



Wokingham Major Highways Programme - South Wokingham Distributor Road (SWDR) - Spine Road and Western Gateway Phase 1 (SRWG1)

**Thames Water Bespoke Manhole TWS01 -
Approval in Principle
WMHP-TG-WOFTR-RP-SE-2501**



Balfour Beatty

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Wokingham Borough Council

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1. PROJECT DETAILS

Name of Project: Wokingham Major Highways Project – South Wokingham Distributor Road (SWDR)
Name of Structure: Thames Water Bespoke Manhole TWS01
OS Grid Reference: (E) 482340.47 (N) 167927.00

2. HIGHWAY DETAILS

2.1. Type of highway

Over: N/A

Under: N/A

2.2. Permitted traffic speed

N/A

2.3. Existing restrictions

N/A

3. SITE DETAILS

3.1. Obstacles crossed

The proposed manhole will provide access to the proposed re-aligned Thames Water (TW) sewer.

4. PROPOSED STRUCTURE

4.1. Description of structure and design working life

As part of the proposed South Wokingham Distributor Road (SWDR) works two existing 1200mm diameter TW surface water sewers require diverting to facilitate the construction of the SWDR. The two existing sewers both outfall into a ditch immediately south of the railway embankment (refer to as-built records in Appendix E). The proposed diversion will take these sewers (arranged orthogonally to each other) via a new bespoke manhole¹ (TWS01), the subject of this AIP, and continue them as 2 no. 1200 diameter outlet pipes for circa 514m and 497m in length. The outlet pipes will run parallel to each other and the railway embankment until they reach Easthampstead Road where they turn to a southerly direction, crossing under the road, continuing south and eventually discharging into a new attenuation pond within the “SANG” (Suitable Alternative Natural Greenspace), a newly created parkland area.

TWS01 is proposed to be a bespoke rectangular manhole consisting of four walls, a base slab and cover slab. It is proposed to be formed from precast reinforced concrete sections either as individual panels to be assembled on site, such as the “Flat Pack” system by Marshalls CPM or other similar modular or monolithic system such as “Stormchamber” by FP McCann, who offer both a panel-based system or segmental rectangular “ring” sections, similar to conventional circular manhole rings. For the purposes of this AIP, the “Flat Pack” system by Marshalls CPM is described.

The proposed internal plan dimensions of the chamber are 4.5m by 3m, with an internal height of 3.9m. The panels are to be bolted together at the corners into cast-in threaded sockets, with a pre-fitted watertight seal at the joint locations. The larger panels might need to be divided into two, depending on final mould arrangement, transportable sizes and available lifting plant / craneage on site. Where they are divided, the Flat Pack system provides for jointing via a proprietary structural tying system consisting of 2 “Peikko” panel connectors with reinforcement bar threaded down the connecting loops (see Figure 1).

A precast reinforced concrete cover slab spanning in two directions between the four walls of the chamber will be bolted to the manhole walls via a dowel bar. The cover slab will include a 1200mm x 900mm opening with ductile iron frame and cover to provide maintenance access via steps (connected to the wall) to a landing area formed by the internal benching.

The internal benching and channels are proposed to be formed in-situ with mass concrete using a proprietary formwork system such as Ant Hire’s “Vertform” or equivalent. The dimensions and falls will be in accordance with Water UK’s Sewerage Sector Guidance Appendix C (2021, version 2.1) *‘Design and Construction Guidance for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England (“the Code”)*’ (also known as Ofwat’s “Adoption Codes”).

Access to the channel can be gained via in toe holds cast into the channel wall. The landing areas/ walkways within the mass concrete base will accommodate handrails and a safety chain to provide safe access to the channels for personnel.

The design working life of the structure is as follows:

- ≥ 120 years for main structural elements (Design working life category 5; BD 100/16, Table A.1).
- Up to 50 years for replaceable structural parts, e.g. handrails, chains, steps (Design working life category 2, BD 100/16, Table A.1).

4.2. Structural type

The chamber is proposed to be formed of precast reinforced concrete panels with the wall panels connected together via bolts into cast-in threaded sockets, forming a pinned frame in plan. Where required, these panels will be provided in two parts, with an in-situ concrete stitch between panels (Figure 1). The four walls will sit on top of shims on a precast base slab with a perimeter recess to provide a “key” for the walls. The gap between the walls and base slab is grouted with structural proprietary grout. The cover slab will be dowelled into the four

supporting walls and together with the base slab will provide lateral restraint to the walls. The internal mass concrete benching / channels will further provide restraint to create an overall stable structure.

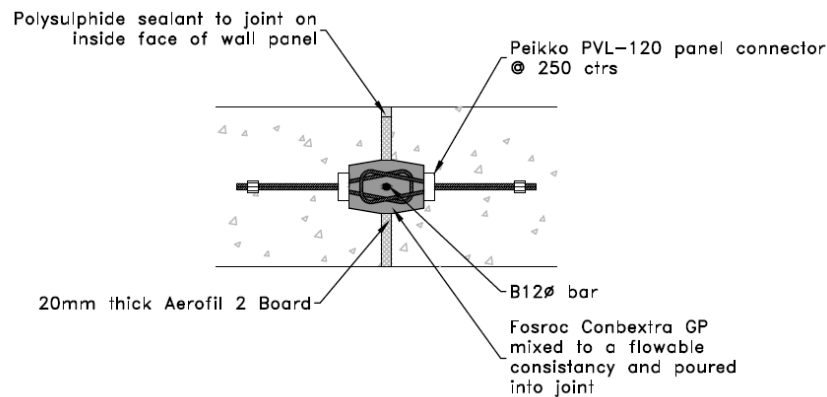


Figure 1. Typical joint detail in jointed panels (Source: Marshalls CPM)

The cover slab will be two-way spanning, simply supported on all four sides by the box culvert walls.

4.3. Foundation type

The precast chamber walls are to be founded on a precast concrete base slab. This base slab is proposed to bear directly onto a nominal 300mm thick compacted granular bedding with a thin sharp sand / cement mix screed layer for levelling purposes.

4.4. Span arrangements

The clear spans of the cover slab (two-way spanning) will be 3m and 4.5m, allowing for a 1.2x0.9m access opening.

4.5. Articulation arrangements

The cover slab will be dowelled to the walls to mitigate uplift when it is loaded, although it will be simply supported on 4 edges. The cover slab will be seated on a nominal 10mm bed of mortar.

The 4 walls are bolted together forming a pinned frame in plan. There will be no physical connection between the walls and the base slab, although the interface will be grouted.

4.6. Classes and levels

Classes and levels below are in accordance with BS EN 1990:2002, the National Annex and BD 100/16 of the DMRB.

4.6.1. Consequence class

CC2 to BS EN 1990:2002+A1:2005 and BD100/16

4.6.2. Reliability class

RC2 to BS EN 1990:2002+A1:2005 and BD100/16

4.6.3. Inspection level

IL2 to BS EN 1990:2002+A1:2005 and BD100/16

4.7. Road restraint systems requirements

1.0m high proprietary galvanised steel tube and fitting ("Kee Klamp") pedestrian guardrails will be provided along the walkways and anchored within the mass concrete base.

4.8. Proposed arrangements for future maintenance and inspection

4.8.1. Traffic management

For routine inspections, it is not anticipated that traffic management will be needed as the TWS01 manhole is located off the public road.

4.8.2. Arrangements for future maintenance and inspection of structure. Access arrangements to structure

Vehicular access to the chamber will be provided by an access track leading off the existing Easthampstead Road (see general arrangement drawing in Appendix C).

Personnel access into the chamber is provided via an access of internal dimensions 1.2 x 0.9m to permit more ventilation and facilitate better access / egress during emergency rescue if that scenario should arise. Stepped access will be provided to the landing within the chamber and will consist of Type D - Class 1 steps in accordance with the requirements of BS EN 13101, as per the Sewerage Sector Guidance Appendix C. The landing will have handrails and a safety chain across the opening, which leads to toe holds for access into the channel, should this be required.

4.9. Environmental and sustainability

The adoption of the solution utilising precast concrete was aided by its environmental and sustainability benefits, these include:

- Precast concrete mixes usually use cement replacement products to achieve the high strength needed for early demoulding, whilst also improving durability against potential aggressive ground conditions. The replacements reduce the amount of embodied energy and carbon in the concrete.
- Utilising precast concrete provides a higher quality finish and therefore durability as the units are cast in the factory under controlled environments.
- The improved durability reduces maintenance requirements providing a low maintenance solution with lower whole life costs. There should be no need to ever replace the main chamber structural panels.

- At the end of its design life, the concrete may be crushed and re-used as aggregate in new concrete or elsewhere.
- Utilising a precast solution is considered quicker than conventional in-situ methods, thereby reducing the social impact /disruption.

4.10. Durability, Materials and finishes

4.10.1. Durability and materials

Mass Concrete

The mass concrete forming the benching and channels will be GEN 3 in accordance with BS 8500-1 and BS EN 206-1, as per Sewerage Sector Guidance Appendix C. The “high strength concrete” topping will be in accordance with E4.3 of the Sewerage Sector Guidance Appendix C to BS 8204-2.

Structural Concrete

Concrete classes will be as indicated in Table 1.

Table 1. Structural Concrete

Structural Element	Min. Compressive Strength Class	Surface	Exposure Class		
			XC	XD	XF
All elements	C40/50	All faces	XC3/4	XD2*	XF3
		*or DC-3, whichever governs			

Notes:

- Concrete strengths are recommended minimum concrete strengths for durability, The precast manufacturer may choose to use a higher strength for early demoulding / handling
- All concrete mixes will be in accordance with the requirements of MCHW, Vol. 1 Specification for Highway Works, Series 1700.

Reinforcement Steel

Ribbed bars grade B500B or B500C to BS EN 10080:2005 and BS 4449:2004.

Steps

Galvanised mild steel with plastic encapsulation to BS 13101.

Waterproofing to buried surfaces

Two coats of cut-back bitumen or equivalent to SHW clause 2004 (applied to all outside faces).

Handrails / guardrails

Grade HFW2 steel tubes to BS EN 10255; grade S275 steel plates to BS EN 10025-2 (base plates) all hot dip galvanised to BS EN ISO 1461

Safety Chains

Medium tolerance chain to BS EN 818-3 Grade 4, hot dip galvanised to BS EN ISO 1461

Bolts, washers and cast-in wavy tail sockets (for "Flat Pack" system)

Grade A2-70 stainless steel

4.10.2. Finishes

The surface finish to concrete will be in accordance with BS EN 13369, consistent with the requirements in SHW 1700 and NG 1700). These will be:

Table 2. Concrete surface finishes

Surfaces	Element	Finish
Unformed	Depending on the precast mould, the unformed face will vary. It is anticipated the main faces will be formed, whilst edges unformed	U2
Formed	Top and soffit of cover slab and base slab, inside and outside faces of walls	F2

4.11. Risks and hazards considered for design, execution, maintenance and demolition. Consultation with and/or agreement from Principal Designer. Appointment of Principal Designer.

4.11.1. Construction phase

A register of hazards to be maintained during the design process as a live document is presented in Appendix D. A few of the significant hazards are listed below together with appropriate mitigating measures intended to reduce the risks. Refer to Appendix D for further risks and details:

Lifting Operations

The precast panels that form the culvert chamber and the cover slab will be manufactured and delivered to site as monolithic units. Suitable lifting arrangements will be required to be designed by the temporary works designer / appointed person under Lifting Operations and

Lifting Equipment Regulations 1998 (LOLER) and in accordance with the manufacturer's instructions and constraints.

Unexploded Ordnance

A pre-desk study assessment of the Spine Road and Western Gateway site by Zetica (29th August 2017, filename "Zetica PDS") has concluded:

"no readily available records of bombing or other significant military activity on the site have been found", and that "the site is likely to have a low UXO hazard level".

