

WHITECHURCH STREAM FLOOD ALLEVIATION SCHEME

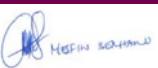
ENGINEERING SERVICES REPORT



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ENGINEERING SERVICES REPORT

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1 INTRODUCTION

RPS was appointed by South Dublin County Council to progress and complete a Planning Application under Section 177AE of the Planning and Development Act 2000 (as amended) in respect of the Whitechurch Flood Alleviation Scheme (FAS) (hereafter called the Scheme) in South Dublin.

The Scheme comprises of defence measures including new walls, removal and/or replacement of low-level bridges, provision of trash screens and debris traps, stream bank improvements, and removal of trees and other vegetation to accommodate the proposed Works. The proposed wall heights generally range from 1.2m-1.3m above ground. Only one location with 1.9m high wall exists where the wall ties into the existing culvert wingwall at Willbrook Lawn Culvert. All the Works are limited to within the flood plain of the Whitechurch Stream.

1.1 Site Location

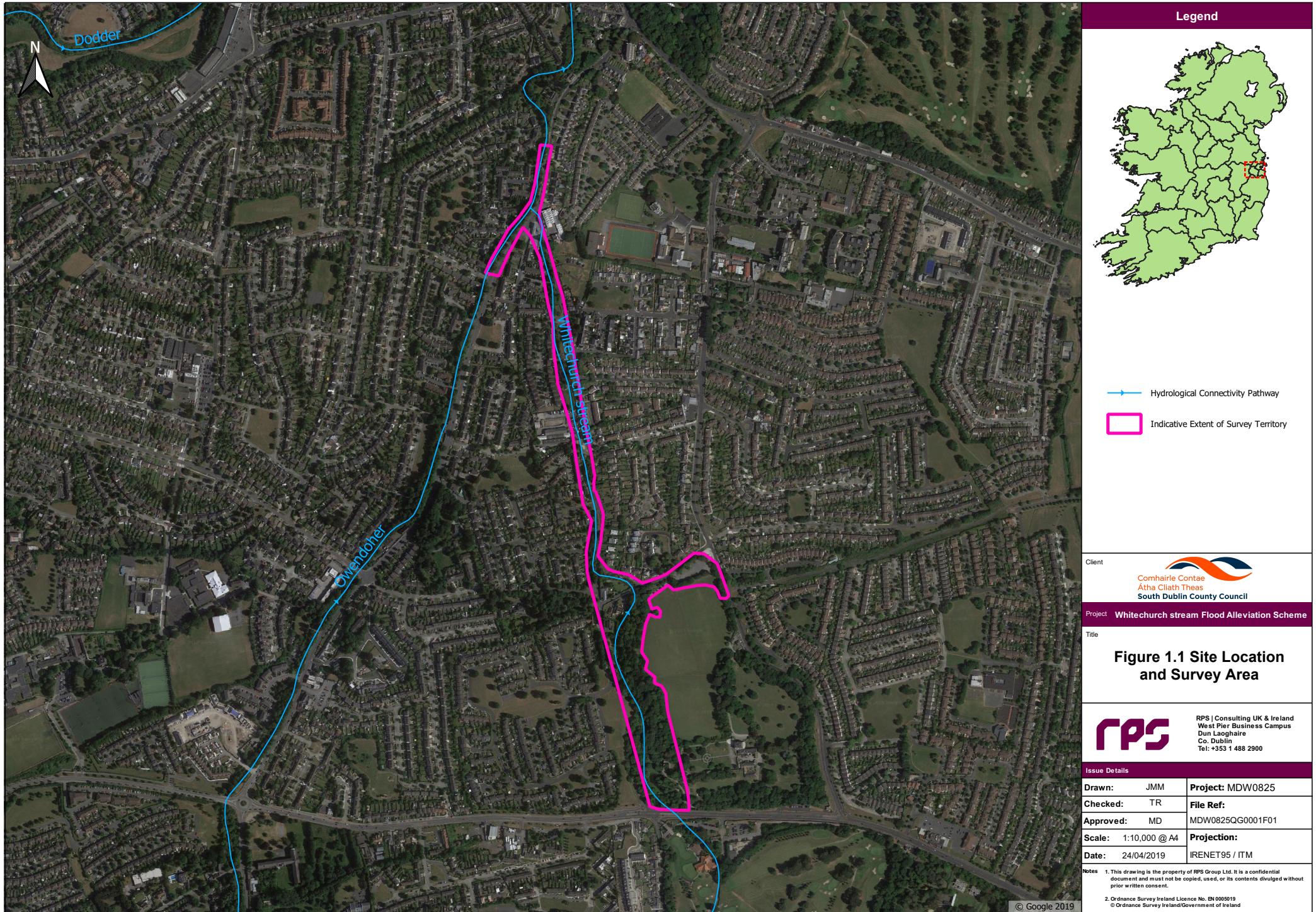
The study area includes the Whitechurch Stream at Rathfarnham, South Dublin and associated infrastructure from the downstream face of the bridge crossing at Taylor's Lane in St Enda's Park down to the upstream face of the bridge inlet crossing Willbrook Road covering approximately 1.5km length. **Figure 1-1** shows a high-level overview of the study area. The stream runs parallel along Whitechurch Road crossing it occasionally, one at a location near Sarah Curran Avenue and another at a location upstream of its confluence with the Owendoher River.

The site levels vary from 72.5m OD at Taylors Lane Bridge in St Enda's Park to 49.5m OD at the northern boundary just upstream of the confluence with the Owendoher River. The Whitechurch Stream at this location is steep with average gradient of 1:65 (1.5%).

A detailed topographical survey along with an extended geotechnical investigation were conducted for the purposes of this Project. RPS also sourced data from a Structural Condition Survey which was completed by Amelio Utilities Ltd in May 2018 for OPW. The topographical survey undertaken during the CFRAM studies was also used for reference.

1.2 Purpose of Report

This report forms part of the Planning Application Documents under Section 177AE of the Planning and Development Act 2000 (as amended) and it is entirely based on the Preliminary Design completed by OPW. It aims to identify the existing services in the study area and identify conflicts and/or potential conflicts and propose mitigation measures, where possible.



2 OVERVIEW OF THE PROPOSED DEVELOPMENT

2.1 Proposed Site Infrastructure

The Scheme consists of a series of proposed flood alleviation measures for each of the 8no. areas divided for ease of reference as described below:

2.1.1.1 Area 1 - Area downstream of Taylor's Lane and within St Enda's Park, (Ch.: 0+000- 0+510.10),

- No flood alleviation measures proposed for this area.

2.1.1.2 Area 2 - Area between St Enda's Park and Sarah Curran Bridge Inlet(Ch.: 0+510.10- 0+572.25),

- Localised bank raising with rip rap erosion protection on the left bank to the design Level of 65.1m OD for approx. 50m length,
- Removal of trees and bankside vegetation to accommodate the proposed Works,
- Debris Trap and slipway at a suitable location upstream of Sarah Curran Bridge.

2.1.1.3 Area 3 - Area downstream of Sarah Curran Bridge outlet to Whitechurch Road Bridge Inlet (weir) (Ch.: 0+578.80- 0+688.70),

- Tree removal along the left bank to reduce blockage risk at Whitechurch Rd. Bridge,
- Bank protection measures on the left bank,
- Replacement of the wooden foot bridge approximately at Ch. 620. The replacement bridge will be a timber bridge of similar size and in the same location as the existing.

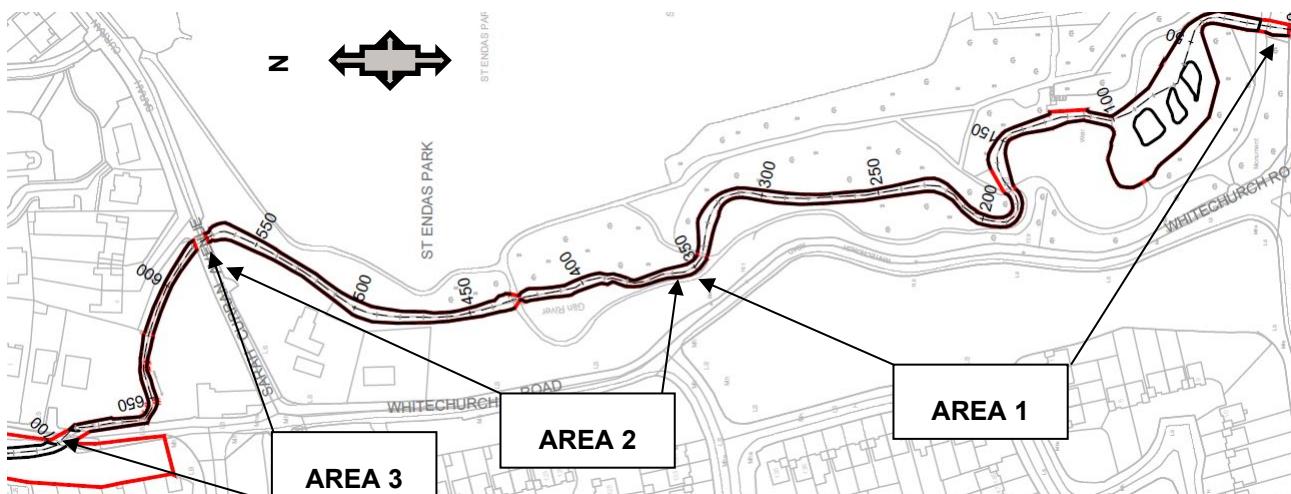


Figure 2-1: Areas 1, 2 and 3

2.1.1.4 Area 4 – Area from Whitechurch Road Bridge Outlet to St Gatiens Culvert inlet (Ch.: 0+700- 0+803.03),

- Tree clearing and vegetation removal on the right bank will be required to reduce blockage risk and to accommodate new flood defence walls.
- Bank protection will be required on the left bank.
- Underpinning will be required on the left bank.
- Proposed tree planting, bulb planting and grass seeding on Whitechurch Road – south of St Gatiens Court.
- New flood wall on the right bank side tying to existing stone wall (Level 62.95mOD) approximately 27m downstream of Whitechurch Rd. Bridge Outlet.
- New head wall at culvert inlet at level 62mOD with return wall on left bank which will replace existing railing.
- New right bank flood wall replacing existing fence. Design level at 62mOD. Wall height 1.1m-1.3m.
- Permanent sheet piling underneath new walls at St. Gatiens culvert inlet, extended upstream for approximately 30m.

2.1.1.5 Area 5 - Area from St Gatiens Court Culvert to the outlet of the Garage Culvert at Rathfarnham Ford (Ch.: 0+828.07- 0+918.61),

- Removal of existing trees and vegetation from the right bank of Whitechurch Stream will be required to facilitate the works
- New head wall at St. Gatiens Court culvert outlet at level 61.8mOD with return wall left bank replacing railing and tying into existing wall
- New right bank flood wall replacing existing low wall and fence. Wall height generally 1.2m but raising to 1.9m at the Garage culvert
- Permanent sheet piling underneath new walls at St. Gatiens culvert outlet, extended downstream for 30m
- New head wall at culvert inlet level 60.4 mOD with return wall left bank tying into existing left bank wall. Wall height 1.9m
- New right bank flood wall tying into new head wall at Garage Culvert inlet at level 60.4mOD
- Permanent sheet piling underneath new wall at Garage Culvert inlet, extended upstream for 30m
- Proposed tree planting, bulb planting and grass seeding on Whitechurch Road – North of St Gatiens Court.
- Staged Trash screen with water level gauge to be provided at Garage Culvert inlet

2.1.1.6 Area 6 - Area from Garage Culvert at Rathfarnham Ford to Willbrook Lawn Twin Culvert Outlet (Ch.: 0+983.91- 1+132.91)

- Removal of existing trees and vegetation from both sides of Whitechurch Stream will be required to facilitate the works;
- Increase concrete plinth around culvert opening to 600mm above ground level and install new railing,

- New head wall to culvert outlet level 58.25mOD. Flood wall left and right bank tying into head wall to design level 58.25mOD. Wall height 1.2m above path level. Right bank wall to tie into existing wall downstream of existing bridge.
- Permanent sheet piling underneath new walls left and right bank, at Garage Culvert outlet, extended downstream for approximately 30m
- Retention of existing right bank walls downstream of existing bridge at Capri Site. Wall to be cladded with stone.
- Proposed beech hedgerow within existing open space upstream of Willbrook Lawn twin culvert
- Replace metal railing at parking area off Whitechurch Stream Bridge with low level 400mm defence wall and railing to tie into bridge parapet and railing.
- Replace left bank existing metal railing with low level defence wall with railing on the left bank, upstream of the inlet of Whitechurch Stream Bridge with wall height 600mm above existing ground levels. Wall and railing to tie into bridge parapet and railing.



Figure 2-2: Areas 4, 5, and 6

2.1.1.7 Area 7 - Area from the outlet of the Twin Culvert at Willbrook Lawn to the Inlet of Bridge crossing Whitechurch Road (Ch.: 1+140.41- 1+410.43).

- Return wall around dual culvert inlet to tie into bridge parapet and existing boundary wall.
- Proposed tree planting on Whitechurch Road within existing open space immediately south of the junction between Whitechurch Road and Willbrook Lawn
- Localised left bank raising with rip rap erosion protection and permanent supports to be provided to decked structures along the bank.
- Left bank wire mesh fence panels at 1.2 m height above the footpath
- Proposed beech hedgerow along left bank fence.
- Right bank railing to be placed above existing wall. Top of railing at 1.2 m height above the footpath.
- Removal of existing trees and vegetation from both sides of Whitechurch Stream will be required. Existing walls right bank to be maintained at current level, however remedial works will be required.
- Suitably designed staged trash screen with water level gauge to be provided upstream of bridge/culvert face with access from the funeral home.
- Proposed planting at the open spaces immediately adjacent to the car park, upstream and downstream of the pedestrian bridge in Willbrook Lawn.

2.1.1.8 Area 8 - Bridge crossing Whitechurch Road outlet to Willbrook Road Culvert inlet (confluence with Owendoher) (Ch.: 1+420.20- 1+455)

- Tree and bankside vegetation management to reduce blockage risk to the culvert discharging to Owendoher.

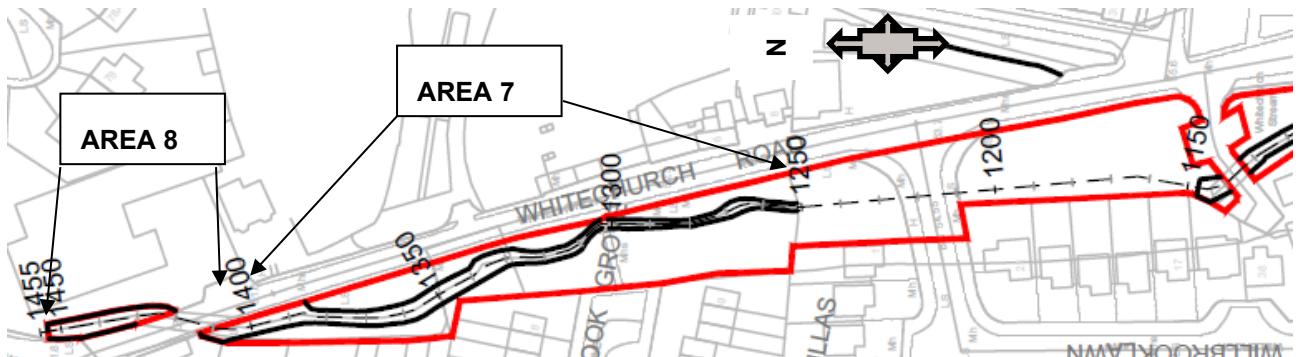


Figure 2-3: Areas 7 & 8

3 EXISTING SERVICES

The services addressed in this report include:

- Stormwater Drainage,
- Foul Sewer,
- Potable Water Supply,
- Other services including gas, electricity and telecom.

The conditions of these services in relation to the proposed Works are described in detail in the next sections.

3.1 Stormwater Drainage

3.1.1 Area 1: Downstream of Taylor's Lane and Within St Enda's Park

Previous surveys identified an existing 400mm dia. stormwater PE pipe discharging into Whitechurch Stream downstream of the footbridge on the north side of Taylor's lane.

There are also two surface water outfalls located downstream of the ornamental pond on either side of the weir. This area is not impacted by any Works, so no mitigation measures were required.



Figure 3-1: Surfacewater Outfalls Downstream of the Weir/Drop Structure

3.1.2 Area 2: Area between St Enda's Park and Sarah Curran Bridge

There are currently two surface water outfalls located on the upstream left and right side of the Sarah Curran Bridge which are shown in the pictures below.



Figure 3-2: Surface water Outfalls Upstream of Sarah Curran Bridge, left and right bank accordingly

The utility survey identified a stormwater drainage network on the west side of the Sarah Curran Bridge that drains the road from the intersection with Whitechurch Road at the bridge. It was not possible to associate either of the two visible surface water outfalls to the network surveyed and therefore not possible to establish a potential impact on the Works. Further investigation prior to commencement of construction must be completed to determine whether these drains are impacted by the Works.

3.1.3 Area 3: Area from Downstream of Sarah Curran Bridge to Bridge Crossing Whitechurch Road

The stormwater drainage network from the area to the west of Sarah Curran Bridge appears to discharge at a location downstream of the bridge although the exact location was not visible. Further investigation may be required to confirm the exact location of the outfall to avoid a possible impact on the proposed Works in this area.

3.1.4 Area 4: Area from Bridge at Whitechurch Road to St Gatiens Culvert

A 525mm diameter concrete stormwater pipe outfalls downstream of the Whitechurch Road Bridge on the left side. This is the outfall of a network that drains the south side of Whitechurch Road. The utility survey identified two other stormwater outfalls at River chainages 720m and 775m approximately.

