## Risk Assessment & Method Statement

<table>
<thead>
<tr>
<th>Site / Depot / Office:</th>
<th>Chelsea To Battersea</th>
<th>RA / MS No:</th>
<th>01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Author(print &amp; sign):</td>
<td>R.M. Scherdel</td>
<td>Date:</td>
<td>18.4.16</td>
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<tr>
<td>Name of Approver(print &amp; sign):</td>
<td>P. Cull</td>
<td>Date:</td>
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<tr>
<td>Activity Title:</td>
<td>Segmental shaft construction (7.5m and 5m ID diameter) Drive Shaft</td>
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### RA / MS Revisions / Confirmation of Review or Changes:

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<tr>
<th>No:</th>
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<th>Author(print &amp; sign)</th>
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Note: Risk Assessment & Method Statement must be approved by a Contracts Manager for activities agreed as high risk. All other RAMS must be approved by a competent person excluding the author.
### Section 1 – Task Risk Assessment

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hazards</th>
<th>Initial</th>
<th>Control measures</th>
<th>Residual</th>
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</thead>
</table>
| **A. Access and egress** | Slips, trips and falls     | 3 4 12  | 1. Tidy site and provide clear defined walkways as per individual compound layout.  
   2. Remove trip hazards around site; store materials in designated areas.  
   3. Keep site access gates locked at all times, keep fencing closed.  
   4. During excavation a ladder will only be used as an alternative (emergency) means of escape, to be retained at the surface.  
   5. Ladders: Max lift height 9m; condition regularly checked; angle 1:4; secured; project 1m above top edge.  
   6. The primary means of access and egress to be via Man rider.  
   7. On completion of the Caisson access and egress to be via a fixed steel shaft ladder. | 3 1 3    |
| **B. Manual handling**     | Back injury                | 3 4 12  | 1. Make use of excavator or crane on site.  
   2. Use correct manual handling technique, keep back straight and bend at knees when lifting.  
   3. Share or split loads with other operatives.  
   4. Use correct gloves to protect from sharp edges. | 3 2 6    |
| **C. General protection**  | Site hazards to public from plant, equipment, substances, materials and site facilities | 3 3 9   | 1. Ensure agreed working area is fenced off, min 2m high secured and closed to public.  
   2. Perimeter signing: "Construction Site Danger Keep Out" to be displayed on perimeter. | 3 1 3    |

