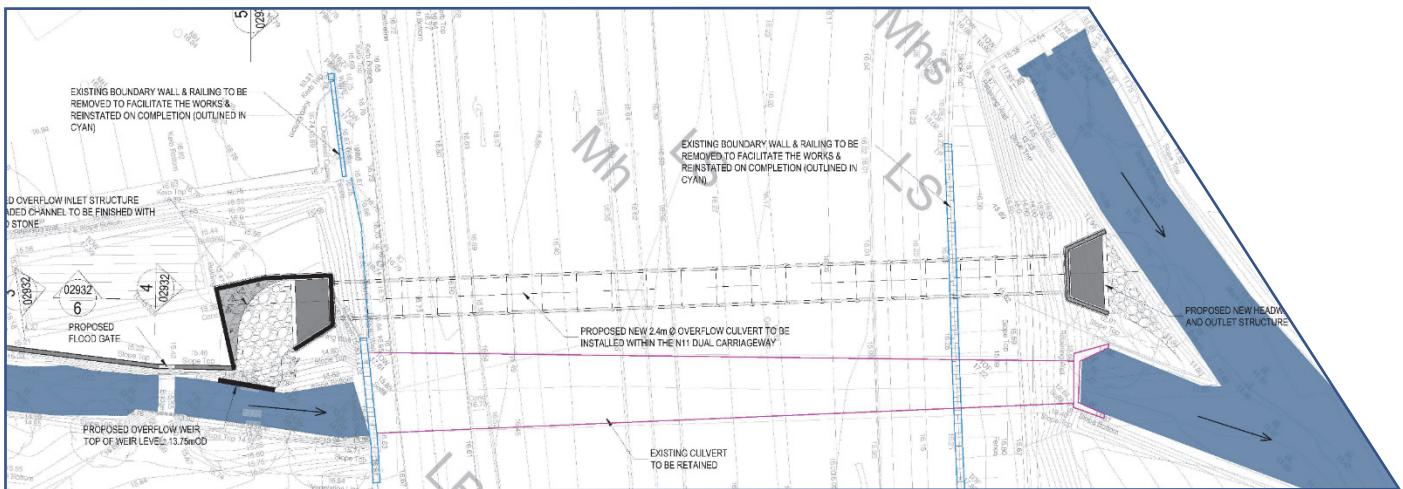




Carrickmines-Shanganagh River Flood Relief Scheme



N11 Overflow Culvert Construction Methodology

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Description	Issue	Prepared by	Checked by	Date
Draft	01	JD	SL	18-Sep-25
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1.0 Construction Methodology

1.1 Introduction

This document is the proposed Construction Methodology Statement for the open cut installation of the 2.4m overflow culvert beneath the N11 dual carriageway as part of the proposed Flood Relief Scheme (FRS) on the Carrickmines–Shanganagh Rivers. The proposed works will largely take place at night due to the volume of traffic on the N11.

The construction methodology has been prepared by John Duggan Consultancy Ltd. The Managing Director, John Duggan, is a Chartered Engineer with over thirty years' experience in planning, implementing, managing, and directing major highway and civil engineering projects in Ireland.

The traffic management solutions provided within the Construction Methodology Statement have been developed by VIAE. The company provides dedicated temporary traffic management solutions with highly trained and experienced operational teams for the installation, maintenance, and removal of all types of temporary traffic management schemes in all environments, serving both the public and private sectors.

A constructability assessment was carried out for each of the proposed measures, including the construction of the overflow culvert beneath the N11, which forms part of the scheme and was utilised to inform the EIAR.

At a meeting on 13th August between the Applicant and TII, further details were requested in relation to the open cut construction methodology at the N11 dual carriageway beyond that described in the presentation given at the meeting and Environmental Impact Assessment Report (EIAR).

This Statement therefore aims to provide a more comprehensive overview of the proposed construction activities, addressing the specific concerns raised by TII.

The additional details are given for a typical night's activities, as well as the phased approach for the overall culvert crossing, including utility protection and traffic management detail showing how the works can be done within the proposed night work hours.

The construction of this culvert will involve a high degree of planning and coordination, including a phased execution, to avoid disruption to all stakeholders. Stakeholders include Dún Laoghaire–Rathdown County Council (DLRCC), Transport Infrastructure Ireland (TII), Office of Public Works (OPW), National Transport Authority (NTA), utility providers (ESB Networks, Uisce Éireann, telecoms), local residents and businesses, and the travelling public.

The proposed work operations will take place within a very restricted timeframe of 10pm to 5am; however, the exact hours will be agreed prior to construction with DLRCC's Traffic Department, as part of the granted road opening licence, after having consulted with TII.

It is noted that recent resurfacing works at this location have been confined to working hours of 8pm to 6am. This is similar to the working hours proposed for the traffic management measures highlighted in the EIAR. The working hours proposed as mitigation within the EIAR state 8pm to 5am and have been assessed based on data from traffic surveys.

This Construction Methodology Statement demonstrates that the proposed works, to be undertaken as night work between 10pm and 5am, are achievable within this timeframe.

The expected duration for these works is 50 days; however, this duration could be reduced if enabling works can take place outside working hours. Increased working hours, similar to those permitted on other schemes in local areas, may also reduce the expected works duration.

This construction methodology is conservative, with works to utilities included as night works only and the more onerous working hours being considered. Further refinement of the programme may be undertaken following detailed design and stakeholder engagement.

1.2 Traffic Management

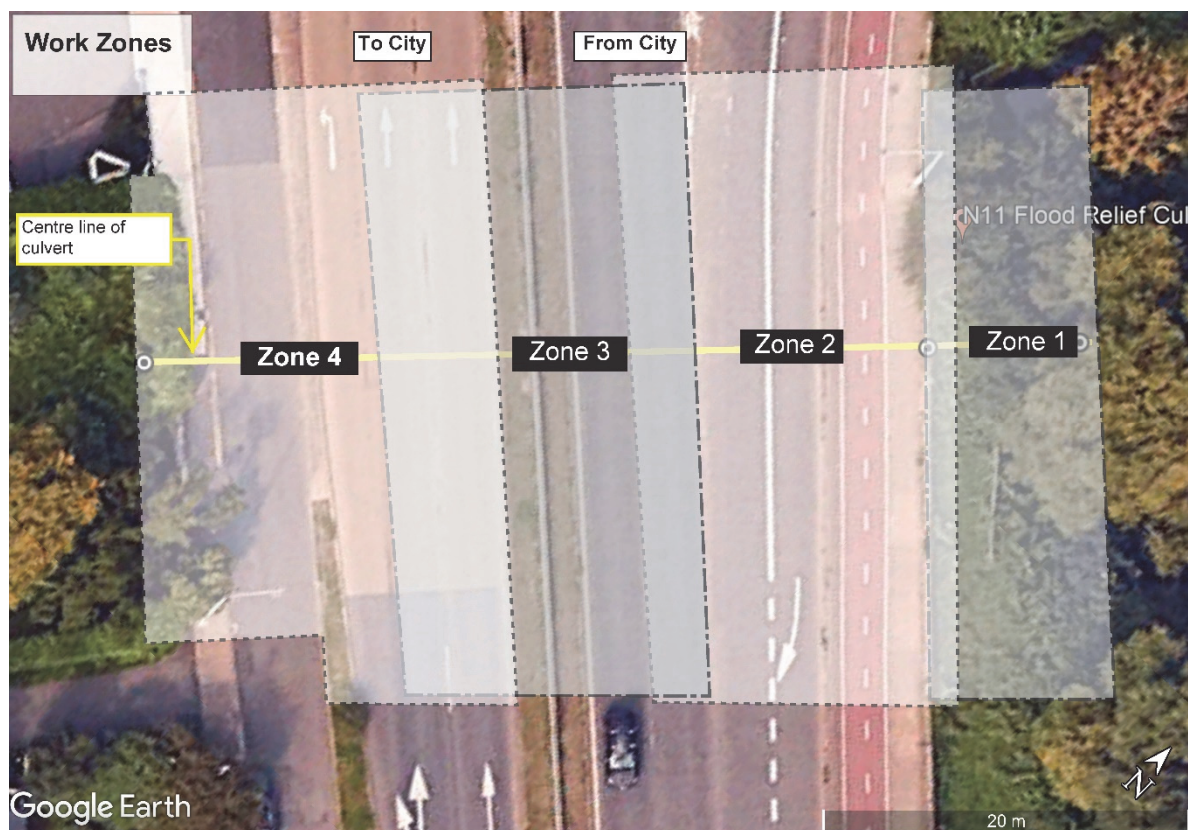
1.2.1 Traffic Management Plan

The methodology will involve the approval of a Traffic Management Plan (TMP), which will be prepared, in consultation with the key stakeholders. This will ensure that the residual impacts to the travelling public during the construction works are minimised. It will include details of the layout of the various work phases, access/egress points, risk assessments, and emergency protocols. It will also describe the management arrangements for the transportation of construction materials, equipment and personnel to and from the works. Contingency measures for adverse weather and emergency vehicle access will also be addressed.

To facilitate the construction, a phased traffic management arrangement will be necessary, which will be in strict compliance with DLRCC requirements. Construction work which affects live traffic lanes will be restricted to off-peak or nighttime hours between 10.00pm and 5.00am.