There exists a 300mm diameter concrete stormwater outfall at the outlet of St Gatiens Court Culvert (see **Figure 3-3**). The utility survey indicated that this pipe is connected to an adjacent stormwater manhole which could represent a potential constraint on the proposed new head wall. A diversion or temporary blockage may be required during construction.



Figure 3-3: 300 mm dia. Concrete Pipe close to the outlet of St Gatiens Court Culvert

No other potential impacts between the proposed flood defence wall and the existing stormwater network have been identified in this area.

3.1.5 Area 5: Area from St Gatiens Court Culvert to the Outlet of Garage Culvert at Rathfarnham Ford

In this area, there is a 225mm diameter PVC stormwater outfall right at the inlet to the Garage Culvert. This network drains St Enda's Drive and hence must be diverted or temporarily blocked during construction of the proposed wall.

The culvert condition survey indicated 8no. outfall pipes within the Garage Culvert, one of which is shown in **Figure 3-4**. However, no Works are proposed in this section of the culvert other than increasing the concrete plinth around the culvert opening in the premises of Rathfarnham Ford.



Figure 3-4: 200mm dia. PVC Outfall Pipe Inside the Garage Culvert

3.1.6 Area 6: Area from Garage Culvert at Rathfarnham Ford to Willbrook Lawn Twin Culvert Outlet

Right at the Garage culvert outlet, there is a stormwater outfall that drains the Garage area at ch.1,020 m.

Another 2no. stormwater pipes are present at ch. 1,110 m and ch.1,040 m and upstream of the twin culvert inlet.

There are 5no. outfall pipes within the twin Garage Culvert, listed in order from upstream to downstream as shown in **Figure 3-5**:

1. 250 mm dia. concrete pipe
2. 250 mm dia. PVC pipe
3. 250 mm dia. concrete pipe
4. 250 mm dia. concrete pipe
5. 100 mm dia. concrete pipe

The 250 mm dia. concrete pipe at the entrance of the culvert could represent a potential clash with the proposed flood defence wall and must be diverted or temporarily blocked during construction.

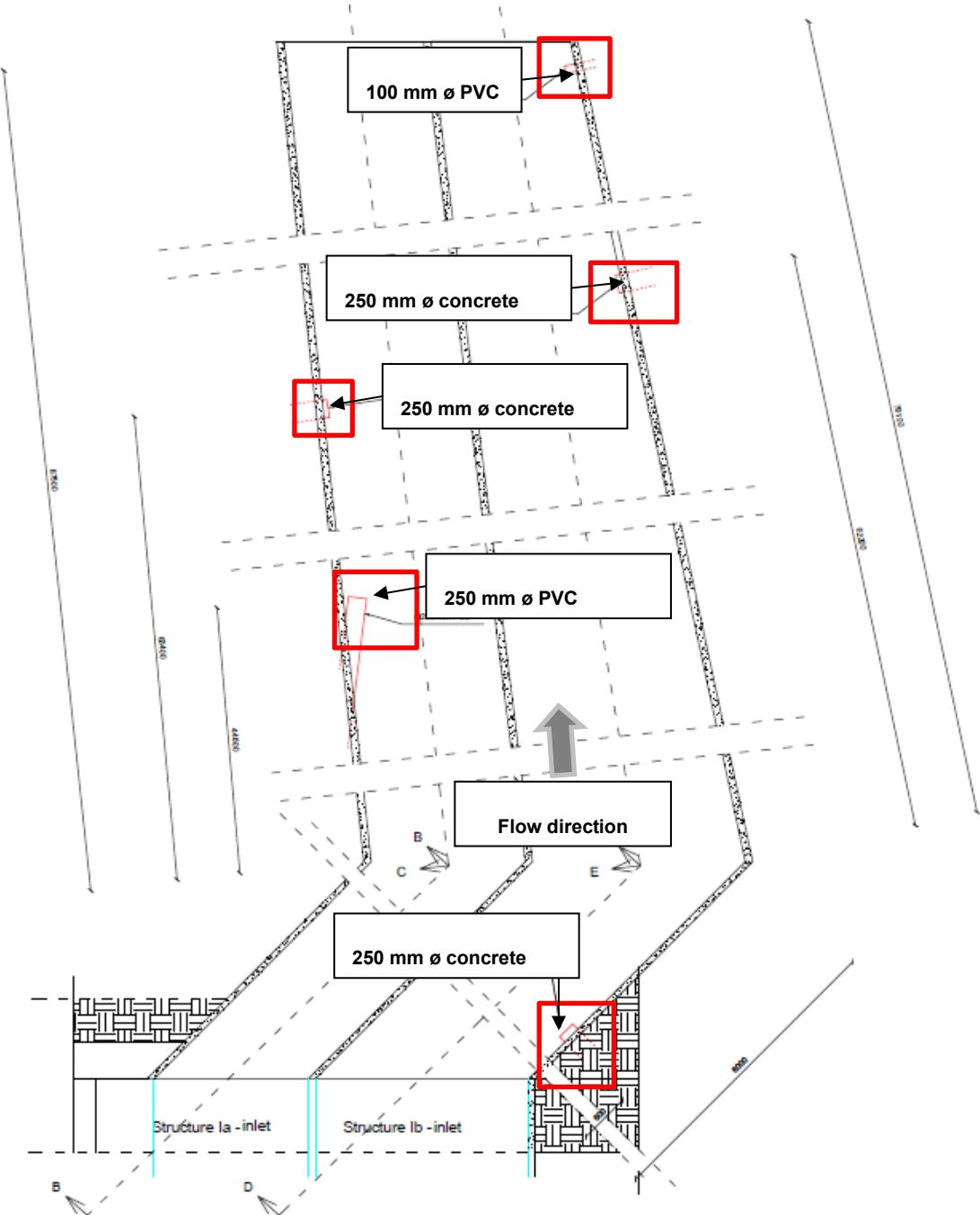


Figure 3-5: Stormwater Outfalls in the Twin Culvert Plan at Rathfarnham Ford

3.1.7 Area 7: Area from the outlet of the Twin Culvert at Willbrook Lawn to the inlet of the Bridge Crossing Willbrook Rd.

There is a 225mm diameter concrete stormwater pipe visible under the footbridge downstream of the twin culvert outlet (**Figure 3-6**). There are five others that drain Whitechurch Road at ch. 1,360m; 1,375m; 1,390m; 1,410m; and 1,425m in this area.



Figure 3-6: 225mm diameter Concrete Stormwater Pipe under the Foot Bridge

3.2 Foul Drainage

A 300mm dia. concrete combined sewer pipe along Whitechurch Road connects to a 600mm dia. concrete combined sewer pipe in Willbrook Road. This network crosses the stream twice: at the bridge between Areas 3 and 4 at the south side of the Scheme (**Figure 3-7**, **Figure 3-8**, **Figure 3-9**) and at the bridge in Area 7 at the northern end of the stream (**Figure 3-10** and **Figure 3-11**).



Figure 3-7: Pipe Crossing Whitechurch Road Bridge (Areas 3 and 4)

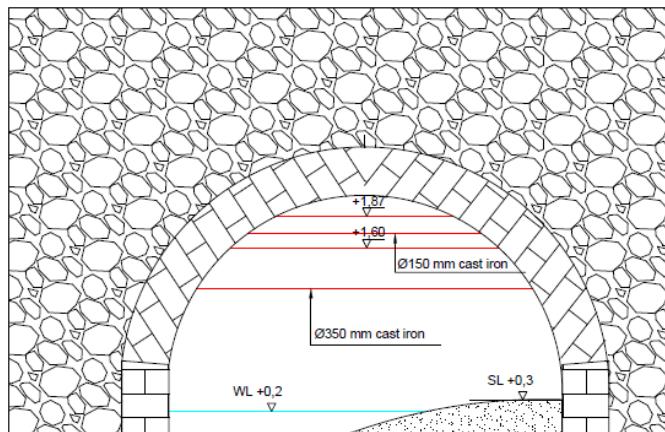


Figure 3-8: Pipe Crossing Whitechurch Road Bridge (Area 3 and 4)

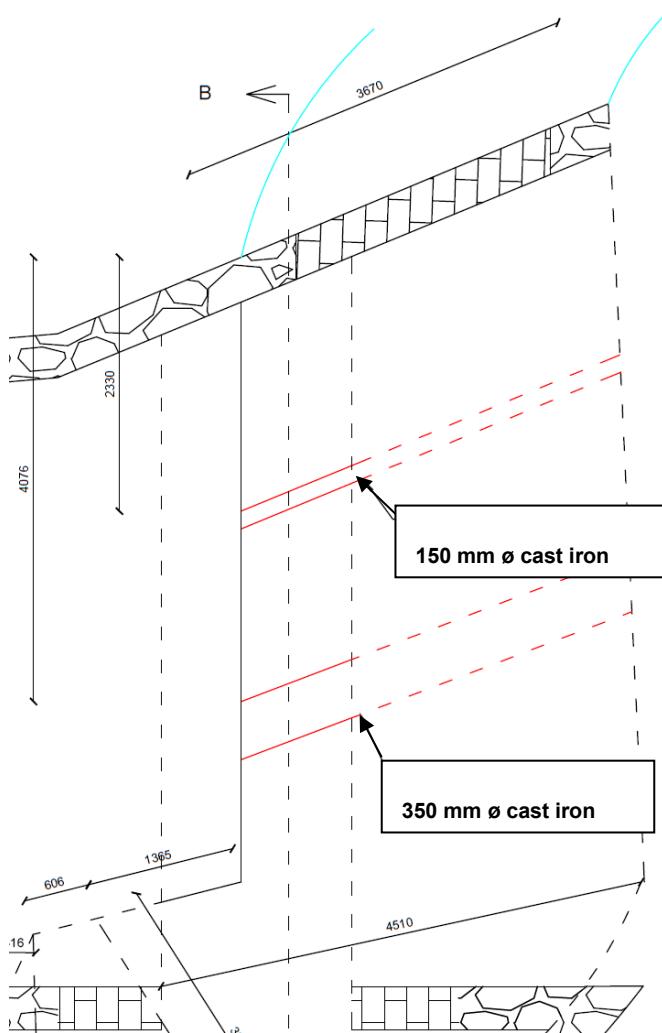


Figure 3-9: Pipe Crossing Whitechurch Road Bridge (Area 3 and 4)

The Condition and Utility Surveys (Appendix A) under the Whitechurch Road Bridge showed two pipes: one small and another bigger pipe. The surveys didn't identify the use of these (i.e. foul, electricity or gas).



Figure 3-10: Pipe Crossing Whitechurch Road Bridge (Area 7)

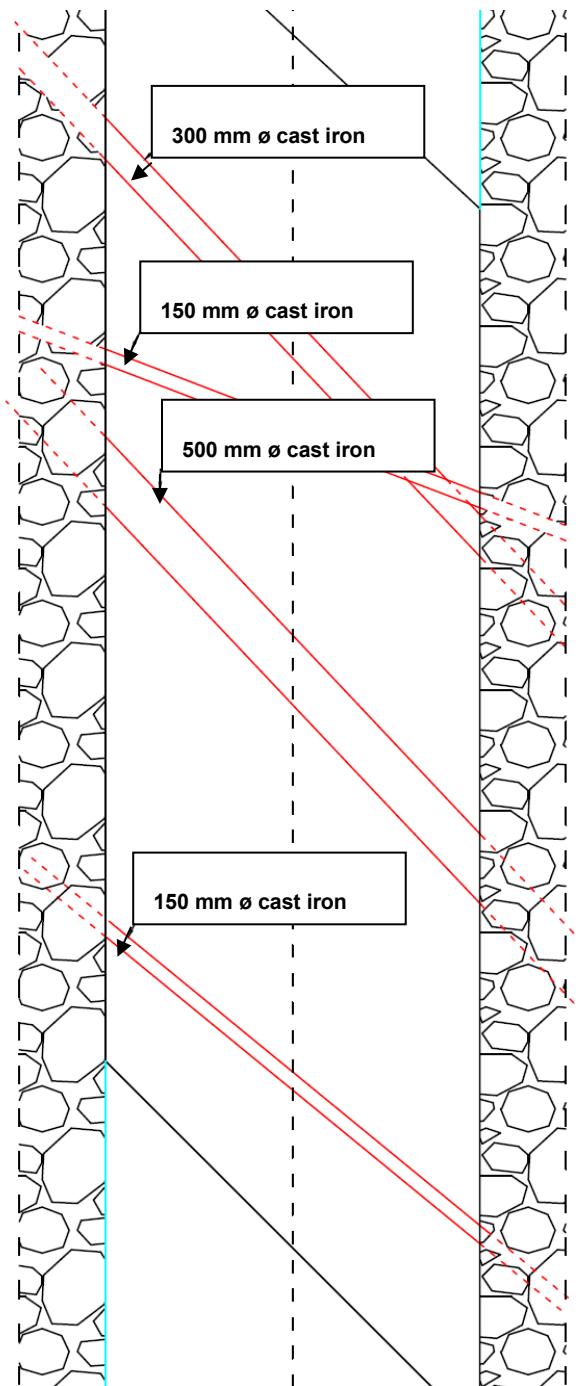


Figure 3-11: Pipe Crossing Whitechurch Road Bridge (Area 7)

Other smaller foul sewer pipes do exist along this section of the Scheme connected to private properties and crossing the stream at several locations. The first pipe, a 225mm dia. concrete pipe, traverses in a northerly direction crossing St. Gatien's Culvert at the outlet and goes underneath Whitechurch Road before turning to St. Enda's Drive.

A second pipe comes from Rathfarnham Ford area crossing the stream at the outlet of the Garage Culvert (Area 5). The utility surveys did not establish the exact cover of this pipe at crossing so further investigation may be required. This pipe joins a 225mm dia. concrete pipe and continues in a northerly direction along Whitechurch Road into a 600mm dia. Concrete pipe at Willbrook Road.

A ground investigation carried out as part of this Scheme determined that there is a possible leakage from the sewage pipe underneath Whitechurch Road in Area 7. The exact location of the leakage must be identified and controlled to avoid pollution issues to the Whitechurch Stream during construction.

3.3 Water Supply

A 4" dia. Cast-Iron water main crosses underneath the Sarah Curran Bridge, as shown in the figures below, (**Figure 3-12**, **Figure 3-13**, **Figure 3-14** and **Figure 3-15**). This pipe runs along Sarah Curran Avenue at the northern corner of St Enda's Park, and hence no diversion of this utility service is required at this location.



Figure 3-12: Suspended Pipe Crossing Sarah Curran Bridge



Figure 3-13: Close-up View of the Pipe Crossing Sarah Curran Bridge

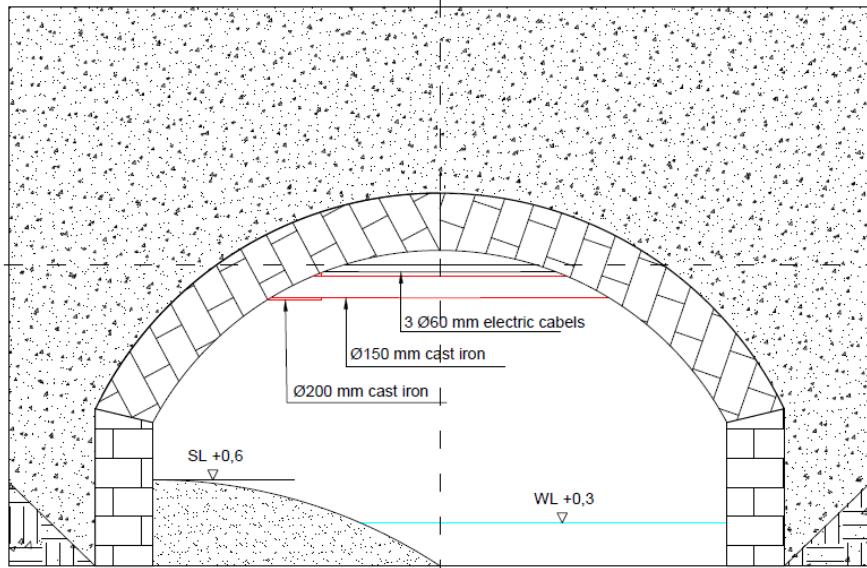


Figure 3-14: Schematic of the Suspended Pipe at Sarah Curran Bridge

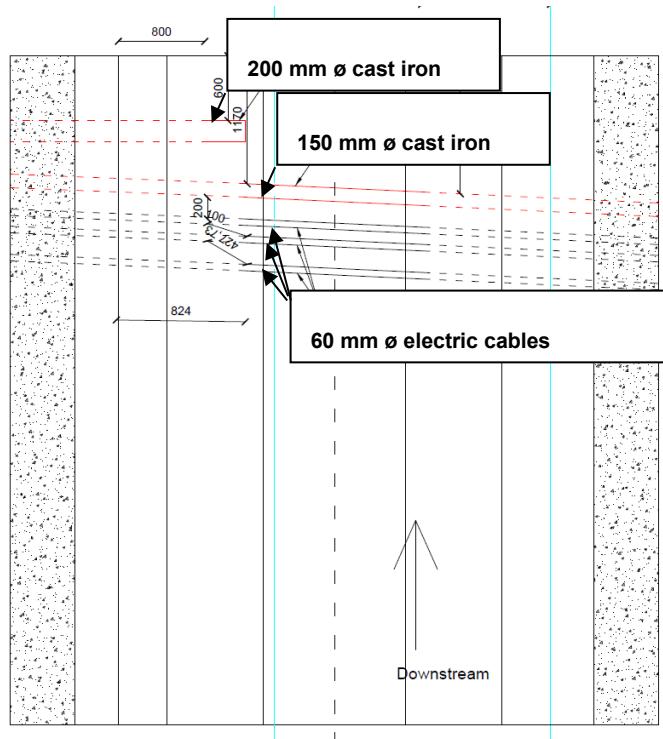


Figure 3-15: Plan View of the Pipe Crossing Sarah Curran Bridge

Another 4" dia. Cast-Iron water main runs along the Whitechurch Road crossing the bridge between Areas 3 and 4 (**Figure 3-7**, **Figure 3-8** and **Figure 3-9**). A branch of this watermain crosses St. Gatiens Culvert next to a foul sewer. Two other watermains cross the stream before entering the twin Culvert (**Figure 3-8** and **Figure 3-9**). A cast iron 150mm dia. main is visible suspended on the upstream side of the bridge deck while another 14" Cast Iron main lies above the twin culvert (**Figure 3-16** and **Figure 3-17**).