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1. Initial and residual ratings: S - Significant, L - Low, R - Remaining.
<table>
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<tr>
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<th>Residual</th>
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<td>D. Excavations</td>
<td>Sides collapsing, falls in to excavation</td>
<td>4</td>
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<td>E. Lifting operations</td>
<td>Drop load, lifting equipment failure</td>
<td>4</td>
<td>3</td>
<td>12</td>
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| F. Working at height | Falls in to excavation                       | 3       | i. Hand rails made of scaffold tubes and pedestrian fencing will be fitted around.  
ii. If Ring projection above ground level is less than 910mm then harnesses connected to handrail **MUST** be used while working near shaft.  
iii. Ladders: Max lift height 9m; condition regularly checked; angle 1:4; secured; project 1m above top edge.  
iv. During excavation a ladder will only be used as an alternative (emergency) means of escape to be retained at the surface.  
v. The primary means of access and egress to be via Man rider.  
vi. On completion of the Caisson access and egress to be via a fixed steel shaft ladder.  
vii. Segregate area from others, only personnel involved in this activity will enter. | 3        |
| G. Fuel Spillage   | Fuel contaminating water or soil             | 3       | i. All stationary plant to have drip tray underneath  
ii. Spill Kit to be provided on site and operatives informed on the location  
iii. Only approved containers to be used for fuel storage.  
iv. Correct PPE to be used when refuelling, gloves mandatory. | 3        |
| H. Vehicle movements | Vehicle collision on site  
Pedestrian RTA (road traffic accident) | 4       | i. Ensure entry/exit points from site allow for adjoining road conditions and use; signs; traffic control; visibility mirrors.  
ii. Establish pedestrian & vehicle routes and where practicable demarcate with fencing if adjacent. See site layout attached to this method statement.  
iii. Locate storage to remove or minimise reversing & handling  
iv. Vehicles fitted with reversing alarms.  
v. Adequate compound lighting  
vi. Unstable ground; route away or bridge existing culverts or ducts;  
    Soft surfaces lay hard-core or other temporary surfacing. | 4        |
| I. Breaking concrete/tarmac | Noise, vibration, flying particles         | 3       | i. Low vibration and noise tools and equipment will be used where possible.  
ii. Persons in or near (within 2m) of the shaft wear ear protection  
iii. Ear protection zone marked | 3        |
<table>
<thead>
<tr>
<th>Activity</th>
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<th>Residual</th>
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<td>S L R</td>
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<td>S L R</td>
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</table>
| **J. Working in confined space** | Hazardous atmospheres:  
  - Oxygen levels (min & Max)  
  - Carbon Dioxide (as chalk)  
  - Carbon monoxide due to traffic  
  - Access and egress hazards  
  - Emergencies- Lack of communications | 4 3 12 | iv. Check all airlines, couplings and tools prior to use  
v. Equipment certificated  
vi. Pneumatic tool operators – frequent short breaks  
vii. Wear working gloves or anti vibration gloves if preferred  
viii. Before cutting make sure no one will be affected by flying objects  
ix. Operative involved to wear appropriate PPE (goggles additional to mandatory PPE) | 4 1 4 |
| **K. Cement grout Caisson** | Unsafe use of mixer  
  Contact with grout pan blades  
  Dust | 3 3 9 | i. Competent and appropriately experienced operator ii. Ensure guard fitted correctly when using mixer  
iii. Use in well ventilated location;  
iv. For small quantities use pre-mixed grout  
v. Do not rotate mixer dry – add water first followed by cement;  
vi. Dust mask; Gloves; Goggles; Keep covered up. | 3 1 3 |
| **L. Use of Slurry/lubricating fluid (shaft sinking)** | Dust and severe slip hazard | 2 2 4 | i. Use premixed slurry.  
ii. Remove spillage’s | 2 1 2 |
| **M. Concrete operations** | Concrete burns | 3 3 9 | i. Avoid direct skin or eye contact with concrete.  
ii. Wash accidental splashes with clean water immediately.  
iii. Use additional PPE as advised by the COSHH assessment, rubber gloves mandatory. | 3 1 3 |
<p>| <strong>N. Waste management</strong> | Disease | 3 4 12 | i. COSHH register developed on site | 3 2 6 |</p>
<table>
<thead>
<tr>
<th>Activity</th>
<th>Hazards</th>
<th>Initial&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Control measures</th>
<th>Residual&lt;sup&gt;1&lt;/sup&gt;</th>
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<td>S  L  R</td>
<td>i. Good order kept on site</td>
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<td>ii. Storage zones identified</td>
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<td>iii. Waste segregated where possible</td>
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<td>iv. Waste management plan setup</td>
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<td>O. Aquifer pollution</td>
<td>Aquifer contamination</td>
<td>4  2  8</td>
<td>i. Refuelling procedures developed for all plant and worked into toolbox talks.</td>
<td>4  1  4</td>
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<tr>
<td></td>
<td>Long term contamination</td>
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<td>ii. COSHH data sheets to be on site for all project items.</td>
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<td>iii. Monitor deliveries.</td>
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<td>v. Environmental plan to be developed to include the use of emergency spill procedures.</td>
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<td>P. Flooding</td>
<td>Injury</td>
<td>5  2  10</td>
<td>i. Development of flood strategy plan.</td>
<td>5  1  5</td>
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<td></td>
<td>Damage of equipment</td>
<td></td>
<td>ii. Early warning systems to be developed.</td>
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<td>Public and surrounding environment endangerment</td>
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<td>iii. Continual monitoring of river walls.</td>
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<td>vi. Emergency response plan to be in place.</td>
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<td>Q. Pollution entering surface water drainage system</td>
<td>Existing system overload leading to high concentrations arriving at treatment works Discharge to watercourse</td>
<td>3  4  12</td>
<td>i. Ensure all surface drainage systems are demarcated on site.</td>
<td>3  1  3</td>
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<td>ii. Wash down systems to be kept clear of surface drainage systems</td>
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<td>iii. Temporary covers for surface to be used where required.</td>
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<td>R. Checks for wildlife</td>
<td>Loss of wildlife</td>
<td>3  3  9</td>
<td>i. A full ecological assessment completed prior to construction activities</td>
<td>3  1  3</td>
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<td>Disturbance of protected species</td>
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<td>ii. Removal of existing trees vegetation to be carried out by competent persons, with a watching brief where required.</td>
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<td>iii. Where specified, monitoring to be carried out where required.</td>
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<td>iv. A specific RAMS to be detailed identifying specific environmental constraints/mitigations.</td>
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<td>iv. Trees with nesting or protected species to be protected.</td>
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<tr>
<td>S. Dewatering</td>
<td>Environmental impact</td>
<td>3  3  9</td>
<td>i. Water treatment facilities to be used on surface including any settlement tanks.</td>
<td>3  1  3</td>
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<td>ii. Discharge licences to be agreed prior to construction with the relevant stakeholders.</td>
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<td>iii. All dewatering to conform to statutory regulations.</td>
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<td>iv. Testing requirements identified in site procedures.</td>
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| **T. Dust**    | Long term damage to respiratory system       | 3 3 9   | I. All works to be carried out in accordance with section 61 dust parameters.  
II. Use wet cutting techniques whenever possible.  
III. Review need for dust extraction systems to be fitted on small tools.  
IV. Minimise bagged cementitious materials – bulk silos’.  
V. Correct dust masks to be worn where dust is a problem, Personnel to have ‘Face Fit’ test to ensure mask is suitable.  
v. At Chelsea a wheel wash will be installed for the shaft and tunnel construction.                                                                 | 3 1 3    |
|                | Local area nuisance                          |         |                                                                                                                                                                                                                  |          |
|                |                                              |         |                                                                                                                                                                                                                  |          |
|                |                                              |         |                                                                                                                                                                                                                  |          |
| **U. Noise**   | Permanent hearing loss                       | 3 3 9   | VI. Noise surveys to be carried out in accordance with section 61.  
VII. Hearing protection will be provided at all times.  
VIII. Personnel in high noise areas to be provided with the correct hearing protection.  
vi. All works carried out in a accordance with section 61.                                                                 | 3 2 6    |
|                | Local area disturbance                       |         |                                                                                                                                                                                                                  |          |
|                | Surrounding wildlife disturbance             |         |                                                                                                                                                                                                                  |          |
|                |                                              |         |                                                                                                                                                                                                                  |          |
| **V. Health Impact** | Health deterioration                    | 3 3 9   | I. Personal hygiene levels must be maintained at all times.  
II. Hand to mouth contact must be avoided as much as possible, and when necessary hands must be cleaned or washed.  
vi. Adequate welfare and washing facilities provided, including chemical washings where required.                                                                 | 3 1 3    |
| **W. Refuelling of Plant** | Contamination of ground water and water courses by leakages | 4 4 16  | I. Spillages will be cleaned up immediately with spill kits to prevent the contamination of ground water.  
II. Spill kits to be available at key points and accessibility/adequacy checked on a regular basis, drip trays to be used under static plant.  
vi. Tank size to be limited, tank to be bunded. Only trained and authorized personnel to fill plant                                                                 | 4 1 4    |
|                |                                              |         |                                                                                                                                                                                                                  |          |
|                |                                              |         |                                                                                                                                                                                                                  |          |
| **X. Abrasive Wheels** | Risk of injury – cuts/bruises              | 4 4 16  | III. Only trained and competent personnel to use equipment.  
IV. Correct goggles / glasses must be worn for the task being carried out, see Euro Code EN 166.  
V. Ear defenders to be worn.                                                                                                                   | 4 1 4    |
<p>|                | Eye injuries                                 |         |                                                                                                                                                                                                                  |          |
|                | Hearing                                      |         |                                                                                                                                                                                                                  |          |
|                |                                              |         |                                                                                                                                                                                                                  |          |</p>
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<tr>
<td>Y. Poor ventilation / toxic flammable gas / lack of oxygen</td>
<td>Inhaling fumes</td>
<td>4 4 16</td>
<td>i. Gas monitoring systems to be in place with alarm system.</td>
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<td>ii. Sufficient Self rescue sets to be provided and all personnel working in the tunnel and shaft to be trained in their use, include visitors.</td>
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<td>iii. Self-rescue sets to be located in accordance with emergency procedures.</td>
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<td>iv. Forced ventilation to be maintained in the tunnel with backup power supply.</td>
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<td>VI. Commutations system from surface to be provided to inform tunnel personnel if need to evacuate or for tunnel personnel to raise the alarm</td>
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<td>Z. Fire/Explosion</td>
<td>Death or serious injury</td>
<td>4 4 16</td>
<td>I. No petrol plant to be used underground. Diesel will be stored only in the generator’s fuel tank.</td>
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<td>II. Fire extinguishers to be maintained in fire points located at intervals along the tunnel.</td>
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<td>III. No gas bottles to be left in the tunnel, all bottles to be returned to the store after use.</td>
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<td>VII. Minimise burning/welding underground – remove work item to surface where possible.</td>
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<td>AA. Poor ventilation / toxic flammable gas / lack of oxygen</td>
<td>Death or Serious Injury</td>
<td>4 4 16</td>
<td>v. Gas monitoring systems to be in place with alarm system.</td>
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<td>vi. Sufficient Self rescue sets to be provided and all personnel working in the tunnel and shaft to be trained in their use, include visitors.</td>
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<td>vii. Self-rescue sets to be located in accordance with emergency procedures.</td>
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<td>viii. Forced ventilation to be maintained in the tunnel with backup power supply.</td>
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<td>x. Commutations system from surface to be provided to inform tunnel personnel if need to evacuate or for tunnel personnel to raise the alarm</td>
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Guidance on Scoring of H, S & E Risks/Aspects

