, 2018) and Policy 53 (Local Environment Impacts) (Land Contamination Section M) of the draft LBR Local Plan (LBR, 2023) ensure that '*the Council promotes, where necessary, the remediation of contaminated land where development comes forward. Potential contamination risks will need to be properly considered and adequately mitigated before development proceeds*'.

10.2.19 The London Borough of Hounslow (LBH) Local Plan 2015–2030, Policy EQ8 (Contamination) (LBH, 2015) states that the LBH has a rich history of industrial development, which has led to potential contamination on many sites. Redevelopment of previously used land is encouraged to remediate contamination and improve water quality, with developers required to ensure safe development and follow guidelines for risk assessment and mitigation.

10.2.20 The LBH Local Plan 2020–2041 (emerging policy), Policy EQ8 (Contamination) (LBH, 2024) focuses on ensuring that contamination is properly addressed in development areas. It promotes the remediation of contaminated land in line with the council's Contaminated Land Strategy, the NPPF, and the Thames River Basin Management Plan.

10.2.21 The Royal Borough of Kingston upon Thames (RBK) Core Strategy 2012, Policy DM 1 (Sustainable Design and Construction Standards) (RBK, 2012) requires that new development should minimise air, noise and contaminated land impacts in line with industry best practice, and that development proposals for contaminated land should include remediation measures.

10.2.22 The RBK Local Plan 2019–2041 (emerging policy), Policy KC9 (Ground Contamination and Hazardous Substances) (RBK, 2022) requires development proposals on contaminated or potentially contaminated land to submit risk

assessments, site investigations, verification plans and remediation strategies. Proposals involving hazardous substances must demonstrate safeguards to ensure no risk to health, safety, or the environment, and provide mitigation for any potential harm to trees.

## 10.3 Consultation, engagement and scoping

### Scoping

10.3.1 The EIA Scoping Report was submitted to seek a Scoping Opinion from PINS, on behalf of the Secretary of State for Environment, Food and Rural Affairs. The EIA Scoping Report set out the Applicant's intended approach to EIA in terms of the scope, methodology and content of the ES that will accompany the Development Consent Order (DCO) application for the Project. The EIA Scoping Report also outlined environmental features and constraints from desk-based studies and described the potential effects that could arise from the Project. Table 10.2 presents the section of the Scoping Opinion (PINS, 2024) relating to ground conditions and contaminated land, and the Applicant's our response to those comments.

Table 10.2 Key scoping opinion comments for ground conditions and contaminated land

| PINS ID reference | Comment | Response |
|---|---|---|
| Planning Inspectorate (3.6.1) | The Scoping Report states that this would be assessed further through ground investigation but that any potential risks would be mitigated by design alteration. In the absence of the ground investigation and detailed mitigation proposals, the Inspectorate does not agree to scope this matter out. The ES should assess effects from potential impacts to ground instability during construction unless robust justification is provided to demonstrate that significant effects are unlikely to occur, with evidence of agreement from the relevant consultation bodies. | The matter has been scoped in. However, it is a fundamental engineering requirement of the detailed engineering design to take account of any ground instability risks; this will be an embedded mitigation measure.<br>It is proposed that the ES would reference tunnelling and ground engineering assessments undertaken following the ongoing programme of GI. The assessments are yet to be conducted and the mitigation measures to ensure no significant effects are yet to be determined but will be described in the ES. |

| PINS ID reference | Comment | Response |
|---|---|---|
| Planning Inspectorate (3.6.2) | The Scoping Report states that there is no high grade agricultural land (i.e. agricultural land classification (ALC) Grade 1 to 3 land) within the study area; based on ALC Provisional mapping data, the study area is classed as urban land. The Inspectorate is content that this matter can be scoped out of further assessment on that basis. | Agricultural and best and most versatile (BMV) land will continue to be scoped out. |
| Planning Inspectorate (3.6.3) | The Scoping Report states that no sites of geological importance have been identified within the study area based on review of Defra MAGIC geological places mapping and London Geodiversity Partnership's list of London geological sites. The Inspectorate is content that this matter can be scoped out of further assessment on that basis. | Sites of geological importance will continue to be scoped out. |
| Planning Inspectorate (3.6.4) | The Scoping Report states that most effects related to land contamination would be controlled by mitigation and through remediation during construction. It states that standard controls would be in place including appropriate drainage and pollution control, and industrial processes would be controlled under an environmental permit. Potential for contamination from spillages and leaks would be managed through working practices, monitoring and emergency responses. The Inspectorate is content with this approach and agrees to scope this matter out of further assessment. However, the ES should describe the measures required to avoid effects and confirm how these would be secured in the DCO. The ES should describe the progress made towards securing the environmental permit and where this may impact on the effectiveness or delivery of avoidance or mitigation measures. | The ES will describe any mitigation measures required to avoid significant effects related to land contamination and detail how these would be secured in the DCO. Information pertaining to securing required Environmental Permits will be included in the ES where relevant. |
| Planning Inspectorate (3.6.5) | A study area of 250m from the scoping boundary is proposed based on guidance from the National House | The Applicant will make efforts to agree the study |

| PINS ID reference | Comment | Response |
|---|---|---|
| | Building Council and the Environment Agency. It is stated that this is appropriate and proportionate considering the distance over which contamination is likely to migrate and the location and type of off-site receptors. The study area and scope of ground investigation should have sufficient coverage to ensure that the baseline conditions are understood for all areas where significant effects are likely to occur. The Applicant should make effort to agree the study area with relevant consultation bodies, including local authorities. | area with the relevant consultation bodies. |
| Planning Inspectorate (3.6.6) | The Scoping Report states that ground investigation is ongoing but does not specify the survey location(s). It is stated that the need for further ground investigation would be considered as part of a land contamination risk assessment, after current ground investigation work. The Inspectorate advises that the scope of ground investigation should be sufficient to establish a robust baseline from which to assess likely significant effects. The Applicant should make effort to agree the scope of ground investigation with relevant consultation bodies, including local authorities. | Figure 10.3 showing the GI locations has been included in the PEI Report.<br>The scope of the current GI has been designed to be sufficient to assess the potential land contamination risks at the key construction areas.<br>The ongoing GI is a 'Phase 1' GI and it is anticipated that more detailed GI may be undertaken if necessary.<br>The scope of the current Phase 1 GI and the proposed Phase 2 GI has been discussed through regular meetings with the relevant bodies. |
| Planning Inspectorate (3.6.7) | The Scoping Report states that risks arising from gas in the ground would be assessed and managed in accordance with guidance in BS8485 and BS8576. The Inspectorate advises that the ES should describe the baseline condition for ground gas, including the results of any monitoring undertaken. The assessment should consider the effects arising from potential release of gases | The Scoping Report and this PEI Report have identified potential sources of ground gas within the study area, particularly in areas where landfills/ areas of infilled land are located. Risks from ground gas will be assessed |

| PINS ID reference | Comment | Response |
|---|---|---|
| | from construction at or near to former landfill sites. | following review of monitoring data obtained during the on-going GI. The results of these assessments will be included in the ES. |

10.3.2 In addition to the PINS comments, comments were also raised by LBR, the Environment Agency, Natural England and HSE. These comments and the responses to them have been summarised below.

10.3.3 The Environment Agency raised concerns regarding tunnelling in proximity to the highly sensitive Chalk aquifer and Crane Avenue Allotment landfill. The current design is that the conveyance tunnel (20-40m bgl) and the TLT connection (10-15mbgl) will be within the London Clay Formation across the majority of the route. At Mogden STW where the tunnel will be required to be deeper to avoid existing piled foundations, the base of the drive shaft will be approximately 60m at the deepest point. The London Clay extends to approximately 65mbgl across the scheme and overlies the Lambeth Group. It is therefore considered that the deeper tunnel route at Mogden STW will remain within the London Clay. Chalk is present beneath the Lambeth Group and therefore is at a significant depth and will not be within the zone of influence from tunnelling. However, the ground model will be confirmed following completion of the on-going GI.As part of the ongoing GI, a borehole is proposed to be drilled within the boundary of Crane Avenue Allotment landfill. The findings will be included in the ES and the assessment updated accordingly. However, it is expected that the base of the landfill will be shallower than the invert level of the conveyance tunnel.

10.3.4 GI is currently in progress and the findings will be incorporated into the ES to address the comments regarding the GI, raised by LBR and Environment Agency from the EIA Scoping Report consultation. A GI Interim Factual Report has been provided in Appendix 10.1 which includes the boreholes logs and data received up to 25 February 2025. These data have been used to update the baseline information in this PEI Report.

10.3.5 The comments related to historical land uses (gravel extraction in Ham and a former aircraft factory), raised by LBR have been addressed in this Chapter of the PEI Report, Section 10.7: Baseline conditions, and it has now been made clear that the infilled former gravel pits should be identified as landfills. Also refer to PINS 3.6.10 in Table 10.2.

10.3.6 LBR The Scoping Report states that this would be assessed further through ground investigation but that any potential risks would be mitigated by design alteration. In the absence of the ground investigation and detailed mitigation proposals, the Inspectorate does not agree to scope this matter out. The ES should assess effects from potential impacts to ground instability during construction unless robust justification is provided to demonstrate that

significant effects are unlikely to occur, with evidence of agreement from the relevant consultation bodies.

10.3.7 Consistent with PINS comment 3.6.1, LBR did not agree to scoping out embankment stability, collapsible ground or ground subsidence impacting the Project or causing damage to neighbouring land. This matter has now been scoped in, refer to the response to PINS comment 3.6.1.

10.3.8 The Environment Agency supports the Applicant's proposed approach for remediation of land contamination and recommends that a watching brief and discovery strategy for the presence of unexpected contamination should be produced prior to construction commencing. Following the GI the Applicant will develop bespoke mitigation which may include watching briefs and a discovery strategy if appropriate.

10.3.9 The Environment Agency accepts the Applicant's proposal to scope out risks of contamination during operation due to the remediation of unacceptable contamination and the use of environmental permits and best practice to control pollution during operation. However, the Environment Agency seeks confirmation that the risks posed by the operational site can be adequately managed by the proposed best practice methods. Mitigation measures will be implemented if necessary, to prevent hazardous substances entering groundwater and surface water during construction or operation. This will be outlined in the CoCP.

10.3.10 The HSE commented that, based on the EIA, it is not clear whether the Applicant has considered the hazard classification of any chemicals that are proposed to be present at the development. The HSE also pointed out that hazardous substances planning consent is required to store or use any of the Categories of Substances or Named Hazardous Substances set out in Schedule 1 of The Planning (Hazardous Substances) Regulations 2015 as amended, if those hazardous substances will be present on, over or under the land at or above the controlled quantities. The Applicant notes that chemicals to be used during operation are not yet known. All relevant legislation and consents for hazardous substances to be used during operation will be complied with. Chapter 5: Water Resources and Flood Risk assesses the risk of hazardous substances entering groundwater and surface water during construction or operation.

10.3.11 Natural England raised comments in relation to adverse impacts to soil and the sustainable use of soils, including whether best and most versatile (BMV) agricultural land would be impacted. Soil management strategies in line with current good practice, and production of a Materials Management Plan, as required (Appendix 4.2 Commitments Register, PCR 33). This is in line with circular economy principles to reduce waste, to keep materials in use for as long as possible, and to minimise embodied carbon. No high grade or BMV agricultural land has been identified within the study area. As such, effects from damage or sterilisation of such land have also been scoped out, with PINS agreement that no further assessment is required. Effects on soils have been

assessed and scoped out, as confirmed by PINS (refer to PINS 3.6.2), with standard good practice (tertiary) mitigation measures implemented to protect soils during construction.

10.3.12 Natural England stated that the assessment should take account of the risks of water pollution, including water-dependant protected conservation sites, and how these can be managed or reduced. Ground Conditions and Contaminated Land assesses the impacts on surface water and groundwater quality as result of potential mobilisation of existing contamination. Potential impacts on aquatic or hydrologically connected protected sites and aquatic ecology are assessed in Chapter 6: Aquatic Ecology. Potential impacts to the quality of surface water and groundwater from the Project are assessed in Chapter 5: Water Resources and Flood Risk.

10.3.13 The full Scoping Opinion, as well as the Applicant's response regarding how and where comments have been addressed in the EIA will be included as an appendix within the ES.

## Consultation and engagement

10.3.14 A meeting was held between the three local planning authorities (LPAs) (LBH, LBR and RBK) and the Applicant on 17 July 2024 to discuss ground conditions and contaminated land. The purpose of the meeting was to discuss the baseline conditions for ground conditions and contaminated land for the ES and to propose what will be scoped in or out from the assessments. At the time of writing this PEI Report, further liaison with each of the LPAs is intended.

## Scope of the EIA

10.3.15 The aspects listed in Table 10.3 have been scoped in/out as a result of the findings of the Scoping Report and the Planning Inspectorate (PINS) Scoping Opinion (PINS, 2024).