Figure 3-16: 150mm dia. Water Main Upstream of the Twin Culvert



Figure 3-17: 14" dia. Cast-Iron above Twin Culvert Inlet

The other water supply pipe within the Works area is found at ch.1,415m and runs along Whitechurch Road. This is a 4" dia. uPVC water main that crosses the bridge in Area 7 between the combined and foul sewers (**Figure 3-10** and **Figure 3-11**) at the confluence of the Whitechurch Stream and the Owendoher River.

All these water mains are on Whitechurch Road running parallel to the stream and cross via bridges or culverts and their impact on the Scheme is limited to only the crossing points.

3.4 Other Services

Gas

A 180mm dia. PE-80 [8 In] 25mba Gas line crosses downstream of Sarah Curran Bridge on the southern side (**Figure 3-14** and **Figure 3-15**). A second 125mm dia. PE- 80 25mbar line runs all the way to Willbrook Road, i.e. from the south to the northern end of the Scheme. This pipe first crosses the bridge between Areas 3 and 4 and then connects to other branches coming from east and west. It then crosses the stream at the bridge in Area 7 together with the foul sewer and watermain.

A third 90mm dia. PE-80 25mbar branch at St Gatien's Court crosses the Culvert. Further to the north, another 90mm dia. PE-80 25mbar gas line crosses the stream upstream of the twin culvert together with the suspended watermain.

Electricity

Electricity lines between Whitechurch Road and St. Enda's Drive interface with the Works. Several underground power lines were noted crossing the stream at:

- Access to St. Gatiens Ct,
- Inlet of Garage Culvert (**Figure 3-18**),
- Access bridge upstream of the Twin Culvert inlet.



Figure 3-18: Possible Electricity Line at the Entrance to Garage Culvert

Overhead wires also exist within the Works area. Details are provided in Appendix A.

The following Works locations have proximity to the overhead power lines:

- Downstream of Sarah Curran Bridge in Area 3, i.e. 7 meters above the pavement,
- Along the access road adjacent to the stream in Area 3, i.e. 6 meters above the pavement,
- Over Whitechurch Road Bridge between Areas 3 and 4, i.e. 6 meters above pavement,
- Over the access bridge to the derelict property in Area 6, i.e. 6 meters above pavement.

Telecom

Telecom lines exist along entire area of the Scheme. 2n. 85mm dia. PP line cross downstream of Sarah Curran Bridge at the southern boundary. Another 85mm dia. ST and 4x100mm dia. PP lines run from

Whitechurch Road to St. Gatien's Court crossing the bridge Between Areas 3 and 4. From St Gatien's Court to the north, the 85mm ST and 4no. 100mm dia. PP lines run separately crossing the bridge in Area 7.

Other telecom lines stream crossing points include:

- At St Gatiens Court access,
- At the access bridge upstream of the Twin Culvert inlet,
- At Willbrook Lawn.

3.5 Ancillary services

Further engagement with electricity and telecoms service providers will take place before construction as the proposed Works will require water supply of three phase electricity.

3.6 Summary

Table 3-1 provides a summary of identified clashes between services and the proposed flood defence Scheme. Confirmed clashes which will require a diversion are highlighted in red. Services at less than 1m clearance are identified as potential clashes and are highlighted in yellow.

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Table 3-1: Summary of Identified Services in the Works Area¹

Service Type	Overhead wires	Telecom line	Electricity	Gas	Watermain	Foul sewer	Stormwater
River Chainage							
580-600	Right bank. 5 m high from ground level. Ensure safe working distance.						
580							Left bank. Potential clash depending on the extent of remedial Works needed on the wall as well as during tree clearing
690	Right bank. 6 m high from slope top, potential clash with tree clearing						
703							Unidentified suspended pipe service downstream of the Whitechurch Road Bridge
730		Right bank.0.5 m distance from proposed wall					
775							Right bank. Potential clash with proposed wall- possible outfall into stream
805		Right bank. Clash with proposed wall. Utility depth <0.4 m.					
826-830		Right bank. Clash with proposed wall. Utility depth <0.4 m.				Right bank. 1 m distance from proposed wall.	
835-840		Right Bank. 0.5 m distance from the proposed wall. Utility depth <0.4 m.					
826-860						Right bank. Clash with proposed wall at all length	
860			Right bank. Clash. Utility depth 0.2 m				
907	Right bank. Overhead wires junction: 1m distance from wall						
911		Right bank. clash. Utility depth 0.4 m					
920		2 lines present. One clashes, the other line's distance < 0.2m from the proposed wall	Right bank. Utility distance <0.2m from proposed wall				
1020						Clash. Utility crosses underneath the riverbed.	

¹ Key: - Red - confirmed, Yellow - services within 1m distance from the proposed Works

				depth<0.2 m from riverbed
1030	Right bank. clash with the proposed wall. Utility depth 0.5 m			
1030-1130	clash with the proposed wall for entire length of the wall (crossing or at a distance <0.5m)			
1070	6 m high from ground level			
1100				Left bank. Clash with the proposed wall. No depth defined for the utility in the utility survey
1110-1130	Left bank. 3m distance from proposed wall, depth 0.9 m	Left bank. 3 m distance from proposed wall, 0.5 m depth	Left bank. 2.5 m distance from proposed wall. No depth defined from the utility survey	
1134	Whitechurch access bridge. 1 m distance from proposed wall, utility depth <0.2 m		Whitechurch access bridge. clash with proposed wall. Utility elevation not specified in the survey.	
1134	Right bank. Clash with proposed wall. Utility depth 0.7m from ground level.		Right bank. clash with proposed wall. Utility elevation not specified in the survey.	
1150				Right bank. Clash with proposed wall. Utility depth <0.2m from slope bottom ground.
1250-1410	Right bank. Utility line above proposed wall, min distance 6.6 from ground level	Right bank. Clashes with proposed wall. Depth 0.5 m from ground level		
1300				Right bank. Clash with proposed wall. Utility depth 0.5 m from ground level.
1360				Right bank. Potential clash wall- outfall, depth 0.5 m from ground

4 BUILDINGS

A Desktop Archaeological Study carried out for this project which concluded that there will be no impact on any of the existing monuments from the proposed development. However, a pre-construction survey and construction monitoring is recommended.

Some private businesses (a Creche and a Funeral Home amongst others) will have a direct or indirect interface with the Works. There will be also a requirement for access to premises to facilitate the Works. Access permission will be sought to the following areas:

1. Bank improvement in Area 3,
2. At the inlet of St. Gatien's Court culvert in Area 4 on the left bank,
3. At Rathfarnham Ford culvert outlet,
4. Willbrook twin culvert in Area 6, and
5. Area 5, at the Garage culvert opening.

5 ROADS AND ACCESS

5.1 Overview

The proposed Scheme will utilise the two semi-urban narrow single carriageway roads: Sarah Curran Avenue and Whitechurch Road. A narrow footpath at the edge of these roads may require diversion during construction. There is no plan proposed to change the existing road layout under this scheme. However, machinery will take up part of the footpath and the carriage way during construction and hence an appropriate temporary traffic management plan (as shown in **Appendix B**) must be in place during construction.

5.2 Access

Access to the Works area will be through the Sarah Curran Avenue and Whitechurch Road. Areas 2, 3 and 5 are accessed via a public entrance to St Enda's Park Car Park. Other Works area will require access permission from landowners. Area 4, the remaining parts of Area 5, 6 and 7 are accessed from the right bank of the stream at the pedestrian walkway.

5.3 Parking Areas

There is a car parking area on the east of the Whitechurch Stream along Sarah Curran Avenue (**Figure 5-1**). Currently, the parking area is used for visitor parking. This area is proposed to be used as a site compound.

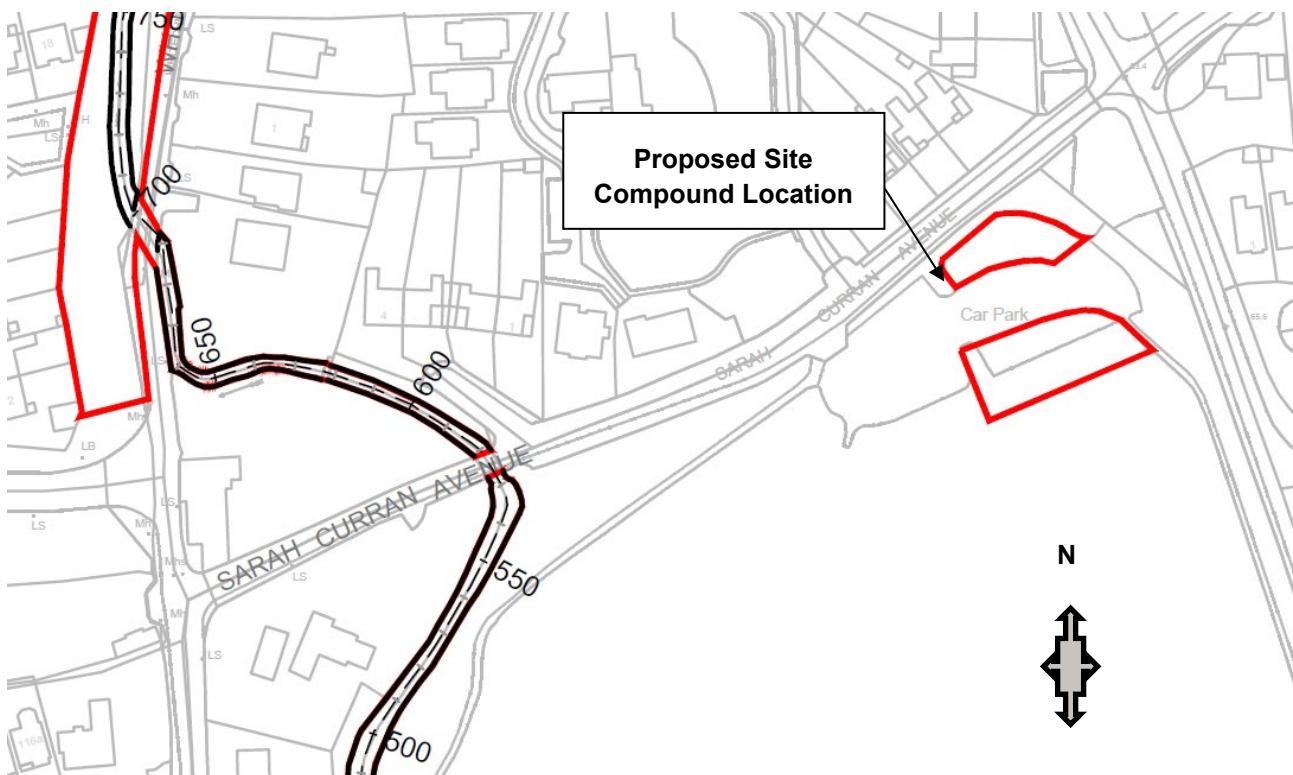


Figure 5-1: Proposed Site Compound in St Enda's Car Park, in the vicinity of Area 2

6 FLOODING

The Whitechurch Stream catchment is approximately 7.3km² with an estimated Qmed value of 3.26m³/sec. The average slope of the catchment is 1:18 (i.e. 5.6%), which is close to the highest end (6%) of a typical flashy (torrential) catchment with a basin response time of less than 3 hours and flow velocities more than 3m/sec. Because of this, the stream is susceptible to the occurrence of sudden, short and violent flood events that leaves little or no response time for flood warning systems to be effective.

Several on site surveys were undertaken along the Whitechurch Stream to better understand flooding mechanisms, morphological characteristics and inline structures that exacerbate the risk of flooding. It is noted that the stream channel traverses via several narrow bridges and culverts, heavily vegetated sections including trees projecting into the channel, sharp corners and several utilities underneath bridge openings. Under no flooding situation, the water surface is well below the banks and confined within the channel. Where the stream is even slightly curved, inertia throws this fast-moving current against the outside of the curve. Near the inner bank, the quietest waters accumulate. The finest sediments deposited in the channel itself are fine sands.



Figure 6-1: Fine Deposits Downstream of the Taylor's Lane within St. Enda's Park

Bottom coarse sediments are concentrated mainly in the vicinity of inline structures as culverts or bridges.



Figure 6-2: Coarse Sediments Upstream of Sarah Curran Bridge

Silts and muds may be also found along the stream, but these are at the boundary of the proper channel. Signs of blockages are visible, caused mainly by trees.



Figure 6-3: Trees in the Riverbank Downstream of Rathfarnham Ford Culvert

As the Works are on the flood plains, flooding may occur during extreme events as result of overbank flows, blockage of culverts and bridges or surface water drainage pipes.

7 EARTHWORKS AND TREE FELLING

A Site Investigation (SI) was carried out in the form of slit trenches, trial pits and boreholes to determine the exact location and nature of services in the Works area. The findings of the SI Works are summarised as follows:

- Topsoil: encountered in 100 to 200 mm thickness in most exploratory holes.
- Silty/Sandy Gravel: Sandy gravelly clay, frequently with low cobble content and occasionally with bands of clayey sand and gravel. Typically, firm in upper horizons, becoming stiff with increasing depth.
- Bedrock (Limestone): Rockhead was encountered during rotary drilling at depths ranging from 3.6 m in BH03 to 5.9 m in BH01.

The Slit trenches excavated during the SI indicated the presence of different service lines which may interfere with the proposed flood defence Works. Some of these services are listed in Table 3-1. A summary of those encountered are listed in Table 7-1.

Table 7-1: Service that Interface with the Proposed Flood Defence Works

Slit Trench ID (River Chainage)	Services interfering with the proposed Flood Defence Works
ST5 (910)	<ul style="list-style-type: none"> • 3 Service ducts (125 mm ø PVC) under the footpath between the grass area and Whitechurch Road at 0.5m depth. • 100 mm ø cast iron possible watermain and a 100 mm ø cast iron possible gas line at 0.16m and 0.6 depth respectively between the footpath and the road.
ST6 (1050)	<ul style="list-style-type: none"> • 2 cable ducts PVC 100mm ø at 0.45m depth • 100 mm ø cast iron possible watermain and a PVC 100mm ø possible gas line at 0.6 depth between the footpath and the road.
ST7 (1123)	<ul style="list-style-type: none"> • 300 mm ø concrete sewage pipe and 250 mm ø clay pipe possible sewage in grassed area at 1.55m and 1.6m depth, respectively. • 2 cable ducts PVC 100 mm under footpath at 0.4m depth and approx. 2m from existing wall
ST8 (1278)	<ul style="list-style-type: none"> • 2 cable ducts PVC 100 mm ø under footpath at 0.4m depth and approx. 2m from existing wall.
ST9 (1340)	
ST10 (1400)	<ul style="list-style-type: none"> • 100 mm cast iron pipe possibly watermain under the footpath at 0.26m depth. • 125 mm ø cast iron pipe possibly gas main at approximately 1m from the footpath below the road at 0.75m depth.

Flood alleviation measures such as bank raising and hard defence construction along with tree removal will require specific earthworks design. It is intended that the proposed ground levels will match the existing ground levels as much as possible while taking into consideration, operational and physical constraints for the drainage of surface water from roads and hardstanding areas. Proposed site levels are indicated on the relevant planning drawings.

Earthworks in general will be fully identified following completion of the geotechnical analysis. In this regard, it is intended to remove the topsoil to accommodate the Works.

All the soil excavated will be stored and managed in the compound located in St Enda's Car park (**Figure 5-1**).