1.2.2 Work Zone Layout – Phased Construction Overview

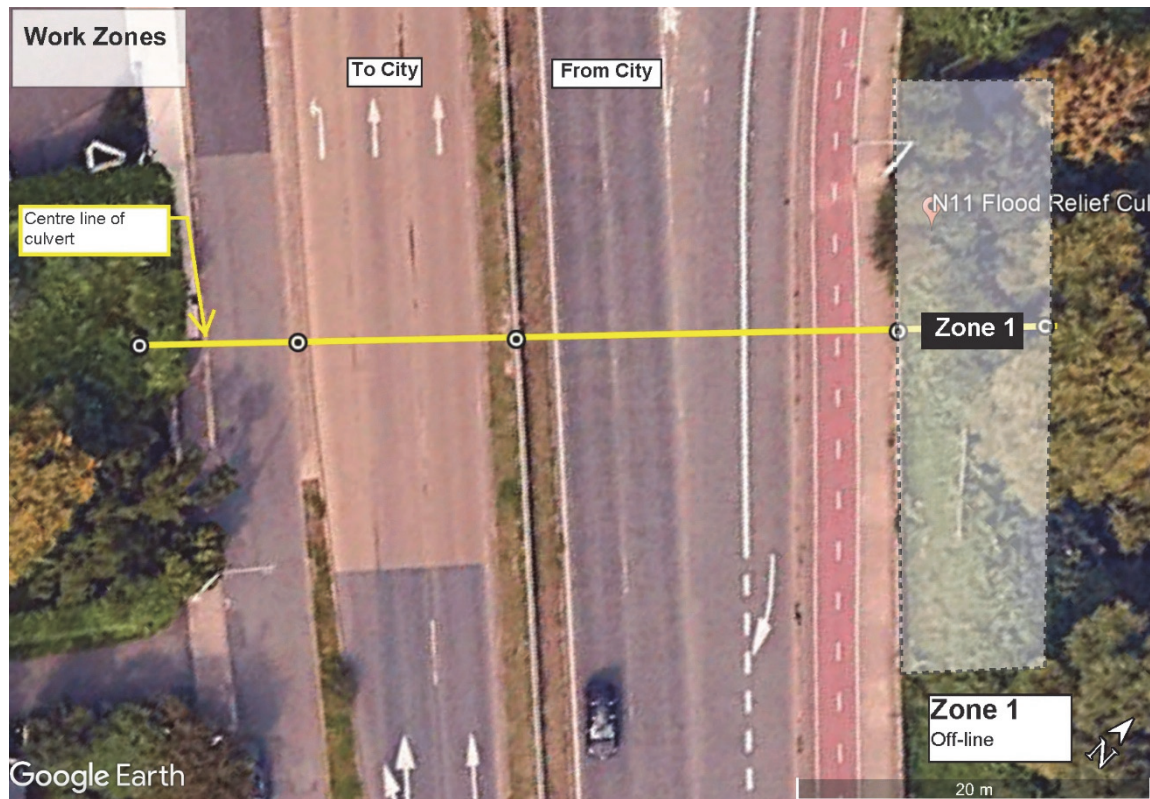
To facilitate the safe and efficient installation of the culvert beneath the N11 dual carriageway, the work site will be divided into four distinct zones, with speed restrictions (see **Appendix 1**). Works will be carried out in a phased manner to maintain traffic flow and reduce cumulative impact. These zones are summarised as follows:



- **Zone 1 (Off-line)**

Off-line element in Loughlinstown Park at downstream end, consisting of 3 no. pipes and downstream headwall. These works can be constructed during normal daytime hours.

Traffic is not affected in this phase.



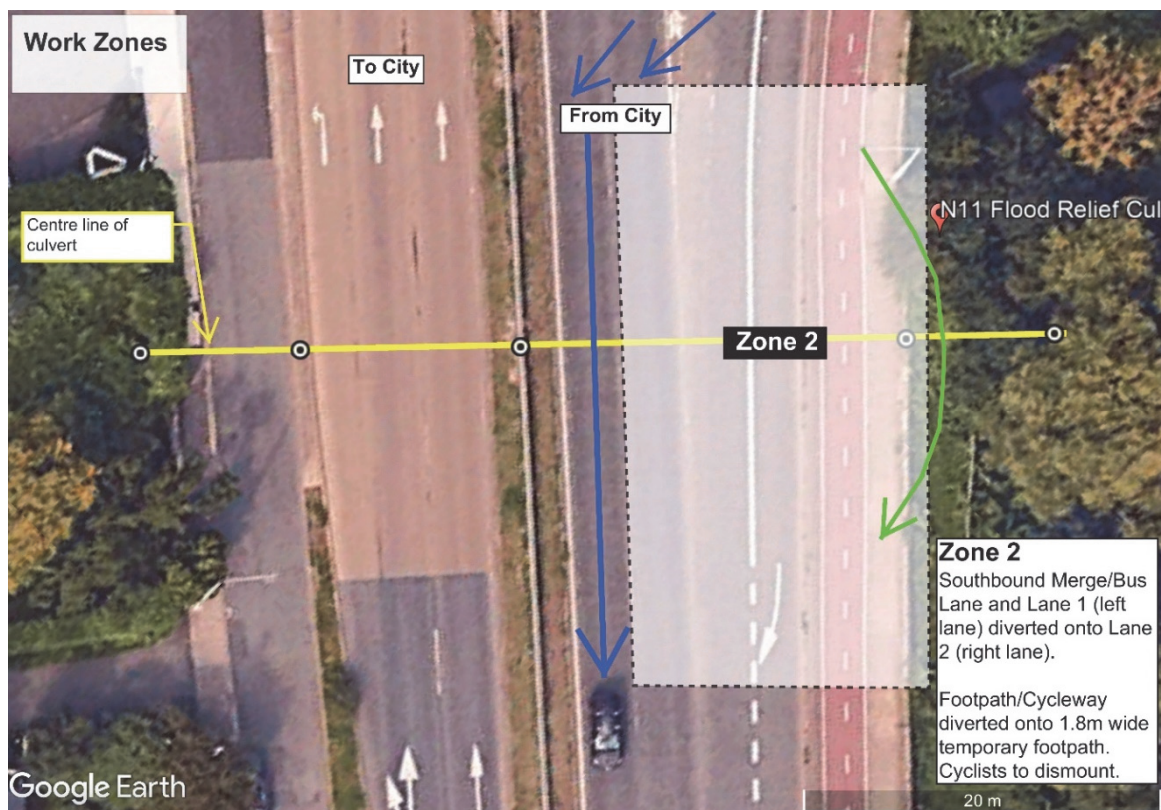
- **Zone 2 (Southbound – 1 lane only)**

Close Southbound Lane 1 (left Lane), Merge Lane and Bus Lane, Footpath/Cycleway. Traffic will be diverted onto Southbound Lane 2 (right Lane).

Footpath/Cycleway will be diverted locally into Loughlinstown Park, routed on a protected temporary surface over the off-line section of the overflow culvert. Minimum width to be 1.8m, and cyclists to dismount. For safety reasons, a flagman will be positioned on the cycleway on the approach to the works from the city. This will give advance warning to cyclists, who may be approaching the works at speed, due to the steep incline.

This temporary footpath/cycleway diversion will remain in place until culvert installation has progressed onto Southbound Lane 1 (left lane), thereby allowing permanent reinstatement of existing footpath/cycleway to take place. The diversion will remain in place for 2 to 3 weeks.

Northbound traffic is not affected in this phase.