Table 10.3 Summary of the scope for ground conditions and contaminated land

| Shaft/ infrastructure reference | Aspect | Potential aspect scoped in/ out | Comments |
|---|---|---|---|
| All locations | Effects from damage to designated geological sites (construction and operation phases) | OUT | No sites identified within the study area. PINS agreement to scope out of further assessment. |
| All locations | Effects from damage or sterilisation of high grade agricultural land or BMV land (construction and operation phases) | OUT | No high grade land identified within the study area. PINS agreement to scope out of further assessment. |

| Shaft/ infrastructure reference | Aspect | Potential aspect scoped in/ out | Comments |
|---|---|---|---|
| Conveyance route, Ham Playing Fields, Ham Street Car Park, Burnell Avenue reception shaft | Effects from impacts of ground conditions and contaminated land (on surface water quality) (construction phase) | IN | To be assessed further following ground investigation (GI). No specific comment from PINS. |
| All locations | Effects from impacts of ground conditions and contaminated land (on human health and groundwater quality) (construction phase) | IN | To be assessed further following GI. No specific comment from PINS. |
| All locations | Effects from impacts of ground conditions and contaminated land (on human health, groundwater and surface waters) (operational phase) | OUT | Ground conditions and contaminated land chapter assesses impacts from existing contamination only. Operational effects will be mitigated through design and controlled through relevant Environmental Permits. PINS agreement to scope out of further assessment. |
| All locations | Effects to land and property from embankment instability, collapsible ground or ground subsidence due to tunnelling (construction phase) | IN | Scoping Report had scoped this out but PINS requires it to scoped in. To be assessed further following GI. |

10.3.16 Aspects that were scoped out in the EIA Scoping Report and remain so are geological sites and high grade agricultural or BMV land in the construction and operation phases, and impacts from existing and new contamination during the operational phase.

## 10.4 Embedded design (primary) mitigation and standard good practice (tertiary)

### Embedded design (primary) mitigation

10.4.1 The Applicant has worked through the design process to avoid or reduce environmental impacts through the Project design. This is referred to as embedded design (primary) mitigation. Chapter 3: Consideration of Alternatives, details the design alternatives that have been considered, including the environmental factors which have influenced the decision making. Embedded design (primary) mitigation relevant to this aspect is outlined in the following paragraphs.

10.4.2 Mitigation measures have been identified and implemented throughout the design process to ensure that potential impacts are eliminated or reduced. These measures include limiting construction footprints, the stripping and sustainable reuse of soils, and spillage containment. For example, the conveyance tunnel will have a proposed diameter of 3.5 metres, which involves changing the construction method from pipe-jacking to using a tunnel boring machine (TBM). This modification reduces the number of intermediate shafts required from five to one. The reduction in the number of shafts offers several benefits, including minimising the construction sites' footprints and their impact on surface soils, as well as decreasing the interaction with potential contamination, areas of Made Ground and landfill, reducing accidental contamination, and reducing the volume of excavated material.

10.4.3 The Project has, where practicable, been designed to avoid land stability issues and risk of encountering collapsible ground, and areas where potential land contamination may be identified. For example, the conveyance tunnel and the TLT connection will be excavated through the London Clay Formation and will not interact with the overlying groundwater-bearing superficial deposits, Made Ground or landfill. Other than the drive shaft and the intermediate shaft, it is not expected that the other shafts and above ground structures will be in areas with significant deposits of Made Ground or contamination issues.

10.4.4 The TBM employed to excavate and construct the conveyance tunnel will assemble concrete segments to support the tunnel as it advances. The ground at the face of the TBM will be stabilised, thereby minimising disturbance to the surrounding area. The Project will be designed as far as reasonably practicable to avoid land stability issues and risk of encountering collapsible ground, high sensitivity/value soils and geological receptors, and areas where potential land contamination has been identified. (Appendix 4.2 Commitments Register, Provisional Commitment Reference (PCR 29)).

### Standard good practice (tertiary)

10.4.5 Standard good practice (tertiary) would occur as a matter of course due to legislative requirements or standard sector practices. An example of standard good practice (tertiary) for this aspect is undertaking an investigation and

assessment of potential land contamination in accordance with relevant standards and best practice guidance (a programme of GI is currently in progress which will aid in this process).

10.4.6 Throughout construction, where construction workers are potentially exposed to contaminated soils, standard mitigation measures will be implemented, such as adherence to task and site-specific risk assessments and method statements, use of appropriate personal protective equipment, dust suppression and emergency responses. Detailed information on mitigation measures will be provided in the ES, CoCP and associated contractors' risk assessments.

10.4.7 Where contamination impacts are identified from the ongoing GIs and subsequent assessments or construction, relevant remediation strategies will be developed as appropriate to the nature and extent of contamination encountered and agreed with the LPAs and Environment Agency (Appendix 4.2 Commitments Register PCR 30).

10.4.8 Topsoils and subsoils disturbed during construction shall be carefully stripped and protected so that that they may be re-used, where reasonably practicable, either within the Project for site restoration or elsewhere. This is included in the Commitments Register (Appendix 4.2 PCR 32) and will be secured through the CoCP/ CEMP.

10.4.9 A Materials Management Plan with the provision for handling of excavated materials including soils so they can be re-used on- or off-site, will be produced in accordance with the Defra Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Defra, 2011) (Appendix 4.2 Commitments Register PCR 33) and will be secured through the CoCP/ CEMP.

10.4.10 Good practice protocols shall be implemented at construction sites to limit the potential for mobilisation of contamination, and to limit potential contamination of soil, surface and groundwater, for example from accidental leaks or spills of fuels or chemicals (Appendix 4.2 Commitments Register PCR 34).

10.4.11 Standard good practice (tertiary) for the mitigation of risks from Unexploded Ordnance (UXO) (refer to paragraph 10.7.25 of this PEI Report), such as proper planning, staff training/ briefings, and adherence to safety and emergency protocols ensure risks are reduced to As Low As Reasonably Practicable (ALARP). Should UXO be discovered on the site, work must stop immediately, the area must be cordoned and the authorities notified. Expert advice must be sought for risk assessment, including advice from the statutory nature conservation bodies regarding safe clearance, removal and disposal, and safety protocols must be adhered to at all times. Low noise alternatives to high order detonations should be prioritised when developing protocols to clear UXO.

10.4.12 An unexploded ordnance risk assessment for construction activities shall be undertaken in accordance with CIRIA C681 (Appendix 4.2 Commitments Register PCR 88). Mitigation will be incorporated into Appendix 4.3 draft CoCP and associated contractors' risk assessments.

## 10.5 Assessment methodology

### General approach

10.5.1 The evaluation of contamination will be in line with the technical approach presented in Land Contamination Risk Management (LCRM) (Environment Agency, 2023). This provides a technical approach for identifying and remediating contaminated land through the application of a risk management process. LCRM can be applied in a range of contexts including planning or under the Part 2A contaminated land regime (Environmental Protection Act 1990).

10.5.2 The process of land contamination risk assessment, as given in LCRM, is summarised as follows:

a. Develop a conceptual site/ground model – carry out a desk study review of available documentary information and identify the potential sources, pathways and receptors relevant to the site, and the potential contaminant linkages

b. Gather site-specific information on the conceptual site/ground model – through site/ground investigation if required

c. Gather information on the nature and extent of contamination, details of pathways for migration of contamination and specific information on the receptors to update the model

d. Risk assessment – apply criteria to determine the value/sensitivity of receptors, determine the magnitude of any impact on those receptors, consider mitigation, and make conclusions about the likely significant effects of the Project from contamination on human health, surface water and groundwater. These criteria must be relevant to each potential contaminant linkage, and can be generic (conservative) criteria, or can be site-specific (less conservative).

10.5.3 A programme of GI for the Project is currently on-going. The GI has been designed to refine the ground model, understand the geotechnical parameters of the ground and to assess potential existing contamination. Soil samples are being collected for chemical analysis. Groundwater samples will also be collected for chemical analysis, and a period of ground gas monitoring is to be undertaken. Soil and groundwater chemical data will be screened initially against published standards to assess the level of contamination (a generic quantitative risk assessment). At the time of writing the PEI Report, not all soil and groundwater data had been received; however, the screening outcomes of the soil chemical data received by 25 February 2025 have been discussed in Section 10.7. The complete dataset will be provided in the ES. A hazard analysis and waste classification assessment will be undertaken using soil chemical data to inform on the hazardous characteristic of soils. Further, more detailed levels of quantitative risk assessment may be required depending on the contaminant concentrations.

10.5.4 Risks arising from ground gas would be assessed and managed in accordance with the guidance in British Standard (BS) 8485 (British Standards Institution, 2019) and BS 8576 (British Standards Institution, 2013).

10.5.5 The need for further GI would be assessed in relation to the conceptual site/ground model produced as part of a land contamination risk assessment, which would be undertaken following the current GI, together with relevant geotechnical and geo-environmental data which may already be available.

10.5.6 The aims and objectives of the assessment are to:

a. Establish the baseline conditions through desk-based assessments and the ongoing GI
b. Determine the value/importance of the identified receptors to be affected by the Project
c. Assess the significance of the impacts
d. Identify likely significant effects of impacts in the absence of any additional (secondary) mitigation
e. Identify mitigation measures to avoid, minimise and/or reduce the likely significant effects and identify additional enhancement measures
f. Establish residual likely significant effects after mitigation has been implemented

10.5.7 The magnitude of impact is to be assessed for the construction phase only as the operational risks for this aspect have been scoped out. Construction is considered from the point of gaining the site access, site preparation including any site remediation, enabling works and construction, up to commissioning.

## Assessing the significance of effects

10.5.8 The criteria for assessing the value (sensitivity) of receptors and magnitude of impacts will be based on the methodology outlined in Chapter 4: Approach to Environmental Assessment of this PEI Report, professional judgement and experience, and with regard to the Design Manual for Roads and Bridges (DMRB) LA 109 Geology and soils (Highways England, 2019) and the Institute of Environmental Management and Assessment (IEMA) Guide: A New Perspective on Land and Soil in Environmental Impact Assessment (IEMA, 2022). This provides criteria for assessing the sensitivity and magnitude of impact to geology and soil receptors and sets out how contaminant concentrations should be evaluated in order to determine magnitude of impact depending upon the receptor to the contamination (human health, surface water, groundwater). The magnitude of impact on surface water and groundwater will be assessed with reference to DMRB LA 113 Road drainage and the water environment (Highways England, 2020). The relevant content from the DMRB LA 113 tables, excluding receptors that have been scoped out, has been combined and presented in Table 10.5 and Table 10.6 The significance of the impact is determined by the magnitude of the impact and the value/sensitivity of the receptors.

10.5.9 Table 10.4 and Table 10.5 show the definitions of value/sensitivity.

10.5.10 The general approach followed in Chapter 5: Water and Flood Risk differs slightly from that in

10.5.11 Table 10.4. Chapter 5 has incorporated a ‘very high’ value category, in accordance with guidance from the DMRB. As a result, there are minor differences in the likely significance of effects on controlled waters between the two chapters. To ensure consistency and clarity in the overall assessment, the results will be updated following the completion of ongoing ground investigations (GI). The final assessment will reflect any changes to ensure both chapters are consistent.