8 HEALTH & SAFETY

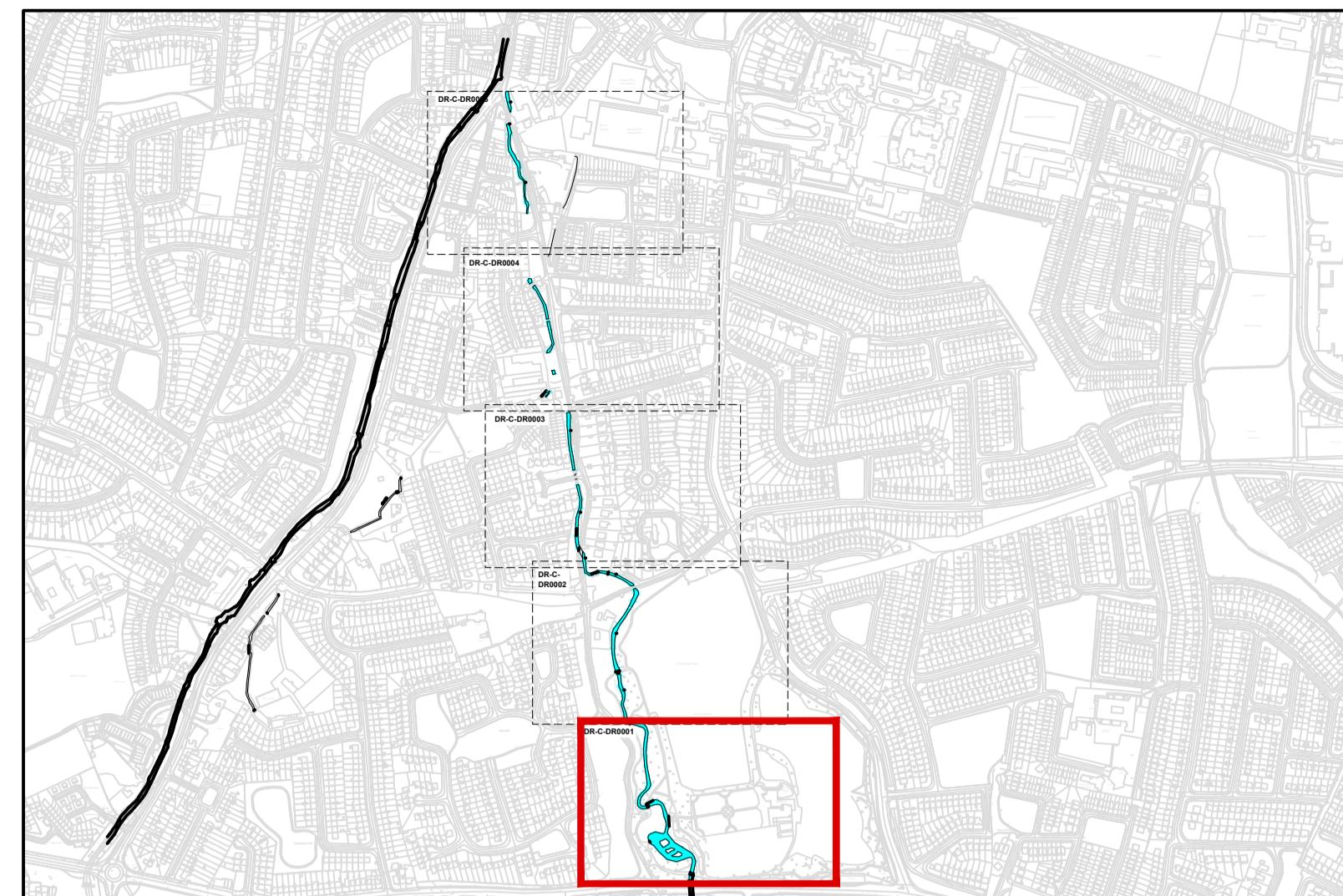
A designer's risk assessment for the Works, as required by the Safety, Health, and Welfare at Work Construction Regulations 2013, was compiled by OPW (the designers) and was passed to RPS. Principles of prevention were considered when the assessment was completed. Identified hazards were designed out where possible and mitigation measures where not. The Contractor (or OPW) will be provided with the Preliminary Health and Safety Plan, prior to the construction stage which contains a record of any residual risks arising during construction.

9 CONCLUSION

This report was compiled in support of the Whitechurch Stream FAS Planning Application under Section 177AE of the Planning and Development Act 2000 (as amended). Its aim was to identify existing services in the study area and identify conflicts wherever they might exist within the proposed Scheme boundary and propose mitigation measures where required. Information on utility services within the Scheme relied on from various sources including utility surveys, ground investigation, culvert condition surveys, etc. carried out between May 2018 and December 2019.

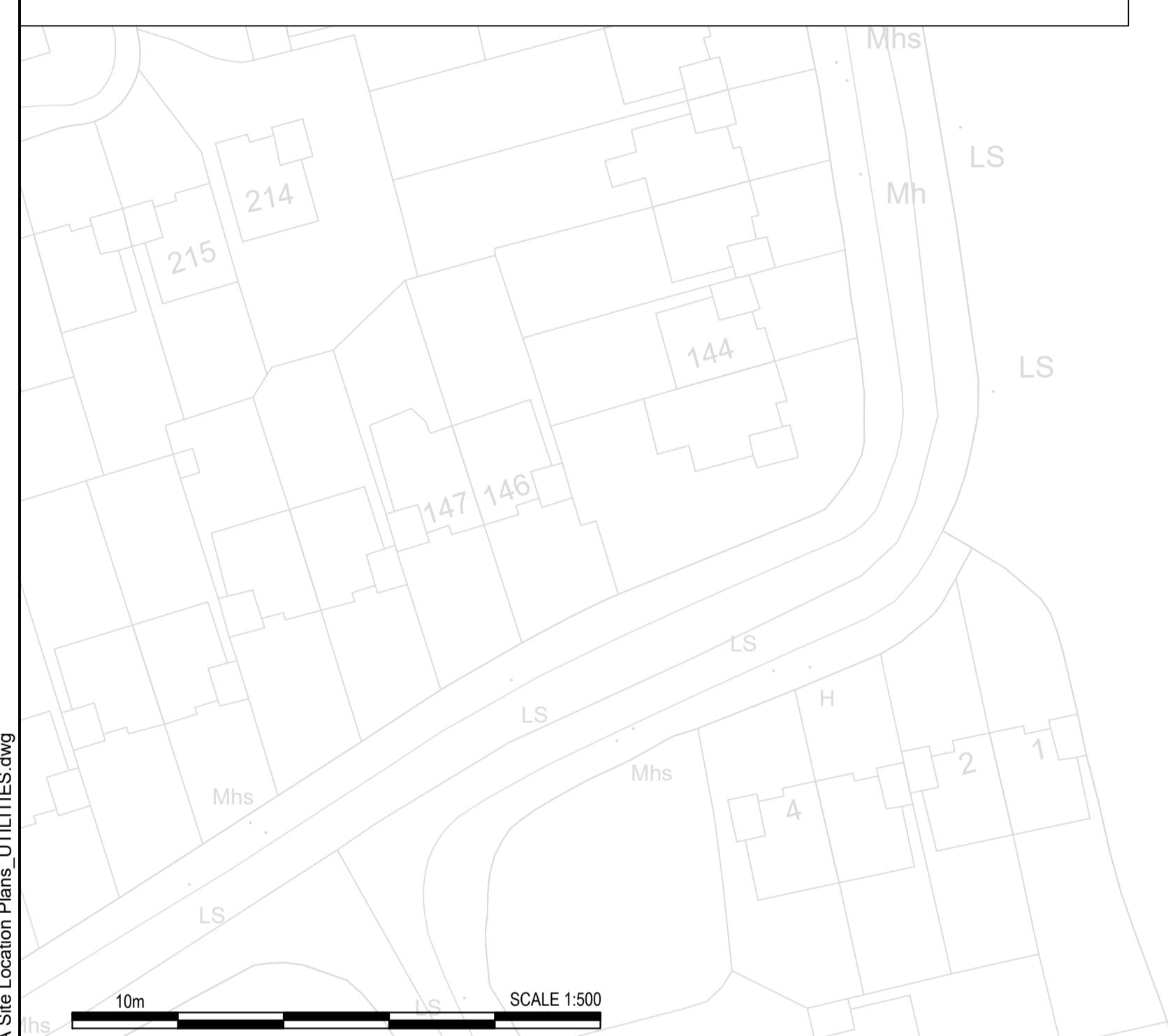
The services identified at the subject site run along Whitechurch Road parallel to the stream above or underground crossing the stream under bridges and culverts. Interfaces with the proposed Scheme were identified at different Works areas of the Scheme and hence diversion or other suitable methods must be used during construction to mitigate impacts on these services.

Appendix A: Utility Survey



SCHEME LOCATION

Scale: 1:10,000



NOTE - SECTIONS

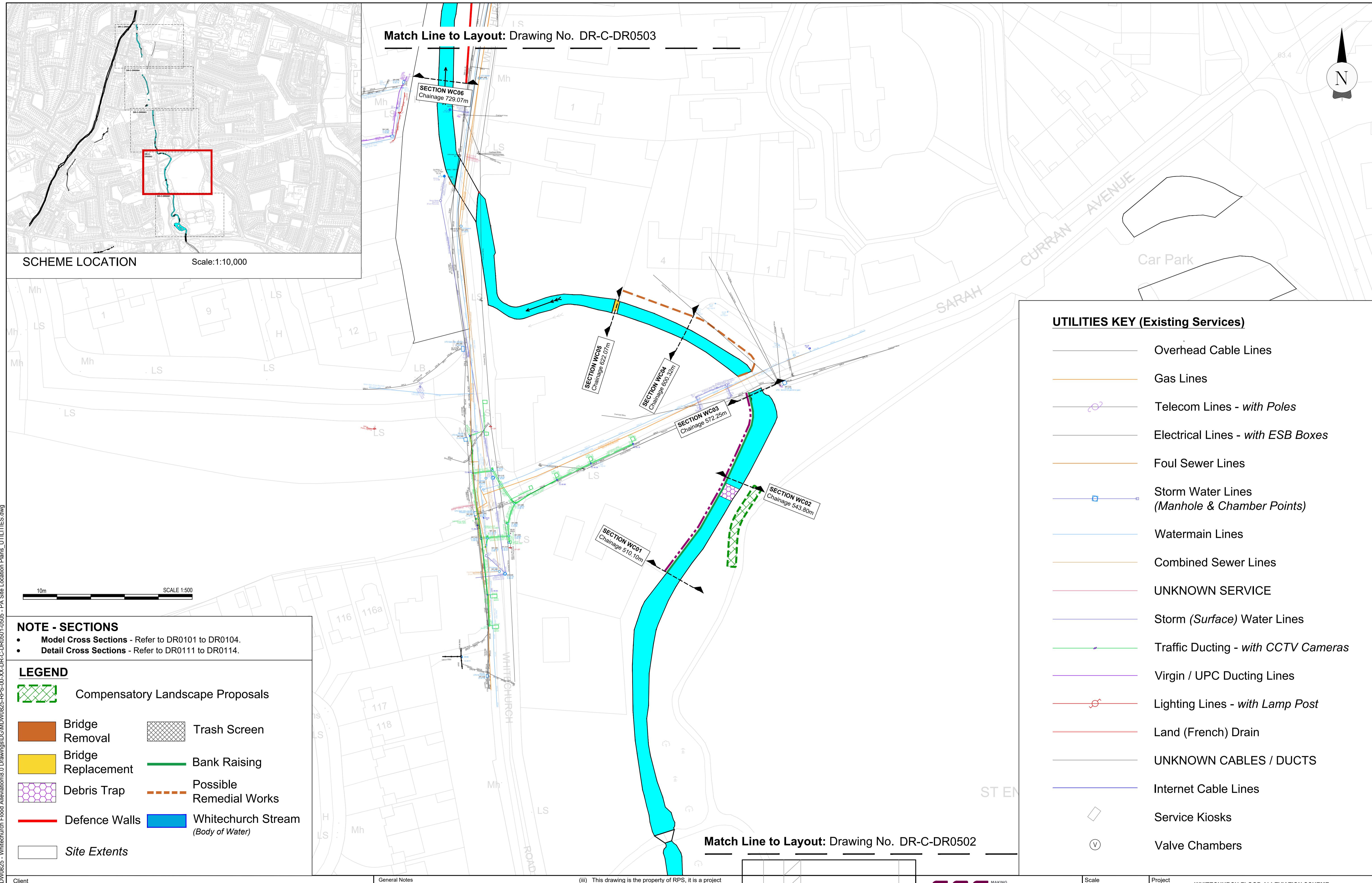
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- Detail Cross Sections - Refer to DR0111 to DR0114.

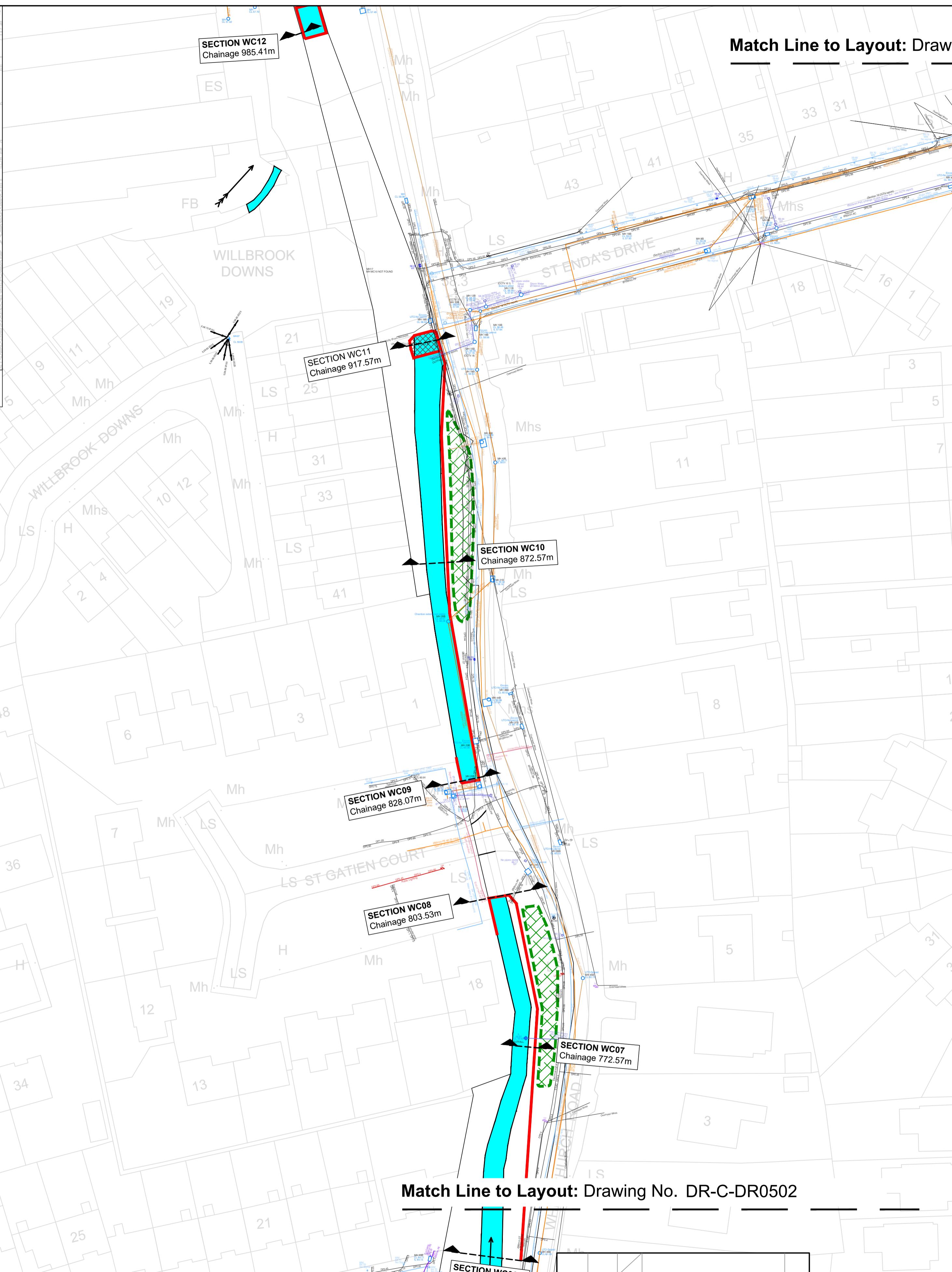
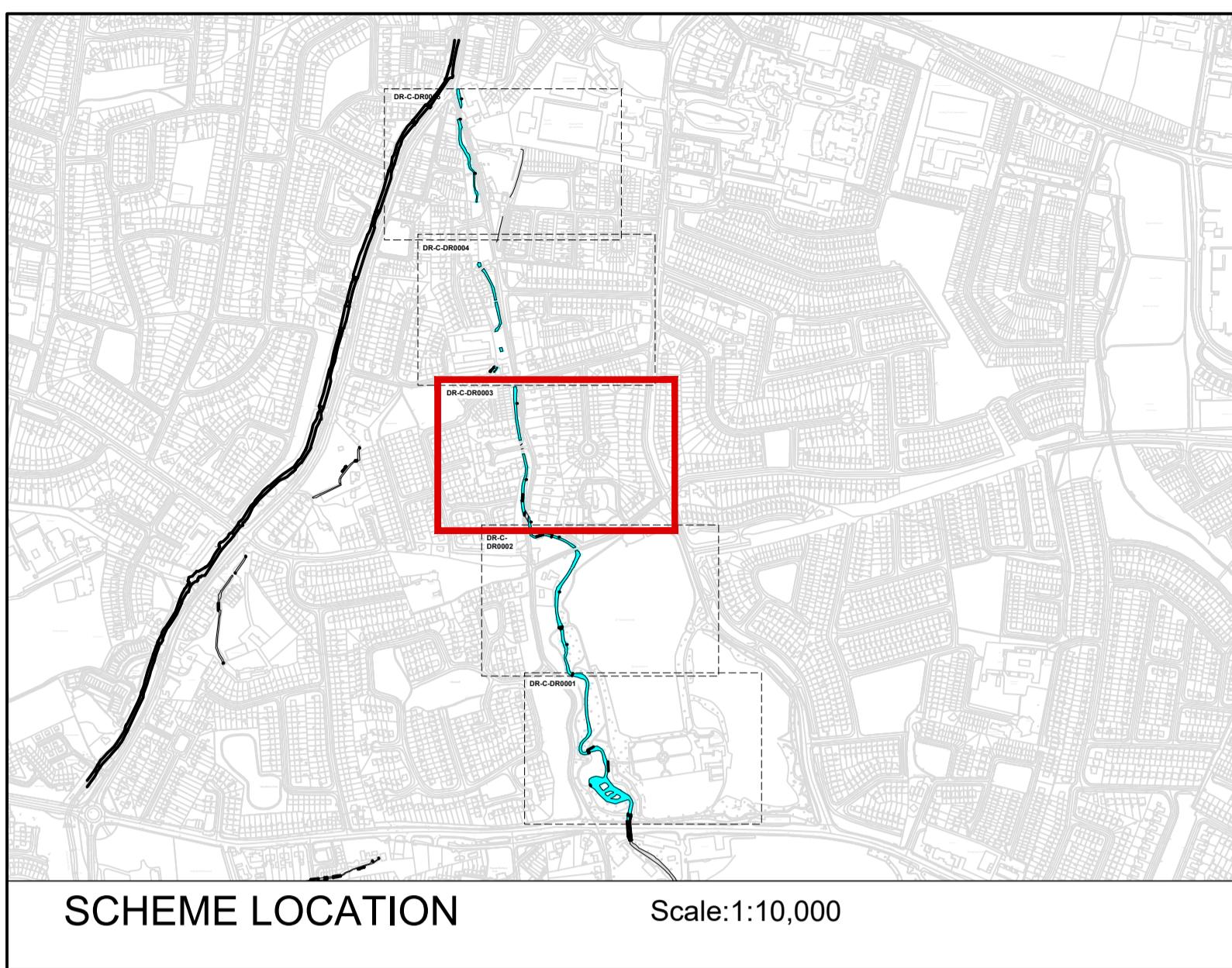
LEGEND