¹Site / Depot / Office specific initial risks should be based on corporate residual risks presented in the company health & safety risk registers (see 621-01). In evaluating site-specific residual risks, scores should only change if controls additional to company controls are implemented locally.

Safety Risk ratings: Severity x Likelihood

<table>
<thead>
<tr>
<th>S = Severity</th>
<th>1 = Minor</th>
<th>2 = 3 Day</th>
<th>3 = Major Injury</th>
<th>4 = Fatality</th>
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<tbody>
<tr>
<td>L = Likelihood</td>
<td>1 = Unlikely</td>
<td>2 = Possible</td>
<td>3 = Likely</td>
<td>4 = Very Likely</td>
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</tbody>
</table>

Environmental risks/aspects

¹Site / Depot / Office specific initial risks should be based on corporate residual risks presented in the company environmental risk registers (see 621-02). In evaluating site-specific residual risks, scores should only change if controls additional to company controls are implemented locally.

<table>
<thead>
<tr>
<th>Severity</th>
<th>Score</th>
<th>Likelihood</th>
<th>Score</th>
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<tbody>
<tr>
<td>Impact could result prosecution?</td>
<td>No = 0, Yes = 1</td>
<td>Unlikely</td>
<td>1</td>
</tr>
<tr>
<td>Impacts are at least regional rather than remain within or close by the site?</td>
<td>No = 0, Yes = 1</td>
<td>Possible</td>
<td>2</td>
</tr>
<tr>
<td>Long term duration of impact e.g. more than 3 months?</td>
<td>No = 0, Yes = 1</td>
<td>Probable</td>
<td>3</td>
</tr>
<tr>
<td>Noticeable damage to our environment will occur?</td>
<td>No = 0, Yes = 1</td>
<td>Certain</td>
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<td>Severity Score (add scores from severity categories)</td>
<td>Max score = 4</td>
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<td>Total score = Severity x Likelihood</td>
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Significant environmental risks/aspects are those scoring 12 or more OR if the risk/aspect is subject to legislation that could lead to prosecution
| Review Date | Activity Description | Comments Following Review of Control Measures / Compliance on Site  
(Monitored on site as activity proceeds) | Name of Reviewing Supervisor | Signature |
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Note:
First review date will be undertaken on the first day of the activity with subsequent review dates on a weekly basis or following changes to working methods/conditions resulting in additional risk realisation and control measures.
Confirmation of Risk Assessment & Method Statement Briefing