Table 10.4 Value and sensitivity criteria definition

| Value/sensitivity | General criteria |
|---|---|
| High | High or very high importance and rarity, international or national scale and limited potential for substitution. |
| Medium | Medium or high importance and rarity, regional scale, limited potential for substitution. |
| Low | Low or medium importance and rarity, local scale. |
| Negligible | Very low importance and rarity, local scale. |

Table 10.5 Determining the value/sensitivity of receptors

| Value/ sensitivity | Receptor type | Examples of receptors |
|---|---|---|
| High | Human health | Construction workers, future site users, maintenance workers, adjacent land users and future construction workers.<br>High sensitivity land use such as public open space, residential and allotments. |
| High | Surface water | WFD classification shown in River Basin Management Plan (RBMP) 3.<br>Nationally or internationally important site, i.e. Ramsar site, Special Area of Conservation (SAC), Special Protection Area (SPA) and Sites of Special Scientific Interest (SSSIs). |
| High | Groundwater | Principal or highly productive aquifers with high aquifer vulnerability.<br>Groundwater abstractions that are public water supplies. |

| Value/ sensitivity | Receptor type | Examples of receptors |
|---|---|---|
| | | Source Protection Zone (SPZ) 1 (Inner Protection Zone) or 2 (Outer Protection Zone).<br>Groundwater supporting nationally or internationally important site, i.e. Ramsar site, SAC, SPA and SSSIs.<br>Groundwater providing locally important resource or supporting a river ecosystem.<br>Groundwater Dependent Terrestrial Ecosystem (GWDTE).<br>WFD water body with Good chemical status. |
| High | Ground instability | Structures of high susceptibility to ground instability and/ or high importance. |
| Medium | Human health | Medium sensitivity land use such as commercial or industrial. |
| Medium | Surface water | Watercourses not having a WFD classification shown in a RBMP3 and $Q_{95}$ greater than 0.001m³/s. Providing water for agricultural or industrial use. |
| Medium | Groundwater | Secondary A aquifers.<br>Secondary undifferentiated aquifer.<br>Groundwater aquifer providing water for agricultural or industrial use.<br>Licensed groundwater abstractions.<br>SPZ3 (Source Catchment Protection Zone).<br>Limited connection to surface water.<br>WFD water body with Good chemical status. |
| Medium | Ground instability | Structures of medium susceptibility to ground instability and/ or medium importance. |
| Low | Human health | Low sensitivity land use such as highways and rail. |
| Low | Surface water | Watercourses not having a WFD classification shown in RBMP3 and $Q_{95}$ less than 0.001m³/s.<br>Private water supplies located within the vicinity of a mains water supply or used for agricultural purposes and not for drinking water purposes. |

| Value/ sensitivity | Receptor type | Examples of receptors |
|---|---|---|
| Low | Groundwater | Unproductive strata.<br>WFD water body with Poor chemical status. |
| Low | Ground instability | Structures of low susceptibility to ground instability and/ or low importance. |
| Negligible | Human health | Undeveloped surplus land/no sensitive land use proposed. |
| Negligible | Surface water | Watercourse that is dry for most of the year. |
| Negligible | Groundwater | Unproductive strata.<br>Non-WFD water body or WFD water body with Poor chemical status. |
| Negligible | Ground instability | Areas without structures, landscaping, footpaths. |

Table 10.6 Determining the magnitude of impact

| Magnitude of impact | Receptor type | Description of impact |
|---|---|---|
| Large | Human health | Adverse: significant contamination identified. Contamination levels significantly exceed background levels and relevant screening criteria (e.g. Category 4 screening levels) with potential for significant harm to human health. Contamination heavily restricts future use of land.<br>Adverse: soil contamination is considered to pose a high risk to potential receptors with one or more contaminant linkages certain to be present.<br>Beneficial: substantial betterment of ground contamination through remediation and/or mitigation and removal of risk to receptors. |
| Large | Surface water | Adverse: loss of regionally important public water supply (licensed surface water abstraction for public water supply).<br>Adverse: reduction in water body WFD classification.<br>Beneficial: removal of existing polluting discharge or removing the likelihood of polluting discharges occurring to a watercourse.<br>Beneficial: improvement in water body WFD status classification in a water body for chemical |

| Magnitude of impact | Receptor type | Description of impact |
|---|---|---|
| | | status elements or supporting elements to ecological status. |
| Large | Groundwater | Adverse: loss of, or extensive reduction in, quality to an aquifer.<br>Adverse: loss of regionally important water supply.<br>Adverse: loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies.<br>Beneficial: substantial betterment of groundwater contamination through remediation and/or mitigation and removal of risk to receptors.<br>Beneficial: removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring.<br>Beneficial: recharge of an aquifer. |
| Large | Ground instability | Adverse: Resulting in direct harm to health (severe injury/ death) and/or resulting in severe structural damage to or immediate collapse of buildings or infrastructure. |
| Medium | Human health | Adverse: contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria (e.g. Category 4 screening levels).<br>Adverse: soil contamination is considered to pose a moderate risk to potential receptors with one or more contaminant linkages present.<br>Beneficial: moderate betterment of ground contamination through remediation and/or mitigation and removal of risk to receptors. |
| Medium | Surface water | Adverse: degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies.<br>Adverse: contribution to reduction in water body WFD classification.<br>Beneficial: contribution to improvement in water quality that does not lead to a change in WFD status classification. |

| Magnitude of impact | Receptor type | Description of impact |
|---|---|---|
| Medium | Groundwater | Adverse: partial loss or reduction in quality to an aquifer.<br>Adverse: degradation of regionally important public water supply or loss of significant commercial/ industrial/ agricultural supplies.<br>Adverse: partial loss of the integrity of GWDTE.<br>Beneficial: moderate betterment of groundwater contamination through remediation and/or mitigation and removal of risk to receptors.<br>Beneficial: support to significant improvements in damaged GWDTE. |
| Medium | Ground instability | Adverse: Ground instability that may cause partial structural damage/ collapse over time. |
| Small | Human health | Contaminant concentrations are below relevant screening criteria (e.g. Category 4 screening levels).<br>Significant contamination is unlikely with a low risk to human health.<br>Good practice measures can be used to avoid or reduce risks to human health.<br>Adverse: soil contamination is considered to pose a low risk to potential receptors with one or more contaminant linkages possibly present.<br>Beneficial: slight betterment of ground contamination through remediation and/or mitigation (benefit) and reduction of risk to some or all receptors. |
| Small | Surface water | Adverse: minor degradation of locally important public water supply or loss of minor commercial/industrial/agricultural supplies.<br>Beneficial: slight betterment of surface water contamination through remediation and/or mitigation (benefit) and reduction of risk to some or all receptors. |
| Small | Groundwater | Adverse: minor effects on an aquifer, GWDTEs and abstractions not representing a risk to existing resource use or ecology.<br>Beneficial: slight betterment of groundwater contamination through remediation and/or mitigation (benefit) and reduction of risk to some or all receptors. |
| Small | Ground instability | Adverse: Ground instability that may cause minor structural damage over time. |

| Magnitude of impact | Receptor type | Description of impact |
|---|---|---|
| Negligible/ no change | Human health | Contaminant concentrations substantially below levels outlined in relevant screening criteria (e.g. Category 4 screening levels).<br>Adverse: soil contamination is considered to pose a very low risk to potential receptors with one or more contaminant linkages unlikely to be present.<br>No requirement for control measures to reduce risks to human health/make land suitable for intended use. |
| Negligible/ no change | Surface water | The Project is not expected to have effects on the water environment. |
| Negligible/ no change | Groundwater | No measurable impact upon an aquifer and/or groundwater receptors. |
| Negligible/ no change | Ground instability | No measurable impact on structures or infrastructure. |

10.5.12 Table 10.7 below will be used to combine the magnitude of the effect and sensitivity of the receptor assessments to determine the overall significance of the effect. This classifies the overall significance of effects (beneficial or adverse). Effects which are classified as being Moderate or above are considered significant effects, while Slight or Neutral effects are not significant.

Table 10.7 Table of significance

| Receptor value/ sensitivity | Magnitude of change | | | | |
|---|---|---|---|---|---|
| | No change | Negligible | Small | Medium | Large |
| Negligible | No change (Not Significant) | Neutral (Not Significant) | Neutral or Minor (Not Significant) | Neutral or Minor (Not Significant) | Minor (Not Significant) |
| Low | No change (Not Significant) | Neutral or Minor (Not Significant) | Neutral or Minor (Not Significant) | Minor (Not Significant) | Minor (Not significant) or Moderate (Significant) |
| Medium | No change (Not Significant) | Neutral or Minor (Not Significant) | Minor (Not Significant) | Moderate (Significant) | Moderate or Major (Significant) |
| High | No change (Not Significant) | Minor (Not Significant) | Minor (Not Significant) or Moderate (Significant) | Moderate or Major (Significant) | Major (Significant) |

## Assumptions and limitations

10.5.13 The receptors identified in this chapter are predominantly based on a review of the publicly available baseline information. Geological and geo-environmental data from the ongoing GI, including post-GI groundwater and ground gas monitoring data, are needed to refine the assessment. The findings of the GI will be incorporated into the ES.

10.5.14 The assumption made about locating the conveyance tunnel within the London Clay Formation will be revisited following completion of the ongoing GI. If it is subsequently determined that the conveyance tunnel needs to enter or pass within influence of the Chalk aquifer the risks to the Chalk aquifer will need to be revised.

10.5.15 It is assumed that effects related to ground stability will be assessed by relevant geotechnical and tunnelling reports produced following completion of the ongoing GI. The ES would then reference and summarise the relevant assessments and update the EIA accordingly.

# 10.6 Study area

10.6.1 The study area comprises the draft Order limits and an area extending 250m from the draft Order limits. This study area has been chosen based on National House Building Council and Environment Agency guidance and is considered appropriate and proportionate in the context of the Project, considering the distance over which contamination is likely to migrate, the distance with sufficient coverage to gather adequate baseline information for all areas where significant effects are likely to occur, and the location and type of sensitive off-site receptors.

10.6.2 The baseline for the study area has largely been assessed using environmental and geological data obtained from open-source data sources, including British Geological Survey Geology (BGS) digital mapping data (BGS, 2022) and purchased from Groundsure Ltd (Groundsure, 2024), plus historical mapping purchased from Groundsure.

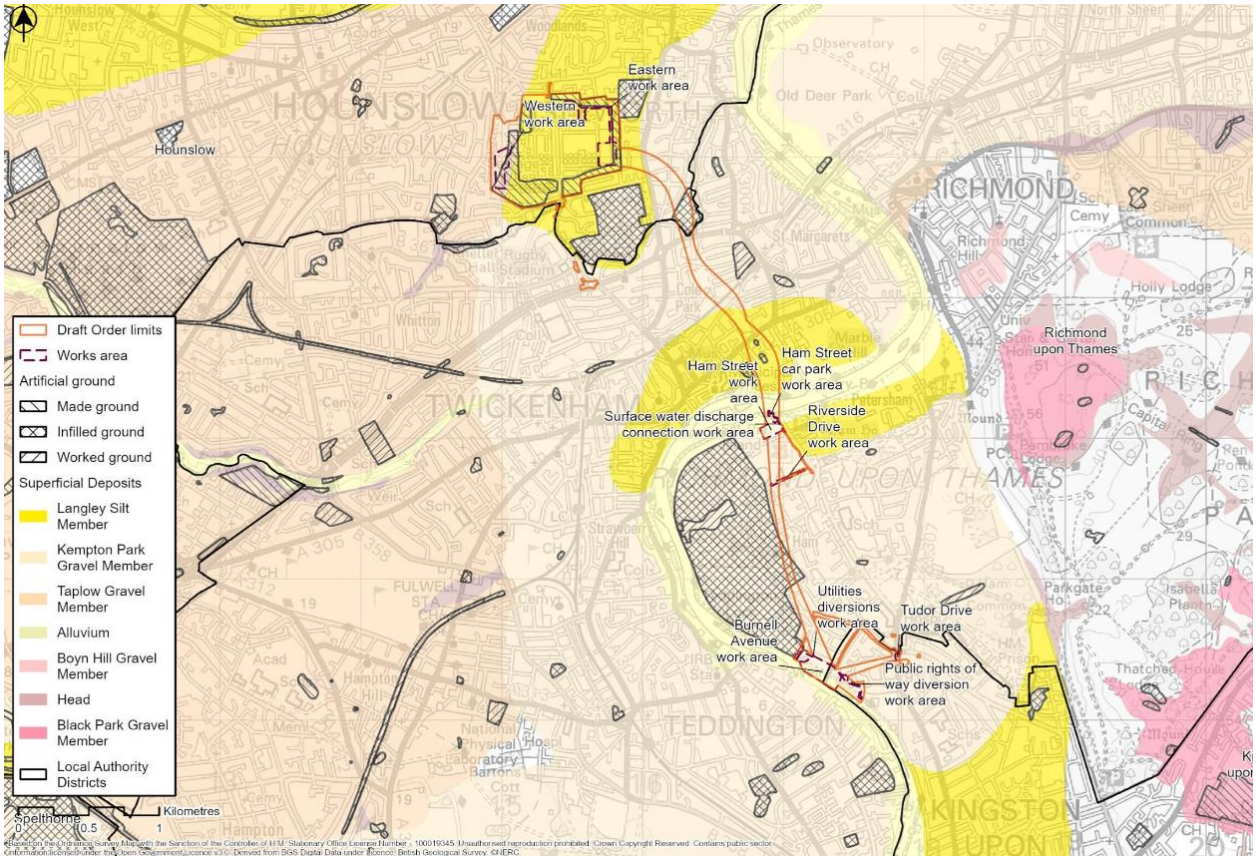
10.6.3 Data from the ongoing GI, reported in the GI Interim Factual Report (see Appendix 10.1) has also been used to develop the baseline geological and soil chemical conditions. As of 25 February 2025, the soil chemical data have been partially received; the complete dataset will be provided in the ES.

# 10.7 Baseline conditions

## Geology

10.7.1 The identified artificial, superficial and bedrock geologies are listed in Table 10.8, and the superficial and artificial geologies are shown in Plate 10.1 (created from an extract of BGS mapping data). The geological units are located within the draft Order limits unless indicated otherwise.