	Compensatory Landscape Proposals
	Bridge Removal
	Bridge Replacement
	Debris Trap
	Defence Walls
	Trash Screen
	Bank Raising
	Possible
	Remedial Works
	Whitechurch Stream (Body of Water)
	Site Extents

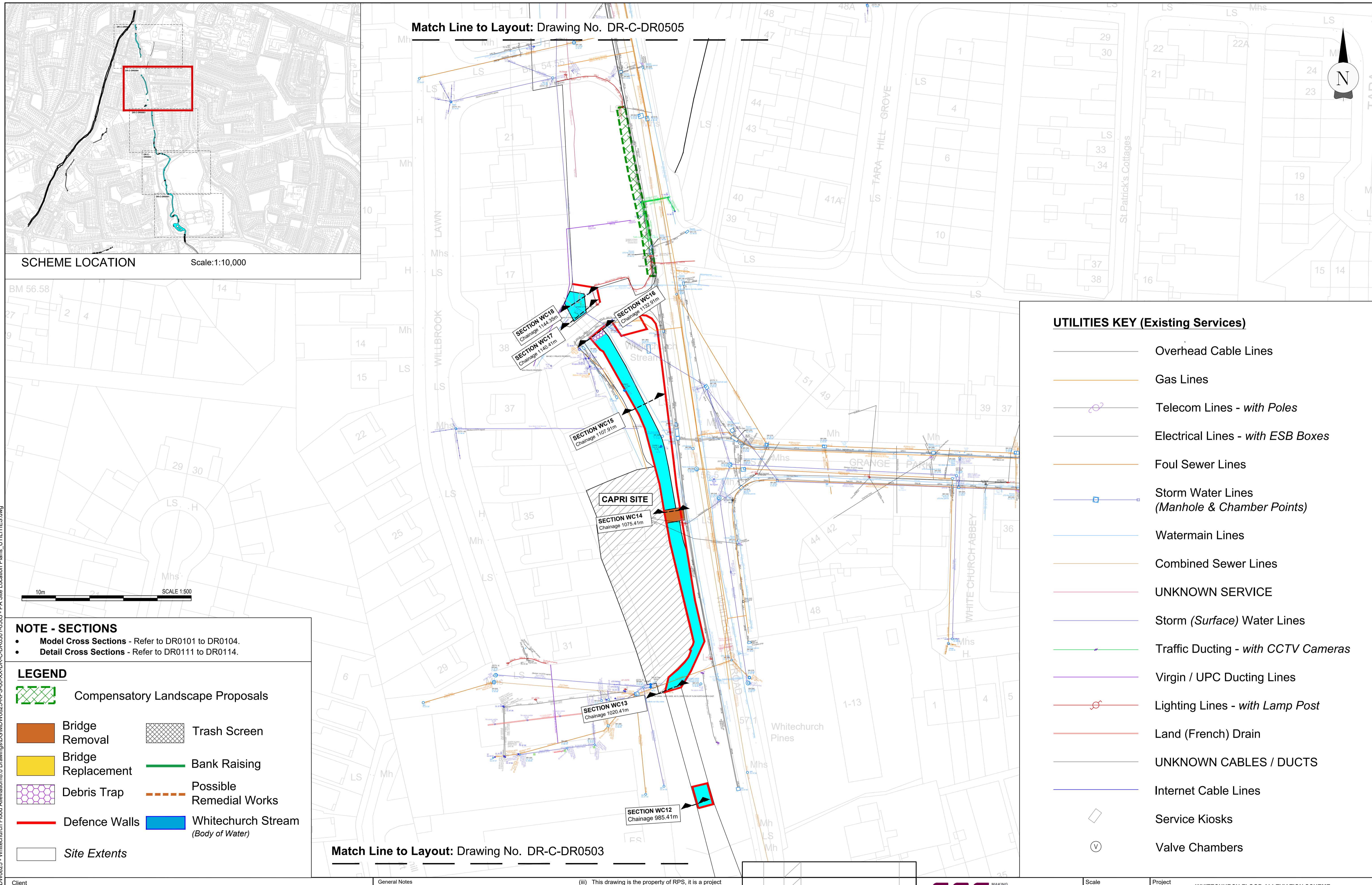
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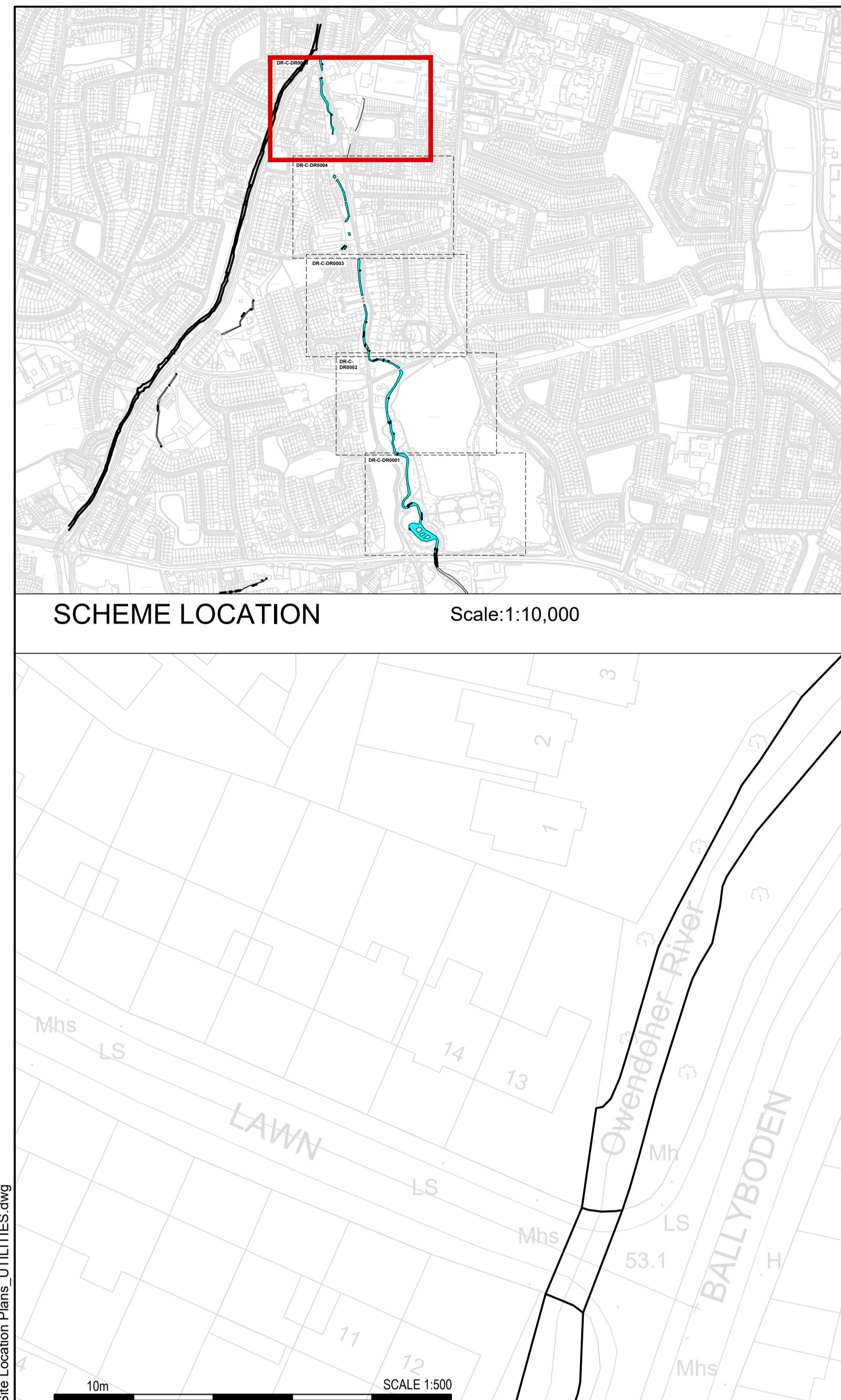






UTILITIES KEY (Existing Services)	
Overhead Cable Lines	
Gas Lines	
Telecom Lines - with Poles	
Electrical Lines - with ESB Boxes	
Foul Sewer Lines	
Storm Water Lines (Manhole & Chamber Points)	
Watermain Lines	
Combined Sewer Lines	
UNKNOWN SERVICE	
Storm (Surface) Water Lines	
Traffic Ducting - with CCTV Cameras	
Virgin / UPC Ducting Lines	
Lighting Lines - with Lamp Post	
Land (French) Drain	
UNKNOWN CABLES / DUCTS	
Internet Cable Lines	
Service Kiosks	
Valve Chambers	



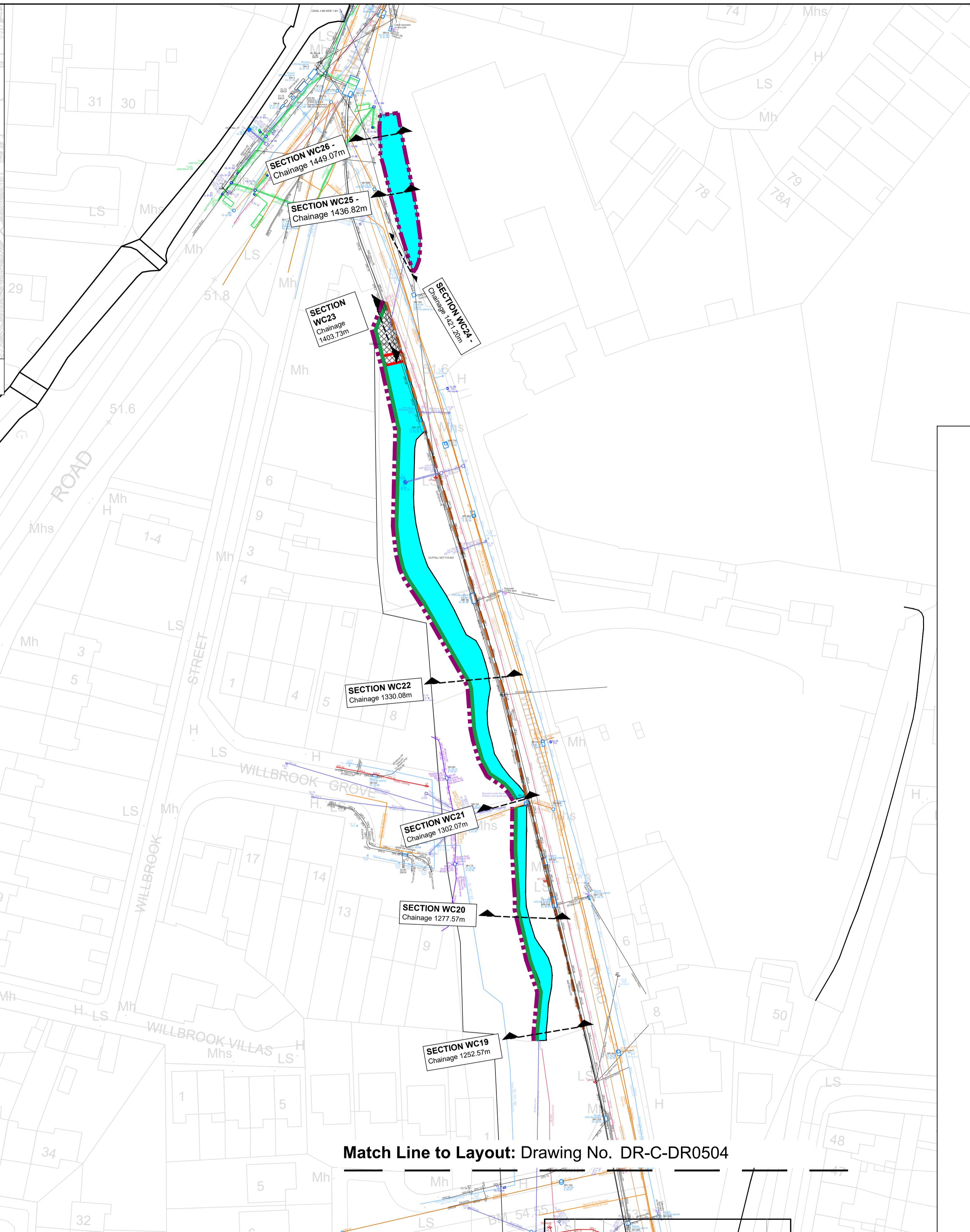


NOTE - SECTIONS

- Model Cross Sections - Refer to DR0101 to DR0104.
- Detail Cross Sections - Refer to DR0111 to DR0114.

LEGEND

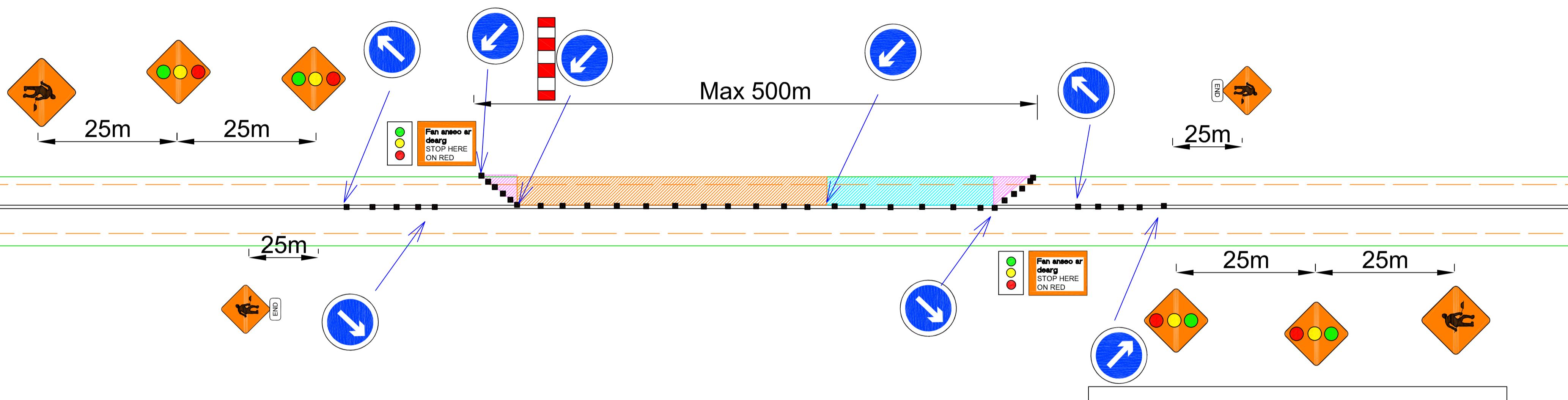
	Compensatory Landscape Proposals
	Bridge Removal
	Bridge Replacement
	Debris Trap
	Defence Walls
	Trash Screen
	Bank Raising
	Possible
	Remedial Works
	Whitechurch Stream (Body of Water)
	Site Extents



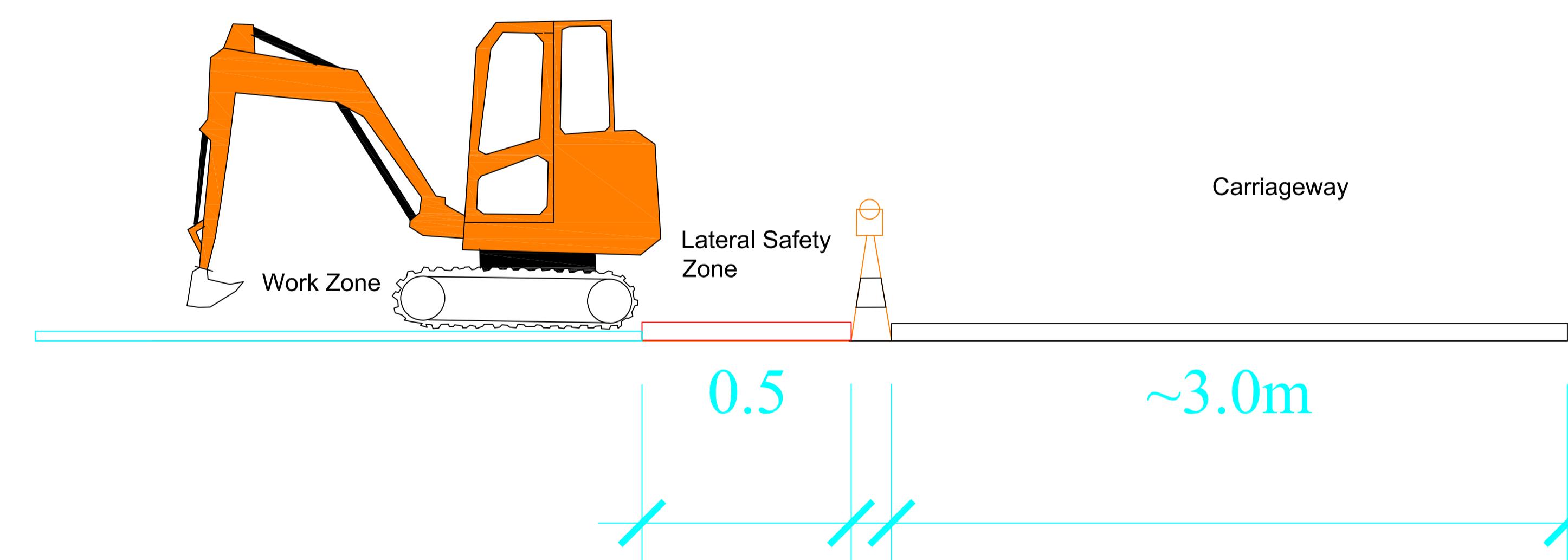
UTILITIES KEY (Existing Services)