Prior to commencing the activities covered in this safe system of work document all personnel are to sign below to confirm that a clear briefing explaining the job has been given and is understood:

<table>
<thead>
<tr>
<th>Name</th>
<th>Signature</th>
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Section 1 - Method Statement

1.0 Scope of Work

The purpose of this method statement is to identify a safe system of work and methodology for construction of the segmental drive shaft within the green area of Chelsea Barracks/Park. This shaft will be used as driving pit for micro-tunnelling works. For the location of this worksite refer to attached drawing.

All personnel involved in the operation will be fully briefed on the contents of this document before the works commence.

2.0 Method

2.1 General

For the purpose of this method statement the following items of work will be covered:
- Site mobilisation for both Battersea and Chelsea
- Collar construction
- Shaft sinking
- Base construction
- Confined space arrangements

2.2 Enabling works prior to shaft construction at both Chelsea and Battersea

All the necessary consents will be obtained and approved prior to works starting on site. All the necessary permits and traffic management arrangements will be agreed with the respective stakeholders.

A full perimeter fencing will be erected around both site locations, with 24hr security provided throughout the duration of the works, any early enabling to works will be carried out prior to the main construction and will include:

- Any removal/modifying of existing vegetation, trees will be conducted in agreement with respective stakeholders (i.e. Battersea Park Manager) and the Environment Agency. All provisions for monitoring will be in accordance with the Ecology Report.
- At both site locations, the design will identify the proposed FFL for construction purposes. At Battersea, an additional RAMS will be generated for any ground reduction/reinstatement, specifically identifying the management of the existing Topography.

2.3 Traffic Management

a. All traffic movements will be in accordance with Barhale traffic management plan.

b. Traffic management will be required at the drive shaft locations- access will be in from the round-all and out via adjacent gate. This will be agreed with local Council and Highways and put in place by a competent contractor before work can start on site. Details of the traffic management for individual locations will be attached in separate method statement.
c. All deliveries, collections and plant / vehicle movements take place with minimal disruption, & will be directed to the lorry holding bay & be cross rail compliant.

2.4 Raising a Permit to Dig
Before any excavating can commence the following checks shall be performed to enable the issue of a permit to dig:

a. A scan of the work area by a qualified operative with CAT Scan on passive mode. Both power and radio modes will be used.

b. Review of all drawings containing information on existing buried services.

c. A visual scan of the area to check for cable warning markers, pit covers or any indicators of buried services.

d. Safe Excavation: trial pits/trenches to be hand dug around known buried services in the area of excavation to confirm location/type/depth.

e. Once the above checks have been completed and no services have been identified or located/known services have been clearly marked on site, the permit to dig will be signed by Barhale Buried Services Coordinator.

2.5 Sequence of work

1.1.1. Site set-up

a. Prior to construction, a detailed layout plan will be communicated to the relevant stakeholders identifying any obstructions which need to be removed. Removal of these items will be agreed by all parties and within a suitable timeframe to meet construction activities.

b. Both shaft locations are in a Public Parks and which has high visibility to passing public. Traffic Management will be erected first before any of the work can start.

c. Traffic management to be installed by a competent contractor as agreed with the relevant Council, and will be installed as per traffic management Plan (TMP).

d. Once the traffic management is in place the compound fencing can be installed. This will be expected to be solid hoarding to the road boundary and Heras fencing double clipped and fitted with debris netting to the open ground.

e. Pedestrian and vehicle routes will be segregated and maintained as per the shaft layout drawings.

1.1.2. Collar construction

• Prior to any excavation activities, a watching brief will be on site to monitor for any archeological developments. The ground conditions expected comprise a layer of made ground circa 2m through to alluvium 5m and into river terrace gravels.

• Once the location of the shaft centre has been identified & all services CAT scanned & clearly marked (are cleared of services by hand dug trial holes) out by a site engineer works will commence.

• A circular of steel sheet piles of 4m long will be pre-driven using a Movac type vibrating pile driver. Within this ring excavation will commence to a depth of 2.0m. Excavation will be with a 18t excavator & all
spoil will be be placed into a dumper and removed from the working area; at all times a banks man will be in attendance) and taken directly to tip.

- Once the shaft has been excavated to depth for the construction of the collar & blinding between 75mm to 100mm will be set out and cast to match the circumference of the complete ring. Accuracy of the blinding will be critical to achieve a level base for receiving the cutting edge & segments. It is envisaged this will be kept down 30/40mm to allow for packing. Independent checks are to be carried so that all levels are correct. The centre point will be reestablished and set out.

- A steel (coned) cutting edge will be constructed on the blinding. The initial sections of the cutting edge will be supported by timber props. Each segment of the cutting edge will be placed into position by crane attached to chains and proprietary lifting equipment. Once the entire cutting edge has been constructed it will be self-supporting, it will be checked by an engineer, the edge will have a wedge for later dismantling.