## Plate 10.1 Superficial and artificial deposits in the vicinity of the Project




## Table 10.8 Geology of the shafts, conveyance tunnel route and surrounding areas

| Location | Artificial | Superficial | Bedrock |
|---|---|---|---|
| Mogden STW site Western Work Area | Made Ground (anthropogenic ground in which the material has been placed with engineering control, and/or manufactured in some way, or arising from an industrial process).<br>Mogden STW historical landfill (refer to the landfills and waste sites section below). | Taplow Gravel Member<br>Langley Silt Member – located 80m west of the site | London Clay Formation |
| Mogden STW site Eastern Work Area | Made Ground. | Langley Silt Member | London Clay Formation |
| Conveyance route north of the River Thames | Infilled Ground (Crane Avenue Allotments historical landfill). | Langley Silt Member<br>Kempton Park Gravel Member | London Clay Formation |

| Location | Artificial | Superficial | Bedrock |
|---|---|---|---|
| Ham Playing Fields site | Infilled ground – 175m west.<br>This is the area of former gravel extraction which was subsequently infilled and can be considered to be landfill (refer to the landfills and waste sites section below and PINS 3.6.10 in Table 10.3). | Kempton Park Gravel Member<br>Alluvium | London Clay Formation |
| Conveyance route south of the River Thames | Infilled ground on the conveyance route and within 250m of the draft Order limits.<br>This is the area of former gravel extraction which can be considered to be landfill PlNS 3.6.10 in Table 10.3) | Alluvium<br>Kempton Park Gravel Member | London Clay Formation |
| Burnell Avenue site | Infilled ground – 30m north-west. This is the area of former gravel extraction which can be considered to be landfill (refer to PINS comment 3.6.10 in Table 10.3). | Alluvium<br>Kempton Park Gravel Member | London Clay Formation |
| Tudor Drive site | None within the shaft site, the draft Order limits or within 250m of the draft Order limits.<br>Infilled ground – 640m west. This is the area of former gravel extraction which can be considered to be landfill (PINS 3.6.10 in Table 10.3). | Kempton Park Gravel Member<br>Alluvium – 400m south | London Clay Formation |

10.7.2 As of the 25 February 2025, all the boreholes, except MT-017a-35, completed for the ongoing GI and reported in the GI Interim Factual Report (see Appendix 10.1) encountered Made Ground with a range of anthropogenic materials present at these locations. The greatest thickness of Made Ground was recorded at borehole MT-019-35 which is within the embankment fill on the western side of Mogden STW in the area where the drive shaft is proposed to be constructed; it is adjacent to a historical landfill.

10.7.3 There is also evidence of suspected landfilling at MT-025-35 in the vicinity of the intermediate shaft (Made Ground to 2.1mbgl) associated with the former gravel workings mapped near the Ham Playing Fields site. Made Ground was also present to a depth of 6m at MT-027-35. This location is along the conveyance tunnel route and the infilled former gravel pits are mapped (as artificial ground on the BGS map) to the west of this location. However, the presence of this thickness of Made Ground indicates that the infilled former gravel pits extend further east than shown on the BGS map.

10.7.4 The boreholes used to make these determinations and inferences are summarised in Table 10.9. Please refer to the GI Interim Factual Report in Appendix 10.1 for more details.

Table 10.9 Anthropogenic material recorded within Made Ground

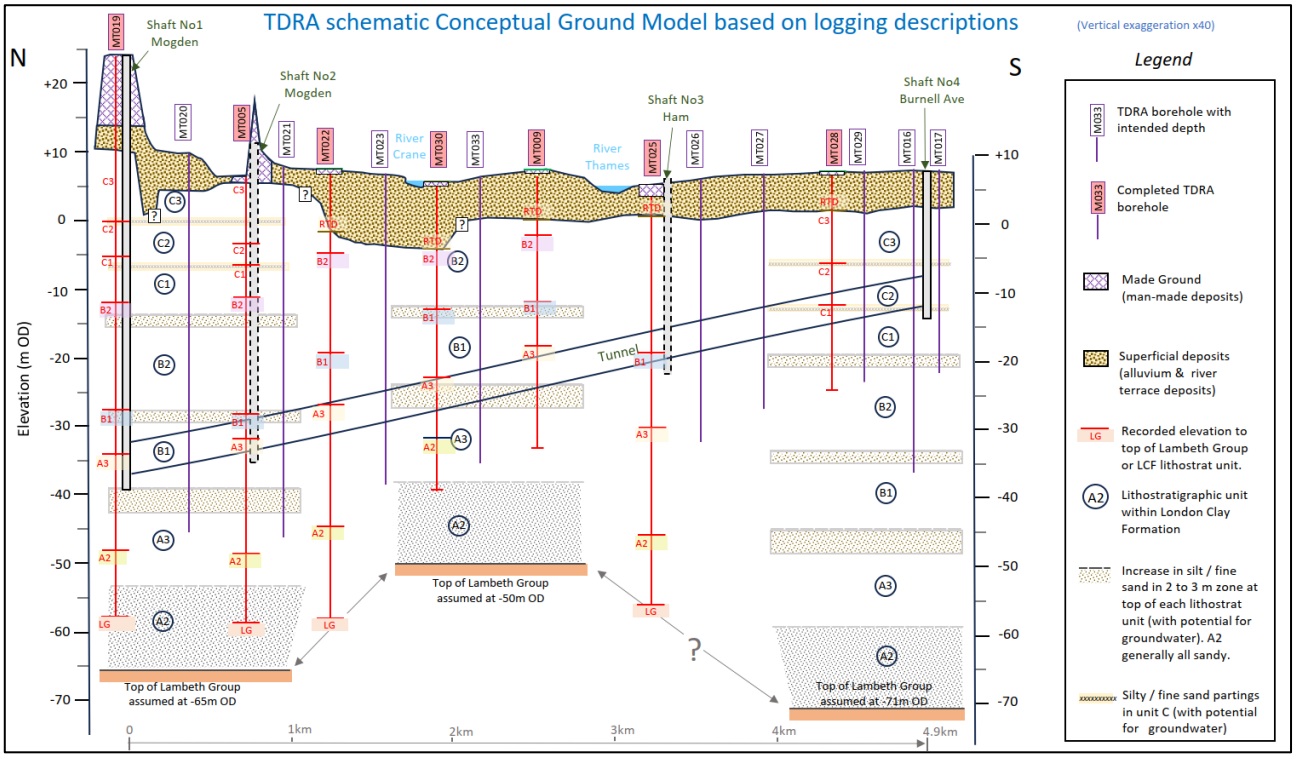
| Location | Base of Made Ground (mbgl) | Anthropogenic constituents | Location |
|---|---|---|---|
| MT-003* | 14.7 | Brick, concrete, charcoal, ash, coal | Interception shaft Mogden STW Eastern Work Area |
| MT-004* | 10.5 | Charcoal | Interception shaft Mogden STW Eastern Work Area |
| MT-005 | 0.4 | None observed | Interception shaft Mogden STW Eastern Work Area |
| MT-009 | 0.8 | Brick, concrete | Tunnel conveyance |
| MT-017a | N/A | No Made Ground recorded | Connection shaft Burnell Avenue |
| MT-019-35 | 10.2 | Concrete, brick, wood, glass | Drive shaft Mogden STW Eastern Work Area |
| MT-022-35 | 0.7 | Glass, potential clinker | Tunnel conveyance |
| MT-025-35 | 2.1 | Brick, ceramics, concrete | Intermediate shaft Ham Playing Fields site |
| MT-026-35 | 0.4 | Brick fragments | Tunnel conveyance |
| MT-027-35 | 6.0 | Fragments of brick, concrete, tarmacadam, slate, clinker, potential asbestos containing material, glass, wood, ceramic, metal | Tunnel conveyance |
| MT-028-35 | 0.35 | Brick, concrete | Tunnel conveyance |
| MT-030-35 | 0.6 | Brick, glass, potential clinker | Tunnel conveyance |
| MT-031-35 | 1.4 | Fragments of brick, concrete, clinker, occasional brick cobbles | TLT connection tunnel |

**Sub-horizontal borehole drilled into the embankment at Mogden STW (Source: Ongoing Ground Investigation)*

10.7.5 The depth of the recycled water conveyance tunnel would be between 20mbgl and 40mbgl for the majority of the route with the final alignment and profile to be determined following further surveys and detailed design. The depth of the tunnel will be approximately 60m at Mogden STW in order to avoid existing piled foundations. Based on borehole data received to date, the top of the Lambeth Group, which immediately underlies the London Clay Formation, is approximately 65mbgl. The conveyance route is expected to be wholly within the London Clay Formation for its entire length, as indicated in the indicative

geological long-section (conceptual ground model) of the conveyance route in Plate 10.2. It should be noted that this current ground model will be refined as further data from the ongoing GI become available.

## Plate 10.2 Conveyance route geological long-section




10.7.6 The TLT connection tunnel will also be wholly within the London Clay Formation. Between Burnell Avenue and Tudor Drive, the top of the London Clay Formation is expected to be approximately 5mbgl, and its base is expected to be approximately 65mbgl. The depth of the connection tunnel is likely to be between 10mgbl and 15mbgl.

## Hydrogeology

10.7.7 The aquifer designations of the geological sequence identified above are listed below based on the Groundsure report and open source data. Further details are provided in Chapter 5: Water Resources and Flood Risk.

a. Alluvium (clay, silt, sand and peat) – Secondary undifferentiated aquifer

b. Langley Silt Member (clay and silt) – Unproductive strata

c. Taplow Gravel Member (sand and gravel) – Principal aquifer

d. Kempton Park Gravel Member (sand and gravel) – Principal aquifer north of the River Thames, Secondary A aquifer south of the River Thames

e. London Clay Formation (clay, silt and sand) – Unproductive strata

10.7.8 Principal aquifers are described as having a geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and

may support water supply/river base flow on a strategic scale. Generally, Principal aquifers were formerly classified as major aquifers.

10.7.9 Secondary A aquifers are described as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

10.7.10 Secondary undifferentiated aquifers are described as aquifers where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type. Secondary B aquifers are mainly lower permeability layers that may store and yield limited amounts of groundwater through characteristics like thin cracks (fissures) and openings, or eroded layers.

10.7.11 Unproductive strata are described as rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

10.7.12 The Groundsure report, dated June 2024, and open source data indicate that there are no groundwater SPZs within 250m of the draft Order limits. There is one active licensed discharge consent to controlled waters within 250m of the draft Order limits for sewer storm overflow, located approximately 55m west of the conveyance route north of the River Thames. There are seven revoked licensed discharge consents in or within 250m of the draft Order limits, and the effluent types include unspecified trade discharges, miscellaneous discharges (mine/groundwater and surface water) and sewer storm overflow.

10.7.13 The Groundsure report and open source data indicate there is one active groundwater abstraction within 250m of the draft Order limits . It is located on the southern side of the River Thames, approximately 150m south of the draft Order limits of the Burnell Avenue site. It is for spray irrigation at The Lensbury Hotel and Watersports Centre, a sports club.

10.7.14 In Chapter 5: Water Resources and Flood Risk (Section 5.7), a review was carried out of active and historical groundwater abstractions in proximity to the draft Order limits; the data were provided by the Environment Agency and the three London boroughs. The review identified 19 active abstractions within the study area, of which 11 are licensed abstractions and eight are deregulated abstractions.

10.7.15 Of the 19, 18 are for the purposes of spray irrigation or horticultural watering, and one is used for a stables/livery facility. It states that the abstraction closest to Burnell Avenue abstracts water from the Kempton Park Gravel Member.

10.7.16 The Groundsure report and open source data indicate the groundwater vulnerability designations within the draft Order limits. These are classified as ‘high to medium vulnerability’ to any pollutant discharged at ground level with regards to both Principal and Secondary superficial aquifers.

## Pollution incidents

10.7.17 The Groundsure report and open source data indicate there have been a total of 18 historical pollution incidents in or within 250m of the draft Order limits. The impact of these on land ranged from Category 3 (Minor) to Category 4 (No Impact), and the impact on water has ranged from Category 2 (Significant) to Category 4 (No Impact). Details of the Category 2 pollution incidents to water in or within 250m of the draft Order limits are provided in Table 10.10.

Table 10.10 Summary of Category 2 pollution incidents within 250m of the draft Order limits

| Location | Date of incident | Pollutant description | Incident identification number |
|---|---|---|---|
| Within the draft Order limits, 225m south of the conveyance route, more than 250m away from Mogden STW shafts. | 08/12/2009 | Construction and demolition materials and waste (inert materials and wastes) | 739003 |
| Within the draft Order limits, 187m south of the conveyance route, more than 250m away from Mogden STW shafts. | 07/06/2009 | Storm sewage | 685449 |
| Within the draft Order limits, 145m north of the conveyance route, more than 250m away from Mogden STW shafts. | 04/08/2002 | Storm sewage | 97293 |
| Outside draft Order limits – 55m north of the draft Order limits (Mogden STW shaft) and close to the Duke of Northumberland's River. | 01/08/2002 | Urban run-off (contaminated water) | 96362 |
| Outside draft Order limits – 10m south-west of the draft Order limits and south-west of River Crane (close to the north of Cole Park Gardens). | 16/09/2003 | Other inorganic chemicals or products | 190377 |

## Hydrology

10.7.18 Hydrological features are discussed in Chapter 5: Water Resources and Flood Risk. Surface water bodies within 250m of the draft Order limits are summarised in Table 10.11.