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	Gas Lines
	Telecom Lines - with Poles
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	Foul Sewer Lines
	Storm Water Lines (Manhole & Chamber Points)
	Watermain Lines
	Combined Sewer Lines
	UNKNOWN SERVICE
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	Traffic Ducting - with CCTV Cameras
	Virgin / UPC Ducting Lines
	Lighting Lines - with Lamp Post
	Land (French) Drain
	UNKNOWN CABLES / DUCTS
	Internet Cable Lines
	Service Kiosks
	Valve Chambers

Appendix B: Active Traffic Management System

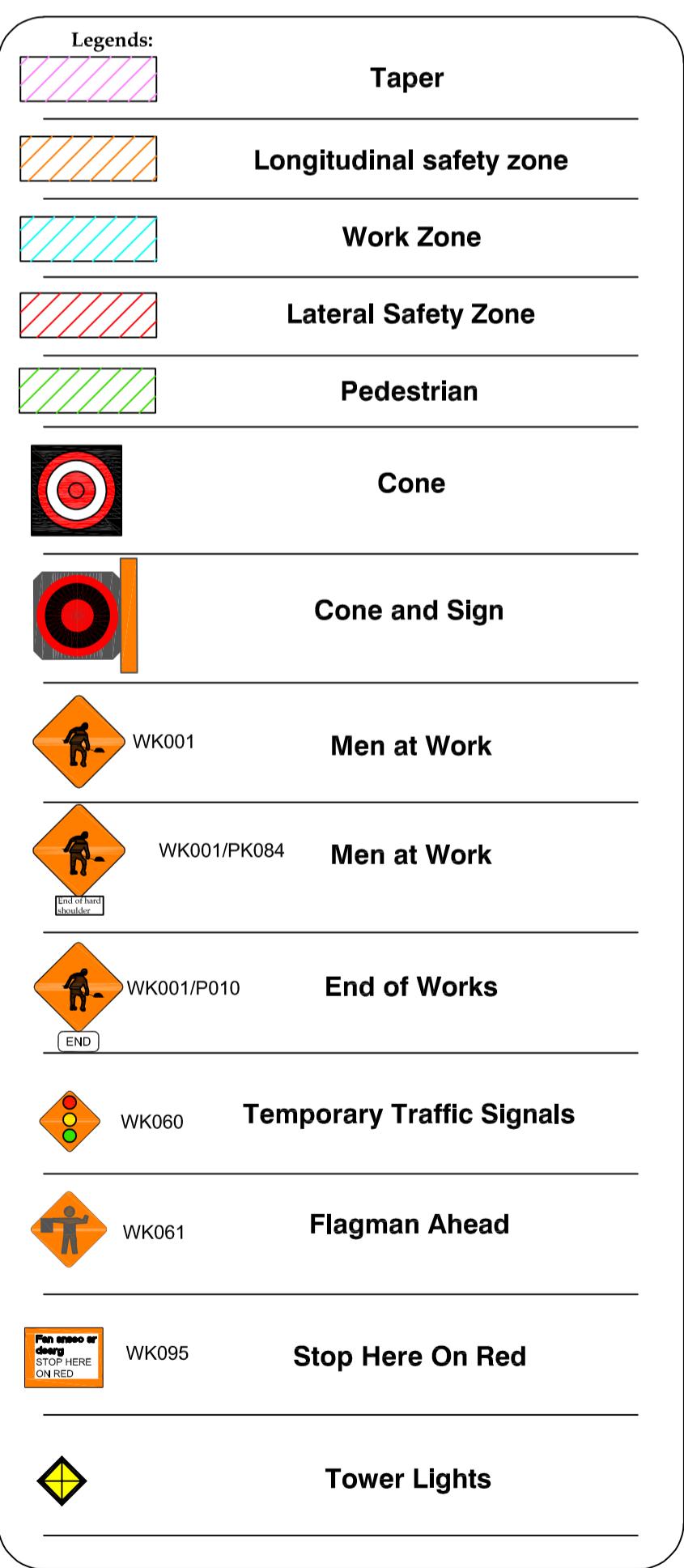


**Traffic Management System
for Excavations Level 2**



**Traffic Management System
for Excavations/Boreholes
Level 2**

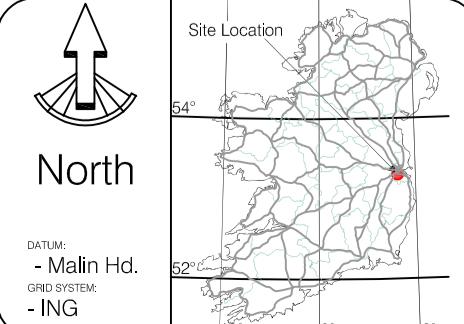
Design Parameters	
Road Level	Level 2
Roadworks Type	Type A&B
Speed limit(Km/hr)	50-60Km/hr
Temporary Signs	
Sign Visibility(m)	50
Number of Signs	3
Advanced Sign Spacings(m)	25
Rate of Taper	
Taper at Lane	1 in 15
Taper at hardshoulder	1 in 10
Safety Zone	
Longitudinal(m)	25
Lateral Behind Cones(m)	0.5
Cone Spacing	
Taper	3.0
Longitudinal	6.0
Minimum Lane Width	
Min Lane Width(m)	3.0
Traffic Management System	
Method	Static lane Closure
Maximum coned Area	500 km
Maximum traffic Volume	AADT>5000vpd



Works Cross Section

General Notes:

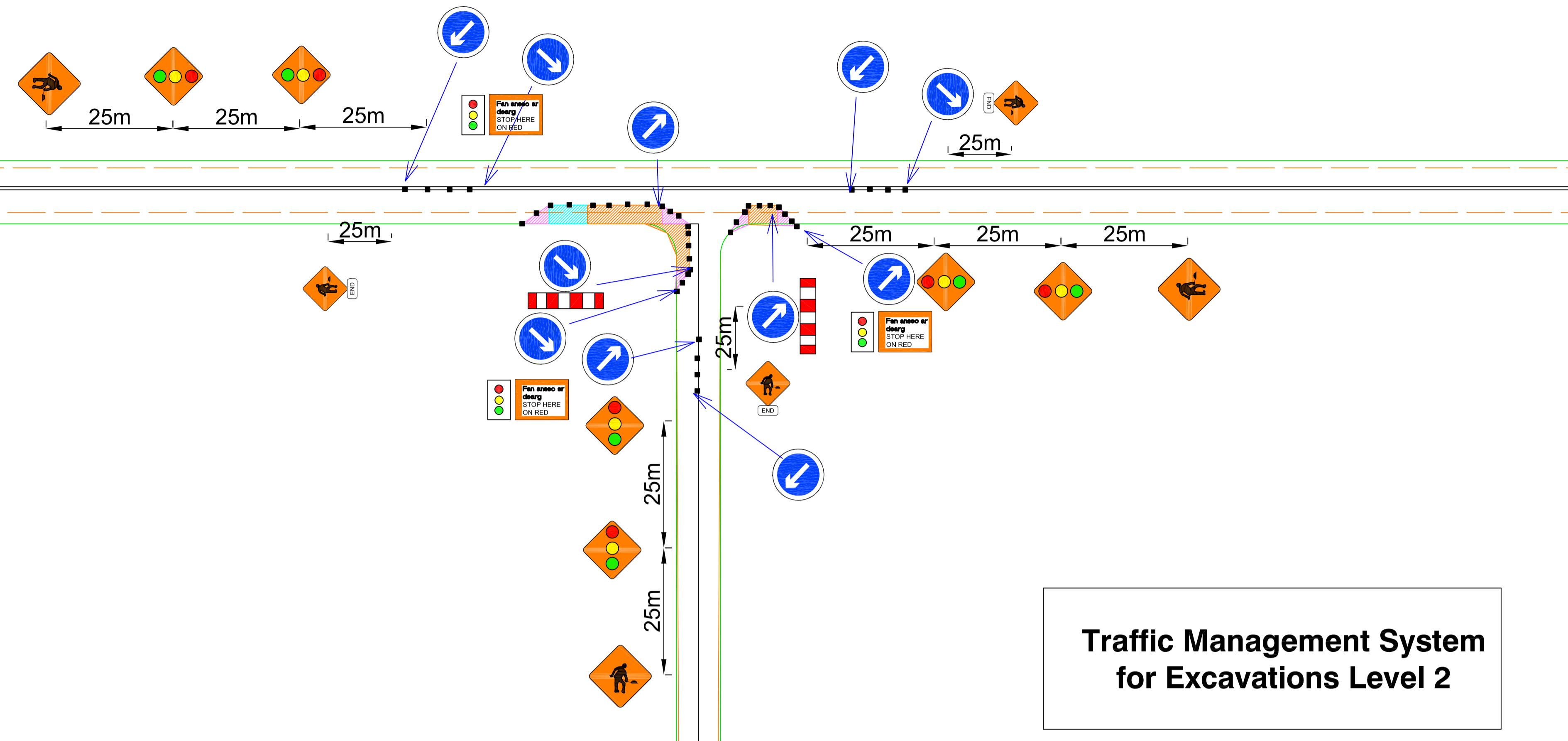
- ALL WORKS ARE TO BE CARRIED OUT IN ACCORDANCE WITH LOCAL AUTHORITY REQUIREMENTS AND TO BE INCLUDED IN THE SITE SPECIFIC SAFETY + HEALTH PLAN.
- SITE INSPECTION AND MAINTENANCE OF THE TRAFFIC MANAGEMENT IS TO BE CONDUCTED ON A DAILY BASIS TO ENSURE THE SAFETY AND INTEGRITY OF THE DESIGN.
- CONTRACTORS TO CARRY OUT A SITE RISK ASSESSMENT PRIOR TO INSTALLATION OF THE TRAFFIC MANAGEMENT PLAN TO ENSURE THAT CONDITIONS REFLECT THOSE CONSIDERED FOR DESIGN POST SUBMISSION.
- ALL SIGNS USED / AND MANUFACTURED AFTER 01/04/06 MUST CONFORM TO THOSE SPECIFIED IN THE TRAFFIC MANAGEMENT PLAN, SO FAR AS THEY ALSO CONFORM TO THE TS4 REGULATIONS(APRIL 2000). THE SIGNAGE THEREFORE MUST INCORPORATE MICRO PRISMATIC RETROREFLECTIVE SHEETING AS PER BS EN 12899-1:04/04.
- CONTRACTORS SHALL BE RESPONSIBLE FOR THE PROVISION OF RAMP ACCESS AT ANY CHANGE IN ROAD SURFACE LEVEL WHERE TRAFFIC RUNS ON A TEMPORARY SURFACE, AND FOR PEDESTRIANS/CYCLE RAMPS WHERE FOOTPATH/CYCLE-WAYS HAVE A LEVEL OF DISCONTINUITY AS A RESULT OF THE WORKS.



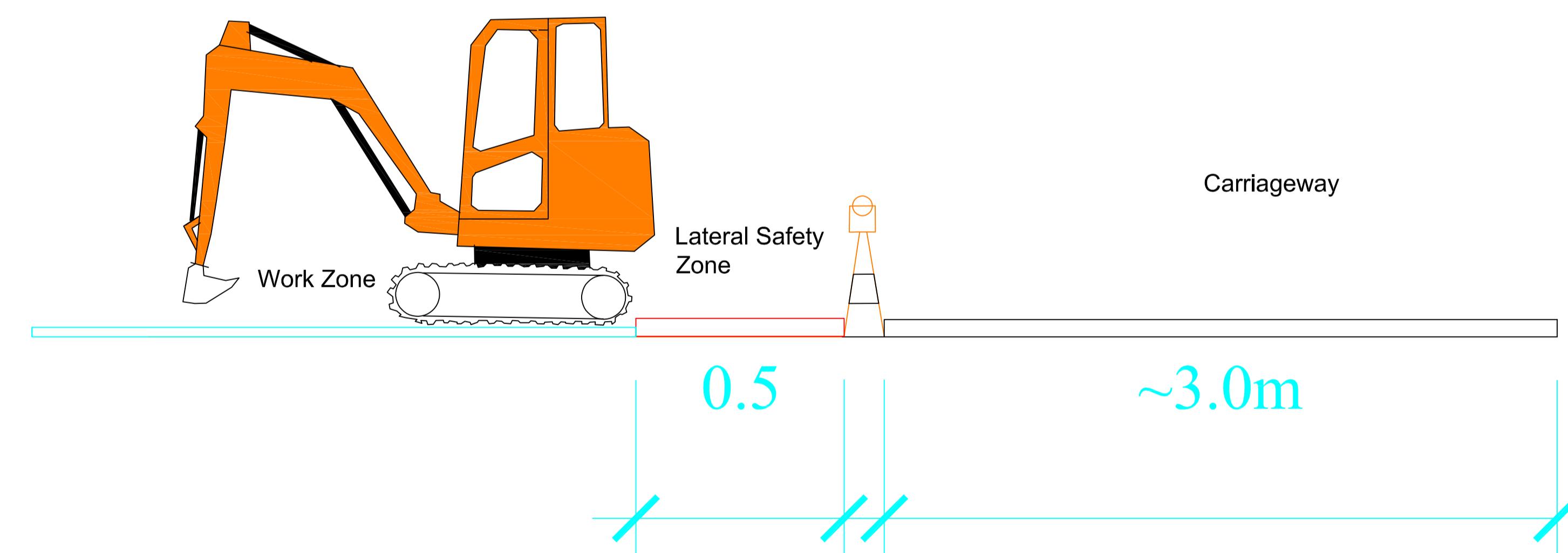
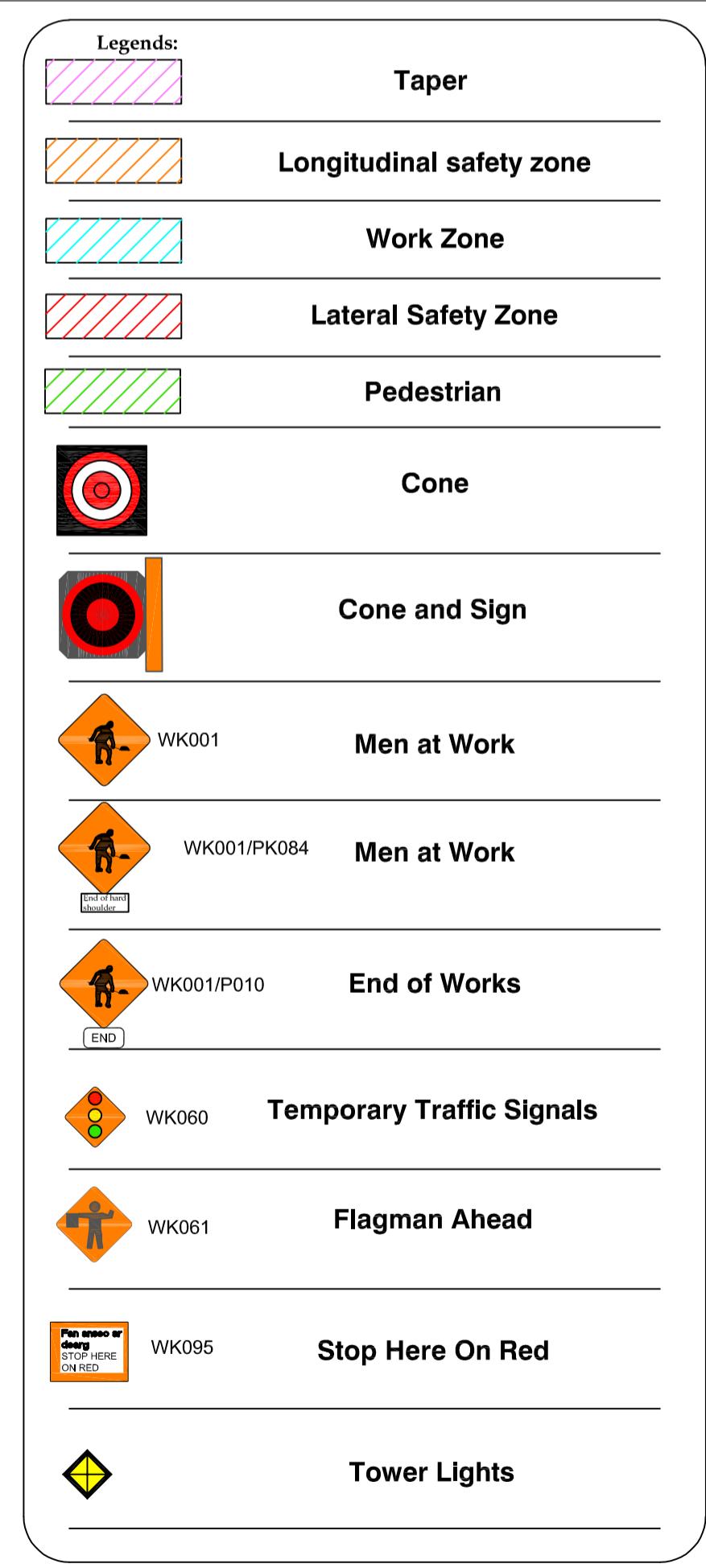
IGSL Limited
Unit F M7 Business Park, Naas, Co.Kildare
Tel: 045 846176 Fax: 045 846187
E-mail: info@igsl.ie
SITE INVESTIGATION
GEOTECHNICAL SPECIALISTS

