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# Thames Tideway Tunnel
## Beckton Siphon Tunnel
### Proposed DCO Amendment
#### Environmental Report

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<td>Checked by</td>
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### Stakeholder approval

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1 Introduction

1.1.1 Thames Water Utilities Limited (TWUL) submitted an application for a Development Consent Order (DCO) for the Thames Tideway Tunnel in February 2013. Consent was granted by the Secretaries of State for Environment, Food and Rural Affairs and Communities and Local Government in September 2014 under The Thames Water Utilities Limited (Thames Tideway Tunnel) Order 2014. This was amended, in part, by The Thames Water Utilities Limited (Thames Tideway Tunnel) (Correction) Order 2015 and Notice of Variation No. 1 issued on 17th March 2015 in respect of the Deemed Marine Licence (collectively the 2014 Order).

1.1.2 This Environmental Report accompanies an application for proposed changes to 2014 Order pursuant to paragraph 2(i) of Schedule 6 of the Planning Act 2008 (“the Non-Material Amendment Application”) and in accordance with the Infrastructure Planning (Changes to, and Revocation of, Development Consent Orders) Regulations 2011 (the Regulations), as amended. For the purposes of the application, and this report, that there have been no other amendments to the 2014 Order and thus we can confirm that the following assessment is made considering the consented scheme and the alternative scheme. It considers the likely environmental impacts of the proposed changes against the baseline set out in the Environmental Statement which accompanied the original DCO application.

1.1.3 The principal purpose of the proposed amendments is to vary the location and depth of the inlet and outlet shafts and siphon tunnel to be constructed within the Beckton Sewage Treatment Works.

1.1.4 This Environmental Report provides an overview of the potential impacts of the proposed amendments and compares these to the conclusions reached in the original Environmental Impact Assessment (EIA) (Thames Water Utilities Limited, 2013) referred to as “the existing assessment”.

1.1.5 The report demonstrates that the potential impacts associated with the proposed amendments are no greater (and would in many cases be less) than those previously considered and assessed for the project as consented under the 2014 Order (consented scheme), and that the proposed changes can therefore be described as non-material for the purpose of Part 1 of the Regulations.

1.1.6 The report is supported by the results of an environmental screening exercise (Section 5) and updated assessments for traffic and transport, ground water, land quality and historic environment (Section 6).

Consented Scheme

1.1.7 The 2014 Order, as amended, granted consent for “a waste water storage and transfer tunnel (the ‘main tunnel’) between the operational Thames Water sites at Acton Storm Tanks and Abbey Mills Pumping Station… The project comprises:

a. tunnels:
- one main tunnel, which will capture and store combined sewage from unsatisfactory [combined sewer overflows] CSOs along its route and transfer it to Abbey Mills Pumping Station, from where the Lee Tunnel will transport it for treatment at Beckton Sewage Treatment Works
  – 11 connection tunnels, which will link flows from CSOs to then main tunnel

b. sites:
- five main tunnel sites
- 16 CSO sites – two system modification sites
- works at Beckton Sewage Treatment Works1 (“the consented project”).

1.1.8 At Beckton Sewage Treatment Works (‘Beckton STW’) the 2014 Order granted consent for works including the construction of two shafts and a siphon tunnel to transfer tunnel overflows to the to the existing River Thames outfall. These works are described under Work 27 (iii), (iv) and (v) within the 2014 Order and shown on approved drawings DCO-WP-000-ZZZZZ-010059 Rev 1 and DCO-WP-000-ZZZZZ-010060 Rev 1.

Proposed Amendments

1.1.9 Following work on the detailed design of the proposed works at Beckton STW, and full contractor involvement in consideration of constructability, it is proposed that a number of changes are made to the consented scheme. These are presented in more detail in section 3 of this report but in summary the proposed changes are as follows:

- The siphon tunnel outlet shaft location is adjusted to sit outside most of the footprint of existing buried, concrete-infilled sludge tanks and thus outside the approved works parameter for the outlet structure, but remains within the overall project limits set out on the approved drawings. This will reduce the need to dig through the substantial depth of concrete in the infilled sludge tanks;
- The siphon tunnel inlet shaft internal diameter is increased to 10.5 metres to assist in launching the tunnel boring machine (TBM). It is proposed to amend the 2014 Order to give flexibility to allow relocation of the inlet shaft closer to the Lee Tunnel shaft to facilitate the connection between the two to be made externally to the Lee Tunnel shaft rather than working within an operational sewer;
- The siphon tunnel depth from ground level is reduced by approximately 8 metres along the siphon tunnel alignment length. This is proposed in order to reduce water pressure acting on the tunnel in the long term and potential hyperbaric working pressure for cutter head maintenance interventions during construction. In addition a shallower tunnel will reduce the requirement for groundwater control

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1 Thames Tideway Tunnel, Thames Water Utilities Limited, Application for Development Consent, Application form, Doc Ref 1.2, Section 5, Non-technical Description of the Development Proposal, January 2013
activities associated with shaft construction. The inlet shaft and the outlet shaft depths will also vary by approximately 8m to accommodate the variation of the siphon tunnel.