Table 10.11 Summary of main water and water bodies on-site and the study area

| Water body | Description |
|---|---|
| Duke of Northumberland's River | The river receives water from the River Crane, and flows from south to north through the middle of the Mogden STW site within a concrete channel, eventually discharging into the River Thames tideway. The channel is raised above ground level for most of the river's course through the Mogden STW. This river is located more than 250m from all the shaft sites. |
| River Crane | The river crosses the tunnel conveyance route north of the River Thames near Chertsey Road (A136) and is located more than 250m from any of the shaft sites. It flows west to east into the River Thames. |
| River Thames | The river is located immediately north of the Ham Playing Fields site and flows south to north. The Burnell Avenue site is immediately adjacent to, and within, the river. The shafts for the intake and outfall structures are approximately 35m to 40m from the river. |
| Thames Tideway | The boundary of the Ham Playing Fields site is adjacent to the Thames Tideway (tidal section of the River Thames, which starts downstream from the Teddington Lock) with the Main Work Area boundary between 200m to 250m inland from the estuary bank. |

10.7.19 The Groundsure report and Flood Map for Planning (Environment Agency, 2024) indicate that the draft Order limits fall within Flood Zones 1, 2 and 3, representing a low to high risk of flooding from rivers. The Conveyance route north of the River Thames, the Ham Playing Fields site, and an area to the south of the Burnell Avenue site are located within Flood Zone 3. Flood Zone 2 extends across the Conveyance route south of the River Thames, while the rest of the site lies within Flood Zone 1. Further information on Flood Zones is provided in Chapter 5: Water Resources and Flood Risk.

## Landfills and waste sites

10.7.20 Historical landfill sites can pose an ongoing threat to the environment and have the potential to pollute surface and groundwaters. In general, the majority of these sites were in operation when approaches to control contamination were not as stringent.

10.7.21 Data from the Groundsure report have been used to identify the landfills within the study area. The Groundsure report indicates that there are no authorised landfill sites; however, there are four historical landfill sites within the study area, and these are shown and labelled in Plate 10.2.

10.7.22 It should be noted that the former gravel extraction pits around the Ham Lands area are identified in the Groundsure report as areas of artificial ground. However, they had been infilled following completion of the extraction works

and as such that area should be considered to be landfill. The landfilling of the former gravel extractions pits was highlighted in the PINS Scoping Opinion comments. Refer to PINS comment 3.6.10 in Table 10.3.

10.7.23 Details of the historical landfills, including the former gravel pits in the Ham Lands area, in and within 250m of the draft Order limits are presented in Table 10.12 arranged by the Project element location.

Table 10.12 Landfills and waste sites within 250m of the draft Order limits

| Location | Historical landfill (within 250m of the draft Order limits) | Historical and licensed waste sites |
|---|---|---|
| Mogden STW site Western Work Area | Two historical landfills within 250m of the draft Order limits:<br>Mogden Sewage Works historical landfill [Landfill No. 1] is located 10m east of the shaft site (EAHLD11062) and accepted inert waste from 1930–1935; and Ivybridge [Landfill No. 3] (EAHLD11374) located approximately 130m south of the draft Order limits but more than 250m away from the shaft site, accepted inert and industrial waste from 1955–1966, and is equipped with gas control measures. | There are two licensed waste site listings for Mogden Sewage Works for sludge treatment dated 15/01/2009 and Mogden Combined Heat and Power Plant (EPR/WP3533LT) landfill gas engine dated 10/06/2021.<br>One historical waste site (Isleworth Site) 70m north of the draft Order limits – 4 Fleming Way Waste Transfer Station for sanitary and clinical wastes, dated 06/05/2020.<br>This site is also listed as a licensed clinical waste transfer station. |
| Mogden STW site Eastern Work Area | Two historical landfills within 250m of the draft Order limits: Redlees Park historical landfill [Landfill No. 2] (EAHLD11059) at 200m east/north-east, accepted inert waste from 1912–1946.<br>Ivybridge (EAHLD11374) at approximately 250m south of the shaft site and 130m south of the draft Order limits, accepted inert and industrial waste from 1955–1966, with gas control in place. | There are two licensed waste site listings for Mogden Sewage Works for sludge treatment dated 15/01/2009 and Mogden Combined Heat and Power Plant (EPR/WP3533LT) landfill gas engine dated 10/06/2021.<br>One historical waste site (Isleworth Site) 70m north of the draft Order limits – 4 Fleming Way Waste Transfer Station for sanitary and clinical wastes, dated 06/05/2020. |

| Location | Historical landfill (within 250m of the draft Order limits) | Historical and licensed waste sites |
|---|---|---|
| | | This site is also listed as a licensed clinical waste transfer station. |
| Conveyance tunnel north of the River Thames | Two historical landfills within 250m of the draft Order limits: Crane Avenue Allotments historical landfill [Landfill No. 4] (EAHLD11058) located directly on the conveyance route – waste type unknown; and Ivybridge (EAHLD11374) located approximately 100m south-west, accepted inert and industrial waste 1955–1966, with gas control. | None in or within 250m of the draft Order limits. |
| Ham Playing Fields site | Infilled former gravel pits located 175m west. | None in or within 250m of the draft Order limits. |
| Conveyance tunnel south of the River Thames | Infilled former gravel pits located with 250m of and directly above a section of the tunnel conveyance route. | None in or within 250m of the draft Order limits. |
| Burnell Avenue site | Infilled former gravel pits bordering the draft Order limits to the west. | None in or within 250m of the draft Order limits. |
| Tudor Drive site | None in or within 250m of the draft Order limits.<br>(Infilled former gravel pits 640m west.) | None in or within 250m of the draft Order limits. |

## Radon

10.7.24 The Groundsure report indicated that the whole study area is within the lowest band of radon potential, where <1% of properties are considered to be affected by Radon.

## UXO

10.7.25 An UXO Desk Study and Risk Assessment was produced by Zetica UXO Ltd in 2024 for the Project (Zetica UXO, 2024). The report shows the land within the draft Order limits is mostly ‘low’ risk with respect to UXO. A section of the River Thames at Burnell Avenue is classified as ‘moderate’ risk. The report’s risk assessment is based on the assumption that no works will be undertaken in the river. The report concludes that no additional measures are considered essential to reduce the UXO risk.

10.7.26 The report also states that a UXO specialist should be contacted if intrusive works are planned in the moderate UXO hazard zone. As construction of the intake and outfall structures will occur within the river and on its bank, the Applicant will continue to consult with a UXO specialist to develop appropriate controls.

## Soils

10.7.27 The agricultural land classification for land within the draft Order limits was assessed using the Agricultural Land Classification – Provisional (England) mapping data (Natural England, 2024). Based on this information the draft Order limits are within an area classed as urban land and effects on agricultural land were proposed to be scoped out of the assessment on that basis. Scoping soils out of the assessment was agreed by PINS; refer to PINS comment 3.6.2 in Table 10.3.

10.7.28 The Groundsure report includes the BGS estimated urban soil chemistry for the land within 50m of the draft Order limits. The concentrations vary for different areas within the draft Order limits; the ranges of these values have been summarised and are shown in Table 10.13. The published soil guideline values (SGVs) for a public open space end use are also included in Table 10.13 to put the concentrations into context. These guideline values are protective of human health in that land use scenario, which could be considered to be the most appropriate for the Project. As shown in Table 10.13, the estimated concentrations are significantly lower than the guideline values.

Table 10.13 BGS estimated urban soil chemistry

| Element | Estimated concentration (mg/kg) | Public open space end use soil guideline value (mg/kg) |
|---|---|---|
| Arsenic | 13 – 35 | 170 |
| Cadmium | 0.3 – 1.8 | 560 |
| Chromium | 51 – 82 | 220 |
| Copper | 34 – 131 | 44,000 |
| Nickel | 14 – 46 | 800 |
| Lead | 107 – 799 | 1,300 |
| Tin | 7 – 71 | N/A |

10.7.29 As part of the ongoing GI, and as reported in the GI Interim Factual Report (see Appendix 10.1) , chemical data for 22 soil samples have been received as of 25 February 2025. These samples have been tested for a range of chemical determinands and screened against published SGVs for a commercial/industrial end use and public open space (residential) end use. The screening table is presented in Annex A.3 of the GI Interim Factual Report.

10.7.30 There have been exceedances of the public open space residential screening criteria for dibenz(a,h)anthracene at MT-019-035, MT-028-035 and MT-030-35.

Plate 10.2 shows the location of the boreholes on the conveyance route. It should be noted that MT-019-35 is within Mogden STW, therefore commercial/industrial criteria would be more appropriately applied in this scenario. There have been exceedances of the public open space residential screening criteria for lead at MT-022-35, and for benzo(b)fluoranthene at MT-028-35 and MT-030-35. Additionally, the commercial/industrial criteria for these two determinands were exceeded at MT-028-35. Given that these locations are on the tunnel conveyance route, the Project should not change human health exposure pathways at the surface. Additionally, the majority of organic contaminants were at concentrations below the laboratory limits of detection (LOD).

10.7.31 Suspected asbestos containing material (ACM) has been identified at MT-027-35 in the Made Ground. This was later proven to be asbestos; however, laboratory analytical data for samples from this location were not received by 25 February 2025. As this borehole is on the tunnel conveyance route and there are no proposed structures or works, there will not be any exposure to human health from asbestos here as a result of the Project.

10.7.32 As the ongoing GI progresses, further soil quality data for the study area will be obtained to better understand the potential impact of soil chemistry upon the Project and to receptors. The outcomes of the GI and subsequent data assessments will be used to develop the ground conditions and contaminated land chapter of the ES.

## Geological sites

10.7.33 Defra's MAGIC maps ('geological places to visit' mapping data), the London Geodiversity Partnership's list of London's geological sites, and the websites of the three London boroughs were used to identify the possible presence of Regionally Important Geodiversity Sites (RIGS) within the draft Order limits.

10.7.34 The RIGS are defined as non-statutory sites selected to protect the most important places for geology, geomorphology and soils, complementing the network of legally protected SSSIs. No RIGS were identified in or within 250m of the draft Order limits based on the data available. As such, geological sites were scoped out of further assessment. This was agreed by PINS; refer to PINS comment 3.6.3 in Table 10.3. It should be noted that mineral resources are considered in Chapter 11: Materials and Waste and were scoped out.

## Historical land uses

10.7.35 Previous editions of Ordnance Survey (OS) mapping spanning the period 1865 to 2025 obtained from the Groundsure report have been reviewed, and a summary of the potentially contaminative historical land uses in and within 250m of the draft Order limits is presented in Table 10.14 by Project site. The dates provided are the dates of the maps on which the features are shown in the historical records.

Table 10.14 Summary of historical OS mapping

| Location | Within the draft Order limits | Within 250m of the draft Order limits |
|---|---|---|
| Mogden STW site<br>Western Work Area<br>Eastern Work Area | In 1865 this area comprised mostly of fields, with a river running south to north through the centre named the Duke of Northumberland's River. Mogden STW is first shown in 1894 as a small site near the centre of this area, which had expanded to cover the eastern half of the area by 1912 and was further expanded to its current boundary by 1935, at which time an embankment is shown along the southern, eastern and northern boundaries of the Mogden STW and the river's orientation has been altered slightly.<br>On the 1962 map the sewage works has expanded significantly to a layout similar to that of the present day and a large amount of ground reprofiling has occurred. The river is in the same orientation as shown on the 1935 map but now there appears to be a culverted section approximately 130m long and the river now runs in a concrete channel in the centre of the site with tunnels passing underneath.<br>Between 1935 and 2025 the Mogden STW has continued to develop with related infrastructure being constructed in the western area of the site.<br>Aerial imagery from 2011 indicates earthworks were undertaken in the western area of the site to accommodate ten new tanks, which can be seen in the aerial image from 2015.<br>Potentially contaminative historical land uses identified within the draft Order limits are:<br>• Tanks: 1935 – 1991<br>• Unspecified heaps, pits and ground workings: 1933 – 1987<br>• Sewage purification and treatment works: 1894 – present<br>• Industrial estate: 1948 – 1987<br>• Tunnel: 1966 – 1987 | Between 1865 and 1912 the majority of the surrounding area of Isleworth comprised fields, minor roads, farms and residential properties. Between 1933 and 1935 the number of residential and commercial properties and associated infrastructure (e.g. roads) increased significantly in the areas surrounding the Mogden STW.<br>Potentially contaminative land uses within 250m of the draft Order limits at this location are:<br>• Nurseries: 1912 – 1966<br>• Unspecified heaps, pits and ground workings: 1896 – 1987<br>• Commercial/industrial works: 1961 – 1987<br>• Iron foundry: 1912 – 1933<br>• Unspecified works: 1948 – 1987<br>• Unspecified depot: 1987<br>• Laundry: 1912 – 1933<br>• Concrete pipes works: 1935 – 1948<br>• Refuse heaps: 1966<br>• Ambulance station: 1991 |