Rev	By	Date	Description
0	CK	24/09	Traffic Light System

Project: Whitechurch Stream Flood Alleviation Scheme			
Component: Active Traffic Management System			
Title: Traffic Lights Level 2			
Designed: CK	Date: 24/09	File Name:	Drawing No:
Drawn: CK	Date: 24/09	Original Scale: N/A	Whitechurch-TMP-001
Checked: JC	Date: 24/09	Date: 24/09/19	



Design Parameters	
Road Level	Level 2
Roadworks Type	Type A&B
Speed limit(Km/hr)	50-60Km/hr
Temporary Signs	
Sign Visibility(m)	50
Number of Signs	3
Advanced Sign Spacings(m)	25
Rate of Taper	
Taper at Lane	1 in 15
Taper at hardshoulder	1 in 10
Safety Zone	
Longitudinal(m)	25
Lateral Behind Cones(m)	0.5
Cone Spacing	
Taper	3.0
Longitudinal	6.0
Minimum Lane Width	
Min Lane Width(m)	3.0
Traffic Management System	
Method	Static lane Closure
Maximum coned Area	500 km
Maximum traffic Volume	AADT>5000vpd

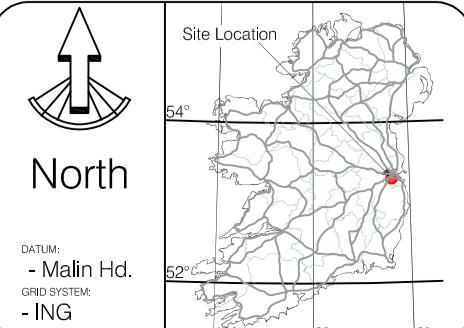


Works Cross Section

Traffic Management System
for Excavations/Boreholes
Level 2

General Notes:

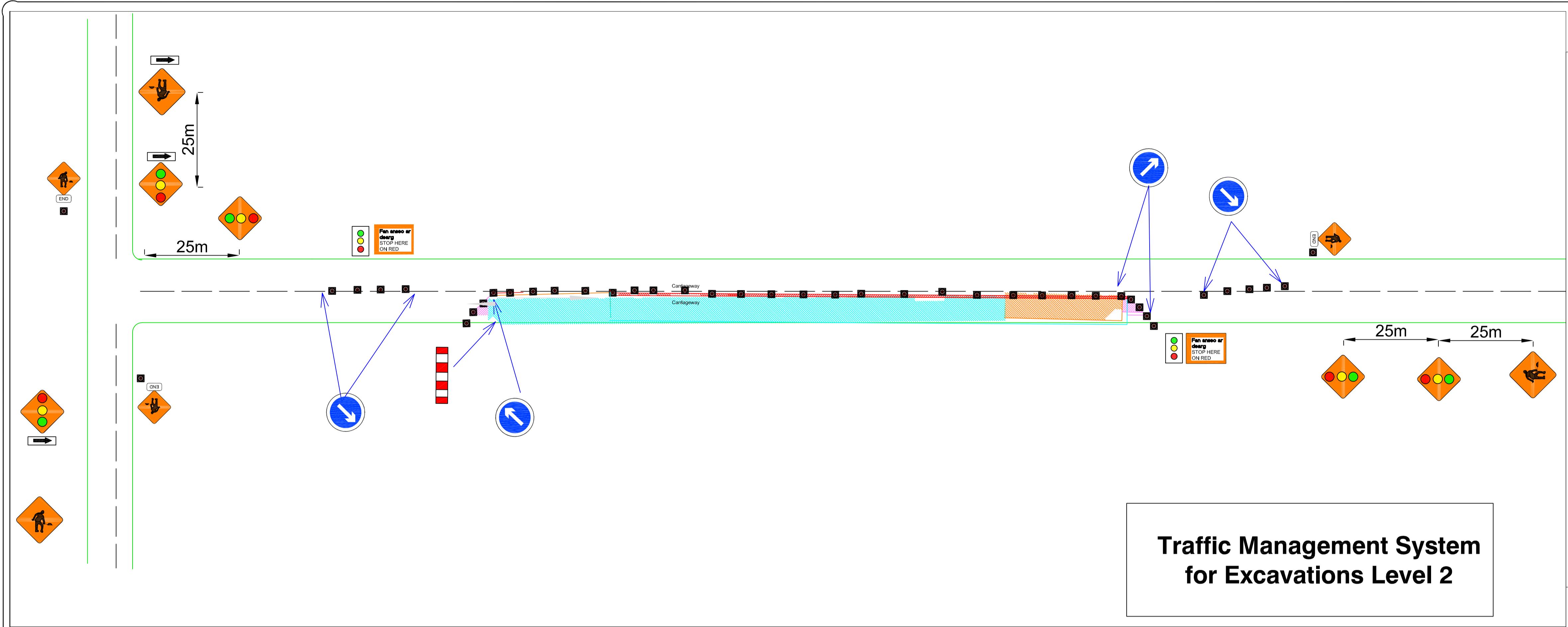
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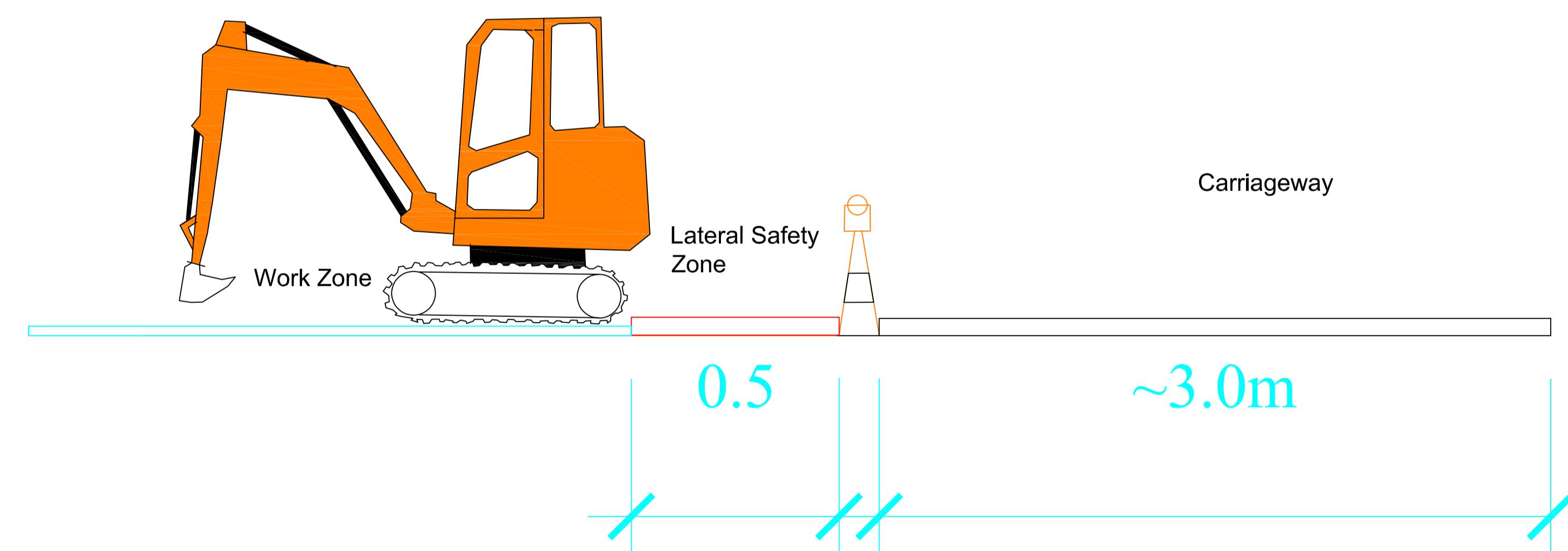
IGSL Limited
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Tel: 045 846176 Fax: 045 846187
E-mail: info@igsl.ie
SITE INVESTIGATION
GEOTECHNICAL SPECIALISTS

Rev	By	Date	Description
0	CK	24/09	Traffic Light System

Project: Whitechurch Stream Flood Alleviation Scheme			
Component: Active Traffic Management System			
Title: Traffic Lights Level 2			
Designed: CK	Date: 24/09	File Name:	Drawing No:
Drawn: CK	Date: 24/09	Original Scale: N/A	Whitechurch-TMP-002
Checked: JC	Date: 24/09	Date: 24/09/19	

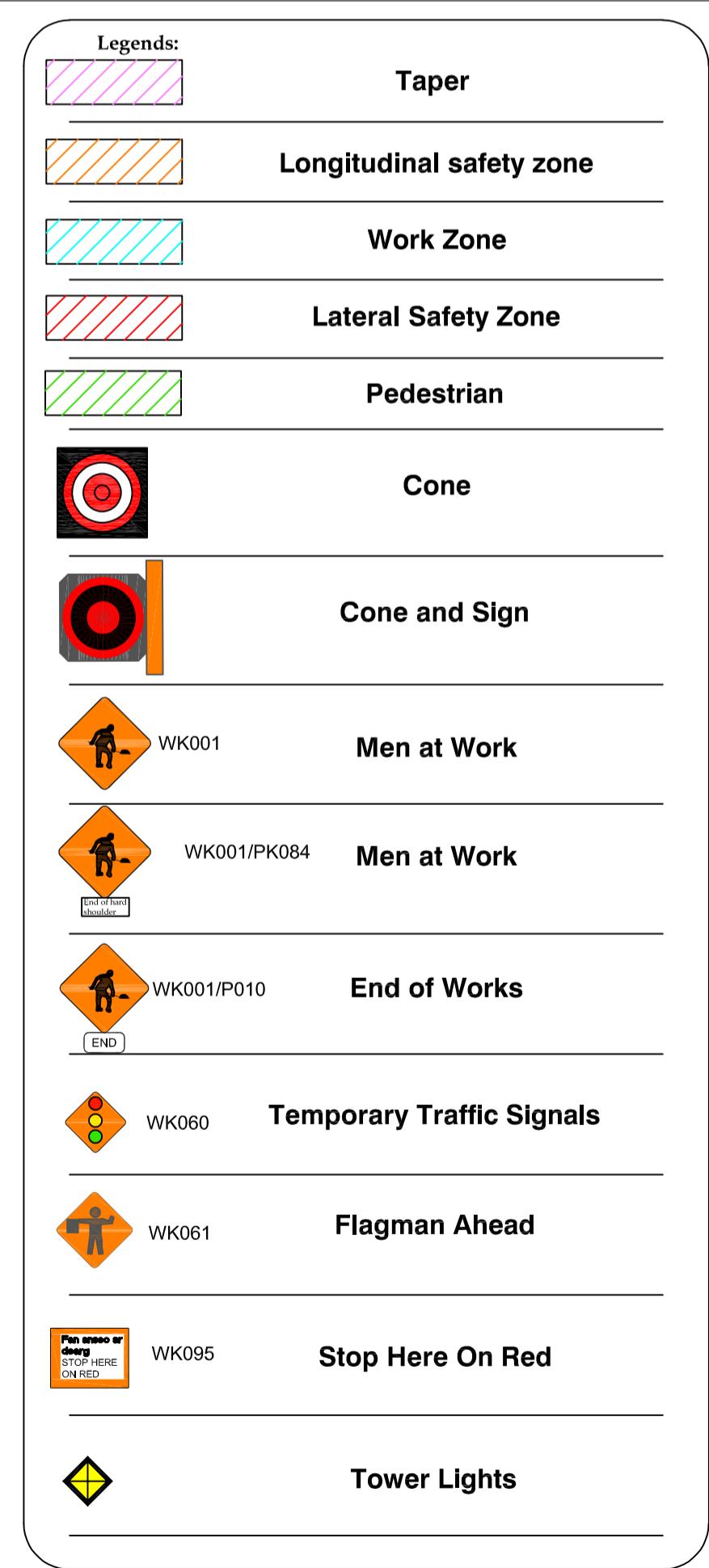


Design Parameters	
Road Level	Level 2
Roadworks Type	Type A&B
Speed limit(Km/hr)	50-60Km/hr
Temporary Signs	
Sign Visibility(m)	50
Number of Signs	3
Advanced Sign Spacings(m)	25
Rate of Taper	
Taper at Lane	1 in 15
Taper at hardshoulder	1 in 10
Safety Zone	
Longitudinal(m)	25
Lateral Behind Cones(m)	0.5
Cone Spacing	
Taper	3.0
Longitudinal	6.0
Minimum Lane Width	
Min Lane Width(m)	3.0
Traffic Management System	
Method	Static lane Closure
Maximum coned Area	500 km
Maximum traffic Volume	AADT>5000vpd



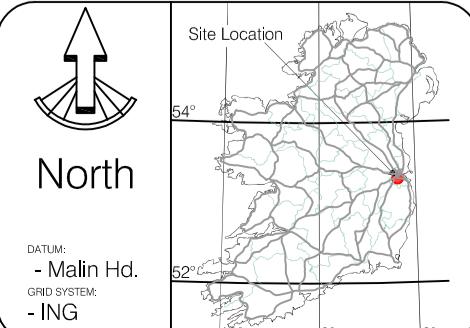
Works Cross Section

Traffic Management System
for Excavations/Boreholes
Level 2



General Notes:

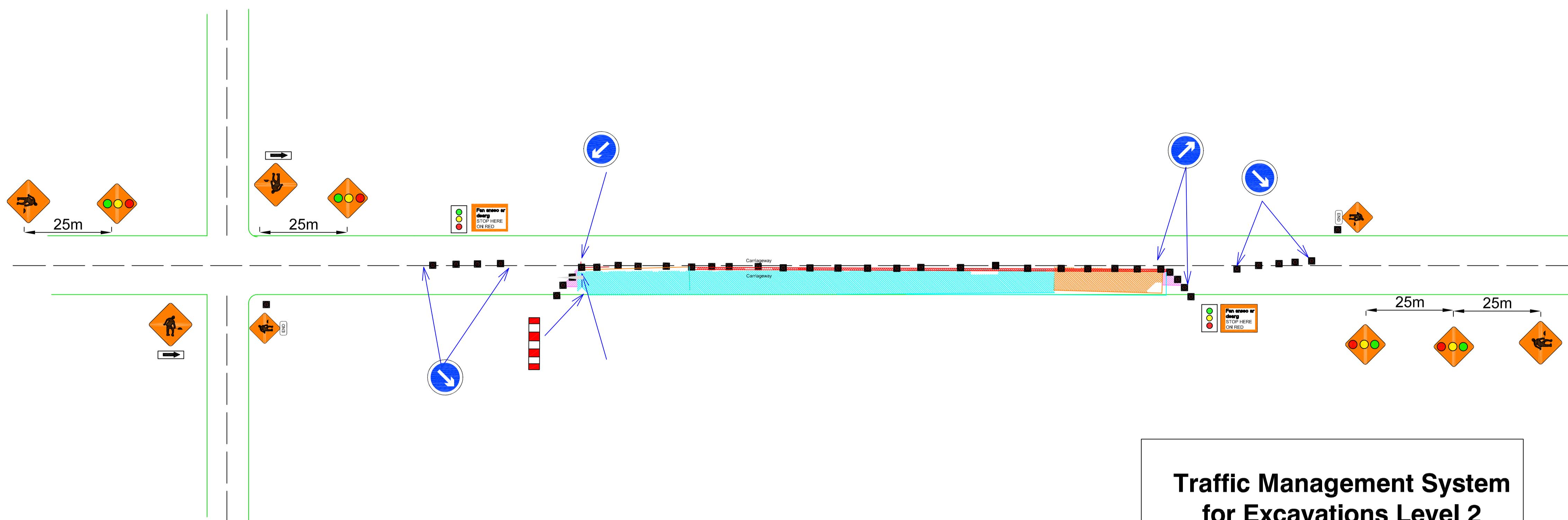
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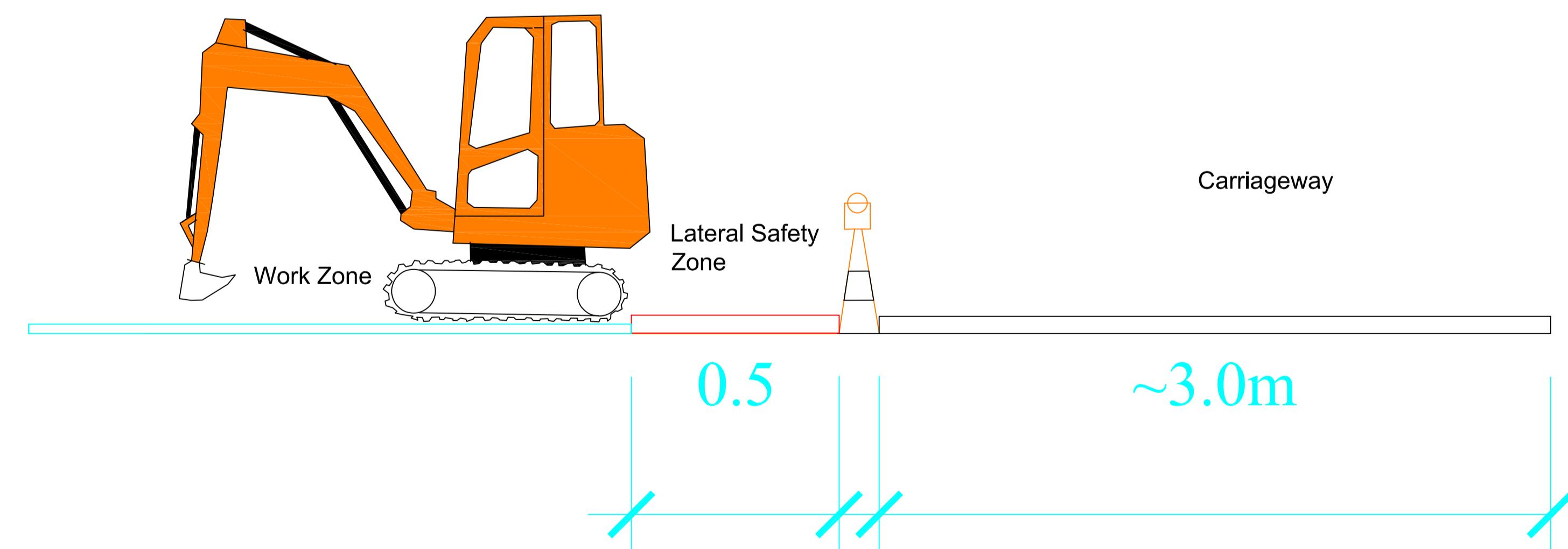
IGSL Limited
Unit F M7 Business Park, Naas, Co.Kildare
Tel: 045 846176 Fax: 045 846187
E-mail: info@igsl.ie
SITE INVESTIGATION
GEOTECHNICAL SPECIALISTS