1.1.10 Thames Water Utilities Limited is therefore seeking to vary the 2014 Order to allow for changes to the authorised works at STW. A plan for information, D382-AC-BECKS1ZZ-101-SK-C-R&P_DESIGN, which shows the comparative locations of the DCO consented scheme and the scheme subject of the non-material change application is included in the pack of drawings.

2 Authorised Project

2.1.1 This report refers to the works at the Beckton STW. The 2014 Order authorises the following works at Beckton STW:

*Work No. 27 Beckton Sewage Treatment Works associated development – modifications to the sewage treatment works to cater for sewage flows from the Thames Tideway Tunnel Project, including:*

- i construction of works above and below ground to transfer flows from the Tideway Pumping Station to the inlet works of the sewage treatment works;

- ii installation of additional equipment at the inlet works; and

- iii construction of a siphon tunnel inlet shaft with an internal diameter of 9 metres and which has a depth (to invert level) of 32 metres (when measured from the top of Work No. 27(iii));

- iv construction of a siphon tunnel outlet shaft with an internal diameter of 7 metres (which extends 3 metres above the proposed ground level) and which has a depth (to invert level) of 31 metres (when measured from the top of Work No. 27(iv));

- v construction of a siphon tunnel with superstructure above the siphon inlet shaft between the siphon tunnel inlet and outlet shafts; and

- vi construction of pits, chambers, culverts, ducts and pipes for cables, hydraulic pipelines, utility connections, utility diversions and drainage, including facilities for drainage attenuation.

2.1.2 The 2014 Order authorised development at Beckton STW will cater for additional flows from the Thames Tideway Tunnel project over and above those from the Lee Tunnel. The Thames Tideway Tunnel project will collect combined sewer overflows (CSOs) along the length of the main tunnel and would deliver these flows via the Lee Tunnel to Beckton STW. The majority of the works required at Beckton STW are currently under construction as part of the Lee Tunnel and other projects. However, some additional works will be constructed as part of the Thames Tideway Tunnel project. This includes the construction of two shafts and
a siphon tunnel to transfer main tunnel overflows to the Lee Tunnel overflow shaft, and the installation of two pumps in the Tideway Pumping Station, in addition to pumps that have already been installed as part of the Lee Tunnel project. Works will also be undertaken to transfer increased flows from the Tideway Pumping Station to the inlet works of Beckton STW, where additional equipment would also be installed.

2.1.3 Article 6 of the 2014 Order provides some flexibility in tunnel depth for the main tunnels but this does not currently extent to the tunnel or associated works under “Work No. 27”.

2.1.4 The Environmental Statement (ES)\(^2\), Appendices\(^3\) and Figures\(^4\) comprising the existing assessment made some assumptions about construction methodology. These are summarised as follows:

a. The shafts would be constructed by diaphragm wall construction techniques. During diaphragm wall excavation the trench would be filled with bentonite for ground support.

b. The siphon tunnel would be driven from the siphon inlet shaft. It is assumed that the tunnel would be constructed by an earth pressure balanced Tunnel Boring Machine (TBM). Ground treatment would be required for the TBM launch and reception. Once launched the TBM would cut the ground by rotating the cutter head whilst hydraulic shove rams would propel it forward. Precast concrete segmental tunnel linings would be installed as the TBM progresses. The excavated material would be transported by conveyor to the surface. The TBM would move forward and a temporary railway would be built behind it within the tunnel as the TBM proceeds to bring material to the TBM including precast concrete segments. The TBM would be received into the shaft on a cradle and would be lifted out of the shaft by heavy lift mobile crane, cleaned then dismantled and transported off site.

c. It has been assumed that the shafts and siphon tunnel would have reinforced concrete secondary linings. It has been assumed that on completion of the tunnelling phase, a batching plant would be mobilised to site. The plant would supply the secondary lining of the tunnel. Concrete would be batched on surface and pumped or skipped to the tunnel. The secondary lining of the tunnel would be constructed by installing steel reinforcement, erecting a cylindrical shutter within a short length of tunnel and pumping concrete into the gap between the shutter and the primary lining. Once the concrete has hardened sufficiently, the shutters would be removed and erected in the next section of tunnel.

d. The siphon inlet shaft would be connected to the flow transfer pipeline by two approximately 2.1m diameter pipes constructed in open trench.

e. The siphon inlet shaft would also have two 600mm internal diameter and 30 metres long drain-down pipes connecting to the existing connection shaft at