Although, the risk is small, there is still a risk and the contractor will be notified of this risk that they need to consider commissioning further UXO surveys / scans as necessary prior to construction.

Striking Services

C2 search results indicated no existing services in the area of the proposed manhole. Given the remote location of the manhole, it is considered a low probability that there will be any services, however the contractor should be made aware that a survey, check and scan of underground utilities is to be undertaken prior to any works, with hand digging to confirm prior to construction.

There is a proposed new 132kV EHV cable north of the proposed TW chamber. Based on the currently known programme for construction, it is likely the manhole and diverted sewer will be constructed before the EHV is diverted from its current overhead position (located approximately 65m south of the proposed TWS01 manhole) to the new underground alignment north of the proposed diverted sewer and TWS01 manhole. In any case it is recommended that the proposed sewer and the TWS01 manhole are constructed prior to the installation of this new cable.

Managing ground water

A trial pit (TP006) was undertaken in November 2020 at the location of the proposed chamber. It was excavated to a depth of 1.5m below ground level into the Head Deposits, described as a sandy clay with cobbles and gravel, to a termination level of 53.42maOD where no groundwater was encountered. Another trial hole (TP014) located approximately 467m southwest of TP006 was dug to a depth of 2m below ground level into the London Clay layer, where water was encountered at 1.9m depth. The founding level of the proposed chamber will be 52.97maOD whilst the bottom of the granular bedding will be a minimum 300mm below, therefore approximately 0.75m deeper than TP 006.

There is therefore a possibility that ground water is encountered during construction of the chamber, and the contractor will need to consider possible groundwater management measures, such as pumping or isolation methods (for example cofferdam).

The Principal Contractor and Principal Designer will coordinate to identify any further risks, where not listed already.

Balfour Beatty Civil Engineering Limited are appointed as both Principal Contractor and Principal Designer. The appointed contact person is:

Gosia Barclay - 07773 963590

4.11.2. Inspection and Maintenance phase

Access for maintenance and inspection is as described in section 4.8.2. The main risk associated with inspection and maintenance is:

Confined space working

The chamber is classified as a confined space with a key risk of asphyxiation / loss of consciousness. A site specific risk assessment for working in a confined space will need to be undertaken and only qualified / trained and experienced personnel must enter the chamber to undertake maintenance activities. Such assessment will need to include for an emergency evacuation / rescue plan. The cover frame opening is proposed to be 1.2 x 0.9m to increase ventilation and improve access / egress in the case of emergency rescue being needed. It is envisaged that the injured personnel would need to be winched out.

The act of planning, entering and working safely within confined spaces will need to be in accordance with The Confined Spaces Regulations, guided by Thames Water's 'Guide to planning entering and working safely in confined spaces'.

4.12. Estimated cost of proposed structure together with other structural forms considered (including where appropriate proprietary manufactured structure), and the reasons for their rejection (including comparative whole life costs with dates of estimates)

The proposed "Flat Pack" system manhole has been quoted (chamber only) at £55,165. Other precast chamber options (from other manufacturers) are envisaged to give similar costs.

Precast box culvert units

The initial option considered casting conventional benching at excavation level then placing precast box culvert units on top acting as manhole rings, closed off with a bespoke precast cover slab, all very similar to conventional manhole construction. This option would reduce the amount of precasting but has a disadvantage that conventional formwork would need to be assembled in the excavation, which might be subject to groundwater ingress, to cast the benching / channels. The formwork would have to remain in place until the concrete has reached sufficient strength, before demoulding and lifting it out in panels. The overall length of construction and working inside the excavation would be higher and it was therefore considered this option was not as safe, or economical as the current proposed option, which effectively uses the flat pack chamber walls as outer formwork for the benching. Using box culvert sections as manhole rings also limits options for optimal sizing due to limited availability of sizes. For these reasons, this option was rejected.

Cast in-situ manhole

This option would achieve a similar result to the current proposed option, except that precasting would largely be replaced with cast in-situ. There are no real advantages of this option mainly because the construction time would be significantly increased with reinforcement fixing in addition to formwork construction prior to casting the concrete. Given also the increased risk of groundwater / flooding in the excavation, this option was rejected.

It is envisaged the cost this option would be higher than the precast options and because in-situ concreting generally achieves a lower quality finish than precast which is undertaken in controlled yard conditions, the durability of the structure could be lower, thus potentially increasing whole life costs.

4.13. Proposed arrangements for construction

4.13.1. Construction of structure

The following sequence is assumed:

1. Scan area for buried services.
2. Excavate to founding level, place granular bedding layer and compact, followed by final sand / cement screed layer to achieve level surface.
3. Lift concrete base slab onto granular bedding
4. Lift precast concrete wall panels onto base slab , temporarily holding each panel in place with temporary propping (to be designed by competent temporary works designer in accordance with manufacturer's instructions).
5. Bolt wall panels together. Grout up gap between wall panels and base slab. Cast in-situ stitch sections in jointed wall panels (Peikko connectors).
6. Position inlet and outlet culverts/pipes through wall panel holes and onto granular bedding, then grout up annular gaps.
7. Backfill around pipes and chamber walls.
8. Construct benching / channels inside chamber and install guardrail / safety chain.
9. Lift in precast cover slab and connect to wall panels with dowels. Grout in dowels.
10. Construct seating ring (precast or 1 course of bricks) and install cover frame.
11. Complete backfill to finished ground level.

4.13.2. Traffic management

No traffic management is required for constructing the chamber as the site is remote from the existing local road network. There may be a requirement for traffic management for the access and egress of plant from site, for example a crane; the access routes are to be planned by the Contractor as part of the wider scheme.

4.13.3. Service diversions

The C2 searches for the scheme have reported that there are no services within the vicinity of the proposed footbridge which will be affected or require diversion. The 132kV EHV overhead electricity lines will be diverted underground as part of the Spine Road and SWDR scheme. This will likely happen in the future after the Spine Road scheme and this TWS01 manhole and connecting sewer diversion is constructed.

4.13.4. Interface with existing structures

To construct the proposed chamber, part of an existing 1200mm diameter TW pipe and its headwall / weir will need to be demolished and removed. New sections of short (butt and spigot) pipes (acting as rocker pipes) will need to connect onto the existing TW pipes to form the inlets to the proposed manhole.

5. DESIGN CRITERIA

5.1. Actions

5.1.1. Permanent actions

Permanent actions will be in accordance with BS EN 1991-1-1:2002 as modified by the accompanying UK National Annex. The material densities assumed for the design are summarised in Table 3.

Table 3. Material densities

Material	Density (kN/m ³)
Mass concrete	24
Reinforced concrete	25
General backfill	20

Actions associated with backfill will be applied in accordance with EN 1997 and PD 6694-1.

5.1.2. Snow, Wind and Thermal actions

Snow loading will be ignored in accordance with BS EN 1991-1-3:2003 Clause NA.4.1.1, as accumulation of any material quantity of snow will by inspection not be critical compared with vehicular loading (see 5.1.7).

Wind actions will be ignored as it is a buried structure.

Thermal actions will be ignored as it is a buried structure not exposed to thermal radiation.

5.1.3. Actions relating to normal traffic under AW regulations and C&U regulations

None. The chamber is not situated under a highway.

5.1.4. Actions relating to General Order traffic under STGO regulations

None. The chamber is not situated under a highway.

5.1.5. Footway or footbridge variable actions

A uniformly distributed load in accordance with clauses 5.3 and 5.5 of BS EN 1991-2 will be considered for the design. This is to account for general maintenance loads.

5.1.6. Actions relating to Special Order traffic, provision for exceptional abnormal indivisible loads including location of vehicle track on deck cross-section

None.

5.1.7. Accidental actions

Although removable bollards are proposed adjacent to the maintenance access track, these are not considered permanent obstacles to prevent a vehicle driving over the chamber. Therefore accidental presence of vehicles will be considered in accordance with clause 5.6.3 of BS EN 1991-2 and clause NA2.43. This stipulates an accidental vehicle with 2 axles, 65kN and 115kN respectively, spaced 3m apart. Due to only a nominal depth (~225mm) of fill on top of the cover slab, and its possible accidental removal, wheel load dispersion through the fill will be ignored for the analysis.

5.1.8. Action during construction

The precast manufacturer will need to consider construction loads during the de-moulding and handling stages.

The precast chamber walls, base slab and cover slab will be designed to be lifted via dedicated anchor points. This will be checked for load effects under self-weight.

Pressures exerted on the structure from compacting the backfill surrounding the chamber will be considered in accordance with the limits given in SHW 600 series.

5.1.9. Any special action not covered above

For surcharge loading causing horizontal pressures, clause NA2.34 in the NA to BS EN 1991-2 will be considered with a 4 axle vehicle in accordance with Figure NA.6, representing loading from normal traffic. With the 1.5 overload factor this equates to a 48T vehicle.

5.2. Heavy or high load route requirements and arrangements being made to preserve the route, including any provision for future heavier loads or future widening

Not applicable.

5.3. Minimum headroom provided

Minimum clearance of 2.03m will be provided from the top of benching / landing to the soffit of cover slab. The overall internal height of the chamber is proposed to be 3.92m.

5.4. Authorities consulted and any special conditions required

Authorities that have been or will be consulted during the preliminary phase of the scheme include:

- Wokingham Borough Council (WBC)
- Thames Water (TW). TW have accepted a S104 adoption application made by WSP, dated 14/08/2020 (see Appendix F)

5.5. Standards and documents listed in the Technical Approval Schedule

See Appendix A for the TAS.

5.6. Proposed Departures relating to departures from standards given in 4.5

None

5.7. Proposed Departures relating to methods for dealing with aspects not covered by standards in 4.5

None.

6. STRUCTURAL ANALYSIS

6.1. Methods of analysis proposed for superstructure, substructure and foundations

6.1.1. Superstructure, substructure and foundation

The cover slab, chamber walls and base slab is proposed to be analysed using a linear elastic analysis 3D shell model. This is to be decided by the proprietary manhole manufacturer based on their established design / analysis methods for their proprietary manhole system.

Earth pressures and surcharge loading will be modelled in accordance with recommendations in PD 6694-1.

Accidental traffic loading and pedestrian loading will be applied separately onto a separate simply supported cover slab model (see Appendix B).

6.2. Description and diagram of idealised structure to be used for analysis

See Appendix B for idealised diagrams.

6.3. Assumptions intended for calculation of structural element stiffness

Member properties will be based on uncracked gross section properties for the analysis.

6.4. Proposed range of soil parameters to be used in the design of earth retaining elements

The geotechnical design will be undertaken based on the following parameters (Table 4) derived from the Ground Investigation reported in document reference D0006-20 (see 7.4):

Table 4. Soil parameters

Material	γ [kN/m ³]	c_u [kPa]	ϕ'_k [°]	c'_k [kPa]
Selected general backfill (Class 2)	20	50	24°	0
Head Deposits	18	30	25	0
London Clay	19	40	24	0

Moderately conservative values have been chosen at this stage to allow a broad range of materials to be considered during detailed design and in order not to unduly limit opportunities for sustainable design. These values will be reviewed prior to detailed design and will be stipulated in the Series 600 specification appendices, on drawings and confirmed within the GDR, once completed.

7. GEOTECHNICAL CONDITIONS

7.1. Acceptance of recommendations of the Geotechnical Design Report to be used in the design and reasons for any proposed changes

The Ground Investigation Report (GIR) and Geotechnical Design Report (GDR) covering design of this manhole is not yet available. The Geotechnical Design Report will be produced following detailed design.