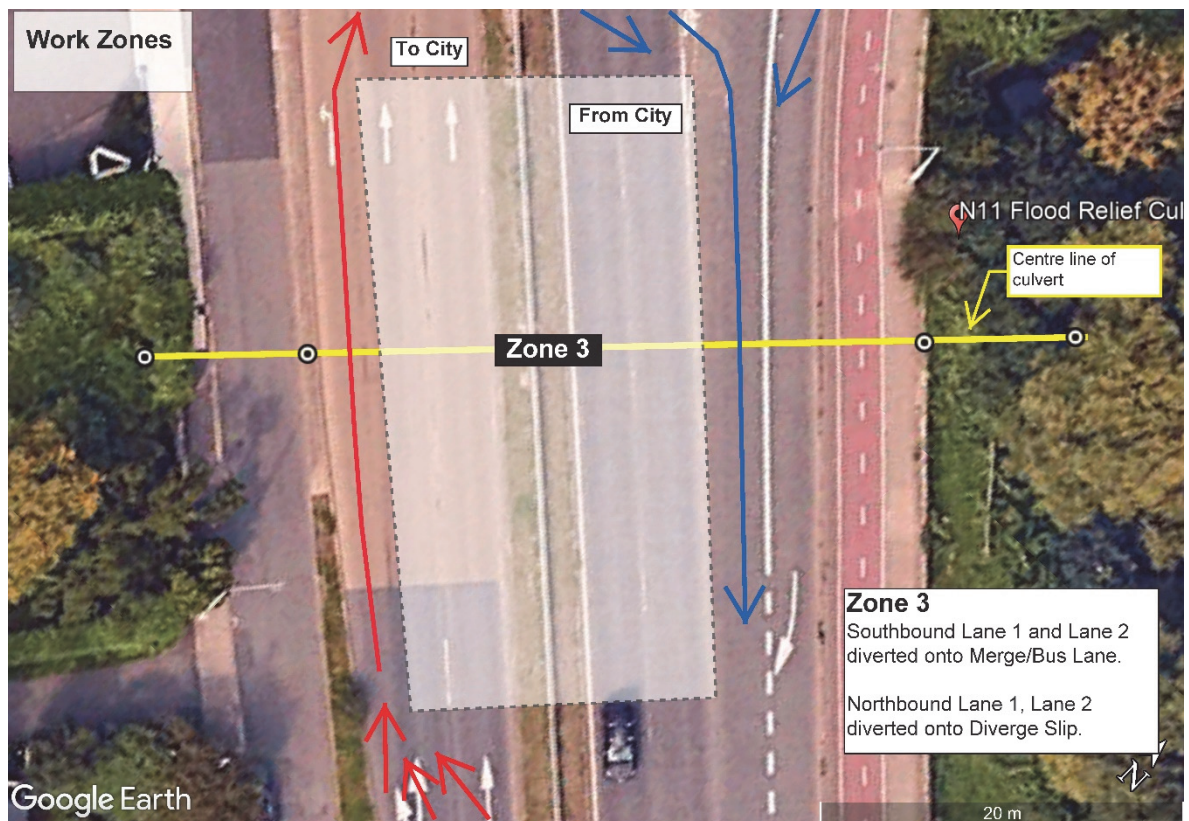


- **Zone 3 (Southbound and Northbound - 1 lane only)**

Close Southbound Lanes 1 and 2 (left and right Lanes), Central Median, Northbound Lanes 1 and 2 (left and right Lanes).

Southbound traffic to be diverted onto Merge Lane / Bus Lane and northbound traffic to be diverted onto Rathmichael diverge slip lane (R116).

The temporary footpath/cycleway diversion has been reinstated.



- **Zone 4 (Southbound – 1 lane only, Northbound - contraflow system on southbound lane)**

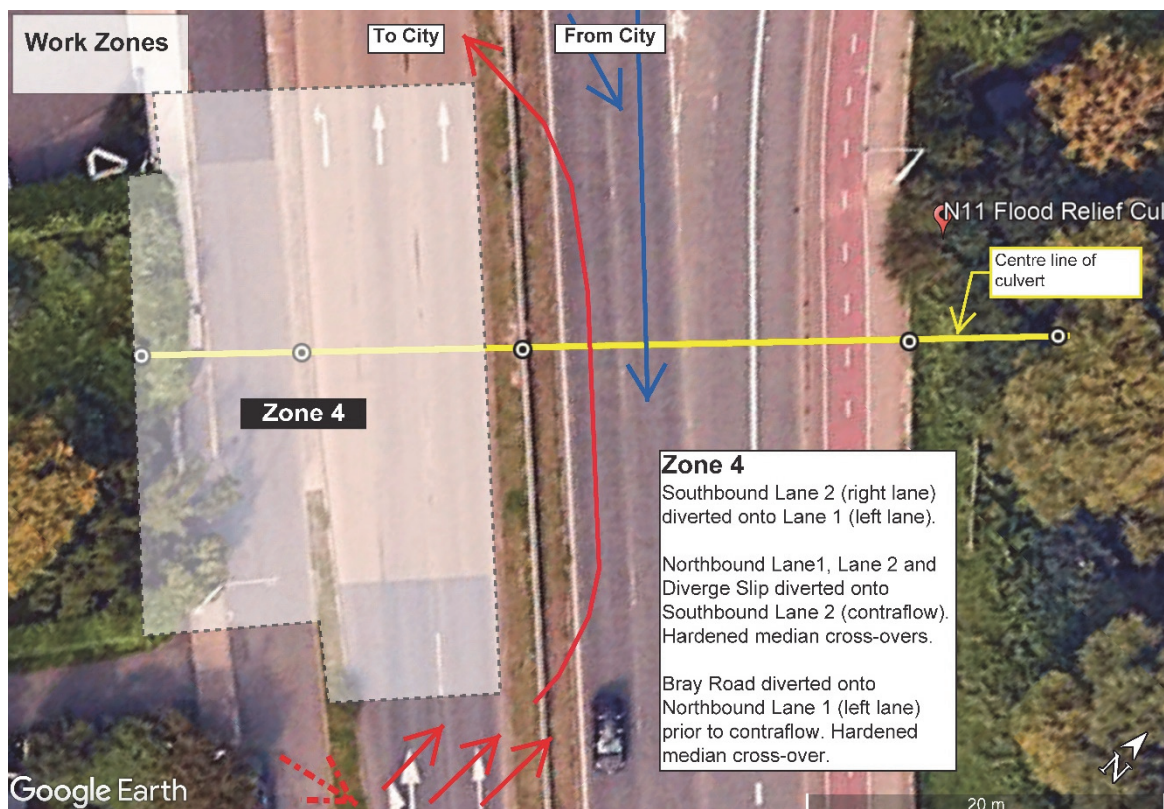
Close Northbound Lanes 1 and 2 (left and right lanes), Rathmichael diverge slip lane and Bray Road.

Southbound Lane 2 (right lane) will be diverted onto Southbound Lane 1 (left lane). Northbound Lanes 1 and 2, together with Rathmichael diverge slip lane, will be diverted onto Southbound Lane 2 (right lane) via a contraflow system.

Sections of the central median will be hardened, to facilitate the crossovers, i.e. one cross-over to divert the traffic onto the contraflow system and another cross-over to return the traffic back onto its correct lane. The cross-over is constructed by excavating the existing soft soils, barriers and kerbs and replacing with compacted granular subbase and bituminous road surfacing material.

The Bray Road will be diverted onto Northbound Lane 1 (left lane) prior to the contraflow system. A hardened median on the Bray Road will be constructed to allow this diversion. (see **Appendix 1**).

The usage of this diversion is expected to be infrequent during nighttime hours and limited to local residents. The Contractor will utilise a flagman to facilitate the safe manoeuvring of vehicles from the Bray Road onto the Northbound Lane 1 of N11. Alternatively, the Contractor may introduce other mitigation measures / revise the temporary traffic management scheme to ensure the safety of road users, subject to approval from the relevant authorities.



1.2.3 Traffic Management Design

Each of these work zones present operational and traffic flow challenges. To facilitate the safe and efficient execution of culvert construction works, a draft set of temporary traffic management concept layouts has been developed for each of the work zones 2, 3, and 4. The plans have been developed by *VIAE Traffic Management*, who are certified traffic management professionals.

The concept layouts have considered best practice and statutory guidance. This includes:

- Chapter 8 of the Traffic Signs Manual (TSM);
- Temporary Traffic Management Design Guidance (TTMDG);
- Temporary Traffic Management Operations Guidance Documents (TTMOG).

These preliminary drawings will be subject to a full detailed TM design before implementation. Traffic management supervisors will be competent and certified, under the LANTRA or CSCS schemes. A dedicated and qualified Traffic Safety Officer (TSO) will oversee compliance and will liaise with key stakeholder representatives.

Each design will be submitted to DLRCC for review and approval prior to implementation. The phased approach ensures that traffic disruption is minimized while maintaining full compliance with statutory safety and operational guidelines.

Appendix 2 contains the draft layout plans for temporary traffic management proposals, as described above.

1.3 Diversion of Services

1.3.1 Protection Measures

Prior to mobilisation on site for culvert installation all services along the route will be identified, verified, protected and mapped. Current anticipated services and approximate spacings are identified on **Appendix 3**. Consultations will take place with the various utility providers to identify their services and agree protective measures. Location of the underground utilities will be confirmed by numerous methods including, but not limited to

- Onsite engagement with utility providers;
- Review of all available as-built records;
- Visual inspections at the site;
- Cat and Genny scanning;
- GPR surveys (Ground Penetration Radar); and
- Slit trenching.

After completion of the existing services review, and following consultation with all stakeholders, a Temporary Works Design (TWD) will be undertaken prior to all the services along the route of the culvert being physically located. The TM plan associated with each work zone will be implemented, and the service will be located by Vacuum Excavation. (see **Figure 1**).

Figure 1 – Vacuum Excavation



Truck mounted vacuum excavation will reduce the amount of plant and space required to safely and efficiently remove the material above and below a service. Once an existing service has been found its exact location and elevation will be recorded accurately by GPS.

After all existing services are located all information will be plotted on an AutoCAD drawing and compared against the proposed line and level of the future culvert. This exercise will identify any potential clashes and will form part of discussions with the service providers regarding protection of their service in-situ or the possibility of raising the service locally, should the clash be marginal. Any proposed diversions and realignment will not take place without prior consultation with the utility provider.

All services, as agreed with the utility provider, will be enclosed in a metal sleeve extending across the entire width of the trench, plus an additional 1500mm on each side. The metal sleeves (see **Figure 2**) will consist of double flanged half-round pipes that will be positioned under and over the service and bolted together forming a sealed sleeve. Spiders will be attached to the circumference of the service and grout will be poured around the annulus of the service should the utility provider require this.