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\(^2\) Environmental Statement, Volume 26: Beckton Sewage Treatment Works site assessment, Doc Ref: 6.2.26
\(^3\) Environmental Statement, Volume 26: Beckton Sewage Treatment Works appendices, Doc Ref: 6.2.26
\(^4\) Environmental Statement, Volume 26: Beckton Sewage Treatment Works figures, Doc Ref: 6.2.26
a depth of approximately 35 metres. Prior to constructing the pipes, eyes would be formed in the base of the siphon inlet shaft and in the connection shaft and the ground in between treated to control groundwater ingress. It is assumed that the pipe would be constructed by pipe-jacking, Horizontal Directional Drilling (HDD), micro-tunnel or auger bore.

f. The siphon outlet shaft would be connected to the Lee Tunnel overflow shaft via a reinforced concrete valve chamber and connecting culvert, constructed using an open trench approach.

g. The siphon tunnel would have an internal diameter of approximately 2.8 metres. The tunnel would be approximately 29 metres deep and 750 metres long and connect the Tideway Pumping Station to the outlet shaft. A new culvert and valve chamber would carry bypass flows from the outlet shaft to the existing overflow shaft outfall culverts.

3 Description of Alternative Scheme

3.1.1 The principal purpose of the proposed amendments is to allow the variation of the locations and depths of the inlet and outlet shaft and the depth of the siphon in the 2014 Order as “Work No.27: Beckton Sewage Treatment Works associated development”.

3.1.2 Following the approval of the 2014 Order, detailed design work has been undertaken, and a construction contractor has been undertaking a constructability review. As a result of these reviews, and additional information becoming available, it is proposed that a number of minor changes are made to the consented scheme.

3.1.3 The alternative scheme to construct the siphon tunnel inlet shaft, siphon tunnel, siphon tunnel outlet shaft, drain-down pipes, flow transfer pipeline and connecting culvert would require a number of limited changes to the layout of the works alongside corresponding reductions in generated excavated material, concrete, embodied carbon and time on site.

3.1.4 The specific changes proposed for the alternative scheme are set out briefly below, and in the following table. The reasons for the proposed amendments are set out later in this section.

a. The siphon tunnel depth below ground level is reduced by approximately 8 metres along the siphon tunnel alignment length;

b. The siphon tunnel inlet shaft depth to invert level is reduced approximately by 8 metres to 24 metres deep when measured to the top of the siphon tunnel inlet shaft;

c. The siphon tunnel outlet shaft depth to invert level is reduced approximately by 8 metres to 23 metres deep when measured to the top of the siphon tunnel outlet shaft;

d. The connecting culvert length is reduced by approximately 20 metres reducing the removal of excavated material and concrete waste material;
e. The siphon inlet shaft drain-down is reduced to a single 600mm internal diameter 30 metres long drain-down pipe connecting to the existing connection shaft which is reduced in depth by approximately 5 metres;

f. The outside diameter of the tunnel is reduced from approximately 4 metres to approximately 3.7 metres resulting in a corresponding reduction in generated excavated material;

g. The horizontal tunnel alignment has been adjusted to reduce the impact to a critical Thames Water asset, the Northern Outfall Sewer, remaining within the horizontal limits of deviation for the siphon tunnel;

h. The siphon tunnel outlet shaft location has been adjusted to be located largely outside the footprint of the buried, concrete-infilled, abandoned sludge tanks to minimise break out and removal of concrete waste material and drilling arisings from coring. The shaft remains within the 2014 Order limits for Work No. 27. The siphon tunnel is extended in length to approximately 792 metres;

i. The siphon tunnel inlet shaft internal diameter is changed to 10.5 metres, an increase in diameter of 1.5 metres, in order to assist in launching the earth pressure TBM in full mode eliminating the construction risk of a sprayed concrete lined forward shunt; and

j. The siphon tunnel inlet shaft will be constructed by caisson sinking precast segments with an external concrete wrap, reducing embodied carbon and using a standard segment design.

Table 3.1: Comparison between DCO authorised scheme and alternative proposal

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<th>Parameter</th>
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<th>Alternative Scheme Assessed</th>
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<tr>
<td>Inlet Shaft Depth to Invert Level</td>
<td>32m</td>
<td>Decreased shaft construction risk.</td>
</tr>
<tr>
<td>Inlet Shaft Diameter</td>
<td>9m</td>
<td>10.5m</td>
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<td></td>
<td></td>
<td>Decreased construction risk as tunnel boring machine (TBM) can be launched without a sprayed concrete lined forward shunt.</td>
</tr>
<tr>
<td>Outlet Shaft Depth to invert Level</td>
<td>31m</td>
<td>23m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decreased shaft construction risk.</td>
</tr>
<tr>
<td>Outlet Shaft Diameter</td>
<td>7m</td>
<td>No change</td>
</tr>
<tr>
<td>Excavated material for Inlet shaft</td>
<td>Inlet Shaft: 1 no. by 9m diameter by approximately 33m deep constructed with diaphragm walling</td>
<td>Inlet Shaft: 1 no. by 10.5m diameter by approximately 33m deep constructed using caisson sinking</td>
</tr>
<tr>
<td>(diameter, depth and method of construction)</td>
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<td>Excavated material reduced.</td>
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The proposed changes will not have any effect on the overall performance of the Tideway system in terms of storage capacity, storage duration, or the ultimate spill frequency from the existing Combined Sewer Outfall at Beckton.