7.2. Summary of design for highway structure in the Geotechnical Design Report

The Geotechnical Design Report will be produced at detailed design stage, as per the requirements of HD22/08. Geotechnical design will include:

- Bearing capacity verification of chamber

In advance of the GDR, the design will be based on the parameters in section 6.4 and Table 5 (see 7.4 for source), showing the geological sequence based on existing ground investigation data at the chamber location as well as the vicinity

Table 5. Preliminary geological stratigraphy

Stratum	Elevation (m AOD)		Thickness [m]	Description
	From	To		
Made Ground / Topsoil	54.9	54.5	<1.0m	Very soft dark brown slightly sandy gravelly sandy clay
Head	54.5	50.8	3.7	Soft orangish brown slightly sandy gravelly clay
Weathered London Clay	50.8	-	Unconfirmed	Slightly sandy clay

7.3. Differential settlement to be allowed for in the design of the structure

Given the relatively small plan area of the proposed manhole and that there will be a minimum of 300mm compacted granular bedding it is not anticipated any significant differential settlement would occur. Differential settlement will therefore not be considered in the structural analysis.

7.4. If the Geotechnical Design Report is not yet available, state when the results are expected and list the sources of information used to justify the preliminary choice of foundations

Targeted ground investigation was scheduled to inform the design of the manhole as well as the rest of the proposed sewer diversion. The ground investigation results are available from the following report:

- Geotechnics (October 2018): South Wokingham Distributor Road – Spine Road and Western Gateway – Factual Report on Ground Investigation. Document ref. PC187196
- Socotec (February 2021): South Wokingham Distributor Road - Spine Road And Western Gateway Phase 1, Wokingham – Factual Report on Ground Investigation. Document ref.. D0006-20

The Geotechnical Design Report will be produced at the detailed design stage.

8. CHECK

8.1. Proposed Category and Design Supervision Level

Category 1, DSL2

8.2. If Category 3, name of proposed Independent Checker

N/A

8.3. Erection proposals or temporary works for which Types S and P Proposals will be required, listing structural parts of the permanent structure affected with reasons

Temporary propping will be required for the wall panels before they are bolted together. As this is part of the proprietary manhole manufacturer's inherent system, this will already have been accounted for in terms of any detrimental effects on the permanent works. A Type S proposal will therefore not be required.

Type P proposals are not envisaged as there will be no public interface or potential effects on public assets. This and possible Type S proposals will, however, need to be reviewed at construction planning stage depending on final construction method / sequencing and plant proposed to construct.

9. DRAWINGS AND DOCUMENTS

9.1. List of drawings (including numbers) and documents accompanying the submission

Drawing Number	Drawing Title
WMHP-TG-SRWG1-DR-DD-2500	Thames Water Culvert Bespoke Manhole TWS01 General Arrangement Sheet 1
WMHP-TG-SRWG1-DR-DD-2501	Thames Water Culvert Bespoke Manhole TWS01 General Arrangement Sheet 2

10. THE ABOVE IS SUBMITTED FOR ACCEPTANCE

Signed:  Digitally signed by
Ken Lam
Location: Esher

Name: Ken Lam

Design Team Leader

Engineering Qualifications: MEng CEng MICE MCIHT

Name of Organisation: Tony Gee and Partners LLP

Date: 26/08/21

11. ~~THE ABOVE IS REJECTED/AGREED SUBJECT TO THE AMENDMENTS AND CONDITIONS SHOWN BELOW~~**

** As Thames Water are the adopting organisation under a Section 104 agreement, this AIP has been reviewed and comments provided by WBC's TAA on a due diligence basis only, considering the interests of WBC and any public / personnel that may have access to the area above the structure.

Signed:  Digitally signed by Pell,
Brendon (UKRBP600)
DN: cn=Pell, Brendon
(UKRBP600), ou=Active,
email=Brendon.Pell@wsp.com
Date: 2021.09.10 14:32:17
+01'00'

Name: Brendon Pell

Position held: Associate at WSP (acting on behalf of WBC)

Engineering Qualifications: BEng (Hons) CEng MICE

TAA: Wokingham Borough Council

Date: 10th September 2021

Appendix A – Technical Approval Schedule (TAS)

All documents are taken to include revisions current as of 5th February 2018:

Eurocode part	Title	Amendment / Corrigenda	
Eurocode 0	Basis of structural design		
BS EN 1990:2002 +A1:2005	Eurocode 0: Basis of structural design	+A1:2005 Incorporating corrigenda December 2008 and April 2010	See BD100 Annex A for additional guidance.
NA to BS EN 1990:2002 + A1:2005	UK National Annex to Eurocode 0 Basis of structural design	National Amendment No.1	See BD100 Annex A for additional guidance.
Eurocode 1	Actions on structures		
BS EN 1991-1-1:2002	Eurocode 1: Actions on structures. General Actions. Densities, self- weight, imposed load for buildings	Corrigenda December 2004 and March 2009	
NA to BS EN 1991-1- 1:2002	UK National Annex to Eurocode 1: Actions on structures. General Actions. Densities, self-weight, imposed load for buildings	-	
~~BS EN 1991-1-3:2003~~ ~~+A1:2015~~	~~Eurocode 1: Actions on structures.~~ ~~General Actions. Snow loads~~	~~+A1:2015~~ ~~Incorporating~~ ~~corrigenda~~ ~~December 2004~~ ~~and March 2009~~	
~~NA to BS EN 1991-1- 3:2003+A1:2015~~	~~UK National Annex to Eurocode 1:~~ ~~Actions on structures. General~~ ~~Actions. Snow loads~~	~~+A1:2015~~ ~~Incorporating~~ ~~corrigendum No.1~~	
~~BS EN 1991-1-4:2005~~ ~~+A1:2010~~	~~Eurocode 1: Actions on structures.~~ ~~General Actions. Wind actions~~	~~+A1:2010~~ ~~Corrigenda July~~ ~~2009 and January~~ ~~2010~~	
~~NA to BS EN 1991-1- 4:2005 + A1:2010~~	~~UK National Annex to Eurocode 1:~~ ~~Actions on structures. General~~ ~~Actions. Wind actions~~	~~National~~ ~~Amendment No.1~~	
~~BS EN 1991-1-5:2003~~	~~Eurocode 1: Actions on structures.~~ ~~General Actions. Thermal actions~~	~~Corrigenda~~ ~~December 2004~~ ~~and March 2009~~	
~~NA to BS EN 1991-1- 5:2003~~	~~UK National Annex to Eurocode 1:~~ ~~Actions on structures. General~~ ~~Actions. Thermal actions~~	~~-~~	
BS EN 1991-1-6:2005	Eurocode 1: Actions on structures. General Actions. Actions during execution	Corrigenda July 2008, November 2012 and February 2013	

NA to BS EN 1991-1-6:2005	UK National Annex to Eurocode 1: Actions on structures. General Actions. Actions during execution	-	
~~BS EN 1991-1-7:2006~~ +A1:2014	~~Eurocode 1: Actions on structures. General Actions. Accidental actions~~	+A1: 2014 Corrigendum February 2010	
~~NA+A1 to BS EN 1991-1-7:2006~~ +A1:2014	~~UK National Annex to Eurocode 1: Actions on structures. Part 1-7: Accidental actions~~	+A1:2014 Incorporating corrigenda August 2014 and November 2015	See BD100 for additional guidance.
BS EN 1991-2:2003	Eurocode 1: Actions on structures. Traffic loads on bridges	Corrigenda December 2004 and February 2010	See BD100 Annex A for additional guidance.
NA to BS EN 1991-2:2003	UK National Annex to Eurocode 1: Actions on structures. Traffic loads on bridges	Corrigendum No.1	See BD100 Annex A for additional guidance.
Eurocode 2	Design of concrete structures		
BS EN 1992-1-1:2004 + A1:2014	Eurocode 2: Design of concrete structures – Part 1-1: General rules and rules for buildings	Incorporating corrigendum January 2008, November 2010 and January 2014	
NA + A2:2014 to BS EN 1992-1-1:2004 + A1:2014	UK National Annex to Eurocode 2: Design of concrete structures – Part 1-1: General rules and rules for buildings		
BS EN 1992-2:2005	Eurocode 2: Design of concrete structures – Part 2: Concrete bridges – Design and detailing rules	Corrigendum July 2008	
NA to BS EN 1992-2:2005	UK National Annex to Eurocode 2: Design of concrete structure – Part 2: Concrete bridges – Design and detailing rules	-	
~~BS EN 1992-3:2006~~	~~Eurocode 2: Design of concrete structures – Part 3: Liquid retaining and containment structures~~	-	
~~NA to BS EN 1992-3:2006~~	~~UK National Annex to Eurocode 2: Design of concrete structure – Part 3: Liquid retaining and containment structures~~	-	
Eurocode 3	Design of steel structures		
BS EN 1993-1-1:2005 + A1:2014	Eurocode 3: Design of steel structures – Part 1-1 General rules and rules for buildings	Corrigenda February 2006 and April 2009	

NA + A1:2014 to BS EN 1993-1-1:2005 + A1:2014	UK National Annex to Eurocode 3: Design of steel structures – Part 1-1 General rules and rules for buildings	-	
~~BS EN 1993-1-3:2006~~	~~Eurocode 3: Design of steel structures – Part 1-3 General rules – Supplementary rules for cold-formed members and sheeting~~	Corrigendum November 2009	
~~NA to BS EN 1993-1-3:2006~~	~~UK National Annex to Eurocode 3: Design of steel structures – Part 1-3 Supplementary rules for cold-formed members and sheeting~~	-	
~~BS EN 1993-1-4:2006~~	~~Eurocode 3: Design of steel structures – Part 1-4 General rules – Supplementary rules for stainless steels~~	-	
~~NA to BS EN 1993-1-4:2006~~	~~UK National Annex to Eurocode 3: Design of steel structures – Part 1-4 Supplementary rules for stainless steels~~	-	
~~BS EN 1993-1-5:2006~~	~~Eurocode 3: Design of steel structures – Part 1-5 Plated structural elements~~	Corrigendum April 2009	
~~NA to BS EN 1993-1-5:2006~~	~~UK National Annex to Eurocode 3: Design of steel structures – Part 1-5 Plated structural elements~~	-	
~~BS EN 1993-1-6:2007~~	~~Eurocode 3: Design of steel structures – Part 1-6 Strength and stability of shell structures~~	+ A1:2017 Amendment No. 1	
~~BS EN 1993-1-7:2007~~	~~Eurocode 3: Design of steel structures – Part 1-7 Plated structures subject to out of plane loading~~	Corrigendum April 2009	
BS EN 1993-1-8:2005	Eurocode 3: Design of steel structures – Part 1-8 Design of joints	Corrigenda December 2005, September 2006, July 2009 and August 2010	
NA to BS EN 1993-1-8:2005	UK National Annex to Eurocode 3: Design of steel structures – Part 1-8 Design of joints	-	
~~BS EN 1993-1-9:2005~~	~~Eurocode 3: Design of steel structures – Part 1-9 Fatigue~~	Corrigenda December 2005, September 2006 and April 2009	
~~NA to BS EN 1993-1-9:2005~~	~~UK National Annex to Eurocode 3: Design of steel structures – Part 1-9 Fatigue~~	-	