This protective sleeve will:

- Provide protection to the service during main excavation works;
- Provide rigid protection as the service traverses the trench;
- Allow the service to be risen should there be a marginal clash;
- Give certainty of service location that will allow the contractor to plan their works in advance. The design of the culvert can be tailored to include shorter sections of pipe (rocker pipes) to enable pipelaying to come up adjacent to a service crossing. This will also assist in the selection of the appropriate trench protection systems; and
- Give clarity on type of trench protection system to utilise at the various locations on the crossing, e.g. Trench Box / Slide Rail System, Pile Chamber with Trench Sheets, Slide Rail System with Trench Sheets.

Figure 2 – Protection Sleeves (half-rounds)



1.3.2 Existing Services

Current information indicates that 10 utility services will be encountered from headwall to headwall, as follows (see **Appendix 3**):

- (1) 1 x medium voltage ESB cable in Loughlinstown Park;
- (2) 2 x 200mm ST4 gas mains under Cycleway/Footpath
- (3) 1 x 150mm ductile iron watermain under southbound merge / bus lane;
- (4) 3 x 100mm telecom ducts in the central median;
- (5) 1 x 250mm ST4 gas main under Bray Road;
- (6) 1 x 150 mm ductile iron watermain under Bray Road; and
- (7) 1 x medium voltage ESB cable in Brides Glen.

The options to deal with the existing services will vary depending on the location/elevation of the service and the type of material (e.g. ductile iron, HDPE, twin wall, uPVC).

Below are proposals that will be discussed with service providers:

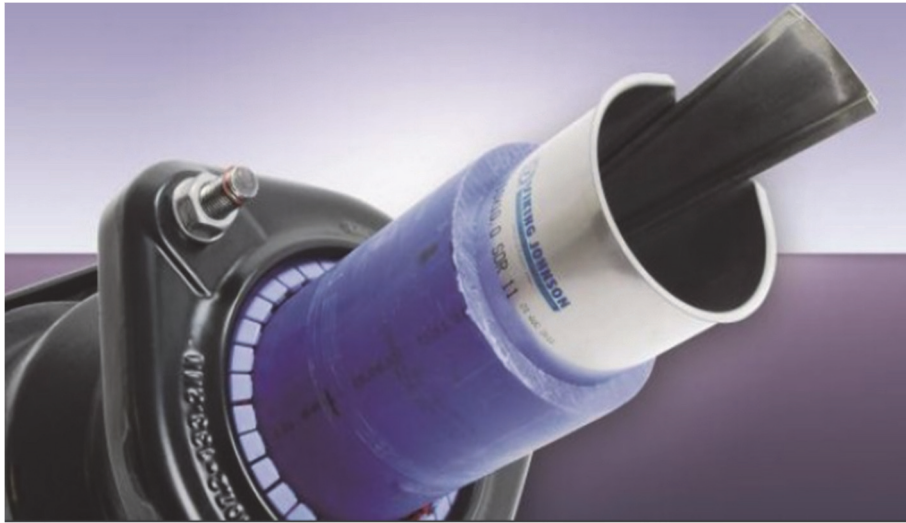
Service (1) This ESB cable will remain in situ and will be sleeved with the half-round sleeves discussed above (see **Figure 2**).

Service (2) These gas mains are under the cycleway/footpath and the proposal will be to dismount the cyclists and provide a combined walkway for both, constructed during daytime hours. If working room does not permit, a temporary walkway will be provided behind the Loughlinstown Park boundary wall, which will give full access to the footpath/cycleway. It is proposed to locate the gas mains individually by vacuum excavation and expose the pipe on all sides. The half-round double flanged sleeves will be placed under and over the gas main and bolted together. The annulus will be filled with grout, if required. It is proposed that the metal sleeve will extend 1500mm beyond the top edges of the trench for the proposed culvert (7000mm total).

Service (3) Traffic will be diverted using a TM Zone 2 layout (see **Appendix 1**). The proposal will be to replace a section of the ductile iron pipe with HDPE. The HDPE pipe will be encased in the half-round sleeves and the annulus grouted, if required. This work can be done in advance off-site. A pre-determined length of ductile iron watermain will be removed and this section will then be replaced by the prefabricated HDPE/half-round encased pipe. Two *Viking Johnston* couplers (see **Figure 3**) will be used to reconnect the new HDPE to the existing ductile iron watermain.

Service (4) A TM Zone 3 layout will be in place when working on these 3 separate 100mm telecoms ducts. A trench will be excavated by vac excavation, and this will expose the service for the required width (1500mm + 4000mm + 1500mm). Double flanged half-round sleeves will be positioned under and over the exposed ducts and the annulus grouted, if required. An additional length of existing duct can be exposed on either end, should there be a requirement to locally raise the existing service to prevent a clash with the crown of the culvert.

Figure 3 – VJ Coupler



Services (5), (6) & (7) will be exposed under a TM Zone 4 layout.

Service (5) will be protected utilising similar methodology as described for Service (2). This gas main may need to be diverted locally.

Service (6) will be protected utilising similar methodology as was described for Service (3). This watermain may need to be diverted locally.

Service (7) This medium voltage ESB cable is clashing with the barrel of the proposed culvert pipe. Once the source of the power is established, consultations will take place with the service provider with options to expose the service on the north and south of the new pipeline and create slack to raise the service over the crown of the new culvert. Diverting the service and installing new cable if required will also be discussed as an option.

1.3.3 Programme

One service diversion / protection will be undertaken per shift, either during daytime or nighttime hours.

The protection of the medium voltage ESB cables in Loughlinstown Park and Brides Glen (Services 1 & 7) will be undertaken during the daytime hours.

The two gas mains (Service 2) under the cycleway / footpath will also be completed during the day, once the temporary diversion is in place behind the boundary wall.

The 150mm watermain under the southbound bus lane will be diverted at night under a TM Zone 2 TM layout. This will be completed in one night shift.

3 nights under a TM Zone 3 layout will be required to protect the 3 x 100mm telecom ducts in the central median.

2 nights under a TM Zone 4 layout will be required to protect the 250mm gas main and the 150mm watermain.

1.4 Culvert Construction

1.4.1 Site Compound

The Bray Road compound (see **Figure 4**) is the preferred location for the main site compound. All materials for the works will be stored here prior to being required on site. A 16- tonne rubber tyred excavator will be positioned here to load all materials. This flexible excavator is also part of an emergency response crew, should one of the excavators at the main line dig break down. All spoil from the excavations will be stored here and will be removed offsite to a licenced facility, once analysed.

Figure 4 – Site Compound



1.4.2 Installation Sequence – Typical Night

- **ZONE 1** (see **Appendix 2**)

The first phase of the works to be installed will be Zone 1, which is offline. A section of the boundary wall will be removed to allow access for the plant and materials to undertake this work. All works will take place inside the line of the wall. Access/Egress onto the footpath/cycleway will be controlled by flagmen. After installation of the precast headwall and three culvert pipes, a parallel 225mm twin wall pipe will be laid in the trench. This will be used to convey water from the excavation as work progresses across the dual carriageway. The culvert pipes will be backfilled with lean mix concrete to

reduce the angle of repose of the backfill material, thereby creating additional room on the surface to place a diversion route for pedestrians and cyclists.

- **ZONES 2, 3 and 4**

The following text outlines the sequence of works throughout a typical night shift.

TIME: 10.00 PM

A Zone 2 TM layout (see **Appendix 2**) will be required for this element of the works. With the first cone being placed on the road at 10.00 PM, the TM installation will be complete and operational at 11.00 PM.

TIME: 11.00 PM

When the TSO confirms that the TM closure is in place, the site manager will notify the works crew to access the site. A typical crew will consist of

- Site Manager
- Site Engineer
- Working Foreman
- Excavator Driver x 2
- Tipper Truck Driver x 2
- Articulated Hiab Truck Driver x 1
- Skilled Ground Operatives x 4

The crew will approach the works area travelling southbound and will enter the site at the dedicated Works Access location. Crew cabs jeeps will be utilised to reduce vehicle movements. The first crew cab to arrive will tow a 10-person mobile welfare unit (see **Figure 5**), consisting of canteen/office/drying room and toilet. This will be positioned away from moving machinery.

Figure 5 – Office / Welfare Unit



A 36-tonne excavator will be the most suitable excavator to carry out the culvert installation, e.g. Komatsu pc360-11. See **Appendix 4** for excavator specification. This excavator can be stored at a mini-compound at the downstream end of the pipe during the day. This will enable immediate access to the works at the start of the night shift.

Correct sizing of the lead excavator is critical. A typical SWL (Safe Working Load) of a Komatsu pc360-11 is 2800kgs. The works will require an excavator that has both power and reach without occupying excessive lane space. The chosen excavator **will not** be required to lift the 2400mm culvert pipe, which weighs 11,600kgs (see **Appendix 5**). It is worth noting that should an excavator be required to lift this pipe within its SWL, a 100-tonne excavator would be required.

The shoring system most appropriate for this culvert construction is the Slide Rail Trench Box Shoring System (see **Appendix 6**). The maximum weight of a single side panel on this shoring system is 770kg.

The culvert pipes will be transported to site and lifted into the trench with a rear mounted hiab truck, which will comfortably undertake the lift at a safe distance from the trench. The Palfinger PK165002 model has the capacity to lift 12700kgs at 8800mm from the centre of the lift. As this will be a side entry installation, this model will provide a very safe lift. See load chart in **Appendix 7**.