- The first ring will be constructed on the cutting edge. With each segment lifted into position by crane attached to 4-leg chains and proprietary segment lifting fingers. Once placed, each segment will be checked.

- On completion of first ring, polystyrene sheets will be wrapped around the extrados of the ring(s) to provide an annulus between the collar and the rings.

- A Re bar ring & Jacking gallow legs will be installed as per TWD (To be confirmed). This will then be checked & signed off by a competent person.

- The TWD will confirm the strength of the collar before loading (nominally 24hrs).

- Concrete placement to Collar will be via a concrete pump concrete and will be brought up evenly around the ring to avoid causing any deformation. Cubes will be taken for early strength results.

- The hydraulic jacking gallow legs will then be bolted to the sacrificial anchors cast into the concrete-f these are to aid in control of verticality and provide a jacking force to the caisson suitable to the expected loads designed for the collar.

**Sinking the shaft**

- Lower the first ordinary segments with the crane to the ring below with the required ‘T’ bolts hanging downward in the through holes. Note: Other holes are provided for installation using the underpinning method.
• Place supports on the top of each segment to avoid trapped hands as the segment over is lowered into position
• Lower the segments onto supports with the segment center directly above a joint on the ring below
• Locate the ‘T’ bolts into the segments below, turning each clockwise through 90° and pulling upwards to lock them in position. A slot is located at the end of the thread. The slot should be in the correct orientation in the locked position i.e. radial. Insert one number locking wedge into each T box.
• The rings will be back bolted to minimize the risk of falling from height.
• Construct the first top segment as described above with the wide side downwards.
• Lower the second top segment. Tighten the bolts as previously.
• Once the ring is complete The polystyrene will be dissolved by a suitable liquid agent, to be confirmed, around the entire collar, & the annulus filled with a suitable bio degradable polymer (Seajack/Sloop) This will be pumped into the annulus to compensate for the over break caused by the cutting edge
  a. Jacking gallows will be craned into place and through bolts will be connected with sacrificial legs
  b. The hydraulic jacking system is to be installed by a BCS fitter.
  c. The jacking gallows will then be used to push the first ring down. This is to be done carefully so as to ensure that the shaft goes down plum. Levels across shaft will be checked and recorded by engineer after construction of each ring. Lines will be marked on the jacking gallows to be used as benchmarks while sinking shaft.
  d. The foam backing board is to be removed from between the collar and the ring segments. Sloop is to be poured down this space to maintain earth pressure and to lubricate the shaft during sinking.
  e. The lead miner is not to operate the gallows unless he ensures that all the jacks are clear of people, to ensure that no one can be caught by the jacking plate. The jacking plates are to be fixed to the jack to prevent them falling into the shaft
  f. An excavator fitted with telescopic grab will be used to remove the muck. Care is to be taken to ensure that the rate of muck removal does not exceed the sinking rate of the shaft.
  g. Once the first ring has been pushed down evenly the jacks are to be retracted and the next ring constructed. Segments will be lifted into place by crane and connected between them before lifting chain is released
  h. Shaft will be lubricated using a mix of sloop granules and water. If clay is encountered TK50 will be added according to mix specification.
  i. Dig level for shaft will be marked on collar and communicated to lead miner.
  j. Excavated material will be stored on site and removed at regular intervals by a licensed waste carrier.

Under pin section
A. The shaft will continue as a caisson to bed within the clays (4m) and thus create a seal from the river terrace gravels. At this level the shaft will stop, the top rings will be dowelled into the collar and the rings back grouted.

B. The cutting edge will then be removed and the shaft continued by underpinning. An excavator working within the shaft will trim and excavate the spoil, loading into skips (once the pole grab is out of reach) loading into skips that will be hauled to the surface by crane. Spoil will be loaded into road going wagons and taken to tip.

C. The shaft will continue as an underpin for its full depth.

D. Once all the rings have been constructed the shaft will be backgrouted.

E. Below the last built ring an undereamed ‘toe’ will be dug 0.2m past the back of the last ring and (expected to be) 0.75m deep, for the full shaft diameter.

1.1.3. **Base construction**

a. Shaft steel ladder will be installed by using a crane. Ladder sections will be assembled on the top and then lifted into position. An operative wearing clipped harness will drill bolts into shaft segments so that ladder is secured in place. A Rebar cage will be fixed within the shaft base. A hydrotite seal will be glued onto the last ring.

b. Concrete will be poured by using a concrete pump. Finishers will vibrate concrete once is placed in the shaft by using a 2” poker.

c. The Shaft will be back grouted by using grout pan placed on top of the shaft. Grouting guns will be inserted into segments and cement will be mixed and pumped into annulus. Grout level will be checked so it doesn’t go around the temporary rings.
1.1.4. Breakout tunnel eye
a. Tunnel eye will be marked by engineer. A steel jamb frame will be bolted to the shaft eye to span the load onto the shaft segments a drive seal plate will be bolted. Within this the concrete segments will be broken out 2100mm square sections will be cut and removed from central of marked circle.
b. A 2400mm square board will be fixed centred with opening created and 9 x 3 sawn timber will be used to brace it against opposite shaft wall.
c. Rest of concrete will be removed and bolts cut to clear tunnel line of any steel.
d. A shutter will be placed around strut and “letter box” profile will be built on top to allow concrete placing.
e. Concrete will be poured by using a concrete skip and shutter removed. Strut and plywood board will be left in place (surrounded in concrete and removed at letter stage when TBM has reached the reception shaft.