Rev	By	Date	Description
0	CK	24/09	Traffic Light System

Project: Whitechurch Stream Flood Alleviation Scheme			
Component: Active Traffic Management System			
Title: Traffic Lights Level 2			
Designed: CK	Date: 24/09	File Name:	Drawing No:
Drawn: CK	Date: 24/09	Original Scale: N/A	Whitechurch-TMP-003
Checked: JC	Date: 24/09	Date:	24/09/19

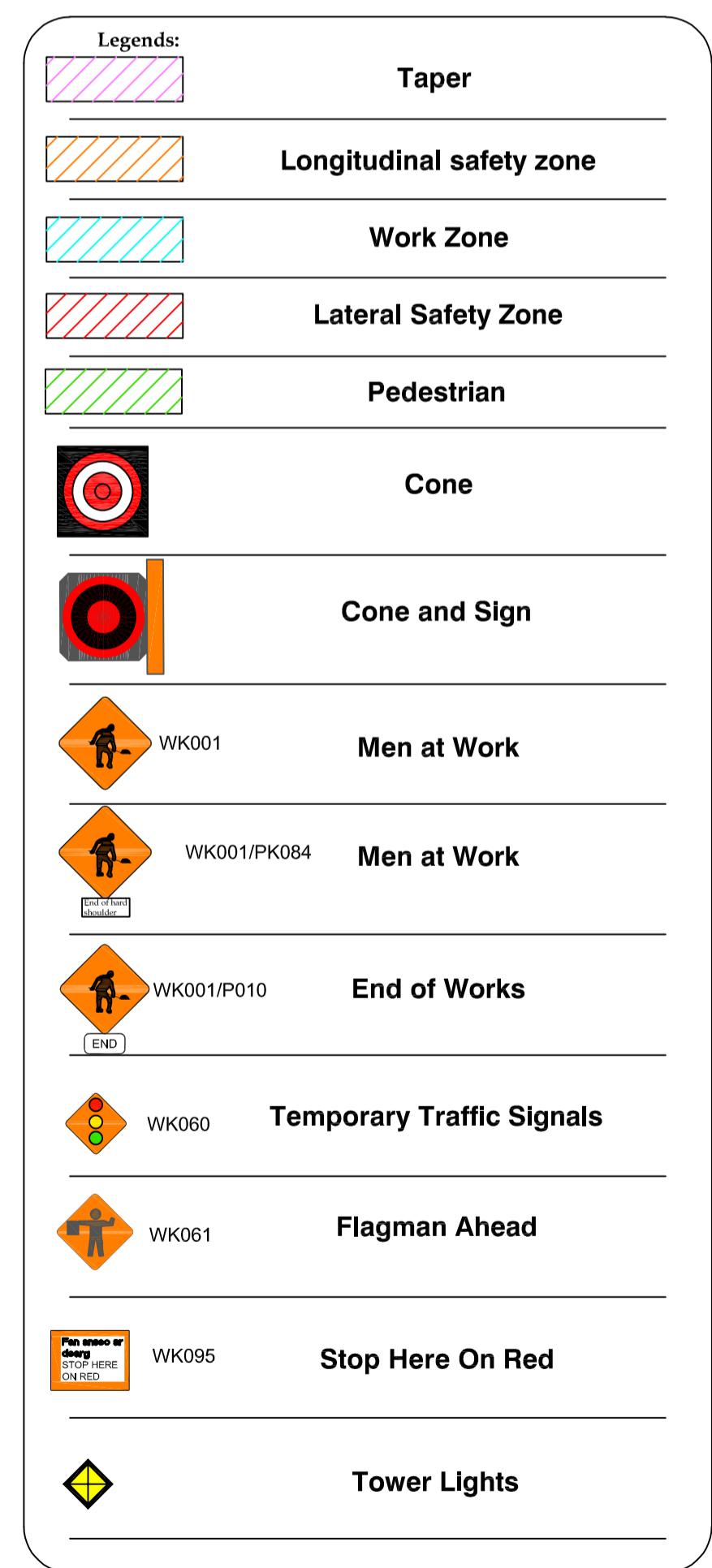


Design Parameters	
Road Level	Level 2
Roadworks Type	Type A&B
Speed limit(Km/hr)	50-60Km/hr
Temporary Signs	
Sign Visibility(m)	50
Number of Signs	3
Advanced Sign Spacings(m)	25
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Safety Zone	
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Cone Spacing	
Taper	3.0
Longitudinal	6.0
Minimum Lane Width	
Min Lane Width(m)	3.0
Traffic Management System	
Method	Static lane Closure
Maximum coned Area	500 km
Maximum traffic Volume	AADT>5000vpd



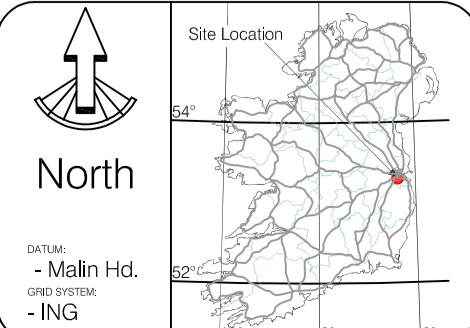
Works Cross Section

Traffic Management System for Excavations/Boreholes Level 2



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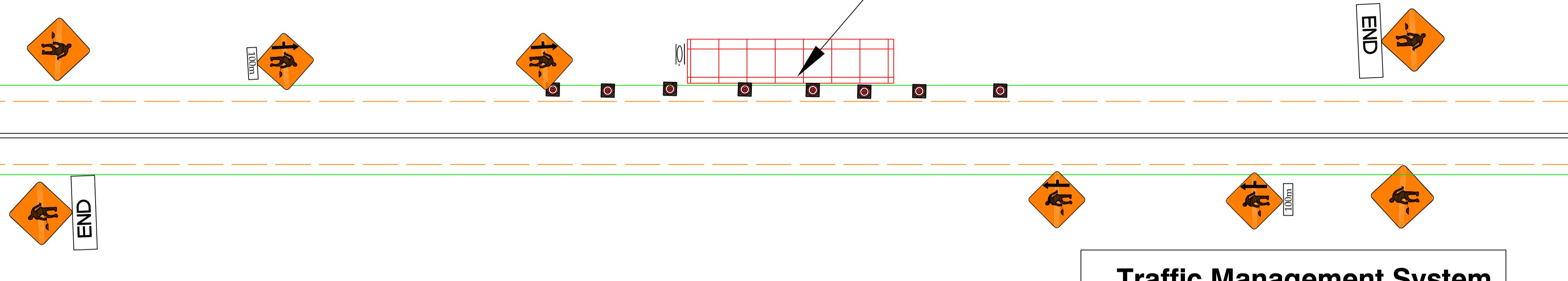


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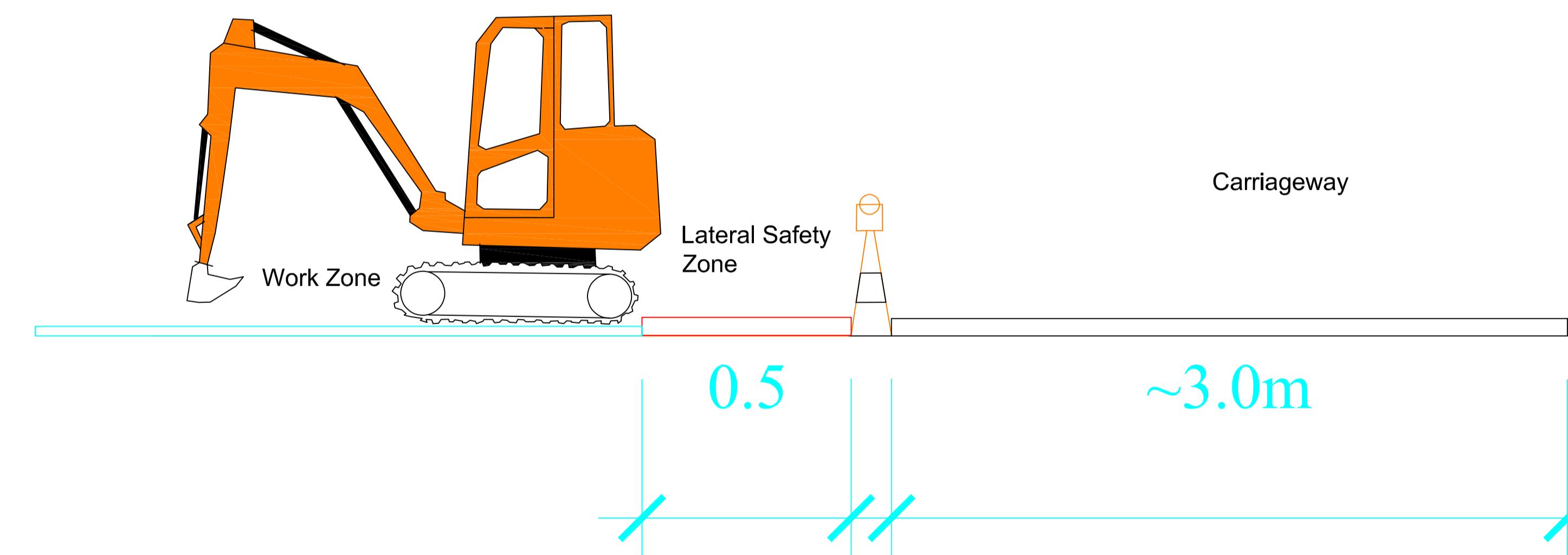
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Project: Whitechurch Stream Flood Alleviation Scheme			
Component: Active Traffic Management System			
Title: Traffic Lights Level 2			
Designed: CK	Date: 24/09	File Name:	Drawing No:
Drawn: CK	Date: 24/09	Original Scale: N/A	Whitechurch-TMP-004
Checked: JC	Date: 24/09	Date:	24/09/19

Site Location Area



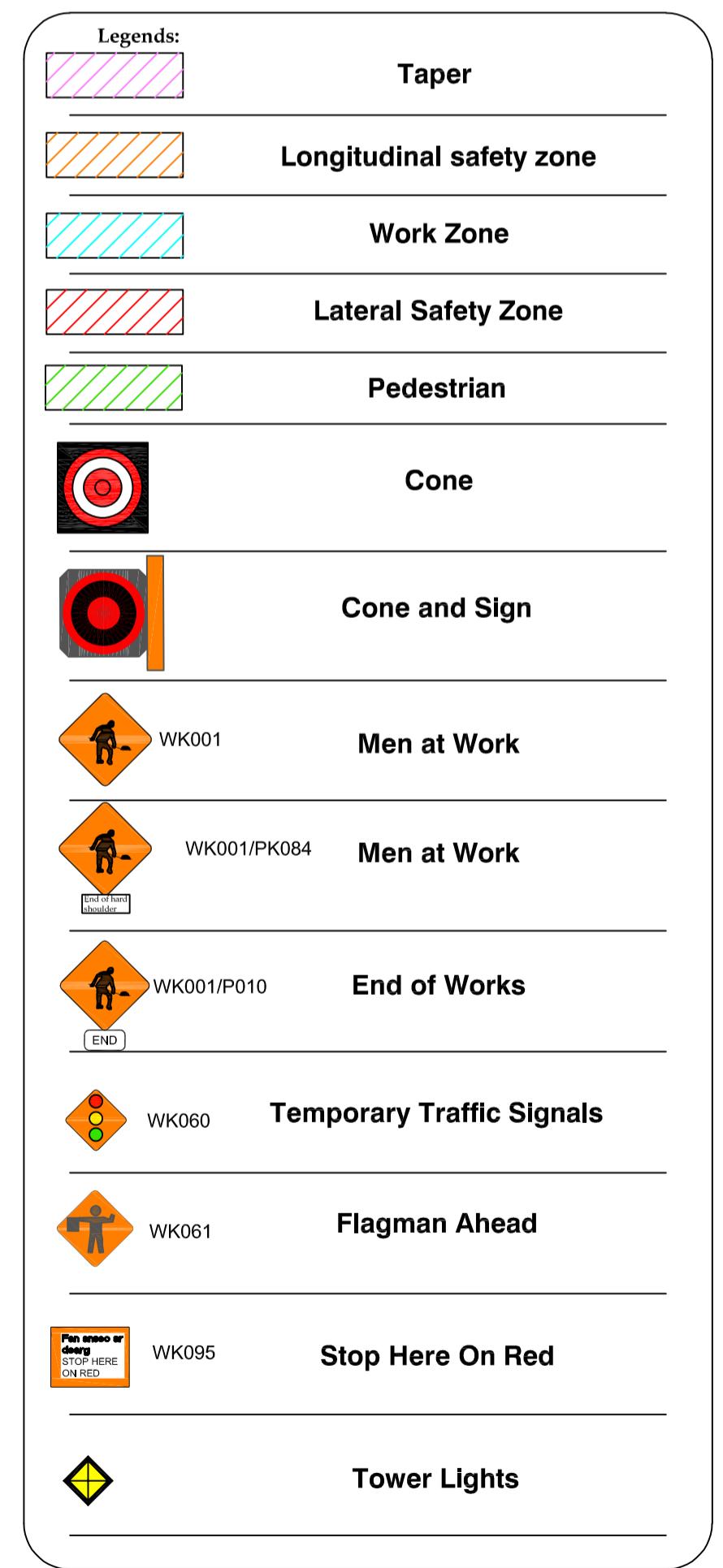
**Traffic Management System
for Excavations Level 2 - Site
Entry**



Works Cross Section

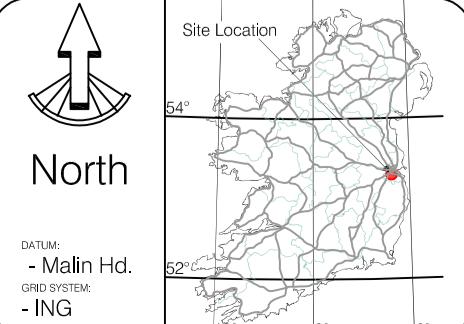
**Traffic Management System
for Excavations Level 2 - Site
Entry**

Design Parameters	
Road Level	Level 2
Roadworks Type	Type A&B
Speed limit(Km/hr)	50-60Km/hr
Temporary Signs	
Sign Visibility(m)	50
Number of Signs	3
Advanced Sign Spacings(m)	25
Rate of Taper	
Taper at Lane	1 in 15
Taper at hardshoulder	1 in 10
Safety Zone	
Longitudinal(m)	25
Lateral Behind Cones(m)	0.5
Cone Spacing	
Taper	3.0
Longitudinal	6.0
Minimum Lane Width	
Min Lane Width(m)	3.0
Traffic Management System	
Method	Static lane Closure
Maximum coned Area	500 km
Maximum traffic Volume	AADT>5000vpd



General Notes:

- ALL WORKS ARE TO BE CARRIED OUT IN ACCORDANCE WITH LOCAL AUTHORITY REQUIREMENTS AND TO BE INCLUDED IN THE SITE SPECIFIC SAFETY + HEALTH PLAN.
- SITE INSPECTION AND MAINTENANCE OF THE TRAFFIC MANAGEMENT IS TO BE CONDUCTED ON A DAILY BASIS TO ENSURE THE SAFETY AND INTEGRITY OF THE DESIGN.
- CONTRACTORS TO CARRY OUT A SITE RISK ASSESSMENT PRIOR TO INSTALLATION OF THE TRAFFIC MANAGEMENT PLAN TO ENSURE THAT CONDITIONS REFLECT THOSE CONSIDERED FOR DESIGN POST SUBMISSION.
- ALL SIGNS USED / AND MANUFACTURED AFTER 01/04/06 MUST CONFORM TO THOSE SPECIFIED IN THE TRAFFIC MANAGEMENT PLAN, SO FAR AS THEY ALSO CONFORM TO THE TS4 REGULATIONS(APRIL 2000). THE SIGNAGE THEREFORE MUST INCORPORATE MICRO PRISMATIC RETROREFLECTIVE SHEETING AS PER BS EN 12899-1:04/04.
- CONTRACTORS SHALL BE RESPONSIBLE FOR THE PROVISION OF RAMP ACCESS AT ANY CHANGE IN ROAD SURFACE LEVEL WHERE TRAFFIC RUNS ON A TEMPORARY SURFACE, AND FOR PEDESTRIANS/CYCLE RAMPS WHERE FOOTPATH/CYCLE-WAYS HAVE A LEVEL OF DISCONTINUITY AS A RESULT OF THE WORKS.



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SITE INVESTIGATION
GEOTECHNICAL SPECIALISTS

Rev	By	Date	Description
0	CK	24/09	Traffic Light System

Project: Whitechurch Stream Flood Alleviation Scheme			
Component: Active Traffic Management System			
Title: Site Entry Level 2			
Designed: CK	Date: 24/09	File Name:	Drawing No:
Drawn: CK	Date: 24/09	Original Scale: N/A	Whitechurch-TMP-005
Checked: JC	Date: 24/09	Date:	24/09/19