The saw cutting of the trench extremities will have taken place on the first night of operation with each of the work zones. A heavy industrial road saw will be used (see **Figure 6**). The only sawcut to be undertaken nightly after that within each work zone is the lateral saw cut at the previous night's newly placed surfacing, at the face of the excavation.

Figure 6 – Road Saw



Waterfilled barriers with mesh guard on top and draped with acoustic blankets (see **Figure 7**) will be placed around the excavation to reduce the noise levels while breaking out the road surface.

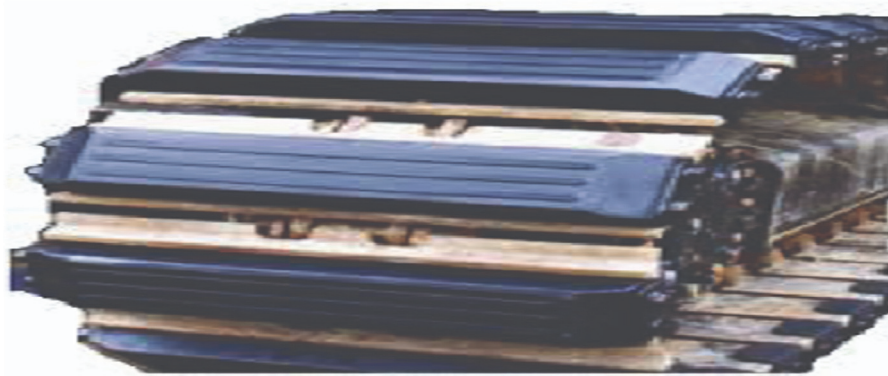
The 36-tonne excavator will be fitted with clip-on rubber pads to prevent damage to the cycleway and road surfaces (see **Figure 8**). It will quickly position itself to assist a 16-tonne rubber tyre excavator, equipped with a *Rota Hitch* and rock breaker in removing the existing road surface over

the required area for the nights work (12 m2 approx. allowing for working room). The programme will allow the installation of one pipe per night. A *Rota Hitch* will be used on the rubber tyre excavator, should side digging be required at any stage during the works.

Figure 7 – Water filled barriers with acoustic blanket



Figure 8 – Clip-on rubber pads on excavator tracks



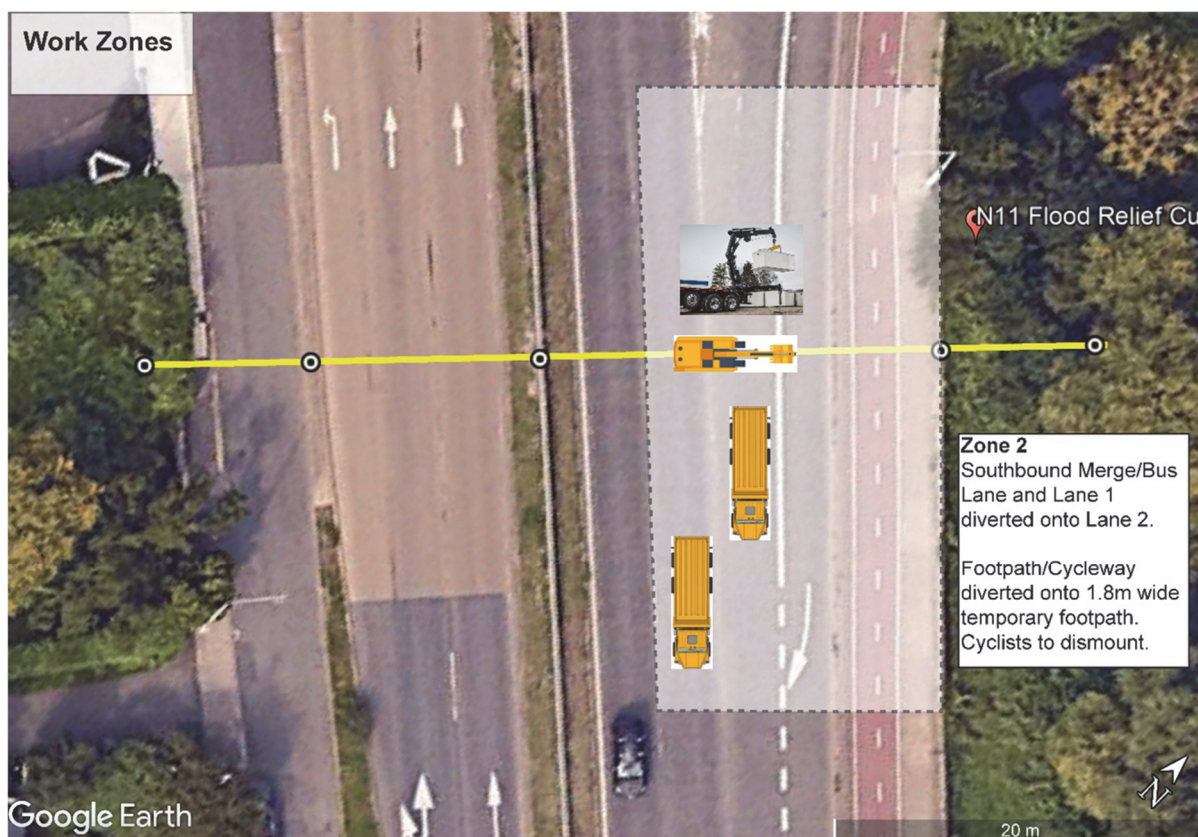
When the road surface has been broken up, the acoustic barrier system will be replaced by traditional pedestrian barriers and will be positioned to allow sufficient room for upcoming activities to take place.

2 No. NWCPO licenced rigid body trucks will enter the site through the works access point and will take up a position on the southside of the trench crossing. One of these trucks will be fitted as a grab truck (see **Figure 9**). The 36-tonne excavator will proceed to remove the top layers of excavation and load onto the rigid trucks (see **Figure 10**).

Figure 9 – Grab Truck



Figure 10 – Plant Layout



The excavation will progress downwards to a point where the excavation sides are stable. At approximately 1000mm below existing ground level a pre-assembled 3000mm long x 2000mm deep trench box (or whichever trench protection system is deemed suitable for this particular pipe) will be transported by the 36t excavator from the mini compound and will be placed in the trench.

Examples of suitable shoring systems include a Standard Trench Box (see **Figure 11**), Trench Box Slide Rail System (see **Figure 12**), Pile Chamber (see **Figure 13**) and Pile Chamber and Slide Rail System combined (see **Figure 14**).

The 36-tonne excavator will then commence excavating down for a further 2000mm and will continue loading the rigid trucks that will be positioned on the south side of the excavation. Two trucks, removing two loads each, are required to complete a night's excavation. A 2000mm extension is attached to the top of the first trench box at this stage and then the excavation will continue down to formation level. The box will be pushed down by the excavator as the dig progresses.

A closure plate will be positioned on the front of the box to prevent any undermining of the leading face. Self-compacting stone chips, 6mm to 8mm, will be placed in any void between the outside faces of the trench box and the vertical soil face. This will assist in stabilising the existing ground.