**Siphon Tunnel**

3.1.6 The siphon tunnel depth from ground level is reduced by approximately 8 metres along the siphon tunnel alignment length. The reduction in depth of the tunnel alignment raises the tunnel into more favourable strata and reduces the pressure at the face of the TBM. Raising the tunnel and shafts reduces the potential compressed air working pressure during tunnel construction by approximately 24% to 40%. Compressed air working during tunnel construction would be require for maintenance / repair of the TBM cutter head. The reduction in required compressed air working pressure would significantly reduce required decompression times and potential risk of workers developing decompression illness. The pressure reduction related to depth decrease improves the overall working conditions for compressed air workers.

**Siphon Tunnel Outlet Shaft**

3.1.7 A decrease in the outlet shaft depth from 31 metres to 23 metres below ground level reduces construction risk as reducing the depth of the Outlet Shaft raises
the shaft base further up into the Thanet Sand layer and away from the chalk interface which reduces the risk to the works of water inundation. The excavated bulk material quantities are reduced.

3.1.8 The siphon tunnel outlet shaft location would be adjusted to partially outside the footprint of existing buried, concrete-infilled sludge tanks and thus outside the current limits of deviation for the outlet structure, but within the overall project limits of deviation set out on the approved drawings. This will reduce the need to dig through the substantial depth of concrete in the infilled sludge tanks. In the reference design the location of the Outlet Shaft is within the centre of the underlying concrete infilled sludge tanks: top of tanks are 1m below ground level and extend down by 8m. This would require coring (drilling) of the buried concrete tanks prior to construction of the shaft wall followed by excavation through the tank. Material excavated from the buried concrete tanks could be contaminated, contain rubble or steel members, and potentially asbestos containing material left in place following previous demolition of associated above ground structures and buildings.

3.1.9 Moving the outlet shaft to the edge of the buried sludge tank footprint:
   a. reduces the time required to excavate the buried concrete tanks;
   b. reduces the amount of concrete break out to construct the connection culvert;
   c. reduces excavation of waste material including arisings with special disposal requirements, and;
   d. reduces the risk of exposure of workers to potentially asbestos containing materials.

Siphon Tunnel Inlet Shaft

3.1.10 The siphon tunnel inlet shaft internal diameter is increased by 1.5m to 10.5 metres. This will assist in launching the TBM in full mode. This means that the TBM is fully assembled within the shaft eliminating the construction risk associated with constructing a sprayed concrete lined forward shunt (launch tunnel) in potentially contaminated ground to accommodate the TBM length. The complexity of constructing the forward shunt is dependent on the prevailing geological conditions and there being appropriate soil strata properties and adequate control of groundwater. Any faulting or connectivity between the soil layers known to exist at this site would increase the risk of encountering contaminated groundwater or inundation. Launching the TBM in full mode allows a seal between the TBM and the tunnel portal of the inlet shaft. The TBM then can apply a pressure to the face (ground) and control ground movement and groundwater. This reduces risk and dependence on ground conditions. During construction of the adjacent Lee Tunnel hydrocarbon contamination was encountered. Construction of a tunnel below the London clay could potentially expose workers to contaminants including benzene (a known carcinogenic compound), a risk which raising the tunnel would reduce.
3.1.11 Reducing the depth of the inlet shaft will minimise the risk of hydrocarbon contamination which was encountered during the dewatering of the Lee Tunnel Connection Shaft and Pumping Station. The hydrocarbons were found during deep well dewatering in the lower aquifer, within the Chalk, and when dewatering was stopped and the groundwater level recovered the hydrocarbons potentially could have risen into the sandier higher strata of Thanet Sands and the lower Lambeth Group. The London Clay layer, an aquiclude (a solid, impermeable area underlying or overlying an aquifer), has potentially prevented further hydrocarbon migration of contamination from the lower aquifer into the upper aquifer.

3.1.12 The shallower inlet shaft depth means:
   a. The shaft base will move up into the clayey layers of the Lambeth Group reducing the risk of excavating hydrocarbon contaminated soil and potential benzene and other contaminant exposure to workers
   b. No requirement for deep dewatering wells in the Chalk. Shallower shaft base depth will still require installation of pressure (passive) relief wells in the Upnor Formation of the Lambeth Group reducing/eliminating the risk of dewatering hydrocarbon contaminated groundwater
   c. Impact to groundwater levels is reduced as a lower drawdown is required
   d. Reduced daily average and total volume of dewater extracted
   e. Reduced quantities of excavated material even though the inlet shaft internal diameter has been increased by 1.5m
   f. Less embodied carbon and less time on site
   g. The proposed amended design will result in less excavation, and a consequent reduction in lorry movements to take away the excavated material. It will also have benefits in that it will allow tunnellers to work in a safer environment.