| Location | Within the draft Order limits | Within 250m of the draft Order limits |
|---|---|---|
| | • Nurseries: 1935 – 1987<br>• Filter beds: 1912 – 1973<br>• Film studio: 1948<br>• Settling tanks: 1991<br>• Embankment: 1935 – present | |
| Conveyance tunnel – north of the River Thames | Between 1865 and 1912 the majority of this area comprised fields, with multiple residential properties and a recreation ground located within the southern extents of the draft Order limits. A river named the River Crane runs from north to south, and the Windsor Line railway crosses through the middle of the area running from north-east to south-west. In 1935 numerous residential properties were constructed in the northern area of the draft Order limits, as well as an allotment garden. A large road has been constructed to the south of the allotment garden, named Chertsey Road.<br>Potentially contaminative historical land uses identified within the draft Order limits are:<br>• Nurseries: 1894 – 1948<br>• Poultry appliance works: 1912 – 1933<br>• Historical railway line: 1935 – 1973<br>• Unspecified heap: 1894 – 1898 | The surrounding area comprised Isleworth to the north, Richmond to the east, and Twickenham to the south and west. Between 1865 and 1894 the majority of the surrounding area comprised fields, with some residential properties to the east. Residential areas and associated roads and infrastructure continued to expand from 1894 to present day. Potentially contaminative land uses within 250m of the draft Order limits at this location are:<br>• Unspecified heaps, pits and ground workings: 1894 – 1898<br>• Historical railway line: 1935 – 1973<br>• Railway station: 1912 – 1935<br>• Railway buildings: 1912 – 1973<br>• Smithy: 1894<br>• Unspecified works: 1966 – 1991<br>• Boat house: 1912 – 1991 |
| Ham Playing Fields site | In 1865 this area comprised fields bounded by the River Thames to the north and a road to the east.<br>‘Gravel pits’, ‘sand and gravel works’ and ‘sand and ballast works’ are shown to the west and south-west on maps from | The surrounding area comprises Twickenham to the north-west, Petersham to the east and Ham to the south. These are residential areas which have been developed and expanded between 1865 |

| Location | Within the draft Order limits | Within 250m of the draft Order limits |
|---|---|---|
| | 1912 and are no longer evident on the 1948 map. These are understood to have been subsequently infilled.<br>In 1973 two playing fields are present, the northernmost of which is Ham Playing Fields. The Ham Street Car Park is first shown in aerial imagery in 1991. | and 2025. The majority of the area to the west/south-west has comprised fields or open parklands since 1865.<br>Potentially contaminative land uses within 250m of the draft Order limits at this location are:<br>• Nurseries: 1933 – 1948<br>• Sand and ballast works/ former gravel extraction pits: 1912 – 1938<br>• Miniature rifle range: 1933 – 1966<br>• Rifle ranges: 1912<br>• Electricity and steam works: 1894 – 1935 |
| Conveyance tunnel – south of the River Thames | The conveyance tunnel crosses the River Thames in the area immediately north of the Ham Playing Fields site. Between 1865 and 1920 the conveyance tunnel route south of the River Thames comprised fields (named Ham Fields) and recreation grounds.<br>In 1933, a sand and ballast works were present within the draft Order limits, and by 1938 residential properties and roads had been developed to the south of the works. By 1966 the sand and ballast works are no longer shown, and numerous residential properties and roads are present in this area, as well as the areas within the draft Order limits to the north. A school is shown within the draft Order limits in the 1973 mapping. The conveyance tunnel route to the south of the River Thames currently passes below playing fields, allotments and residential areas in the town of Ham.<br>Potentially contaminative historical land uses identified within the draft Order limits are: | The surrounding area comprises Twickenham to the north-west and Petersham to the east. These are residential areas which have been developed and expanded between 1865 and 2025.<br>The majority of the area to the west/south-west has comprised of fields or open parklands since 1865.<br>The residential areas surrounding the draft Order limits expanded in all directions between 1966 and 1973.<br>Potentially contaminative land uses within 250m of the draft Order limits at this location are:<br>• Sewage works: 1912 – 1966<br>• Rifle ranges: 1912 |

| Location | Within the draft Order limits | Within 250m of the draft Order limits |
|---|---|---|
| | • Nurseries: 1933 – 1948<br>• Unspecified ground workings/ former gravel extraction pits: 1896 – 1898<br>• Miniature rifle range: 1933 – 1966<br>• Rifle ranges: 1912 | • Sand and ballast works/ former gravel extraction pits: 1912 – 1938<br>• Refuse heap: 1938 – 1948<br>• Nursery: 1966 – 1991 |
| Burnell Avenue site | Between 1865 and 2025 this area comprised fields in the north-east and the River Thames in the south-west, with a towpath running parallel with the northern bank of the river.<br>No potentially contaminative historical land uses were identified within the draft Order limits in this area. | The surrounding area comprises Ham to the north and east, Kingston upon Thames to the south-east, and Teddington to the west and south-west. These areas mainly comprised fields in the 1800s, with some residential areas.<br>The residential areas and associated infrastructure and roads were further developed and expanded between 1865 and 2025.<br>An aircraft factory was constructed in 1917 on Richmond Road. In 1920 it was sold to Leyland Motors, and then sold in 1948 to Hawker Aircraft (later Hawker Sidley then British Aerospace). The factory was demolished in 1993 and replaced by housing.<br>Potentially contaminative land uses within 250m of the draft Order limits at this location are:<br>• Sand and ballast works/ former gravel extraction pits: 1912 – 1938<br>• Works (aircraft factory and Leyland Motors): 1917 – 1993<br>• Boat house: 1934 – 1948<br>• Pumping station: 1933 – 1938 |

| Location | Within the draft Order limits | Within 250m of the draft Order limits |
|---|---|---|
| | | • Sewage tanks: 1933 – 1938 |
| Tudor Drive site | Between 1865 and 1920 this area comprised a field adjacent to a road that ran from north to south named Upper Ham Road. In 1933 a motor works was located approximately 50m west (this is known to have been an aircraft factory and motor works, present between 1917–1993). Between 1938 and 2025 the site is shown as an area of open space. Aerial imagery from between 1999 and 2022 shows greenery within the draft Order limits and indicates that this area has remained largely unchanged.<br>'Unspecified works', potentially related to the aircraft factory/ motor works, are also identified within the draft Order limits. | This site is located within the town of Ham, and the surrounding areas mainly comprised fields in the 1800s, with some residential areas.<br>Potentially contaminative land uses within 250m of the draft Order limits at this location are:<br>• Icehouse: 1913<br>• Works (aircraft factory and Leyland Motors): 1917 – 1993<br>• Filter station: 1966 – 1991<br>• Pumping station: 1933 – 1938<br>• Sewage tanks: 1933 – 1938<br>• Unspecified works: 1933 – 1983<br>• Industrial estate: 1991<br>• Unspecified tanks: 1912 – 1991<br>• Allotment garden: 1920<br>• Fire station: 1960 |

## Current potentially contaminative land uses

10.7.36 Current potentially contaminative land uses in and within 250m of the draft Order limits are presented in Table 10.15 by Project site.

Table 10.15 Current potentially contaminative land uses in and within 250m of the draft Order limits

| Site | Within the draft Order limits | Within 250m of the draft Order limits |
|---|---|---|
| Mogden STW site | Sewage treatment works and associated infrastructure/activities including sludge tanks, electricity substations, sewage purification and sewage sludge digesters | Electricity substations; the closest is located 40m north. |
| Conveyance tunnel – north of the River Thames | Electricity substations. | Electricity substations; the closest is 15m south-east.<br>Shell petrol station located 175m north-west.<br>Unspecified works located 105m south-east. |
| Ham Playing Fields site | None. | Electricity substations, the closest being located 30m south.<br>Unspecified works located 180m north. |
| Conveyance tunnel – south of the River Thames | None. | Ham and Petersham Rifle and Pistol Club located 88m south-west.<br>Miniature rifle range located 90m south-west. |
| Burnell Avenue site<br>Tudor Drive site | None. | Kingston (London) Fire Station, adjacent to Tudor Drive.<br>Electricity substations, the closest being located 15m east.<br>BP petrol station located approximately 70m northwest of TLT connection shaft. It lies immediately north-west of the draft order limits.<br>Gas governor located 150m north-east. |

## Preliminary conceptual site model

10.7.37 The purpose of the development of a Conceptual Site Model (CSM) is to identify potential contaminant linkages based on the information available. The contaminant linkage concept relies on the identification of:

a. a potential contaminant (source) in, on, or under the land at a concentration likely to have the potential to cause harm or pollution;

b. a receptor, which may suffer harm or be polluted; and

c. a pathway by which the receptor may be exposed to the contaminant.

10.7.38 Where all three are present, 'potential contaminant linkages' could be identified that may require further investigation or assessment to help determine whether or not they represent potentially significant unacceptable risks.

10.7.39 Based on the review of the existing baseline conditions of the study area and Project-specific construction and operation details, the following potential sources of land contamination, exposure pathways and receptors have been identified. These will be amended and refined following the completion of the GI and associated interpretive reports and will be updated in the ES.

10.7.40 Potential sources of contamination are:

a. Excavation within areas of Made Ground, infilled ground and the embankment at Mogden STW may pose a contamination risk to human health and groundwater in the superficial geology as the specific ground conditions are currently unknown (prior to completion of the GI) and potentially variable. Therefore, there is potential for construction workers, nearby occupants, and groundwater to be impacted during construction works.

b. The former aircraft factory and motor works on Richmond Road, which the pipe jack connection tunnel for the Thames Lee Tunnel will pass beneath.

c. Excavation within and close to areas of historical landfills, including the infilled former gravel pits, as identified in Table 10.12 may pose a ground gas risk and groundwater risk. Therefore, there is potential for construction workers, nearby occupants, and groundwater to be impacted.

d. Contaminants introduced through the use of fuels and chemicals in the construction process, including those which may be used in conveyance tunnel and shaft construction.

10.7.41 Potential contaminants associated with the study area are:

a. Polychlorinated Biphenyls associated with electricity substation on-site

b. Metals, hydrocarbons and inorganics, volatile organic compounds

c. Presence of micro-organisms (pathogens)

d. Asbestos associated with the Made Ground, storage areas and pipework

e. Potential generation of ground gas (composed primarily of methane and carbon dioxide) associated with the historical landfill on-site and where significant Made Ground exists

10.7.42 10.7.42 Potential pathways for contaminants include:

a. Human health:

i. Dermal contact, ingestion and inhalation of contaminated soils/groundwater

ii. Inhalation of contaminated soil dusts and asbestos fibres

iii. Inhalation of ground gas

b. Controlled waters:

i. Leaching and infiltration (for groundwater)

ii. Surface runoff (for surface waters)

iii. Surface water flooding (for surface waters)

10.7.43 10.7.43 Potential receptors for contaminants include:

a. Human health:

i. Construction workers

ii. Off-site users during construction (members of public)

b. Controlled waters:

i. Nearby River Thames, River Crane and other surface water features within 250m of the site

ii. Secondary undifferentiated, Secondary A and Principal Aquifers related to superficial geology

## Future baseline

10.7.44 In general, climate change is expected to lead to an increase in temperatures, with a greater frequency of hotter, drier summers and warmer, wetter winters. Climate change is also expected to lead to sea level rise which will affect tide levels and associated flood risk within the tidal section of the River Thames as far west as Teddington Weir. Further information on projected changes in climate parameters is provided in Chapter 18: Climate Change. Projected future changes in climate (e.g. increase in temperatures) have the potential to interact with effects identified within some environmental aspects and exacerbate or diminish their impact. Such combined impacts are termed In-Combination Climate Impacts (ICCI). Consideration of the potential ICCI associated with ground conditions and contaminated land is provided in the Cumulative effects subsection in Section 10.8 of this chapter.

10.7.45 It is considered that any contamination remediation or mitigation measures which may be required for the Project would improve the current condition of areas requiring such measures and reduce contamination risks or block potential contamination linkages. This would therefore result in the betterment of the baseline.

10.7.46 Climate change could influence contamination pathways and migration patterns. For example, higher intensity rainfall can lead to increased surface runoff and more extreme flooding events, potentially bringing contaminants from off-site sources to within the draft Order limits. Changes in groundwater levels and climatic conditions could influence the movement of contaminants in groundwater and changes to the ground gas regime.

10.7.47 It should be noted that future developments (not associated with the Project) within the draft Order limits would likely require their own land contamination

assessments to determine whether remediation or mitigation measures are required to protect sensitive receptors associated with that development from contamination.

## 10.8 Preliminary assessment of likely significant effects

### Construction phase

10.8.1 This section sets out the likely significant effects of the Project on ground conditions and contaminated land during construction. The assessment assumes that embedded design (primary) mitigation and standard good practice (tertiary) measures (as listed in subsection Standard good practice (tertiary) from paragraph 10.4.5 onwards) will be implemented, and the results of the assessment then inform the need for any additional (secondary) mitigation requirements during construction.

10.8.2 The impact assessments for each of the construction sites and the recycled water conveyance tunnel route have been identified and divided into sub-categories for impacts to human health, controlled waters and ground stability.