Figure 11 – Standard Trench Box



Figure 12 – Trench Box – Slide Rail System



Figure 13 – Pile Chamber

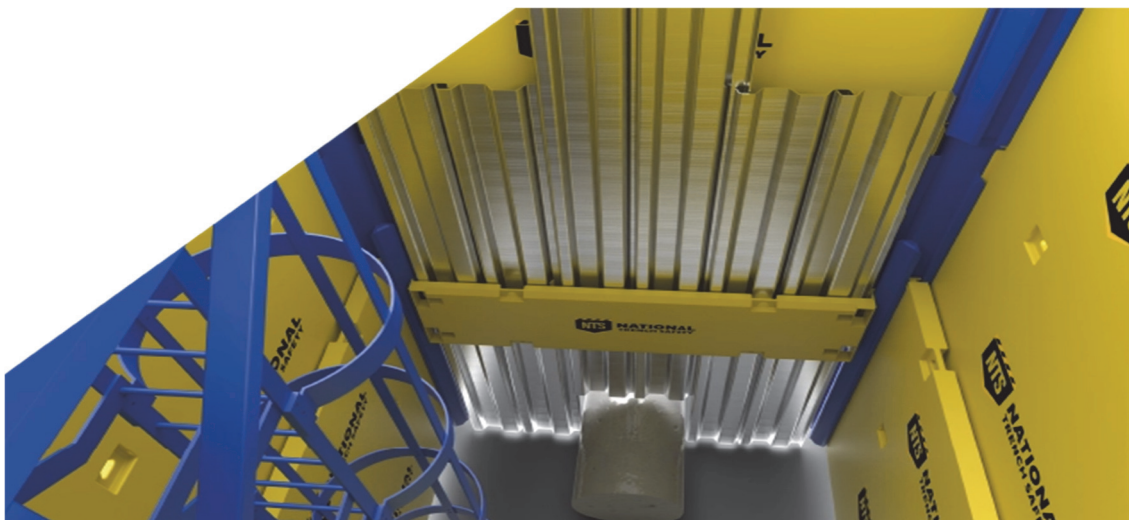
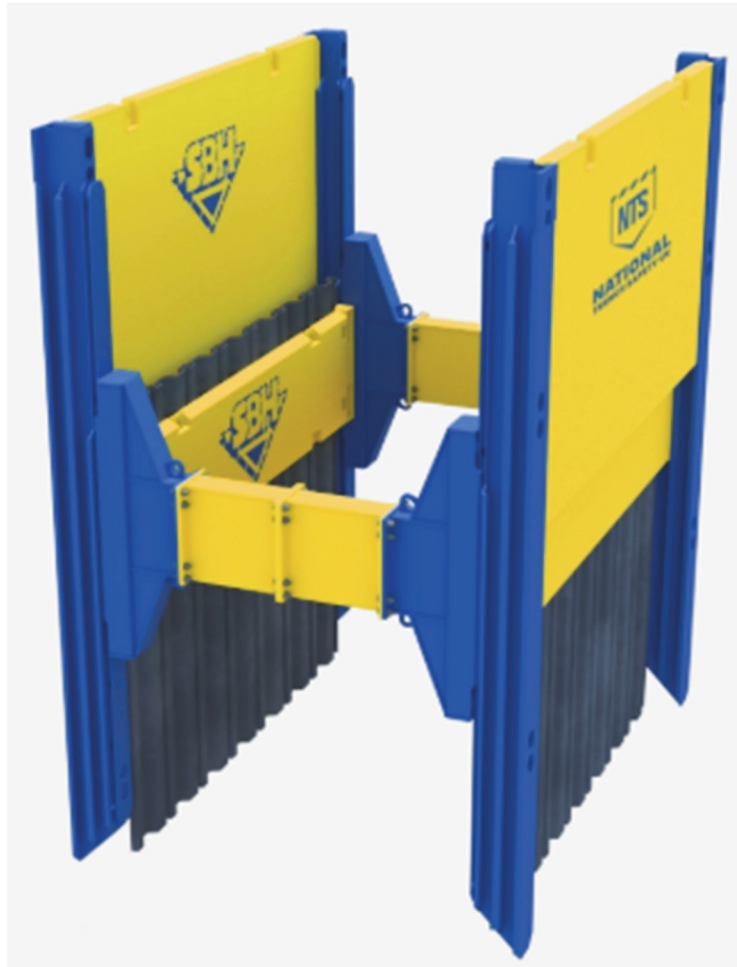


Figure 14 - Pile Chamber and Slide Rail System combined



In areas where there are limited utility services, it is proposed to use either a standard trench box or a slide rail system.

In an area that is congested with utility services and consequently insufficient room to install a full-length side panel of a slide rail system, the use of the pile chamber/slide rail combined box would be used instead (see **Figure 14**). This system is designed for excavations that encounter services running perpendicular to the line of the trench excavation.

The top section of the box utilises the 1400mm high side panels (see **Appendix 6** and extract in **Figure 15**).

The trench sheets are then installed, and they follow the dig downwards as the excavation progresses. The short metal trench sheet directly over the service (less than 1000mm high) is allowed to sit on the previously installed half-round steel utility protection sleeve. The sheet directly after this short sheet is an L-shaped sheet, and this prevents any soil under the service from falling into the trench and thus ensures that the trench is safe for personnel inside.

Figure 15 – Slide Rail System

Slide rail plates

Plate length L [m]	Plate height H [m]	Thickness t _{PL} [m]	Pipe clearance length L _c [m]	Pipe clearance height h _c [m]	Permissible earth pressure [kN/m ²]	Weight [kg]
2.00	2.40 1.40	107	1.80	2.27	158.2	550 355
2.50	2.40 1.40		2.30	2.77	101.2	650 420
3.00	2.40 1.40		2.80	3.27	70.3	770 495
3.50	2.40 1.40		3.30	3.77	51.6	900 580
4.00	2.40 1.40		3.80	4.27	39.5	1010 650

When the excavation reaches formation level a modular handrail system and caged ladder will be attached to the inside of the trench box to allow personnel to enter the excavation.

A handheld *Terra Meter Falling Weight Deflectometer* (FWD) will be used to determine if the formation level is achieving the minimum permissible bearing capacity. (see **Figure 16**). This will give an average of five results in less than 5 minutes. Should the formation level be less than the bearing required, an additional 300mm depth of excavation will be undertaken and replaced with 300mm of class 6N stone and re-tested. The pipe bedding will be placed after formation is approved.

Figure 16 - FWD Test to Check Formation



If water is encountered in the excavation, a mobile super silent pump (see **Figure 17**) will be utilised to dewater the trench. The water will be pumped into the 225mm sacrificial pipe which is installed at crown level of the 2400mm pipe culvert. A filtration system (e.g. see **Figure 18**) will be in place on the downstream end of the culvert. This trench water will pass through this system before it is allowed to enter the river.

Figure 17 – Super Silent Pump



Figure 18 – Water Filtration System



TIME: 12.30 AM

The truck with rear mounted hiab crane with a 2400mm pipe on board will move into its position on the north side of the excavation. It will have collected this pipe from the nearby Bray Road compound. All chains, gaskets/rubber rings will have been installed on the pipe at the compound. The pipe will be lowered into the trench and placed at the socket of the previously installed pipe. (see **Figure 19**).

Figure 19 – Hiab truck places 2400mm pipe into the trench.



Once aligned, the 36t excavator will push the pipe home to its final position. Should there be a requirement to side dig the excavation (as the excavation approaches the TM boundary behind the operation) the pipe will be pulled home by a *Culvert Puller* (see **Figure 20**) positioned within the previously laid culvert pipes. When the pipe is installed, a temporary metal shield will be placed into the socket of the last pipe to prevent any backfill material entering the pipe.

Figure 20 – Culvert Puller



TIME: 1.00 AM

The spoil removal trucks will now move into position on the south side of the excavation and will have either 6mm – 8mm self-compacting stone chips or lean mix concrete on board. The self-compacting chips will be placed down the sides and brought to level with the crown of the pipe. The shoring system will be removed in stages as the backfilling process progresses.

The 225mm twin wall pipe acting as the outfall for trench water will be installed at crown level of the 2400mm culvert pipe. The lean mix concrete will be placed and compacted in layers from the crown of the pipe to the underside of the road surfacing base layer. The FWD will again be utilised at this point to verify the bearing capacity at this level.

TIME: 2.00 AM

A road surfacing batching plant will be requested to open specifically at nighttime and batch the required mix and deliver to site. Subject to design approval, a road surfacing material such as Stone Mastic Asphalt (SMA) 14 will be used in all layers for the temporary reinstatement of the trench.

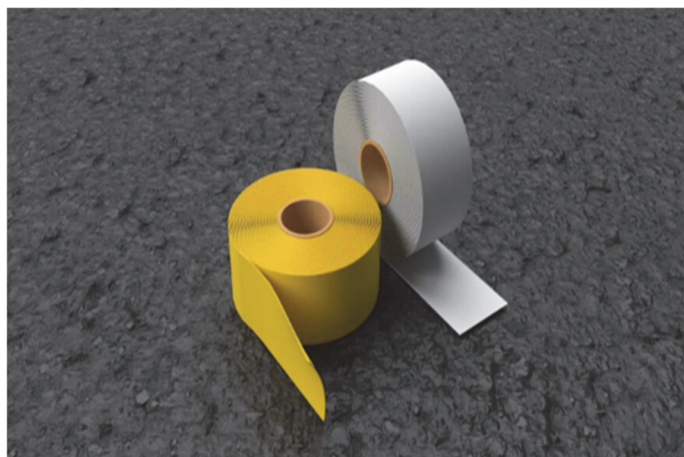
During the nights of culvert installation, the sawcut through the existing road surface will be cut vertically down through all layers and not be keyed in at base/ binder / wearing course level. The permanent reinstatement will be installed later, over three nights, and will require the use of a road planer. During this activity all layers will be correctly stepped back and keyed in, as per design specification.

All trucks will be removed off site. The 16-tonne rubber tyred and 36t tracked excavator will return to the mini-compound that will be located on the existing cycle lane/footpath. All barriers etc will also be returned to the mini-compound. The crew cab unit will remove the mobile welfare unit to the Bray Road compound.

TIME: 3.00 AM

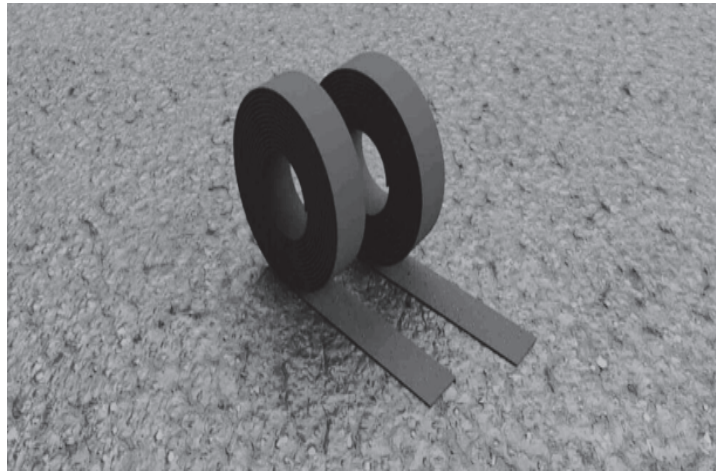
Thermoplastic road markings and cats eyes that were removed during the excavation will be replaced each night. Subject to approval, the temporary thermoplastic road lines will be supplied in rolls (*Euro lines*) and will be applied by handheld blow torch (see **Figure 21**). This will negate the requirement for truck mounted line extruders.