3.1.13 It is also proposed to amend the DCO to give flexibility to allow relocation of the inlet shaft closer to the Lee Tunnel shaft to facilitate the connection between the two to be made externally to the Lee Tunnel shaft rather than working within an operational sewer.

4 Methodology

4.1.1 This environmental report has taken into account the methodology used in the existing assessment so that there is a consistency of approach to the assessment of likely significant effects between the consented scheme and the proposed alternative scheme. Reference has been had to the findings set out in the original ES.

4.1.2 All topics assessed in relation to the consented scheme were considered in terms of the alternative scheme description as set out in Section 3 above. The following steps were undertaken:
a. All topics and potential impacts as set out in the existing assessment were screened against the parameters of the alternative project description. This involved a consideration of the environmental effects of the proposed changes and whether these effects could result in a different level of impact to that identified in the existing assessment;

b. Where there was a clear case that the significance of the impact would be unchanged or reduced (e.g. due to a decrease in spoil or material management of the project), these topics were screened out from further assessment. The outcome of the screening assessment is presented in Section 5 (Table 5.1);

c. Where further analysis was required to determine whether the significance of the impact would be unchanged or reduced, updated assessments have been provided. These assessments are presented in Section 6;

d. Where the significance of the impact would be unchanged or reduced from the Tideway works at Beckton STW alone, it is considered that the significance of any cumulative impacts would also be unchanged or reduced; and

e. Where the outcome of the screening or updated assessments confirmed that the significance of the impact would be unchanged or reduced, the associated changes are considered to constitute non-material amendments for the purposes of the Regulations.

5 Screening and Scoping

Introduction

5.1.1 As described in Section 4, following a screening exercise on a topic by topic basis, topics have been screened out from further assessment where it is clear that there would continue to be no impacts due to the nature of the works, or the nature of the site.

5.1.2 Following the screening, the scope of the environmental assessment has been established for those environmental disciplines not screened out. Where it is clear that the identified impacts of the change in shaft and tunnel location and dimensions will not change from those assessed in the consented scheme, these environmental disciplines have been scoped out.

5.1.3 Where environmental disciplines have not been screened our scoped out, assessments are presented in Section 6. These assessments have been undertaken against the baseline set out in the original ES.

5.1.4 Table 5.1 sets out the results of the screening and scoping.

Identification of changes and effects relevant to the assessment

5.1.5 The proposed changes to the project description (Section 3) that are relevant to the assessment of topics are as follows:
The proposed siphon tunnel, and associated inlet and outlet shafts, would not be constructed as deep as authorised by the 2014 Order, each reducing in depth by approximately 8m from the depth approved in the 2014 Order;

The proposed inlet shaft would be constructed with a larger diameter than authorised by the 2014 Order; and

The proposed outlet shaft would be in a different location from that authorised by the 2014 Order.

5.1.6 Note that there are no changes proposed to the overall consented Order limits or horizontal limits of deviation.

5.1.7 As a consequence of the proposed works described above, the following paragraphs set out the potential changes to the assessed environmental effects for topics during the construction, operation and decommissioning phases. Whether these effects could result in a different level of impact to that identified in the existing assessment is considered in Table 5.1.

Construction

5.1.8 The following main changes are associated with the construction phase for the proposed alternative scheme:

- Increased footprint of inlet shaft;
- Reduced disturbance of the lower aquifer due to the proposed shafts and tunnel not being constructed as deep as authorised in the 2014 Order;
- Overall reduction in the amount of waste materials removed from the site during construction; and
- Reduced disturbance to former sludge tanks located at the outlet shaft site.

5.1.9 The programme for construction of the works associated with the proposed changes will remain within the envelope of the programme assessed within the Environmental Statement which supported the approved DCO.

5.1.10 The proposed changes will remain within the scope of mitigation set out in the project Code of Construction Practice, including Part A: General Requirements and Part B: Site Specific Requirements, which apply under the approved DCO.

5.1.11 An assessment of the anticipated settlement associated with the proposed changes has been undertaken. The proposed changes have been discussed with Thames Water Utilities Limited’s operational division, and with the operators of other equipment on the site, including UK Power Networks and National Grid. No potential for damage from the proposed works has been identified which would require consequential works that would give rise to significant environmental effects.
Operation

5.1.12 No changes are expected in the proposed operation of the Tideway infrastructure as a result of the proposed changes and therefore operational effects have not been considered in this report.