#### Mogden STW site

##### *Human health*

10.8.3 There is potential for contamination associated with the historical landfills within the vicinity of the Mogden STW, from STW activities having impacted the ground, and associated with Made Ground, including the embankment in the Eastern Work Area and the embankment and landfill in the Western Work Area. It will not be possible to avoid the landfill, Made Ground or the embankment during construction. However, soil chemical data from the boreholes completed in the landfill (MT-019-35), the embankment (MT-003-35, MT-004-35) and adjacent to the embankment (MT-005-35) from the ongoing GI do not have any exceedances of the commercial/industrial screening criteria (indicating no long-term or chronic risk to human health in the operation phase), and the organic contaminants are predominantly below detection limits. The Made Ground recorded at the landfill was mainly described as a slightly gravelly clay; the Made Ground encountered in the embankment was described as slightly gravelly clay or gravelly sand. It is possible that hitherto unidentified contamination, including asbestos or groundwater contamination, could be present. It is expected, however, that construction workers are unlikely to be significantly affected by contaminated soils or groundwater during construction activities with the implementation of good practice and appropriate health and safety (H&S) measures.

10.8.4 The landfill at Mogden STW could potentially generate localised ground gases such as methane and carbon dioxide and result in depleted oxygen, posing a risk of asphyxiating or explosive conditions. There is a risk that construction workers will encounter ground gas from the landfill at the drive shaft. Preliminary borehole results indicate that the risk of gas generation during

construction is negligible, due to the insufficient quantities of organic material detected. Ground gas monitoring at this location is part of the scope for the ongoing GI and the conclusions from the data assessment will be presented in the ES.

10.8.5 Throughout construction, standard mitigation procedures will be implemented to prevent any impact on nearby off-site users. The measures include the use of dust suppression systems. Consequently, it is unlikely that off-site users will be exposed to wind-blown soil contaminants or asbestos fibres.

### *Controlled waters*

10.8.6 There are potential pathways for leaching and migration of contaminants in Made Ground to the aquifers underlying it. The BGS geological map shows the majority of the Mogden STW is on Langley Silt which is ‘unproductive strata’. The westernmost area of the site is shown to be on the Taplow Gravel, a Principal superficial aquifer. Borehole MT-019-35 at the drive shaft seems to confirm the presence of the Taplow Gravel or Kempton Park Gravel (identified on the borehole logs), both of which are Principal aquifers, directly underlying the Made Ground. A groundwater strike was recorded at 11.7mbgl at the top of the granular part of this unit, which is present at 11.7–13.2mbgl. This is likely to be encountered during excavation of the shaft, which could create pathways for contaminants.

10.8.7 The are no active groundwater abstraction licences within 1km of Mogden STW.

10.8.8 The removal of the overlying Made Ground during construction of the drive shaft is unlikely to exacerbate potential contamination of the groundwater compared to the current situation given the ground conditions (Made Ground directly overlying the granular Taplow Gravel/ Kempton Park Gravel). However, the construction method is expected to require groundwater control to manage the levels and flow, and to isolate/seal groundwater during excavation, thereby reducing the potential risk to groundwater quality. Effects are expected to be temporary, localised and short term.

10.8.9 Borehole MT-005-35 at the interception shaft encountered Made Ground to 0.4mbgl directly overlying London Clay (unproductive strata), therefore superficial deposits are not present here; these were seemingly excavated to construct the Mogden STW. A water strike was not observed during drilling. As such, groundwater at this location would not be considered to be a receptor.

10.8.10 The Duke of Northumberland’s River, a WFD water body, runs through the middle of Mogden STW from north to south. However, the river is within a concrete channel which is raised above ground level for most of its length through the STW, and the construction works in the Eastern and Western Work Areas will be at least 270m from the river. As such, it is not in hydraulic connectivity with the groundwater and is not considered to be a receptor at Mogden STW.

### *Ground instability*

10.8.11 There is potential for ground instability in the area of Mogden STW due to the presence of an adjacent landfill and significant depth of Made Ground within the embankment. This will be taken into account in the detailed engineering design.

10.8.12 The preliminary assessment of likely significant effects of the Mogden STW site construction is summarised in Table 10.16.

Table 10.16 Preliminary assessment of likely significant effects during construction

| Receptor | Sensitivity of receptor | Magnitude of impact | Likely significance of effect |
|---|---|---|---|
| Construction workers (Human health) | High | Negligible | Minor (Not Significant) |
| Off-site users during construction (members of public – Human health) | Medium | Negligible | Minor (Not Significant) |
| Superficial geology – Principal aquifer (Controlled waters) | High | Small | Moderate (Significant) |
| Ground instability | Medium | Negligible | Minor (Not Significant) |

## Conveyance route north and south of the River Thames

### *Human health*

10.8.13 There is potential for contamination associated with three historical landfills within 250m of the boundary of the conveyance route between Mogden STW and the River Thames, and the historical landfill/ infilled gravel pits south of the Thames which extends from the Ham Playing Fields site to Burnell Avenue. Other potential sources of contamination identified within 250m of the draft Order limits for the conveyance route include electricity substations, petrol station (175m away) and unspecified works (105m away). Given the conveyance tunnel will be constructed within the London Clay Formation and at an approximate depth of 20–40mbgl and that no groundworks will be undertaken at the surface, it is expected that construction workers will not come into contact with contaminated soils or groundwater, or be in the zone of influence of possible ground gases during construction activities. Similarly, adjacent site users will not be affected by groundworks in potentially contaminated ground, and future site users will not be a potential receptor.

10.8.14 Boreholes MT-009-35, MT-022-35, MT-026-35, MT-027-35, MT-028-35 and MT-030-35 have been completed as part of the ongoing GI as of 25 February 2025. Except at MT-027-35, all the boreholes recorded less than 1m thickness

of Made Ground. Made Ground at these locations contained gravel-sized fragments of brick, glass, concrete and suspected clinker. At MT-027-35 the Made Ground contained fragments of brick, concrete, tarmacadam, slate, clinker, potential ACM, glass, wood, ceramic and metal and is indicative of landfilling at the former gravel pits in the area. This material was later confirmed to contain asbestos; however, laboratory analytical data for samples from this location had not been received by 25 February 2025. The complete data will be provided in the ES.

10.8.15 Soil chemical data for these locations have been screened and there are exceedances of the public open space residential screening criteria for lead at MT-022-35, and for benzo(b)fluoranthene and dibenz(a,h)anthracene at MT-028-35 and MT-030-35. Additionally the commercial/industrial criteria for these two determinands were exceeded at MT-028-35. Given that these locations are on the tunnel conveyance route, the Project should not change human health exposure pathways at the surface. Additionally, the majority of organic contaminants were at concentrations below the LOD.

10.8.16 As of 25 February 2025, boreholes yet to be completed along the conveyance route are MT-020-35, MT-021-35, MT-023-35, MT-029-35, MT-032-35, MT-016, MT-033-35, MT-034-35 and MT-035-35. The data from these boreholes including post-GI monitoring will be assessed and included in the ES.

### *Controlled waters*

10.8.17 The conveyance route partially passes beneath the Kempton Park Gravel north of the River Thames and beneath the Kempton Park Gravel south of the River Thames. North of the river it is designated as a Principal aquifer and to the south of the river it is designated as a Secondary A aquifer. The bedrock geology along the whole of the conveyance route – the London Clay Formation – is unproductive strata. There are two groundwater abstraction points within 1km of the Project; these are located within 500m of the draft Order limits at Burnell Avenue and are for spray irrigation from the Kempton Park Gravel. It is considered unlikely that groundwater will be affected. As the conveyance tunnel will be constructed at depth in the London Clay Formation it is expected that it will not be within the zone of influence of the aquifers or of the underlying Chalk.

10.8.18 The conveyance route passes beneath the River Crane and the River Thames. As the conveyance tunnel will be constructed at depth in the London Clay it is expected that it will not be within the zone of influence of the rivers.

### *Ground instability*

10.8.19 There is potential for ground instability due to the presence of landfilled areas and existing structures. This will be taken into account in the detailed engineering design.

10.8.20 The preliminary assessment of likely significant effects of the conveyance route north and south of the River Thames during construction is summarised in Table 10.17.

Table 10.17 Preliminary assessment of likely significant effects during construction

| Receptor | Sensitivity of receptor | Magnitude of impact | Likely significance of effect |
|---|---|---|---|
| Construction workers (Human health) | High | Negligible/ no change | Minor (Not Significant) |
| Superficial geology – Principal Aquifer (Controlled waters) | High | Negligible/ no change | Minor/ neutral (Not Significant) |
| Superficial geology – Secondary A Aquifer (Controlled waters) | Medium | Negligible/ no change | Neutral (Not Significant) |
| River Crane (Controlled waters) | Medium | Negligible/ no change | Neutral (Not Significant) |
| River Thames (Controlled waters) | High | Negligible/ no change | Minor/ neutral (Not Significant) |
| Ground instability | Medium | Negligible | Minor (Not Significant) |

## Ham Playing Fields site

### *Human health*

10.8.21 The historically infilled gravel pits are mapped approximately 200m west of the Ham Playing Fields site. The comments from PINS in the Scoping Opinion stated that infilling with rubble/rubbish took place from the late 1940s to the early 1960s, and that the depth is an estimated 15m or more. There are no other potential contamination sources located near the Ham Playing Fields site.

10.8.22 Borehole MT-025-35 has been completed as part of the ongoing GI; it was located approximately 280m east of the mapped former gravel pits. Made Ground comprising slightly gravelly sand was encountered to a depth of 2.1m, which is likely associated with the infilled gravel pits. The GI Interim Factual Report highlighted no visible presence of asbestos and the anthropogenic composition of Made Ground does not show any harmful materials, only gravel-sized fragments of brick, concrete and ceramic. The soil chemical data were not available at the time of writing the PEI Report; the complete dataset will be provided in the ES.

10.8.23 It is possible that hitherto unidentified contamination, including asbestos or groundwater contamination, could be present. It is expected, however, that construction workers are unlikely to be significantly affected by contaminated soils or groundwater during construction activities with the implementation of good practice and appropriate health and safety measures.

10.8.24 Following construction, it is expected that the construction areas would be reinstated, breaking the pathway for potential contaminants in soil. Therefore, it is unlikely that future site users will come into contact with contaminated land.

10.8.25 Landfill/infilled ground at the former gravel pits could potentially generate localised ground gases such as methane and carbon dioxide and result in depleted oxygen, posing a residual risk of asphyxiating or explosive conditions. The borehole completed at this location did not show evidence of quantities of organic materials which would be considered to generate volumes of gases to pose risks. However, gases from the infilled gravel pits may migrate to the construction area. Ground gas monitoring at this location is part of the scope for the ongoing GI and the conclusions from the data assessment will be presented in the ES.

10.8.26 The closest residential properties are some 300m from the construction site. Throughout construction, standard mitigation procedures will be undertaken to avoid impacting nearby off-site users, including the use of dust suppressing systems. As such, it is unlikely that off-site users will be exposed to wind-blown soil contaminants or asbestos fibres.

### *Controlled waters*

10.8.27 There are potential pathways for leaching and migration of contaminants in Made Ground to the aquifers underlying it. The London Clay Formation underlying this site and the wider area is classified as unproductive strata. The superficial aquifers are Secondary A (Kempton Park Gravel) at the Ham Street Playing Fields site, and ‘Secondary undifferentiated’ (Alluvium) at the car park. There are no groundwater abstraction points within 1km of the site location. Groundwater was not encountered at borehole MT-025-35 but is expected to be present in the Kempton Park Gravel, which was encountered from 2.1mbgl to 4.4mbgl, immediately below the Made Ground. A programme of groundwater level monitoring at this borehole is part of the GI scope and will be reported in the ES. It is likely that groundwater will be encountered during excavation, which could create pathways for contaminants.

10.8.28 The River Thames is located approximately 150m north of the intermediate shaft, and the draft Order limits of the Ham Playing Fields site construction area are approximately 70m from the river. The draft Order limits for the Support Work Area extend into the river and are for additional storage, welfare, contractor parking and surface water discharge connection. This could lead to temporary impacts on surface water quality from contamination, such as accidental fuel spill, sediment runoff and the introduction of silt to the river, and potential contamination within soil or groundwater could mobilise towards the river via groundwater. However, these would be mitigated by implementing environmental permits where appropriate and controls and good practice, and possible impacts would be temporary.

10.8.29 The preliminary assessment of likely significant effects is summarised in Table 10.18.

### *Ground instability*

10.8.30 here is potential for ground instability due to the presence of landfilled areas and existing structures. This will be taken into account in the detailed engineering design.