Figure 21 – Temporary road lines



The joint between the existing and new temporary surfacing will also be sealed each night with *grip roll* which can be applied by hand blow torch (see **Figure 22**).

Figure 22 – Temporary Joint Sealant



TIME: 4.00 AM

When the site manager confirms that the road is clear of all construction equipment, they will consult with the Traffic Safety Officer (TSO). The traffic management crew will commence the removal of the temporary traffic management setup.

TIME: 4.50 AM

The TSO will liaise with Site Manager, who in turn will contact the client's site representative and verify that all work is complete and the road network is fully operational.

1.4.3 Emergency Plan

An Emergency Response Plan will be developed for the works, in consultation with all stakeholders. It is a requirement that the network is fully operational at 5.00 AM each morning. With that in mind all eventualities will be looked at in a worst-case scenario and contingency plans in place to deal with unexpected issues.

Sufficient time risk has already been allowed across the various stages during the night shift. Additional resources, including TM resources can be further introduced, if required, during the detailed design stage.

The 16-tonne rubber tyre excavator that is tasked with loading at the site compound can be deployed to the culvert site within minutes should an issue develop with either of the excavators.

The rigid truck fitted with the grab can replace the 16-tonne excavator operating from the site compound on the Bray Road. There will be sufficient aggregate stored in the site compound should the works have to be abandoned on any night, and the excavation closed. On-call plant fitters within the area will be on standby should any mechanical issue arise with an item of plant.

1.4.4 Project Programme

There are four elements to the programme that will require nighttime closures.

- Locating existing services;
- Installation of hardened median to allow a contra flow system;
- Diversion / Protection of existing services; and
- Installation of the 2400mm pipe culvert.

3 separate nights will be required to conduct a full GPR survey with TM sequencing.

4 nights will be allowed to install the cross-overs for the contra flow system. A separate crew will work on each crossing, and both can be done simultaneously.

5 nights will be allowed to install a temporary exit from the Bray Road and reinstate upon completion.

Both gas mains under the Southbound Cycleway/ Footpath will be protected during daytime hours on the basis that the pedestrians / cyclists are diverted onto a temporary surface behind Loughlinstown Park boundary wall. Cyclists to dismount.

There are currently 6 known services under the Southbound / Northbound / Bray Road that require a nighttime diversion. One per night will be the target.

The project will require 21 pipes to be installed plus the two precast headwalls. 18 of these pipes will require a nighttime closure of the N11 dual carriageway. 20 nights will be allowed for this, as there is kerbing and drainage that will have to be reinstated without delay after installing the culvert.

3 nights will be required to plane out the temporary reinstatement (SMA 14) and place the permanent surfacing, together with the thermoplastic road markings.

4 nights will be allowed to remove each of the temporary median cross-overs.

5 nights will be allowed to temporarily replace the existing VRS system on the median and reinstall on completion of the works.

In summary, there will be 44 to 50 nighttime shifts required to complete the culvert installation works on the N11 dual carriageway.

APPENDIX 1

Work Zones (Concepts)

Work Zones

To City

From City

Centre line of culvert

N11 Flood Relief Cul

Zone 4

Zone 3

Zone 2

Zone 1

Google Earth

20 m



Work Zones

To City

From City

Centre line of culvert

N11 Flood Relief Cul

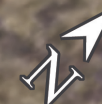
Zone 1

Zone 1

Off-line

Google Earth

20 m



Work Zones

To City

From City

Centre line of culvert

Zone 2

N11 Flood Relief Cul

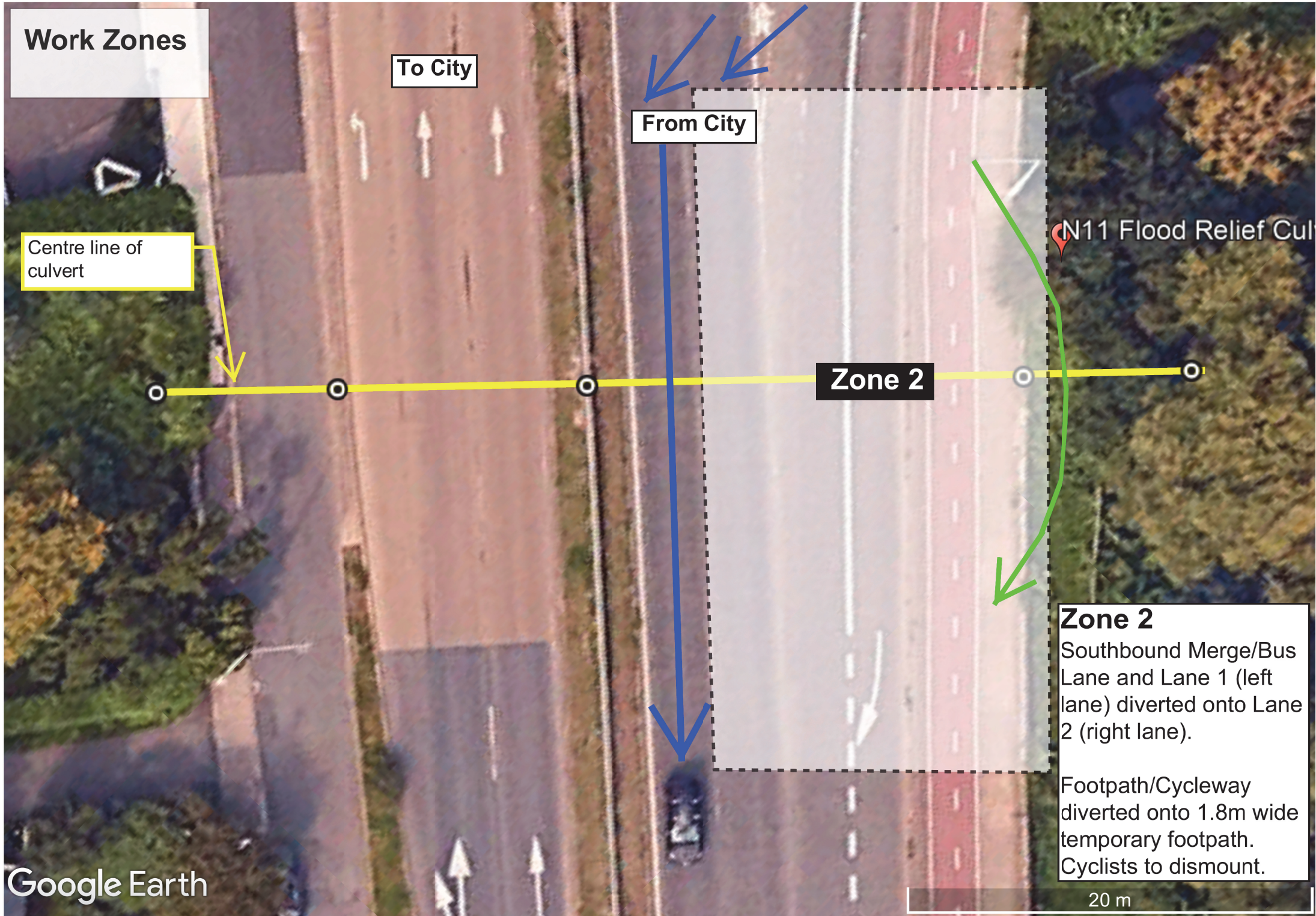
Zone 2

Southbound Merge/Bus Lane and Lane 1 (left lane) diverted onto Lane 2 (right lane).

Footpath/Cycleway diverted onto 1.8m wide temporary footpath. Cyclists to dismount.