2.6 Confined space procedure
a. All entries to the shaft are to be treated as confined space entries.
b. A Confined Spaces Permit is to be completed by competent person on a daily basis before entering a shaft.
c. A nominated CP2 trained person is to monitor the shaft from the top at all times if operatives are working inside the shaft.

2.7 Equipment required at shaft prior to persons entering shaft :
- 10 Minute BA sets – one per person entering (to be at their disposal whilst in the shaft)
- 30 Minute Rescue Set – to be kept at the top of the shaft
- Resuscitator
- Gas Detector
- Man Rider
- Stretcher – (for crane use)
- Shaft Ladder
- Air Ventilation Fan (if necessary)

Two means of access are to be available at all times. A ladder will be placed by the Top Man when required and made accessible to all personnel involved in this operation. A Man Rider and Stretcher are also to be available and lowered if needed by using the crane.
3.0 Labour Force

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<tr>
<th>Trade</th>
<th>Training</th>
<th>Number</th>
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<tbody>
<tr>
<td>General Foreman</td>
<td>CSCS Accredited, First Aid, Thames Water Passport, CP1, NRSWA,</td>
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<tr>
<td>Excavator Operator</td>
<td>CPCS Accredited</td>
<td>1</td>
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<tr>
<td>Crane Operator</td>
<td>CPCS Accredited</td>
<td>1</td>
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<tr>
<td>Slinger/Signaller</td>
<td>CPCS Accredited</td>
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<tr>
<td>Pipe fitter</td>
<td>CSCS Accredited, Thames Water Passport</td>
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<td>Miners</td>
<td>CSCS Accredited, Thames Water Passport, CP1</td>
<td>2</td>
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<tr>
<td>Top Man</td>
<td>CSCS Accredited, Thames Water Passport, CP2</td>
<td>1</td>
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<tr>
<td>Rescue Team</td>
<td>CSCS Accredited, Thames Water Passport, CP2</td>
<td>From top team</td>
</tr>
<tr>
<td>General Operatives</td>
<td>CSCS Accredited, Thames Water Passport, CP1</td>
<td>2</td>
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<tr>
<td>Engineer</td>
<td>CSCS, First Aid, Crane Supervisor</td>
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4.0 Portable Tools / Equipment

The following portable tools and equipment will be used during these works:

- Submersible pump
- Wacker plate
- Petrol saw
- Electric drill 110V
- Electric grinder 110V
- Various Small Tools

All portable electrical tools shall have a current PAT test and labelled clearly identifying the next test date.

5.0 Plant and Equipment

The following items of mechanical plant will be used during these works:

- 360° Excavator 20T
- 7.5t mini digger
- Loading skips
- Grab Excavator
- Crane
- Compressor
- Jacking gallows and power pack
- Man rider
- Confined space kit
- Grout pan and pump
- Movac
- Concrete pump

6.0 Work Permits and Licenses

The following permits and licenses will be required during the course of this operation:

- Environment Agency Consent
- Permit to dig
- Lifting plan
7.0 Housekeeping

Barhale supervisor will ensure that a good standard of housekeeping is maintained at all times throughout the work. All waste material will be properly segregated and disposed of at the earliest opportunity in accordance with the project site waste management plan. All plant, tools and materials will be properly tidied away and secured at the end of each shift.

Key Points
- Each site will have a respective wheel wash system which will be managed daily by the site team.
- Surface drainage will be managed on a daily basis.
- Any surface lines will be trenched through roads and identified by appropriate signage around site locations

8.0 Control of Work with Hazardous Substances and Processes

8.1 Instructions on the control measures to be implemented when working with the hazardous substances associated with these works are detailed in the referenced relevant COSHH assessments. These include:
- Diesel
- Petrol
- Leptospirosis
- Lubricating fluid (shaft sinking)
- Concrete
- Cement
- Sika 4A

8.2 The contents of the COSHH assessment relevant to each substance will be briefed to the workforce before the start of any operation requiring the use of that substance.

9.0 Storage and Handling of Hazardous Substances and Materials

9.1 All hazardous substances and materials to be used during these works will be stored in accordance with the referenced relevant COSHH assessments and approved storage licenses.

9.2 The appropriate control measures for each substance are detailed in the relevant above referenced COSHH assessment. These control measures, including any additional PPE requirements, will be briefed to the workforce. Storage of hazardous substances and materials will include, where appropriate, bunding and local accessible emergency spill kits.

10.0 Noise and Vibration

10.1 These works will be carried out in strict accordance with an approved section 61 application.

10.2 Notwithstanding the requirements of section 61, all plant and equipment will be operated and maintained in such a way as to reduce or eliminate noise and vibration nuisance. Should any item of plant or equipment generate noise greater than 80dBA, suitable hearing protection will be worn and appropriate noise monitoring measures will be implemented. If the noise level exceeds 87dBA, a hearing protection zone will be implemented.

10.3 Where possible, silenced and/or low vibration plant & equipment will be used throughout the operation.

10.4 A vibration assessment will be carried out on any tools or equipment that is likely to give rise to excessive vibration. Refer to the Appendix for the results of this assessment.
11.0  Air Quality and Dust
11.1 For work that creates excessive dust or impinges on the quality of air all reasonably practicable means will be adopted to reduce poor air quality. Controls will include dampening down areas, cutting and grinding in outside areas and providing an exclusion zone with barriers.
11.2 Appropriate PPE/RPE will be used when air pollution cannot be further reduced and/or there is a hazardous element to the work.