~~BS EN 1993-1-10:2005~~	~~Eurocode 3: Design of steel structures — Part 1-10 Material toughness and through thickness properties~~	~~Corrigenda December 2005, September 2006 and March 2009~~	
~~NA to BS EN 1993-1-10:2005~~	~~UK National Annex to Eurocode 3: Design of steel structures — Part 1-10 Material toughness and through thickness properties~~	~~-~~	
~~BS EN 1993-1-11:2006~~	~~Eurocode 3: Design of steel structures — Part 1-11 Design of structures with tension components~~	~~Corrigendum April 2009~~	
~~NA to BS EN 1993-1-11:2006~~	~~UK National Annex to Eurocode 3: Design of steel structures — Part 1-11 Design of structures with tension components~~	~~-~~	
~~BS EN 1993-1-12:2007~~	~~Eurocode 3: Design of steel structures — Part 1-12 Additional rules for the extension of EN 1993 up to steel grades S 700~~	~~Corrigendum April 2009~~	
~~NA to BS EN 1993-1-12:2007~~	~~UK National Annex to Eurocode 3: Design of steel structures — Part 1-12 Additional rules for the extension of EN 1993 up to steel grades S 700~~	~~-~~	
~~BS EN 1993-2:2006~~	~~Eurocode 3: Design of steel structures — Part 2 Steel bridges~~	~~Corrigendum July 2009~~	
~~NA + A1:2012 to BS EN 1993-2:2006~~	~~UK National Annex to Eurocode 3: Design of steel structures — Part 2 Steel bridges~~	~~+ A1:2012~~	
~~BS EN 1993-5:2007~~	~~Eurocode 3: Design of steel structures — Part 5 Piling~~	~~Corrigendum May 2009~~	
~~NA + A1:2012 to BS EN 1993-5:2007~~	~~UK National Annex to Eurocode 3: Design of steel structures — Part 5 Piling~~	~~+ A1:2012~~	
Eurocode 4	Design of composite steel and concrete structures		
~~BS EN 1994-1-1:2004~~	~~Eurocode 4: Design of composite steel and concrete structures — Part 1-1 General rules and rules for buildings~~	~~Corrigendum April 2009~~	
~~NA to BS EN 1994-1-1:2004~~	~~UK National Annex to Eurocode 4: Design of composite steel and concrete structures — Part 1-1 General rules and rules for buildings~~	~~-~~	
~~BS EN 1994-2:2005~~	~~Eurocode 4: Design of composite steel and concrete structures — Part~~	~~Corrigendum July 2008~~	

	2-General rules and rules for bridges		
NA to BS EN 1994-2:2005	UK National Annex to Eurocode 4: Design of composite steel and concrete structures—Part 2 General rules and rules for bridges	-	
Eurocode 5	Design of timber structures		
BS EN 1995-1-1:2004 + A2:2014	Eurocode 5: Design of timber structures—Part 1-1 General—common rules and rules for buildings	+ A2:2014 Incorporating corrigendum June 2006	
NA to BS EN 1995-1-1:2004 + A1:2008	UK National Annex to Eurocode 5: Design of timber structures—Part 1-1 General—common rules and rules for buildings	+ A1:2008 Incorporating National Amendment No. 2	
BS EN 1995-2:2004	Eurocode 5: Design of timber structures—Part 2 Bridges	-	
NA to BS EN 1995-2:2004	UK National Annex to Eurocode 5: Design of timber structures—Part 2 Bridges	-	
Eurocode 6	Design of masonry structures		
BS EN 1996-1-1:2005	Eurocode 6: Design of masonry structures—Part 1-1 General rules for reinforced and unreinforced masonry structures	Corrigenda February 2006 and July 2009	
NA to BS EN 1996-1-1:2005 + A1:2012	UK National Annex to Eurocode 6: Design of masonry structures—Part 1-1 General rules for reinforced and unreinforced masonry structures	Corrigendum October 2015	
BS EN 1996-2:2006	Eurocode 6: Design of masonry structures—Part 2 Design considerations, selection of materials and execution of masonry	Corrigendum September 2009	
NA to BS EN 1996-2:2006	UK National Annex to Eurocode 6: Design of masonry structures—Part 2 Design considerations, selection of materials and execution of masonry	Corrigendum No.1	
BS EN 1996-3:2006	Eurocode 6: Design of masonry structures—Part 3 Simplified calculation methods for unreinforced masonry structures	Corrigendum October 2009	
NA + A1:2014 to BS EN 1996-3:2006	UK National Annex to Eurocode 6: Design of masonry structures—Part 3 Simplified calculation methods	+A1:2014	

	for unreinforced masonry structures		
Eurocode 7	Geotechnical design		
BS EN 1997-1:2004+A1:2013	Eurocode 7: Geotechnical design – Part 1 General rules	+A1:2013 Corrigendum February 2009	
NA+A1 to BS EN 1997-1:2004+A1:2013	UK National Annex to Eurocode 7: Geotechnical design – Part 1 General rules	+A1:2013 Incorporating Corrigendum No.1	
BS EN 1997-2:2007	Eurocode 7: Geotechnical design – Part 2 Ground investigation and testing	Corrigendum June 2010	
NA to BS EN 1997-2:2007	UK National Annex to Eurocode 7: Geotechnical design – Part 2 Ground investigation and testing	-	
Eurocode 8	Design of structures for earthquake resistance		
BS EN 1998-1:2004 + A1:2013	Eurocode 8: Design of structures for earthquake resistance – Part 1 General rules, seismic actions and rules for buildings	Corrigendum June 2009, January 2011 and March 2013	
NA to BS EN 1998-1:2004	UK National Annex to Eurocode 8: Design of structures for earthquake resistance – Part 1 General rules, seismic actions and rules for buildings	-	
BS EN 1998-2:2005+A2:2011	Eurocode 8: Design of structures for earthquake resistance – Part 2 Bridges	Corrigenda February 2010 and February 2012	
NA to BS EN 1998-2:2005	UK National Annex to Eurocode 8: Design of structures for earthquake resistance – Part 2 Bridges	-	
BS EN 1998-5:2004	Eurocode 8: Design of structures for earthquake resistance – Part 5 Foundations, retaining structures and geotechnical aspects	-	
NA to BS EN 1998-5:2004	UK National Annex to Eurocode 8: Design of structures for earthquake resistance – Part 5 Foundations, retaining structures and geotechnical aspects	-	
Eurocode 9	Design of aluminium structures		
BS EN 1999-1-1:2007 + A2:2013	Eurocode 9: Design of aluminium structures – Part 1-1 General structural rules	+ A2:2013 Incorporating corrigendum March 2014	

NA to BS EN 1999-1-1:2007 + A1:2009	UK National Annex to Eurocode 9: Design of aluminium structures—Part 1-1 General structural rules	National Amendment No.1 Corrigendum No.1	
BS EN 1999-1-3:2007 + A1:2011	Eurocode 9: Design of aluminium structures—Part 1-3 Structures susceptible to fatigue	+ A1:2011	
NA to BS EN 1999-1-3:2007 + A1:2011	UK National Annex to Eurocode 9: Design of aluminium structures—Part 1-3 Structures susceptible to fatigue	+ A1:2011	
BS EN 1999-1-4:2007 + A1:2011	Eurocode 9: Design of aluminium structures—Part 1-4 Cold formed structural sheeting	+ A1:2011 Corrigendum November 2009	
NA to BS EN 1999-1-4:2007	UK National Annex to Eurocode 9: Design of aluminium structures—Part 1-4 Cold formed structural sheeting	-	

BSI Published Documents

For guidance only unless clauses are otherwise specified in BD 100/16 Annex B.

PD 6688-1-1:2011	Recommendations for the design of structures to BS EN 1991-1-1	See BD100 Annex B for additional guidance.
PD 6688-1-4:2015	Background paper to the UK National Annex to BS EN 1991-1-4	See BD100 Annex B for additional guidance.
PD 6688-1-7:2009 + A1:2014	Recommendations for the design of structures to BS EN 1991-1-7	See BD100 clause 2.17 and Annex B for additional guidance.
PD 6688-2:2011	Recommendations for the design of structures to BS EN 1991-2	See BD100 Annex B for additional guidance.
PD 6687-1:2010	Background paper to the UK National Annexes to BS EN 1992-1 and BS EN 1992-3	See BD100 clauses 2.15, 2.16 and Annex B for additional guidance.
PD 6687-2:2008	Recommendations for the design of structures to BS EN 1992-2:2005	See BD100 clause 2.16 and Annex B for additional guidance.
PD 6695-1-9:2008	Recommendations for the design of structures to BS EN 1993-1-9	See BD100 Annex B for additional guidance.
PD 6695-1-10:2009	Recommendations for the design of structures to BS EN 1993-1-10	See BD100 Annex B for additional guidance.
PD 6695-2:2008 + A1:2012 Incorporating Corrigendum No.1	Recommendation for the design of bridges to BS EN 1993	See BD100 Annex B for additional guidance.
PD 6696-2:2007 + A1:2012	Background paper to BS EN 1994-2 and the UK National Annex to BS EN 1994-2	See BD100 Annex B for additional guidance.
PD 6694-1:2011	Recommendations for the design of structures subject to traffic loading to BS EN 1997-1	See BD100 Annex B for additional guidance.

PD 6698:2009	Recommendations for the design of structures for earthquake resistance to BS EN 1998	See BD100 Annex A for additional guidance.
PD 6703:2009	Structural bearings—Guidance on the use of structural bearings	
PD 6705-2:2010 + A1:2013	Recommendations for the execution of steel bridges to BS EN 1090-2	Amended 30 April 2013
PD 6705-3:2009	Recommendations on the execution of aluminium structures to BS EN 1090-3	
PD 6702-1:2009	Structural use of aluminium. Recommendations for the design of aluminium structures to BS EN 1999	

Execution Standards referenced in British Standards or Eurocodes

BS EN 1090-1:2009+A1:2011	Execution of steel structures and aluminium structures - Part 1: Requirements for conformity assessment of structural components	
BS EN 1090-2:2008+A1:2011	Execution of steel structures and aluminium structures – Part 2: Technical requirements for the execution of steel structures	
BS EN 1090-3:2008	Execution of steel structures and aluminium structures – Part 3: Technical requirements for aluminium structures	
BS EN 13670:2009 Incorporating corrigenda October 2015 and November 2015	Execution of concrete structures	

Product Standards referenced in British Standards or Eurocodes

BS EN 206:2013	Concrete – Specification, performance, production and conformity	Corrigendum May 2014
BS EN 1317-1:2010	Road Restraint Systems – Part 1 – Terminology and general criteria for test methods	
BS EN 1317-2:2010	Road Restraint Systems – Part 2 – Performance classes, impact test acceptance criteria and test methods for safety barriers.	
BS EN 1317-3:2010	Road Restraint Systems – Part 3 – Performance classes, impact test acceptance criteria and test methods for crash cushions.	