5.1.13 The proposed changes do not change the requirements for ventilation and air treatment compared to those set out in the original DCO.
<table>
<thead>
<tr>
<th>EA(1) Topic</th>
<th>Change in project parameters (as applicable to each topic)</th>
<th>Key change in effect/s(2)</th>
<th>Change in impact significance</th>
<th>Updated assessment?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Quality and Odour (Original ES Section 4)</td>
<td>Increase in inlet shaft internal diameter, raised tunnel construction horizon, length increased and reduced external diameter. No change in operation proposed.</td>
<td>Minor reduction in construction activity and construction related transport.</td>
<td>Minor reduction in the magnitude of effect, no change in impact significance. No change in operation.</td>
<td>Scoped Out - residual effects remain negligible for construction effects and minor adverse for operation (odour)</td>
</tr>
<tr>
<td>Ecology – aquatic (Original ES Section 5)</td>
<td>Re-location of outlet shaft</td>
<td>Construction activity not assessed in original ES. No change predicted.</td>
<td>Construction activity not assessed in original ES. No change predicted.</td>
<td>Screened Out – there would be no construction activities ‘in-river’ at this site therefore no significant effects on aquatic ecology are likely</td>
</tr>
<tr>
<td>Ecology – terrestrial (Original ES Section 6)</td>
<td>Increase in inlet shaft internal diameter, raised tunnel construction horizon, length increased and reduced external diameter.</td>
<td>Minor reduction in construction activity</td>
<td>Minor reduction in the magnitude of effect, no change in impact significance.</td>
<td>Scoped Out – residual effects remain negligible</td>
</tr>
<tr>
<td>Historic environment (Original ES Section 7)</td>
<td>Increase in inlet shaft internal diameter</td>
<td>Minor increase in shaft excavation footprint (3)</td>
<td>No change in impact significance.</td>
<td>Scoped Out – residual effects remain negligible</td>
</tr>
<tr>
<td></td>
<td>Relocation of outlet shaft.</td>
<td>Potential for increased impact during excavation outside footprint of 19th deep sludge settlement tanks</td>
<td>Historical Environment assessment confirms the impacts are minor, therefore impact significance would be minor adverse. This is the same as the assessment of the consented scheme.</td>
<td>Reassessed</td>
</tr>
<tr>
<td>Land quality (Original ES Section 8)</td>
<td>Reduction in construction depths, increase in inlet shaft internal diameter and movement of outlet shaft.</td>
<td>Reduction in excavated material</td>
<td>The magnitude of impact and effect as previously assessed would not change.</td>
<td>Reassessed</td>
</tr>
<tr>
<td>EA(^{(1)}) Topic</td>
<td>Change in project parameters (as applicable to each topic)</td>
<td>Key change in effect(s)(^{(2)})</td>
<td>Change in impact significance</td>
<td>Updated assessment?</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------------------------------------------------</td>
<td>---------------------------------</td>
<td>-------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Noise and vibration (Original ES Section 9)</td>
<td>Increase in inlet shaft internal diameter and movement of outlet shaft.</td>
<td>Construction activity not assessed in original ES. No change predicted.</td>
<td>Construction activity not assessed in original ES. No change predicted.</td>
<td>Screened Out – Construction and operational effects for noise and vibration for this site have not been assessed. This is on the basis that there are no noise or vibration sensitive receptors / resources located within the 300m assessment area for the site.</td>
</tr>
<tr>
<td></td>
<td>Tunnel construction horizon raised and minor increased in length</td>
<td>Construction activity not assessed in original ES. No change predicted.</td>
<td>Construction activity not assessed in original ES. No change predicted.</td>
<td></td>
</tr>
<tr>
<td>Socio-economic (Original ES Section 10)</td>
<td>Minor reduction in construction activity due to less excavation and material requirements.</td>
<td>Construction activity not assessed in original ES. No change predicted.</td>
<td>Construction activity not assessed in original project ES. No change predicted.</td>
<td>Screened Out - As no sensitive socio-economic receptors/resources are located within 300m of the works, construction and operational assessments have not been undertaken.</td>
</tr>
<tr>
<td>Townscape and visual (Original ES Section 11)</td>
<td>No change to the nature or location of the proposed works</td>
<td>Construction activity not assessed in original ES. No change predicted.</td>
<td>Construction activity not assessed in original ES. No change predicted.</td>
<td>Screened Out - There is no potential for likely significant effects on townscape and visual receptors arising from the construction or operation of the proposed development at Beckton STW.</td>
</tr>
<tr>
<td>Transport (Original ES Section 12)</td>
<td>Increase in inlet shaft internal diameter, raised tunnel construction horizon, length increased and reduced external diameter.</td>
<td>Minor reduction in construction activity (^{(3)})</td>
<td>Minor reduction in the magnitude of effect, no change in impact significance.</td>
<td>Reassessed</td>
</tr>
</tbody>
</table>

\(^{(1)}\) EA – Environmental Assessment

\(^{(2)}\) Key change in effect(s) refers to the impact on the receptors or resources affected.