12.0  Waste Management
12.1 All waste will be properly segregated and disposed of in the appropriate bins or skips on site as per Barhale Waste Management Plan.
12.2 Any excess materials not used during the work will be stored in the storage area for later re-use or removal.
12.3 Concrete delivery vehicles will be escorted to the wash down area after their load was discharged, in order to wash out into a suitably lined concrete waste skip.
12.4 All waste will be disposed of to licensed recycling and waste disposal sites.

13.0  Inspection and Environmental Auditing
Barhale health and safety policy requires that regular, on-going inspections and audits be carried out on site. The aim is to ensure that all activities on site comply with current legislation and best practice and to ensure that any deficiencies are noted and rectified at the earliest opportunity. All such inspections are recorded on the appropriate form and the relevant actions followed up as required.

14.0  Records and Documentation
All statutory records are kept in the Barhale site office at:
Swindon

15.0  Manual Handling
15.1 All site operatives will be properly trained in correct manual handling techniques before the works commence.
15.2 See Appendix for manual handling assessments.

16.0  Other Considerations
16.1 Lifting Equipment
An approved Lift Plan will be in place prior to commencement of lifting operations on site.

16.2 Archaeology
An archaeological watching brief is to be employed during the excavation period of the shaft.

16.3 Management of Pests and Weeds
Appropriate measures will be taken to ensure that pests and weeds are not encouraged by the on site works.

16.4 Contaminated Land
If contaminated land is discovered the area should be immediately vacated, warn others in the vicinity and report the matter immediately to the supervisor.
16.5 Protection of Water Quality
All drains adjacent to the worksite will be suitably protected with spill booms and covered as required during operations. Discharge permits will be approved by the relevant authorities prior to starting works on site. Flow meters will be used and testing carried out in compliance with the associated approvals.

17.0 Contingency Plans (Emergency Arrangements)

Emergency numbers will be displayed at each shaft location

17.1 Flood Risk management Plan
TBC - details to be completed during detailed design stage, including trigger levels of monitoring met

17.2 Emergency procedure and fire Plan
TBC - details to be completed during detailed design stage

17.3 Environmental emergency Plan
TBC - details to be completed during detailed design stage

17.4 Health and Safety Emergency Plan

17.5 Rescue plan
TBC - details to be completed during detailed design stage

1.1. PERSONNEL

a. A competent supervisor shall be on site whilst men are working in the shaft or inside the tunnel.

b. A Slinger / Signaller to be in attendance at or near shaft top whilst men are in the shaft.

c. Crane operator to be immediately available whilst men are in the shaft (in or near crane).

d. An adequate number of personnel are to be on site to ensure safe operations under normal works and for any possible emergencies.

1.2. TRAINING

a. All personnel employed to work in the confined space shall be to a minimum of CP1 commensurate level and competent. A minimum of three CP2 trained operators/staff on site will be nominated and form the rescue team.

b. Mobile plant operators must hold a current plant operators training certificate for the category of the equipment being operated. As per Thames Water handbook Section 4.7 - General Information and Guidelines on Health, Safety and Welfare for contractors and subcontractors.

c. Banks man to be formally trained in slinging and signalling.

d. At least one man on site (preferably two) will hold a current First Aid (or Appointed Persons) certificate.

e. A CP2 qualified person will be nominated as Top Man and be available on site whilst men are working inside shafts.
f. All miners are to be trained in the use of the suitable rescue stretcher by the appointed trainer from the suppliers. Toolbox talks will be carried out on a monthly basis which shall include the operating of the stretcher.

1.3. ACCESS/EGRESS

Two available means of access/egress should be maintained or be available. Variations may include any of the following:

Note: This list is not exhaustive

a. Man rider and crane
b. Vertical shaft ladder with landings at no more than 9m intervals
c. Ladder bays and landings with suitable edge protection.

1.4. ACCESS CONTROL

Access and egress will be controlled by a designated/competent person who must be able to account for and be aware of how many men are below ground at all times. Tally boards will be required for deeper shafts and shafts with headings etc. (i.e. when persons are not visible from the surface).

1.5. PLANT AND EQUIPMENT

a. Electrical equipment to be 110 volt where practicable. If other voltages must be used, suitable electrical and physical protection must be provided i.e. residual current devices and armoured cabling.
b. All items of mobile plant that will operate in shafts will carry a dry powder fire extinguisher.
c. All cranes used for the transportation of personnel shall conform to Para 4.4 and 4.7 of Thames Water General Information and Guide on Health, Safety and Welfare for contractors and Subcontractors. Para 21.4.2 and BS 6164; and the Lifting Operation and Lifting Equipment Regulation 1998.
d. All lifting equipment used in the rescue shall conform to all the above requirements.
e. A copy of all statutory documents for equipment present on site shall be available and be checked by Barhale senior member of staff on site. These documents must either be with the equipment or at a nearby site/office.