DD-ENV 1317-4:2002	Road Restraint Systems—Part 4—Performance classes, impact test acceptance criteria and test methods for terminals and transitions of safety barriers.	<i>Draft BS-EN 1317-4 for public comment published in June 2012</i>
BS-EN 1317-5:2007+A2:2012	Road Restraint Systems—Part 5—Product requirements and evaluation of conformity for vehicle restraint systems	Incorporating corrigendum August 2012 <i>Draft prEN 1317-5 for public comment published in December 2013</i>
PD-CEN/TR 16949:2016	Road Restraint System—Pedestrian restraint system—Pedestrian parapets	<i>Bsi Published Document /CEN Technical Report published in July 2016</i> <i>(This document should temporarily not be used. The requirements of BS 7818:1995 apply.)</i>
Draft prEN 1317-7	Road restraint systems—Part 7: Performance classes, impact test acceptance criteria and test methods for terminals of safety barriers	<i>Draft prEN 1317-7 for public comment published in June 2012</i>
PD-CEN/TS 1317-8:2012	Road restraint systems—Part 8: Motorcycle road restraint systems which reduce the impact severity of motorcyclist collisions with safety barriers	<i>Bsi Published Document /CEN Technical Specification published in May 2012</i>
BS-EN 1337-1:2000	Structural bearings—Part 1: General Design Rules	
BS-EN 1337-2:2004	Structural bearings—Part 2: Sliding elements	
BS-EN 1337-3:2005	Structural bearings—Part 3: Elastomeric bearings	
BS-EN 1337-4:2004	Structural bearings—Part 4: Roller bearings	
BS-EN 1337-5:2005	Structural bearings—Part 5: Pot bearings	
BS-EN 1337-6:2004	Structural bearings—Part 6: Rocker bearings	
BS-EN 1337-7:2004	Structural bearings—Part 7: Spherical and cylindrical PTFE bearings	
BS-EN 1337-8:2007	Structural bearings—Part 8: Guide bearings and restraint bearings	
BS-EN 1337-9:1998	Structural bearings—Part 9: Protection	
BS-EN 1337-10:2003	Structural bearings—Part 10: Inspection and maintenance	

BS EN 1337-11:1998	Structural bearings — Part 11: Transport, Storage and Installation.	
BS EN 1794-1:2011	Road traffic noise reducing devices — Non-acoustic performance Part 1: Mechanical performance and requirements	
BS EN 1794-2:2011	Road traffic noise reducing devices — Non-acoustic performance Part 2: General safety and environmental requirements	
BS EN 10025-1:2004	Hot rolled products of structural steels Part 1: General technical delivery conditions.	
BS EN 10025-2:2004	Hot rolled products of structural steels Part 2: Technical delivery conditions for non-alloy structural steels.	
BS EN 10025-3:2004	Hot rolled products of structural steels Part 3: Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels.	
BS EN 10025-4:2004	Hot rolled products of structural steels Part 4: Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels.	
BS EN 10025-5:2004	Hot rolled products of structural steels — Part 5: Technical delivery conditions for structural steels with improved atmospheric corrosion resistance	
BS EN 10025-6:2004+A1:2009	Hot rolled products of structural steels — Part 6: Technical delivery conditions for flat products of high yield strength structural steels in the quenched and tempered condition.	
BS EN 10080:2005	Steel for the reinforcement of concrete – Weldable reinforcing steel - General	
BS EN 10210-1:2006	Hot finished structural hollow sections of non-alloy and fine grain steels — Part 1: Technical delivery conditions	
BS EN 10210-2:2006	Hot finished structural hollow sections of non-alloy and fine grain steels — Part 2: Tolerances, dimensions and sectional properties	<i>Incorporating corrigendum no.1</i>
BS EN 10248-1:1996	Hot rolled sheet piling of non-alloy steels. Technical delivery conditions	
BS EN 10248-2:1996	Hot rolled sheet piling of non-alloy steels.	

	~~Tolerances on shape and dimensions~~	
~~BS EN 12063:1999~~	~~Execution of special geotechnical work. Sheet pile walls.~~	
~~BS EN 15050:2007 + A1:2012~~	~~Precast concrete products – Bridge elements~~	~~See BD100 clause 2.18 for additional guidance.~~

British Standards

BS 4449:2005+A3:2016	Steel for the reinforcement of concrete	No longer covers plain round bar. (See BS4482 up to 12mm dia, see BS EN 10025-1 for larger sizes and dowels. See BS EN 13877-3 for dowel bars in concrete pavements.)
~~BS 5896:2012~~	~~Specification for high tensile steel wire and strand for the prestressing of concrete~~	
BS 7818:1995	Specification for pedestrian restraint systems in metal	Currently the requirements of BS 7818:1995 are to be used instead of PD CEN/TR 16949:2016
BS 8002:2015	Code of practice for earth retaining structures	
BS 8004:2015	Code of practice for foundations	
~~BS 8006 1:2010+A1:2016~~	~~Code of practice for strengthened/reinforced soils and other fills~~	
BS 8500-1:2015+A1:2016	Concrete – Complementary British Standard to BS EN 206 : Method of specifying and guidance for the specifier.	Incorporating Corrigendum No.1
BS 8500-2:2015+A1:2016	Concrete – Complementary British Standard to BS EN 206 : Specification for constituent materials and concrete.	
BS 8666:2020	Scheduling, dimensioning, bending and cutting of steel reinforcement for concrete	Incorporating Amendment No.1

The Manual Contract Document for Highway Works (MCHW)

MCHW Volume 1: May 2017	Specification for Highway Works	<i>Specification compliant with the execution standards must be used. A Departure is necessary for the parts where a compliant revision has not been published.</i>
MCHW Volume 2: May 2017	Notes for guidance on the Specification for Highway Works	<i>Notes for guidance compliant with the execution standards must be used. A Departure is necessary for the parts where a compliant revision has not been published.</i>

MCHW Volume 3: February 2017	Highway Construction Details	
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The Design Manual for Roads and Bridges (DMRB)

BD 2/12	Technical Approval of Highway Structures	
BD 7/01	Weathering steel for highway structures	<i>See IAN 124/11 Annex C for additional guidance.</i>
BD 9/81	Implementation of BS 5400: Part 10: 1980. Code of Practice for Fatigue	
BD 10/97	Design of highway structures in areas of mining subsidence	<i>See IAN 124/11 Annex C for additional guidance.</i>
BD 13/06	Design of steel bridges. Use of BS 5400-3:2000	
BD 21/01	The Assessment of Highway Bridges and Structures	
BD 27/86	Materials for the Repair of Concrete Highway Structures	
BD 29/17	Design criteria for footbridges	
BD 31/01	The Design of Buried Concrete Box and Portal Frame Structures	
BD 33/94	Expansion joints for use in highway bridge decks	<i>See IAN 124/11 Annex C for additional guidance.</i>
BD 35/14	Quality assurance scheme for paints and similar protective coatings	
BD 36/92	Evaluation of maintenance costs in comparing alternative designs for highway structures	
BD 37/01	Loads for Highway Structures	
BD 43/03	The impregnation of reinforced and prestressed concrete highway structures using hydrophobic pore lining impregnants	
BD 44/15	The Assessment of Concrete Highway Bridges and Structures Incorporating Amendment August 2016	
BD 45/93	Identification markings of highway structures	
BD 47/99	Waterproofing and surfacing of concrete bridge decks	<i>See IAN 124/11 Annex C for additional guidance.</i>
BD 48/93	The Assessment and Strengthening of Highway Bridge Supports	
BD 49/01	Design Rules for Aerodynamic Effects on Bridges	
BD 51/14	Portal and cantilever signs/signal gantries	
BD 53/95	Inspection and Records for Road Tunnels	
BD 54/15	Management of Post-tensioned Concrete Bridges	
BD 56/10	The Assessment of Steel Highway Bridges and Structures	
BD 57/01	Design for durability	<i>Not to be used. See IAN 124/11 Annex C for additional guidance.</i>
BD 60/04	Design of Highway Bridges for Vehicle Collision Loads	
BD 61/10	The Assessment of Composite Highway Bridges and Structures	

BD 62/07	As built, operational and maintenance records for highway structures	<i>See IAN 124/11 Annex C for additional guidance.</i>
BD 63/17	Inspection of Highway Structures	
BD 65/14	Design criteria for collision protection beams	
BD 67/96	Enclosure of bridges	<i>See IAN 124/11 Annex C for additional guidance.</i>
BD 78/99	Design of road tunnels	<i>See IAN 124/11 Annex C for additional guidance.</i>
BD 79/13	The Management of Sub-standard Highway Structures	
BD 84/02	Strengthening of Concrete Bridge Supports Vehicle Impact Using Fibre Reinforced Polymers	
BD 85/08	Strengthening Highway Structures Using Externally Bonded Fibre Reinforced Polymer	
BD 86/11	The Assessment of Highway Bridges and Structures For The Effects of Special Types General Order (STGO) and Special Order (SO) Vehicles	
BD 87/05	Maintenance Painting of Steelwork	
BD 89/03	The Conservation of Highway Structures	
BD 90/05	Design of FRP bridges and highway structures	
BD 91/04	Unreinforced Masonry Arch Bridges	
BD 94/17	Design of minor structures	
BD 95/07	Treatment of Existing Structures on Highway Widening Schemes	
BD 100/16	The use of Eurocodes for the design of highway structures	
BD 101/11	Structural Review and Assessment of Highway Structures	
BA 09/81	The Use of BS 5400: Part 10: 1980. Code of Practice for Fatigue Amendment No. 1	
BA 16/97	The Assessment of Highway Bridges and Structures. Amendment No. 1 Amendment No. 2	
BA 19/85	The Use of BS 5400: Part 3: 1982	
BA 26/94	Expansion joints for use in highway bridge decks	<i>See IAN 124/11 Annex C for additional guidance.</i>
BA 28/92	Evaluation of maintenance costs in comparing alternative designs for highway structures	
BA 35/90	Inspection and Repair of Concrete Highway Structures	
BA 36/90	The use of permanent formwork	<i>Not to be used. See IAN 124/11 Annex C for additional guidance.</i>
BA 37/92	Priority Ranking of Existing Parapets	
BA 38/93	Assessment of the Fatigue Life of Corroded or Damaged Reinforcing Bars	
BA 39/93	Assessment of Reinforced Concrete Half joints	
BA 40/93	Tack Welding of Reinforcing Bars	
BA 41/98	The design and appearance of bridges	
BA 47/99	Waterproofing and surfacing of concrete bridge decks	<i>See IAN 124/11 Annex C for additional guidance.</i>

BA 51/95	The Assessment of Concrete Structures Affected by Steel Corrosion	
BA 52/94	The Assessment of Concrete Highway Structures Affected by Alkali-Silica Reaction	
BA 54/94	Load Testing for Bridge Assessment	
BA 55/06	The Assessment of Bridge Substructures and Foundations, Retaining Walls and Buried Structures	
BA 57/01	Design for durability	<i>Not to be used. See IAN 124/11 Annex C for additional guidance.</i>
BA 59/94	Design of highway bridges for hydraulic action.	<i>Not to be used. See IAN 124/11 Annex C for additional guidance.</i>
BA 67/96	Enclosure of bridges	<i>See IAN 124/11 Annex C for additional guidance.</i>
BA 72/03	Maintenance of Road Tunnels	
BA 82/00	Formation of continuity joints in bridge decks	
BA 83/02	Cathodic Protection for Use in Reinforced Concrete Highway Structures	
BA 85/04	Coatings for concrete highway structures & ancillary structures	
BA 86/06	Advice Notes on the Non-destructive Testing of Highway Structures Incorporating Amendment May 2017	
BA 92/07	Use of recycled concrete aggregates in structural concrete	
BA 93/09	Structural Assessment of Bridges with Deck Hinges	
TD 19/06	Requirement for road restraint systems	<i>See IAN 124/11 Annex C for additional guidance.</i>
TD 27/05	Cross-sections and headrooms	<i>See IAN 124/11 Annex C for additional guidance.</i>
HD 22/08	Managing geotechnical risk	
HD 39/16	Footway and Cycleway Design	
HA 66/95	Environmental barriers	<i>See IAN 124/11 Annex C for additional guidance. Work on update being undertaken.</i>
GG 000 (Aug 2018)	Alphanumeric and Volume Contents	
GG 101 Revision 0 (Jun 2018)	Introduction to the Design Manual for Roads and Bridges	
GD 2/16	Quality Management Systems for Highway Design	
GD 5/16	Asbestos Management in Trunk Road Assets	
GG 104	Requirements for Safety Risk Assessment	
CD 375	Design of corrugated steel buried structures	

Interim Advice Notes

IAN 69/15	Designing for maintenance
IAN 96/07r1	Guidance on implementing results of research on bridge deck waterproofing.