\(^{(3)}\) This change in construction activity is expected to reduce the overall noise and vibration impacts, hence the reduced impact significance.
## Impact Assessment Screening

<table>
<thead>
<tr>
<th>EA(1) Topic</th>
<th>Change in project parameters (as applicable to each topic)</th>
<th>Key change in effect/s(2)</th>
<th>Change in impact significance</th>
<th>Updated assessment?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water resources – groundwater (Original ES Section 13)</td>
<td>Change of design parameters and construction techniques</td>
<td>Minor change of impacts to groundwater from proposed changes in design parameters.</td>
<td>Updated ‘Water Resources – Groundwater’ assessment (see Section 7) confirms the proposed alternative works will have a negligible impact on a high value receptor, the lower aquifer with regard to quantity, and would result in a minor adverse effect and a negligible effect on quality. This is the same as the assessment of the consented scheme.</td>
<td>Reassessed</td>
</tr>
<tr>
<td>Water resources – surface water Original (ES Section 14)</td>
<td>Increase in inlet shaft internal diameter, raised tunnel construction horizon, and reduced external diameter.</td>
<td>Minor reduction in construction activity (3)</td>
<td>The original ES did not identify any potential impacts as a result of the proposed development, therefore no significant construction effects are considered likely for the construction phase at this site.</td>
<td>Scoped Out – no potential impacts identified</td>
</tr>
<tr>
<td>Water resources – flood risk (Original ES Section 15)</td>
<td>Increase in inlet shaft internal diameter</td>
<td>Small increase in inlet shaft footprint.</td>
<td>Minor increase in the magnitude of effect, no change in impact significance.</td>
<td>Scoped out – impacts remain as assessed in the original ES</td>
</tr>
</tbody>
</table>

### Notes

1. Environmental Statement Volume 26 Beckton Sewage Treatment Works site assessment
2. Operation remains unaffected by proposed alternative
3. Variation in material volumes and lorry movements is supplied in Section 6
6 Updated Assessments

Introduction

6.1.1 Following the outcome of the screening process (Section 5), the following section presents the updated assessments that have been undertaken for traffic and transport, groundwater, land quality and historic environment.

Traffic and transport

6.1.2 An assessment of the predicted traffic movements for the alternative scheme has been undertaken, using the same assumptions used for the original ES and Transport Assessment.

6.1.3 The assessment used the same programme for the proposed alternative scheme as for the consented scheme. It should be noted that, although the traffic and transport effects have been assessed against the original programme, since consent was granted, the selected contractors have confirmed a revised programme, and assessment is therefore also shown between the consent scheme and the alternative scheme using the revised programme.

6.1.4 Figure 6.1 below is the traffic movement histogram used for the original ES and Transport Assessment, indicating that the monthly average peak vehicle movements would be 25 vehicles (i.e. 50 movements) per day.

Figure 6.1 HGV Histogram during construction: consented scheme

6.1.5 As Figure 6.2 demonstrates, using the same programme for the alternative scheme, the monthly average peak vehicle movements would be 23 vehicles (i.e. 46 movements) per day.
6.1.6 As figure 6.3 illustrates, using a revised, anticipated, construction programme, monthly average peak vehicle movements would be 24.5 vehicles (i.e. 49 movements) per day.

Figure 6.3 HGV Histogram during construction: alternative scheme, revised programme
6.1.7 We can therefore conclude that the changes to the consented scheme would not cause any new or significant environmental effects associated with traffic and transport.

**Water Resources – Groundwater**

6.1.8 Two alternative methods are proposed for the construction of the inlet shaft; diaphragm wall or wet caisson method. The proposed diaphragm wall would be extended to a depth of approximately 65 m below ground level to restrict groundwater inflows such that water levels outside the shaft are not adversely affected, passive relief wells installed to a depth of approximately 50 m below ground level would be used to control groundwater within the shaft. The alternative method proposed (wet caisson) consists of an initial shaft being sunk as a dry caisson into the upper aquifer facilitated by installing a sheet piled cofferdam toed into the London Clay. The shaft would be excavated into the London Clay layer as a dry caisson (level based on soil plug properties) and then the method would switch to accommodate a wet caisson method. This involves filling the shaft with water to balance the hydrostatic head in the lower aquifer with excavation below the water level in the shaft followed by installation of a mass concrete base plug.

6.1.9 Both the proposed methods for construction for the inlet shaft are considered to have little to no impact on groundwater levels outside the shaft and therefore the changes proposed in Section 3 are in line with the conclusions presented in the existing assessment. The proposed alternative works will have a negligible impact on a high value receptor, the lower aquifer with regard to quantity, and would result in a minor adverse effect and a negligible effect on quality.

6.1.10 The changes to the design of the outlet shaft are considered minimal with respect to the water environment as the construction technique has not changed and therefore the effect on the groundwater environment is in line with what was assessed within the original ES.

6.1.11 We can therefore conclude that the changes to the scheme would not cause any new or significant environmental effects associated with water resources - groundwater.

**Land quality**

6.1.12 The alternative scheme would result in the changes to the land quality assessment as follows.

6.1.13 The proposed changes to the shaft and associated siphon tunnel depths, and changes in tunnel shaft location, are considered to have a negligible effect for land quality as contaminated material is considered likely to be within Made Ground and in the upper and lower aquifers. This would result in a negligible effect on above ground construction workers and a minor adverse effect on those involved in intensive below ground works (although the effect is defined as minor adverse, it is considered unlikely that the effects would occur).
6.1.14 It is considered that overall the alternative scheme would not substantially change the scope of the CoCP and measures taken to mitigate against risk to human health, the built environment, and off-site receptors from contamination in soil or groundwater, UXO or Japanese Knotweed. Mitigation as outlined in the existing assessment still applies.