Table 10.18 Preliminary assessment of likely significant effects during construction

| Receptor | Sensitivity of receptor | Magnitude of impact | Likely significance of effect |
|---|---|---|---|
| Construction workers (Human health) | High | Negligible/ no change | Minor (Not Significant) |
| Off-site users during construction (members of public – Human health) | High | Negligible/ no change | Minor (Not Significant) |
| Secondary A and Secondary undifferentiated aquifers (Controlled waters) | Medium | Small | Minor (Not Significant) |
| River Thames (Controlled waters) | High | Negligible/ no change | Minor (Not Significant) |
| Ground instability | Medium | Negligible | Minor (Not Significant) |

## Burnell Avenue site

10.8.31 Two boreholes, MT-0165 and MT-017a, are proposed as part of the ongoing GI in this area. The draft borehole log for MT-017ahas been received as of 25 February 2025; however, the draft log for MT-016has not. Based on desk-based information, the geology is expected to be Kempton Park Gravel (Secondary A aquifer), with Alluvium (Secondary undifferentiated) within the River Thames and in close proximity of the riverbank, overlying the London Clay Formation (unproductive strata). The log for MT-017adoes not show Made Ground is present; it shows clay (possibly Alluvium) to 0.7mbgl, and Kempton Park Gravel to 6.3mbgl overlying London Clay Formation. The rest groundwater level was recorded at 3.5mbgl. Soil chemical data have not yet been received for this location and the complete dataset will be provided in the ES.

10.8.32 The former gravel pits which have subsequently been infilled/ used as landfills are mapped just within the draft Order limits, and approximately 150m and 300m west of the two shafts.

10.8.33 No other current or historical potentially contaminative land uses were identified within the draft Order limits. Potentially contaminative current land uses within 250m are:

a. Electricity substations, the closest located 15m east

b. Petrol station located 70m north-west of the TLT connection shaft and immediately north-west of the draft Order limits.

c. A gas governor located 150m north-east

10.8.34 In addition to the infilled former gravel pits, potentially contaminative historical land uses within 250m of the draft Order limits at this location are:

a. Aircraft factory/ motor works

b. Boat house

c. Pumping station

d. Sewage tanks

### *Human health*

10.8.35 There is potential for contamination associated with landfilling of the former gravel pits having impacted the ground and groundwater within the Burnell Avenue site, and for Made Ground to be present. At the time of writing this PEI Report, the data for the GI around this area have not yet been fully received. Once received, the GI data will be assessed and included in the ES.

10.8.36 Ground gas from the infilled gravel pits may migrate to the construction area. Ground gas monitoring at this location is part of the scope for the ongoing GI and the conclusions from the data assessment will be presented in the ES.

10.8.37 It is possible that soil and groundwater contamination could be present. It is expected, however, that construction workers are unlikely to be significantly affected by contaminated soils or groundwater during construction activities with the implementation of good practice and appropriate H&S measures.

10.8.38 Residential properties are adjacent to the northern site boundary. Throughout construction, standard mitigation procedures will be undertaken to avoid impacting nearby off-site users, including the use of dust suppressing systems. As such, it is unlikely that off-site users will be exposed to wind-blown soil contaminants or asbestos fibres.

10.8.39 Following construction, it is expected that the construction areas would be reinstated, with unacceptable contamination having been appropriately managed or remediated, breaking the pathway for potential contaminants in soil. Therefore, it is unlikely that future site users will come into contact with contaminated land.

### *Controlled waters*

10.8.40 There are potential pathways for leaching and migration of contaminants from the infilled gravel pits and other off-site potential sources of contamination. The bedrock is unproductive strata, and the superficial geology is predominantly a Secondary A aquifer. There is one active groundwater abstraction, which is for spray irrigation from the Kempton Park Gravel, located approximately 150m south of the draft Order limits; this would be considered to be low sensitivity.

10.8.41 The reception and connection shafts are proposed to be approximately 20m deep and will go through the superficial aquifer. Excavation works, including construction of the shafts, has the potential to cause localised changes in water quality in the superficial aquifer and may include mobilisation of pollutants on-site if present. Potential impacts to groundwater would be temporary and localised. All construction activities would be controlled using good practice, which would mitigate any risk to groundwater contamination through spills, leaks or fuels. Therefore, construction is not likely to cause any effect on groundwater quality.

10.8.42 The River Thames runs immediately adjacent to the site. Construction of the intake and outfall structures will occur within the river and on its bank which could lead to temporary impacts on surface water quality from contamination, such as accidental fuel spill, sediment runoff, the introduction of silt to the river and concrete runoff. However, these would be mitigated by implementing controls and good practice, and possible impacts would be temporary.

10.8.43 Potential impacts to surface water quality from in-river construction and from groundwater dewatering discharge have been assessed in Chapter 5: Water Resources and Flood Risk.

### *Ground instability*

10.8.44 There is potential for ground instability due to the presence of landfilled areas and existing structures. This will be taken into account in the detailed engineering design.

10.8.45 The preliminary assessment of likely significant effects is summarised in Table 10.19.

Table 10.19 Preliminary assessment of likely significant effects during construction

| Receptor | Sensitivity of receptor | Magnitude of impact | Likely significance of effect |
|---|---|---|---|
| Construction workers (Human health) | High | Negligible/no change | Minor (Not Significant) |
| Off-site users during construction (members of public – Human health) | High | Negligible/no change | Minor (Not Significant) |

| Receptor | Sensitivity of receptor | Magnitude of impact | Likely significance of effect |
|---|---|---|---|
| Secondary A and Secondary undifferentiated superficial aquifers (Controlled waters) | Medium | Negligible/no change | Minor/ Neutral (Not Significant) |
| River Thames (Controlled waters) | High | Negligible/no change | Minor (Not Significant) |
| Ground instability | Medium | Negligible | Minor (Not Significant) |

### Tudor Drive site

10.8.46 As of 25 February 2025, one borehole, MT-032-35, proposed as part of the ongoing GI, has not yet commenced at the Tudor Drive site; the complete dataset from the GI will be provided in the ES. However, the geology is expected to be Kempton Park Gravel (Secondary A aquifer) overlying the London Clay Formation (unproductive strata). It is likely that some Made Ground will be present at the surface associated with past land uses.

10.8.47 No current potentially contaminative land uses were identified within the draft Order limits. Potentially contaminative current land uses within 250m are:

a. Kingston (London) Fire Station
b. Electricity substations
c. Petrol station
d. Gas governor

10.8.48 Potentially contaminative historical land uses within the draft Order limits are the aircraft factory/ motor works (also formerly adjacent to the site), and unspecified works. Other off-site potentially contaminative historical land uses within 250m are:

a. Pumping station
b. Sewage tanks
c. Industrial estate
d. Unspecified tanks
e. Allotment garden

#### *Human health*

10.8.49 As of 25 February 2025, the GI has not yet commenced at the Tudor Drive site; the complete GI dataset will be provided in the ES.

10.8.50 It is possible that soil and groundwater contamination could be present. It is expected, however, that construction workers are unlikely to be significantly affected by contaminated soils or groundwater during construction activities with the implementation of good practice and appropriate H&S measures.

10.8.51 The site is located in a residential area. Throughout construction, standard mitigation procedures will be undertaken to avoid impacting nearby off-site users, including the use of dust suppressing systems. As such, it is unlikely that off-site users will be exposed to wind-blown soil contaminants or asbestos fibres.

10.8.52 Following construction, it is expected that the construction areas would be reinstated, with unacceptable contamination having been appropriately managed or remediated, breaking the pathway for potential contaminants in soil. Therefore, it is unlikely that future site users will come into contact with contaminated land.

### *Controlled waters*

10.8.53 There are potential pathways for leaching and migration of contaminants from Made Ground and other off-site potential sources of contamination. The bedrock is unproductive strata, and the superficial geology is a Secondary A aquifer.

10.8.54 The shafts will go through the superficial aquifer. Excavation works, including construction of the shaft, have the potential to cause localised changes in water quality in the superficial aquifers and may include mobilisation of pollutants on-site if present. Potential impacts to groundwater would be temporary and localised. All construction activities would be controlled using good practice, which would mitigate any risk to groundwater contamination through spill, leaks or fuels. Therefore, construction is not likely to cause any effect on groundwater quality.

10.8.55 The River Thames is approximately 390m to the south of the Tudor Drive site. It is unlikely that contaminants found in the soil and groundwater will migrate towards the river as a result of the construction works.

### *Ground instability*

10.8.56 There is potential for ground instability due to the presence of existing structures. This will be taken into account in the detailed engineering design.

10.8.57 The preliminary assessment of likely significant effects of the construction at the Tudor Drive site is summarised in Table 10.20.

Table 10.20 Preliminary assessment of likely significant effects during construction

| Receptor | Sensitivity of receptor | Magnitude of impact | Likely significance of effect |
|---|---|---|---|
| Construction Workers (Human health) | High | Negligible/ no change | Minor (Not Significant) |
| Off-site users during construction (members of public - Human health) | High | Negligible/ no change | Minor (Not Significant) |
| Secondary A aquifer (Controlled waters) | Medium | Negligible/ no change | Minor/ Neutral (Not Significant) |
| River Thames (Controlled waters) | High | Negligible/no change | Neutral (Not Significant) |
| Ground instability | Medium | Negligible | Minor (Not Significant) |

## Operation phase

10.8.58 Operational impacts related to ground conditions and contaminated land are not anticipated. It is assumed that the majority of effects related to land contamination would likely be controlled by standard good practice (tertiary), along with remediation of unacceptable contamination during construction. Standard controls would be in place, such as the use of hardstanding and appropriate drainage/pollution control systems and any industrial processes (such as discharges) would be controlled under an Environmental Permit by the Environment Agency. At this stage, based on the baseline data available, it is not envisaged that remediation techniques other than excavation would be implemented. Therefore, there would be no associated temporal effects or long-term management associated with this as opposed to a capping layer. As such, operational impacts of ground conditions and contaminated land are scoped out of the EIA.

10.8.59 Following construction, it is expected that hardstanding will be present across the construction areas in Mogden STW; that areas which are currently open space will be reinstated with existing or imported soil of a chemical quality suitable for that scenario; and a sheet pile wall will be present at the embankment, breaking the pathway for potential contaminants, including asbestos, in soil. Therefore, it is unlikely that future site users will come into contact with contaminated land.

10.8.60 Appropriate working practices, monitoring, controls and emergency responses would be in place to limit the occurrence and impact of the introduction of

contamination from spillages and leaks of fuels, lubricants and dosing agents used in operation and maintenance activities.

10.8.61 The use of hazardous substances during operation is assumed to be managed according to all relevant legislation and consents/permits for hazardous substances. Operational risks will also be assessed as part of the relevant Environmental Permit applications.

## Cumulative effects

10.8.62 A preliminary assessment of intra-project and inter-project cumulative effects (excluding climate change) for ground conditions and contaminated land is contained in Chapter 19: Cumulative Effects.

### In-combinations effects with climate change

10.8.63 Climate change could influence the pathways, receptors and sensitivity of impacts in environmental assessments. Variations in temperature, extreme weather events such as floods, drought and intense rainfall can alter contaminant migration patterns and may increase the severity of impacts. Therefore, additional (secondary) mitigation measures to address these changes may be required.

10.8.64 Appendix 18.1 of the PEI Report provides further details of the identified ICCIs relevant to Ground Conditions and Contaminated Land for both construction and operation phases.

# 10.9 Additional (secondary) mitigation and enhancement measures

## Additional (secondary) mitigation

10.9.1 Types of mitigation are defined in Chapter 4: Approach to Environmental Assessment of this PEI Report. Embedded design (primary) mitigation and standard good practice (tertiary) specific to this aspect are provided in Section 10.4 of this PEI Report.

10.9.2 Operation and maintenance activities could introduce new contamination from spillages and leaks of fuels, lubricants and dosing agents. It is considered that control by appropriate working practices, monitoring, controls and emergency responses should be sufficient to limit these occurrences and their potential impact.

## Enhancement measures

10.9.3 Remediation of soil contamination, if risk assessments determine there is an unacceptable risk to receptors, will improve the current baseline. This is particularly relevant for areas which may be publicly accessible where there is a more viable contamination pathway to receptors.

## 10.10 Summary of Residual Likely Significant Effects

Table 10.21 Summary of residual likely significant effects for ground conditions and contaminated land

| Site | Description of effect | Likely significance of effect | Additional (secondary) mitigation and enhancement measures | Residual effects |
|---|---|---|---|---|
| Mogden STW Eastern Work Area | Potential contamination of Principal aquifer in the superficial geology when constructing the drive shaft where the historical landfill and embankment are located. | Moderate (Significant) | Further detailed assessment to quantify the risk if the initial generic assessment confirms a potential unacceptable risk and, if required, development of additional bespoke remediation and mitigation measures. | Minor adverse (Not Significant) |

## 10.11 Next steps

10.11.1 A programme of GI is currently ongoing to gather data on baseline conditions including the geology, groundwater levels, soil and groundwater geochemistry, and ground gas concentrations.

10.11.2 Following completion of the GI, the data gathered from it and from the post-GI environmental monitoring will be used to refine the conceptual site model for the Project and to undertake ground gas, human health and controlled waters contamination risk assessments. These will confirm if mitigation is required, and which mitigation options may be suitable to reduce any impacts.

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