IAN 97/07	Assessment and upgrading of existing parapets
IAN 104/15	The anchorage of reinforcement and fixings in hardened concrete.
IAN 105/08	Implementation of construction (design and management) 2007 and the withdrawal of SD 10 and SD 11
IAN 117/08r2	Certification of combined kerb and drainage products
IAN 124/11 Annex C	Use of Eurocodes for the design of highway structures
IAN 127/10r1	The use of foamed concrete
IAN 131/11	Deflection of Permanent Formwork
IAN 136/10	Structural safety reporting
IAN 149/11	Existing Motorway Minimum Requirements
IAN 161/15	Smart Motorways
IAN 177/13	Introduction of the Construction Products Regulation (EU) 305/2011
IAN 184/16	Highways Agency Data & CAD Standard
IAN 186/15	In-situ concrete barriers based on proprietary designs commercialised as products
IAN 193/16	Requirements for the provision of access arrangements on gantries

Miscellaneous

CHE Memorandum 227/08	The Impregnation of Reinforced and Prestressed Concrete Highway Structures using Hydrophobic Pore Lining Impregnants	CHE memoranda are internal Highways England documents and not available to external organisations. This CHE memorandum is included as a useful reference for the Technical Approval Authority.
CIRIA C543	Bridge Detailing Guide	
CIRIA C686	Safe Access for Maintenance and Repair	
CIRIA C760	Guidance on embedded retaining wall design	
CIRIA C766	Control of cracking caused by restrained deformation in concrete	
BS EN 13369-2013	Common rules for precast concrete products	
HA 107/04	Design of Outfall and Culvert Details	

Regulations

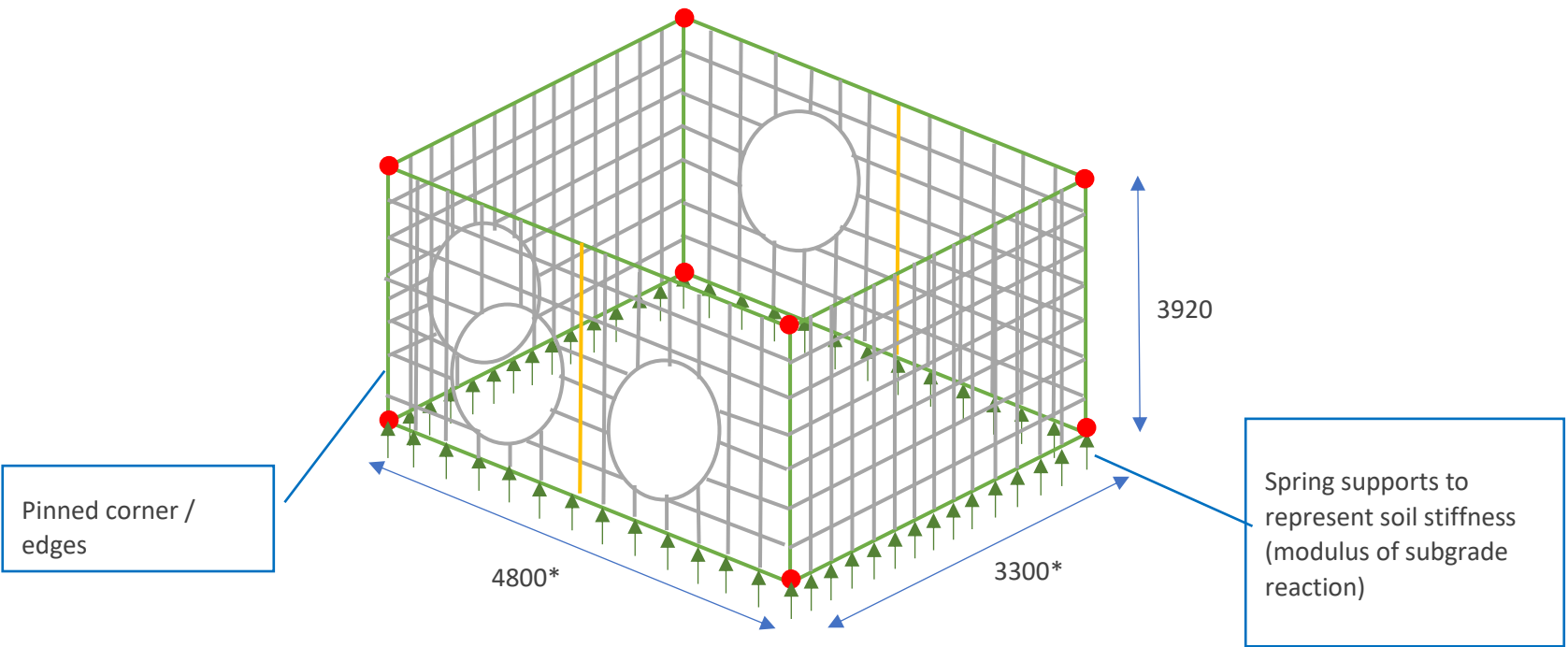
The Construction (Design and Management) Regulations 2015
The Lifting Operations and Lifting Equipment Regulations 1998
The Work at Height (Including Amendment) Regulations 2007

Reference Literature

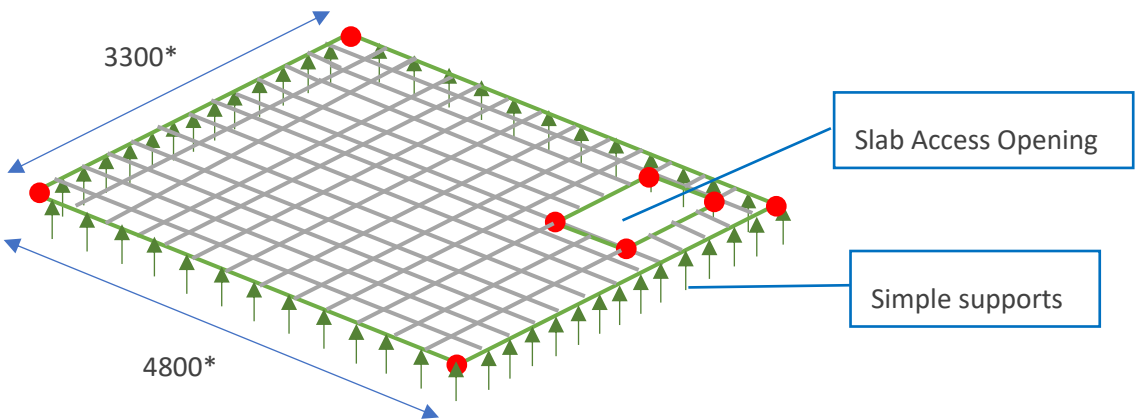
E.C. Hambly	2 nd Edition	Bridge Deck Analysis
-------------	-------------------------	----------------------

Water UK	Approved Version 1 (Oct 2019)	Sector Guidance in relation to the adoption of sewerage assets by sewerage companies in England
Water UK	Approved Version 2.1 (May 2021)	Design and Construction Guidance for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England ("the Code") [Sewerage Sector Guidance Appendix C]
Thames Water	May 2021	Your new sewer construction guide

Appendix B – Idealised Diagrams



Isometric View of Culvert Unit (Model 1)



Plan View of Cover Slab (Model 2)

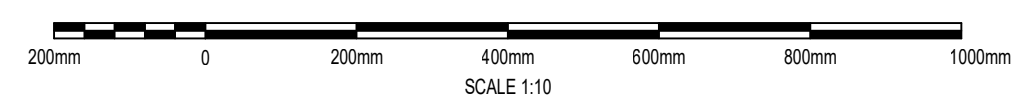
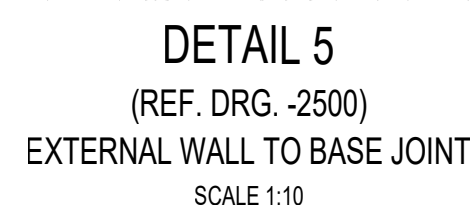
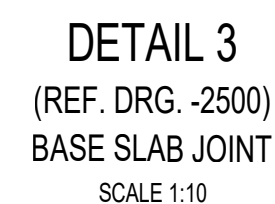
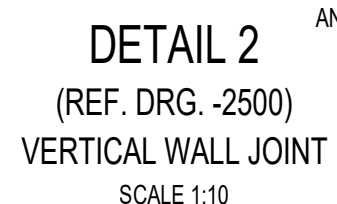
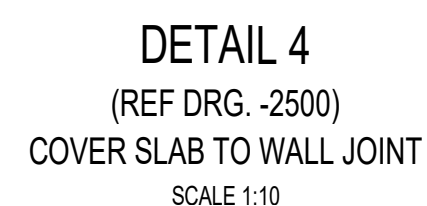
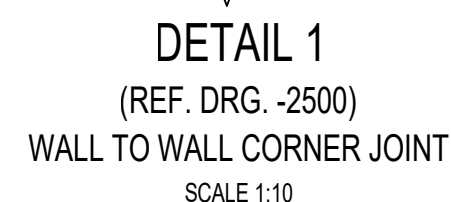
*Dimensions based on distance between centroids of chamber walls, subject to change at detailed design.

Notes:

1. Model 1 consists of the chamber walls only for their reinforcement design
2. Model 2 consists of the cover slab to the chamber. The purpose of model two is to understand the impact the openings have on the stresses within the concrete under loading. Reactions from this model can be used to form the loading applied in Model 1.

— = pinned connection (Peikko PVL joint)

Appendix C – Drawings



1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AOD UNLESS NOTED OTHERWISE.
3. DIMENSIONS AND LEVELS SHOWN ON DRAWING ARE TO BE CONFIRMED AT DETAILED DESIGN BY MANUFACTURER OF PROPRIETARY MANHOLE SYSTEM.
4. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DRG. WHMP-TG-SRWG1-DR-DD-2500.
5. ALL BOLTS, WASHERS AND WAVY TAIL CAST-IN STEELS TO BE STAINLESS STEEL GRADE A2-70.



PROJECT:
WOKINGHAM MAJOR HIGHWAYS PROGRAMME
SPINE ROAD AND WESTERN GATEWAY PHASE 1

TITLE: THAMES WATER CULVERT
BESPOKE MANHOLE TWS01
GENERAL ARRANGEMENT

SCALE @ 1":		CHECKED:		APPROVED:	
AS SHOWN		KL		CMF	
PROJECT NO:		DESIGNED:	DRAWN:	DATE:	
C118047		WA	AJT	July 21	
DRAWING No:					REV:
WMHP-TG-SRWG1-DR-DD-2501					P01