6.1.15 We can therefore conclude that the changes to the scheme would not cause any new or significant environmental effects associated with land quality.

**Historic Environment**

6.1.16 The relocation of the outlet shaft from outside of the existing 19th Century deep sludge settlement tanks footprints has been identified to have the potential to have different impacts on the historic environment previously considered in the original ES.

6.1.17 Under the alternative scheme the outlet shaft would be moved approximately 22m from its previous location. The proposed siphon outlet shaft at Site B would be constructed in an area which has seen the extensive previous disturbance from the 19th century sewage works infrastructure, particularly the extensive and deep sludge settlement tanks. The extent of the 19th century works, along with ground contamination, led to this area being scoped out for buried heritage mitigation during the Lee Tunnel construction. The depth of the Victorian sludge tank foundations is shown on contemporary drawings as 22 feet below Ordnance Datum Liverpool (ODL), c 93.0m ATD (although there is some potential for inaccuracy in ODL measurements).

6.1.18 Given the past impact from the sludge tanks, the siphon tunnel outlet shaft at Site B is only likely to have further impact on the lowest palaeo-environmental remains (low to medium asset significance), if they exist at that depth, because all later deposits will have been removed by the sludge tanks. This would result in a minor adverse effect.

6.1.19 The 19th century sludge tanks, now filled in with concrete, are of low asset significance. The localised removal by the shaft would result in a minor adverse effect.

6.1.20 Mitigation as outlined in the original ES for the outlet shaft still applies.

6.1.21 We can therefore conclude that the changes to the scheme would not cause any new or significant environmental effects associated with the historic environment.

**Additional Considerations**

6.1.22 The original DCO Environmental Statement indicated that there are no noise or vibration sensitive receptors / resources located within the 300m assessment area for the site (Volume 26, paragraph 9.1.1) and that as a result noise and vibration as a topic was scoped out of the original DCO environmental assessment. The overall construction methodology for the Siphon Tunnel under the non-material change proposal remains consistent with the assumptions in the original DCO Environmental Statement and thus noise and vibration effects have been scoped out the assessment for the non-material change.
6.1.23 An assessment of the anticipated settlement associated with the proposed changes has been undertaken. The proposed changes have been discussed with Thames Water Utilities Limited’s operations division, and with the operators of other equipment on the site, including UK Power Networks and National Grid.

6.1.24 No potential for damage resulting from settlement from the proposed works has been identified which would require consequential works that in itself would give rise to significant environmental effects.
## Conclusions

7.1.1 Thames Water Utilities Limited is seeking to vary the 2014 Order to amend the depth of the Beckton siphon tunnel, and the associated inlet and outlet shafts, the radius of the inlet shaft, and the location of the outlet shaft.

7.1.2 This report has considered the potential impacts of the alternative scheme and compared them to the conclusions reached in the existing assessment for the consented scheme.

7.1.3 An environmental screening exercise and updated assessment with respect to traffic and transport, groundwater, land quality and historic environment has been undertaken, the result of the updated assessments are summarised in Table 7.1 below.

### Table 7.1: Environmental Impact Assessment summary

<table>
<thead>
<tr>
<th>Environmental Impact Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EA</strong>(1) Topic</td>
</tr>
<tr>
<td>Historic environment (Original ES Section 7)</td>
</tr>
<tr>
<td><strong>EA</strong>(1) Topic</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Land quality (Original ES Section 8)</td>
</tr>
<tr>
<td>Transport (Original ES Section 12)</td>
</tr>
</tbody>
</table>
### Environmental Impact Assessment

<table>
<thead>
<tr>
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<td>Both the proposed methods for construction for the inlet shaft are considered to have little to no impact on groundwater levels outside the shaft. The proposed alternative works will have a negligible impact on a high value receptor, the lower aquifer with regard to quantity, and would result in a minor adverse effect and a negligible effect on quality. The changes to the design of the outlet shaft are considered minimal with respect to the water environment as the construction technique has not changed and therefore the effect on the groundwater environment is in line with what was assessed within the original ES. The changes to the scheme would not cause any new or significant environmental effects associated with water resources - groundwater.</td>
</tr>
</tbody>
</table>

**Notes**

1) Environmental Statement Volume 26 Beckton Sewage Treatment Works site assessment
2) Operation remains unaffected by proposed alternative
3) Variation in material volumes and lorry movements is supplied in Section 6

#### 7.1.4

Taken together these demonstrate that the potential magnitude of impacts associated with the proposed changes are no greater than those previously assessed for the consented scheme, with no resulting change in significance of impacts, and no new significant impacts.