1.6. SAFETY EQUIPMENT

* These additional items must be provided where the shaft was deemed as a confined space.

a. *Operational gas monitors x1 with x1 spare.
b. CO2 gas monitors x1 with x1 spare if working in chalk.

c. *Oxygen resuscitator

d. Adequate amount of lifting slings appropriate for the work to be undertaken

e. Adequate number of safety harnesses complete with strops/fall arrest systems

f. First aid kit

g. *Adequate number/type of fire extinguishers, suitably positioned and clearly identified

h. Adequate number of self-rescue units commensurate with the number of men working in the shaft

i. *Self-contained breathing apparatus (working sets) should be available and ready for immediate use for the purpose of rescue operations

j. Suitable warning signs will be displayed at or near the shaft top including relevant rescue Procedures.

k. Adequate supplies of PPE will be made available and ready for use

l. *Suitable stretcher to enable casualty removal from inside the shaft

1.7. PROTECTION OF EXCAVATIONS

a. Suitable edge protection of a minimum height of 970mm from ground level with toe boards 150mm and no gap greater than 470mm.

b. If vehicles are likely to get close to the shafts edge protection and adequate strength and/or exclusion areas shall be provided.

c. Shafts should be adequately covered during periods of non-working hours with steel shaft covers or additional line of Hera’s panels around shaft

1.8. VENTILATION

a. Adequate ventilation must be maintained at all times, natural ventilation will be used for shaft construction. Up to 7.5m deep from then on forced (after caisson)

b. Atmospheric monitoring must take place prior to and during working hours in all areas/work places designated as a confined space.

Any change of construction method which will require mechanical ventilation will be covered under a revised method statement.

1.9. COMMUNICATIONS

Communication will be maintained at all times between people working in the shaft and those at the top (surface). This can be by word of mouth or if need be by the use of a proprietary system such as the Mobile comm (radio) System. Mobile phones must be available for communications with the emergency services.

1.10. LIGHTING

a. Sufficient shaft lighting shall be provided.
b. Emergency lighting will be provided as necessary.

1.11. **EMERGENCY RESCUE PROCEDURES GAS ALARM SOUNDING**

Should a gas detector alarm be activated or a miner becomes unconscious the following must happen:

a. Surviving miner working in the same area to put on his self-rescue set first and fit the remaining set to the unconscious operative.

b. The surviving miner must exit the shaft via the access egress points, emergency services will be called at this point by the top man.

c. The top man will then start rescue procedure utilizing the two remaining CP 2 confined space trained operatives.

d. The rescue team will enter the shaft wearing the self-contained breathing apparatus.

e. The top man will use the crane to lower all rescue equipment including a suitable rescue stretcher.

f. The rescue team will enter the shaft, the casualty will be assessed and if required stretcher will be used to lift person out of shaft.

g. Due to the men lifting out the injured person wearing BA sets all crane directions will be done by hand signals.

h. The rescue team will attach the stretcher to the lifting point on the crane the signals will be given to take up the slack. Once this has been done the banks man will take over the lift.

i. The rescue team will now exit the pit bottom using existing means of access.

j. Safe access and egress will be provided for the emergency services.

k. Access near the shaft top must be maintained for emergency vehicles.

1.12. **EMERGENCY RESCUE PROCEDURES NO GAS ALARM SOUNDING**

Should a person sustain an injury or lose consciousness the following must be carried out by the other operative.

a. The top man will be informed there is a problem in the confined space.

b. A second person will be nominated to enter the confined space. This person will be entered on to the confined space entry log by the top man. The person will enter the pit bottom and prepare to receive the rescue equipment.

c. The top man will use the crane to lower all rescue equipment including a suitable rescue stretcher.

Once the equipment has reached the rescue team, the top man will call the emergency services if needed.
d. The casualty will be lifted by both men onto the stretcher using the best ergonomic principles possible.

e. All crane directions will be by hand signals.

f. The rescue team will attach the stretcher to the lifting point on the crane the signals will be given to take up the slack. Once this has been done the banks man will take over the lift.

g. The rescue team will now exit the pit bottom using the means of access.

h. Safe access and egress will be provided for the emergency services.

i. Access to the shaft top must be maintained for emergency vehicles.
Appendix A Manual Handling Assessment

### Manual handling assessment record

**premises / contract:** Wichelstowe  
**assessor:** Chris Badea  
**date:** 07/06/2012

**activity:** Shaft sinking  
**materials to be handled:** Fencing, plywood, fluid containers  
**location:** MH 2, 5, 7, 8

**hazardous contents:** No  
**can manual handling be eliminated:** Yes [] No [x]

---

**Control measures [see overleaf]**
- Use mechanical lifting as first line of address
- Operatives to share loads
- Keep back straight and bend at knees when lifting
## Appendix B HAVS Assessment

### Hand-Arm Vibration Exposure Calculator

<table>
<thead>
<tr>
<th>Vibration magnitude m/s² r.m.s.</th>
<th>Time to reach EAV 2.5 m/s² A(8) time in min</th>
<th>Time to reach ELV 5 m/s² A(8) time in min</th>
<th>Exposure duration hours</th>
<th>Exposure partial exposure m/s² A(8)</th>
<th>Partial exposure points</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

**Notes / Controls:**

- Daily exposure m/s² A(8)
- Total exposure points

**DATE:** 07/06/12

**SITE:** Wichelstowe Trunk Sewer

**OPERATION / OPERATOR:** Braking concrete/tarmac

**Time to reach EAV:**
- 2.5 m/s² A(8) time in min
- 5 m/s² A(8) time in min

**Exposure duration hours:**
- Partial exposure m/s² A(8)
- Partial exposure points

**Partial exposure details:**
- Time i exposure m/s² A(8)
- Partial exposure points