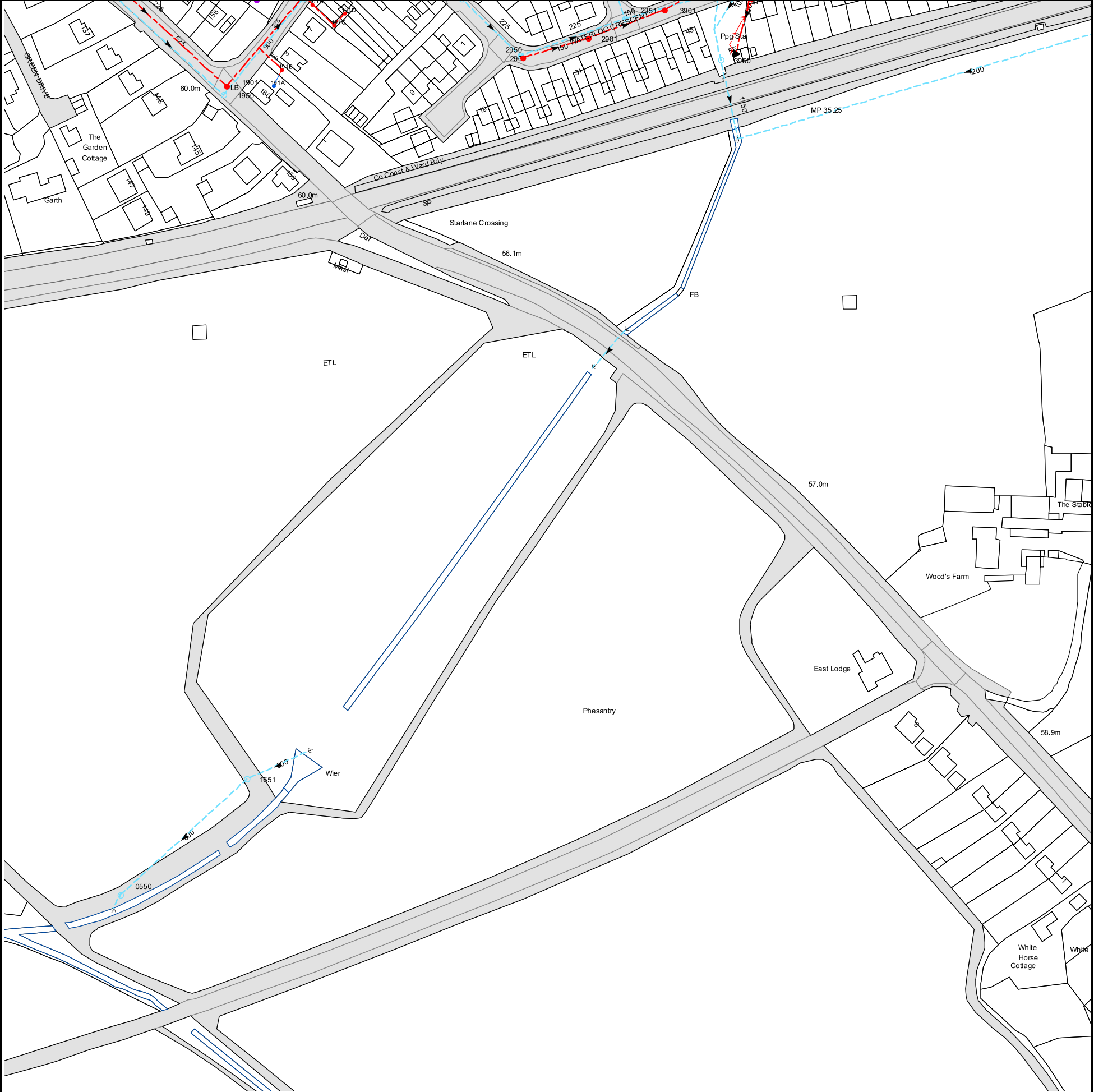
Appendix D – CDM review

Project No: C118047		Date: 22/07/2021	
Document No. WMHP-TG-SRWG1-RG-HS-2502		Rev: P01	
Project Name: WOKINGHAM MAJOR HIGHWAYS PROJECT – THAMES WATER CHAMBER TWS01			
Design Stage: AIP Design			
Description of Project or Element <i>As part of the proposed South Wokingham Distributor Road (SWDR) works two existing 1200mm diameter TW sewers require diverting to facilitate the construction of the new spine road. The diversion results in two new pipes, 514m and 497m in length, running parallel underground until they outfall to a drainage basin south of the proposed road. The first chamber (ID no. TWS01), accommodating a change in horizontal alignment of the two pipes, will be bespoke and forms the basis of this CDM review.</i> <i>The proposed bespoke Thames Water Chamber houses two sewer channels. The structure comprises a mass concrete base, a proprietary box culvert forming the upper walls of the chamber and a precast reinforced concrete cover slab. The structure is to be situated below ground level with two openings in the cover slab to provide access to the channels for maintenance purposes.</i>			
Design Principles: <i>The chamber design is based on conventional design principles for concrete structures to BS EN 1992. The design of the substructure will be in accordance with BS EN 1997.</i>			
Key Construction, Operation, Maintenance and Decommissioning Activities:			
C	<u>Construction</u> • Scan area for buried services • Excavate to founding level of ground slab, place granular bedding layer and compact. • Install precast concrete base slab • Install precast concrete wall panels and partially backfill • Install drainage pipes at inlets and outlets, cast in-situ benching • Lift in precast concrete cover slab and bolt to chamber walls. Install seating ring / brick course and access frame • Complete backfill to finished ground level.		
O	<u>Operation</u> • Thames water pipes/culvert in use.		
M	<u>Maintenance</u> Inspection and potentially cleaning activities and working over / in water.		
D	<u>Decommissioning</u> • Decommissioning will follow a general reversal of the construction sequence. The materials will need to be collected for safe disposal/ recycling from top down in manageable sections. Materials will need collecting in accordance with the contractor's waste management plans. All materials can be re-cycled for future re-use.		
E			

Project No: C118047			Date: 22/07/2021		
Document No. WMHP-TG-SRWG1-RG-HS-2502			Rev: P01		
Hazard and Mitigating Action to be taken					
Ref on drg	Stage (COM DE)+	Hazard / activity	Mitigating action	ERIC*	Actions complete?
TG - SU	C/O /M/ D	Working below ground water level	Ground water is expected to be low at time of construction if during summer months. Use of offline “precasting” and lifting in of units reduces duration of construction and work within excavation and therefore risk of flooding . If groundwater is encountered, contractor will need to manage water ingress using suitable cut off or pumping, or possibly replacing fill with self-compacting class 6A fill. Waterproof sealant to be used between structure joints to avoid water ingress during operation. Might need to temporarily close off the pipe openings in the walls or end of stub pipes, if large volumes of ground water expected to ingress into chamber during construction	R/C/I	
TG - SQ	C	Potential for striking underground services	C2 / C3 search results indicated no existing services in the area of the proposed chamber. It is thought unlikely, given the location is remote from the main road (Easthampstead Road) that there will be any services However the contractor should be made aware that a check of underground utilities is to be undertaken prior to any works.	R/I	
	C	Temporary excavation stability	It is not envisaged any temporary earth retaining structures are required to ensure earth stability. Stability of the earth is to be ensured by benching / battering excavation at safe angle. TG are not the temporary works designer for temporary excavations, and it is considered reasonable this element will be undertaken by a competent temporary works designer.	R	
TG - SX	C	Risk of asbestos containing materials (ACM) in existing structure	There is risk of ACMs within the materials of the existing culvert network (for example any waterproofing on culvert headwalls or pipes possibly). Contractor to conduct appropriate surveys to determine risk of ACMs in prior to demolition / removal. Where ACMs are detected from survey, appropriate licensed asbestos removal will need to be adopted by a licensed contractor in accordance with the Control of Asbestos Regulations.	I	
	O	Accidental presence of vehicle on structure	Accidental vehicle load in accordance with BS EN 1991-2 to be accounted for in design. Bollards to be provided adjacent to maintenance access track	E	

Project No: C118047			Date: 22/07/2021		
Document No. WMHP-TG-SRWG1-RG-HS-2502			Rev: P01		
TG - SY	M	Access inside chamber - confined space	The chamber is classified as a confined space with a key risk of asphyxiation / loss of consciousness. Size of chamber size of opening have been made larger than minimum sizes given in SSG Appendix C and BS EN 752 to improve ventilation. A site specific risk assessment for working in a confined space needs to be undertaken and a suitably qualified and experienced personnel employed. Such assessment needs to include for an emergency evacuation plan. In the case of personnel injuring themselves in the structure, the cover slab opening has been made larger (1200 x 900) to aid winching out of personnel. The act of planning, entering and working safely within confined spaces shall be in accordance with Thames Water's 'Guide to planning entering and working safely in confined spaces'.	R/I	
	C	Overstressing of precast units during lifting operations	Proprietary product has been specified by a reputable experienced precast manufacturer who produces drainage products. The specified product comes in precast panels which will be designed by the manufacturer to ensure safe demoulding and loading / offloading onto transportation. Temporary works design for lifting operations will therefore be designed by the manufacturer to ensure no detrimental effect on the panels and avoid overstressing.	R/I	
	C / D	Stability of precast panels during assembly	"Flatpack" panel system by Marshalls CPM specified and shown on drawings with alternative of FP McCann similar system also specified. Where flatpack system is used, the contractor will need to ensure temporary propping to the wall panels before they are bolted to the base slab. Competent contractor will be aware of this, as they will need to follow the manufacturer's assembly instructions which clearly states the need for suitable propping. Where FP McCann non-flat pack system used, this hazard will not be relevant, however, the choice will depend on size of crane / lifting plant possible / available to lift in units.	R/E	
TG -ST	C/D	Unexploded ordnance	A pre-desk study assessment of the Spine Road and Western Gateway site by Zetica (29th August 2017, filename "Zetica PDS") has concluded: "no readily available records of bombing or other significant military activity on the site have been found", and that "the site is likely to have a low UXO hazard level. Although, the risk is small, there is still a risk and the contractor will be notified of this risk that they need to consider commissioning further UXO surveys / scans as necessary prior to construction.	I/R	
+Construction, Operation, Maintenance, Decommissioning, Environmental hazard *Eliminate Reduce Inform# Control					
# those marked "I" for inform need to be transferred to the drawings in the significant residual hazards box					
Designer's CDM Review by: Eunan McGregor / Will Anderson (Engineer) 22/06/21 (Date)					
Review Approved by: Ken Lam (Principle Engineer) 26/07/21 (Date)					

Appendix E – Existing records / As-built drawings



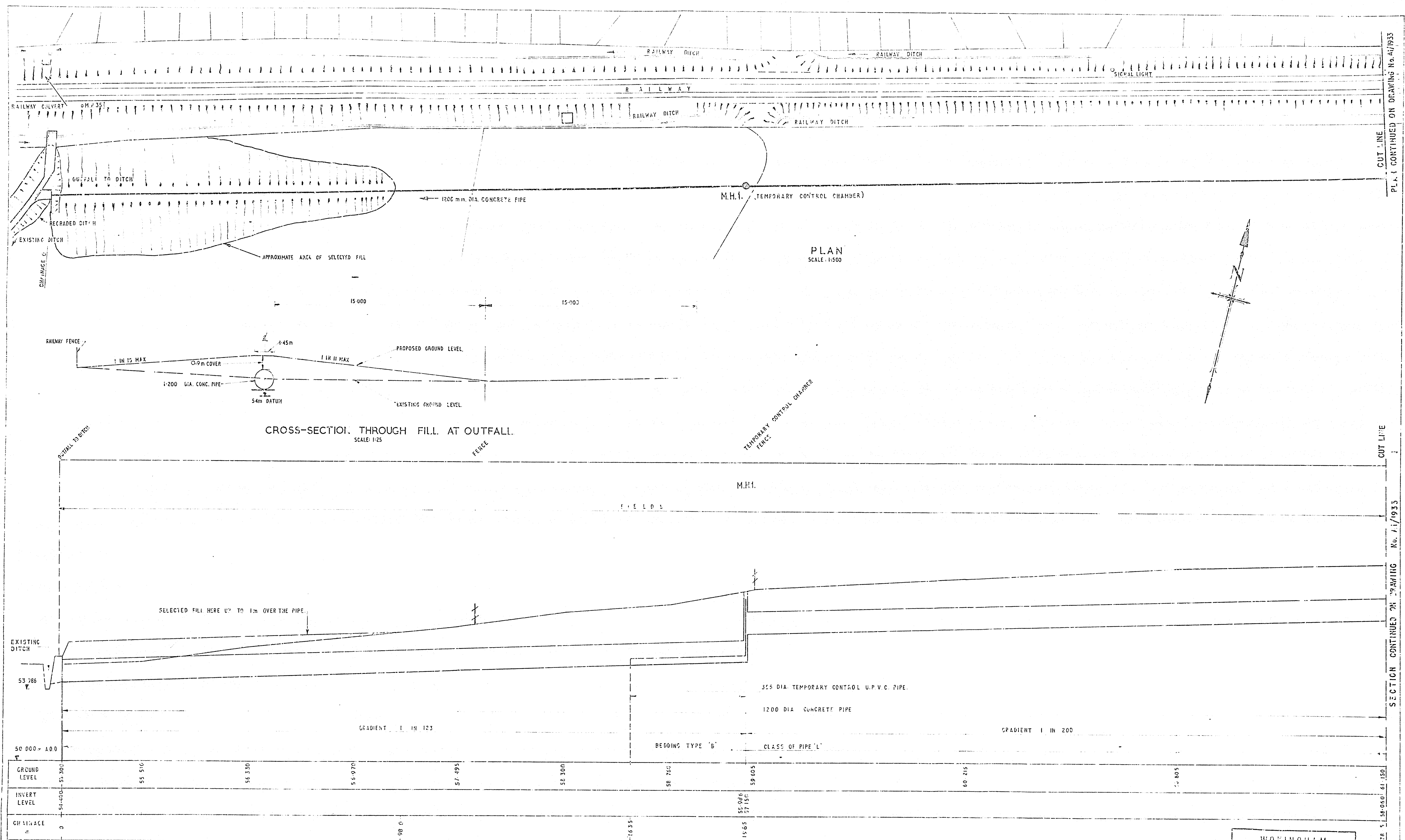
The width of the displayed area is 500m and the centre of the map is located at OS coordinates 482250,167750

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
3950	56.35	54.11
191D	n/a	n/a
2950	58.05	56.4
2902	58	56.32
2901	57.42	56.01
2951	57.08	55.61
3901	56.75	55.64
1950	59.29	56.24
1901	59.35	56.66
191A	n/a	n/a
191B	n/a	n/a
101A	n/a	n/a
191C	n/a	n/a
0550	n/a	n/a
1651	54.83	51.74
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.		



SECTION OF SEWER — SHEET 1.

SCALES: Horiz. 1/500
Vert. 1/100

=000917=

WOKINGHAM DISTRICT COUNCIL
EAST WOKINGHAM SURFACE WATER
DRAINAGE SCHEME

Phase 1.

PLAN AND SECTION OF SEWER — SHEET 1.

CONTRACT REF
06/00/33/03

SANDFORD FAWCETT WILTON & BELL
CONSULTING ENGINEERS
21 INNER PARK ROAD
LONDON SW19

REVISION A FEB. 1973
INCHARGE TO WATER DEPT.
FOR THE SEWERAGE ACTION
THROUGH FILL

AFFILIATED DRAWINGS
A1/1233

DATE AUGUST 1975
SCALE AS STATED

DRAWING No.
A1/1932A

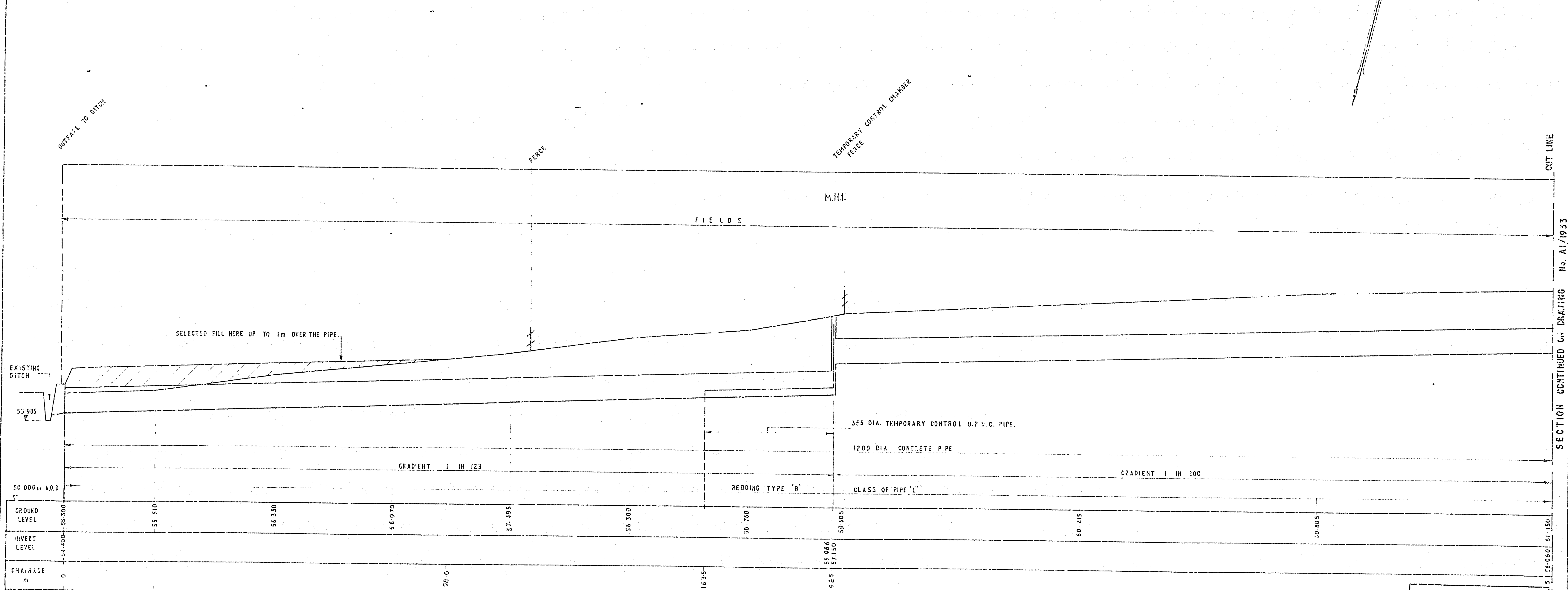
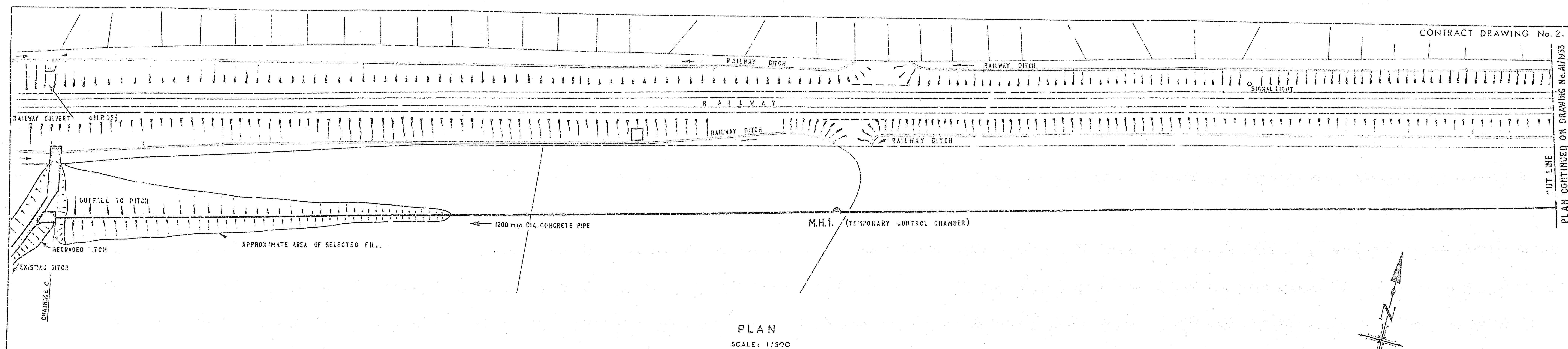
A1

A2

MR-DATA MANAGEMENT LTD

15X

21X



SECTION OF SEWER — SHEET 1.

SCALE: Horiz. 1/500
Vert. 1/100

WOKINGHAM DISTRICT COUNCIL
EAST WOKINGHAM SURFACE WATER DRAINAGE SCHEME
Phase 1.

PLAN AND SECTION OF SEWER — SHEET 1.

CONTRACT REF. 06/00/33/03

AFFILIATED DRAWINGS. A1/1933

DATE AUGUST 1975

SCALE AS STATED

SANDFORD FAWCETT, WILTON & BELL
CONSULTING ENGINEERS
21 INNER PARK ROAD
LONDON S.W.19.

DRAWING No. C.A1/1932

WOKINGHAM DISTRICT COUNCIL
DISTRICT COUNCIL
SCALE: HORIZ 1/500
VERT 1/100
DWG No. 2025/22
DATE 1/10/75

000916

Appendix F – Thames Water S104 agreement



Yonas Ogbai



Suite 1, Grosvenor House,
Grosvenor Square,
Southampton,



DS reference number

DS6070156



developer.services@thameswater.co.uk

geoff.nokes@thameswater.co.uk

0800 009 3921 07747 640 228

Mon-Fri 8am-5pm

14 August 2020



We've accepted your design

Dear Yonas,

RE: Sewer Adoption/Diversion under Section 104/116 of the Water Industry Act 1991

Site address: Wokingham SW Diversion WN TA

Thank you for your S185 application for the above site. As the surface water sewers you propose to divert are not strategic your contractor under a Section 104/116 diversion Agreement can carry out these works. Your own suitably qualified contractor, whose operatives are qualified for working in confined spaces, will undertake the works which will be inspected by Thames Water and subject to a legal Agreement. Sewers under Section 104 requires Thames Water to agree to adopt the new sewer in advance of construction (S104).

We're happy to confirm that we can accept your proposals in principle, as per drawing drawings 1567-S104-001 Culvert Divn, subject to completion of a suitable Section 104/116 Agreement.

Please note the above acceptance can't be used for the discharge of any drainage-related planning conditions.

What to do next

Please fill out the enclosed legal pro-forma document carefully so that we can start preparing your agreement. Don't forget that any missing information could cause delays or add to your costs.

- Complete all sections marked 'Developer'
- Pay your inspection fees of £17750

We'll then instruct our solicitors to carry out the necessary land checks and prepare the Section 104/116 agreement for your site. You'll need this before you can start work.

Preparing your plans

Remember to include the following statement on all your plans: *All adoptable drainage works to be constructed as detailed in the Code for Adoption Design and Construction Guidance and Thames Water's local practice.*

Please don't show private drainage in colour on your proposed agreement plan.

Starting work

Send the enclosed inspection request form to sewer.adoptions@thameswater.co.uk so that we can arrange any pre-start meetings or inspections as quickly as possible.

For the work itself, you can use any competent contractor of your choice as long as their workers are qualified to operate in confined spaces and have all relevant HSE requirements.

Please don't plant large trees/shrubs that have an overhanging canopy or moderate to high water demand within your sewer easement.

Moving to maintenance

Before we can place your sewers onto a maintenance period, we'll need to:

- Undertake a satisfactory inspection of all the manholes and outfalls
- Receive satisfactory as-built drawings showing as-laid invert and cover levels of all manholes
- Receive a satisfactory CCTV survey of all adoptable sewers

If you're constructing sewers using thermoplastic pipework less than 400mm in diameter, please wait to carry out the CCTV survey at the end of the maintenance period to confirm that any high-pressure jetting hasn't damaged or deformed the pipework and the CCTV survey must be a light ring survey to measure the deflection or ovality within the pipes. For complex developments, we may also ask you to provide additional air testing to demonstrate compliance of your plastic pipework.

After we've issued a provisional certificate of completion and started your 12-month maintenance period, 80% value of the total cash deposit will be released.

Adopting your sewer

After your 12-month maintenance period ends, we'll need to carry out a satisfactory inspection before we issue your final vesting certificate and refund the final 20% of the deposit to conclude the diversion.

If you need to discuss your development at any point during this process, please call or email us using the details at the top of this letter, quoting your DS application reference number.

Best regards,

Geoff Nokes

Adoption Engineer

Enclosed with this letter:

Legal instruction proforma

Inspection form

Construction guide