Google Earth

20 m



Work Zones

To City

From City

Zone 3

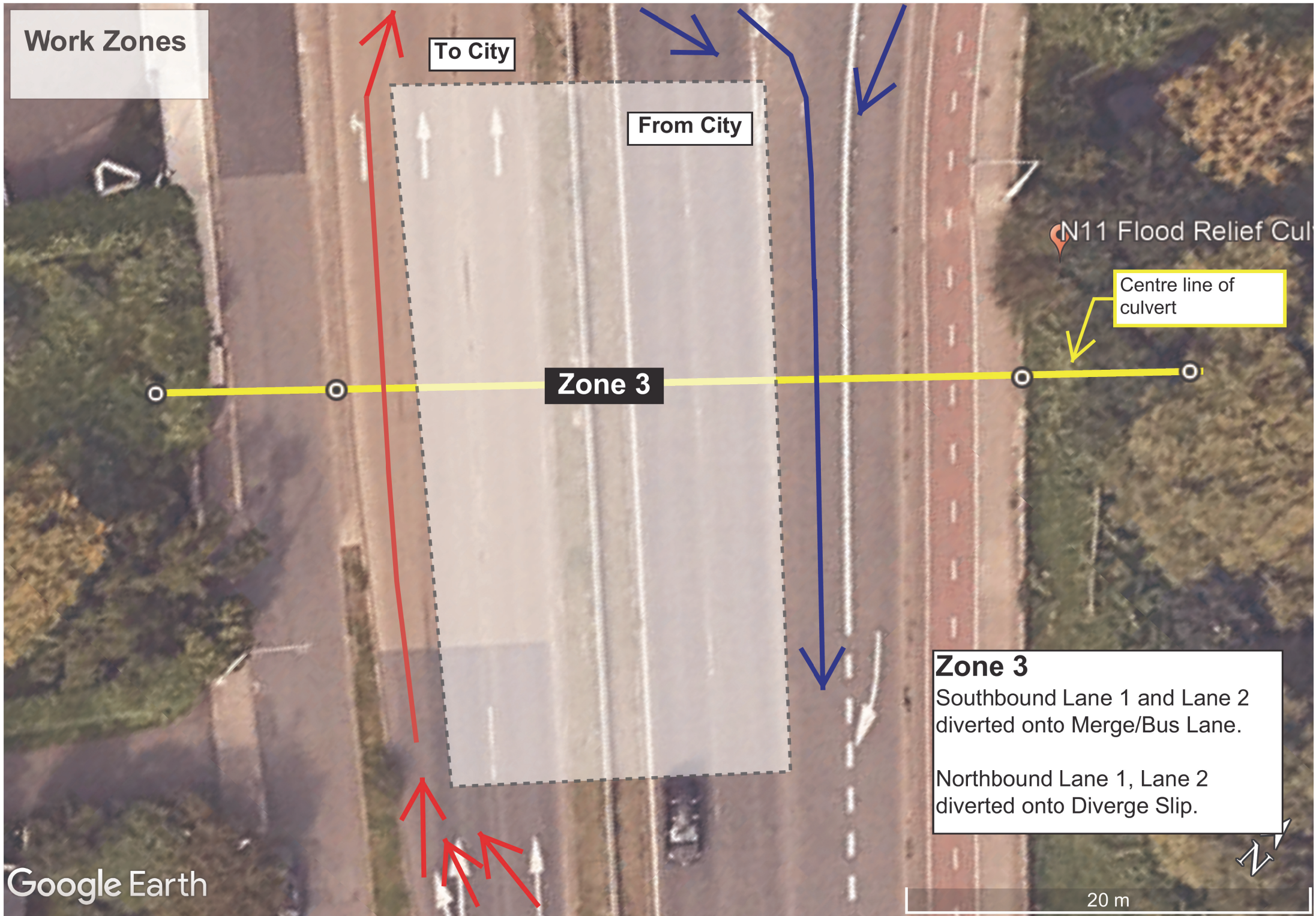
N11 Flood Relief Cul

Centre line of
culvert

Zone 3

Southbound Lane 1 and Lane 2
diverted onto Merge/Bus Lane.

Northbound Lane 1, Lane 2
diverted onto Diverge Slip.



Work Zones

To City

From City

N11 Flood Relief Cul

Centre line of
culvert

Zone 4

Zone 4

Southbound Lane 2 (right lane)
diverted onto Lane 1 (left lane).

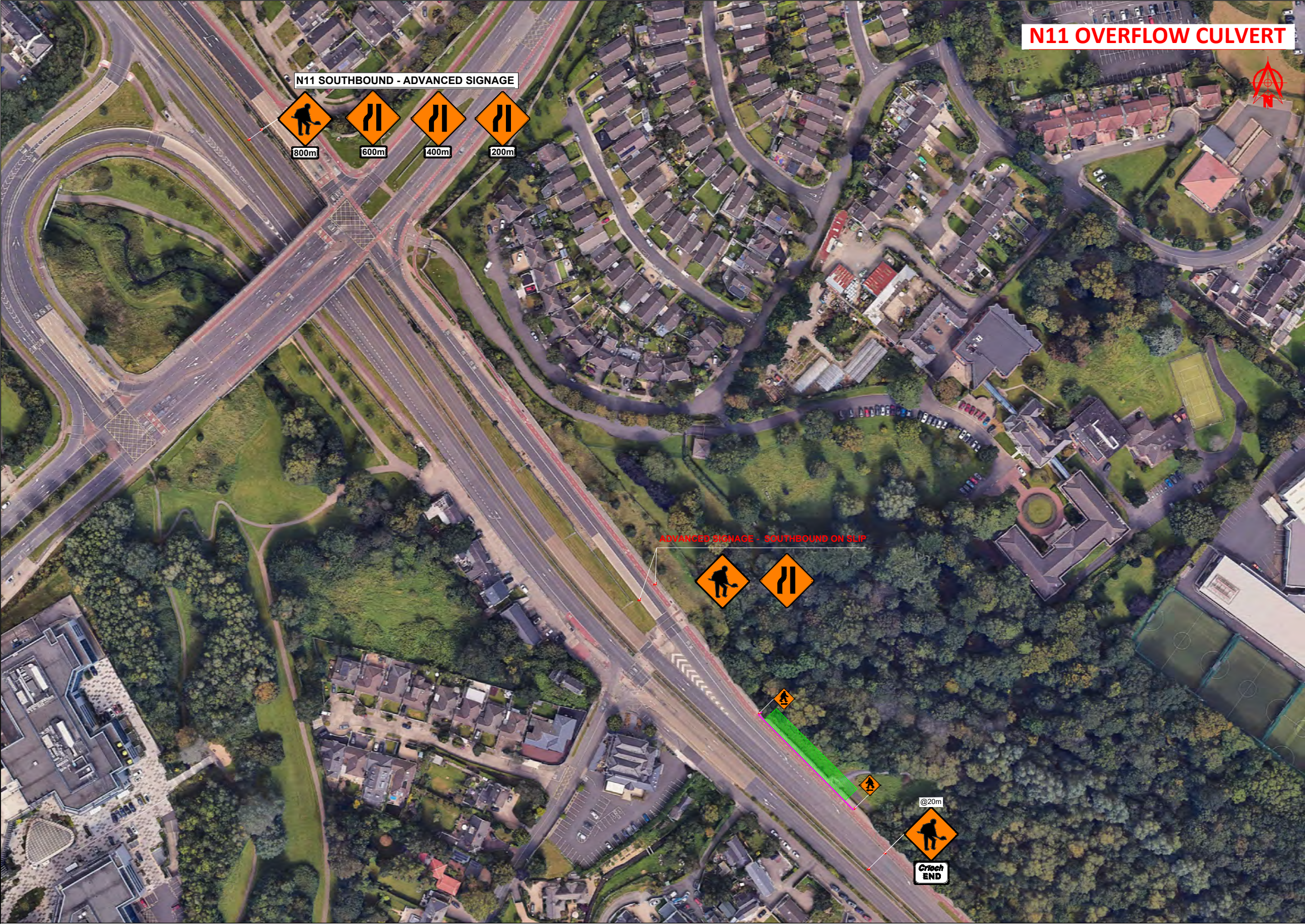
Northbound Lane 1, Lane 2 and
Diverge Slip diverted onto
Southbound Lane 2 (contraflow).
Hardened median cross-overs.

Bray Road diverted onto
Northbound Lane 1 (left lane)
prior to contraflow. Hardened
median cross-over.



APPENDIX 2

Traffic Management Concept Layout Drawings



N11 OVERFLOW CULVERT

DESIGNS PARAMETERS:

Table 3.2.1 Minimum Design Parameters for Level 3(a) Roads
Dual Carriageways and Motorways of 80km/h

Design Parameter	Type A > 12 hours	Type B < 12 hours	Type C < 15 mins
Advance Warning Signage			
Sign Size (mm)	750	750	500
Sign Visibility (m)	90	90	50
Number of Signs	4 (both sides)	3 (both sides) 4 (left side only)	2
Cumulative Distance (m)	480	360 480	120
Distance between advance warning signs (m)	120	120	30
Taper			
Lane Taper Length (m)	180	180	90
Hard Shoulder Taper Rate	1 in 20	1 in 20	1 in 20
Transition Length (m)	360	360	180
Cones			
Cone Height (mm)	750	750	500
Taper Spacing (m)	3	3	1.5
Longitudinal Spacing (m)	12	12	6
Lamps (unit areas only)			
Taper Spacing (m)	6	6	3
Longitudinal Spacing (m)	24	24	12
Safety Zones			
Longitudinal (m)	45	45	22.5
Lateral (m)	1.2	1.2	0.6
Set Back (m)	0.4	0.4	0.2
Lanes			
Lane Width (m)	3.3	3.3	2.7

- GENERAL NOTES:**
1. All signs to be in accordance with Chapter 8 of TSM Guidance Document 2019.
 2. Signs to be placed so as not to cause a hazard to road users and pedestrians.
 3. Safety Zones to be in accordance with Chapter 8 and maintained at all times.
 4. All necessary consultation, liaison and approvals will have taken place before installation.
 5. Any changes to TM Plan undertaken on site must be communicated to and approved by the Designer and notified to the PSDP and PSCS.
 6. Installation of central coning to be assessed by TM Supervisor on-site. If there is not enough room, central coning not to be placed.

- DUTIES & RESPONSIBILITIES :**
1. The Designer has designed the attached TTM plan with all the best available information at the time of design. Should any further information become applicable it should be communicated to the designer for review and inclusion in the design as necessary.
 2. It is the client's responsibility to employ a competent person to ensure that the scheme is installed safely.
 3. For safe and consistent methods of TTM installation the installer of the scheme should as a minimum refer to the DTT as documents "Temporary Traffic Management Operations Guidance Parts 0, 1, 2 & 3" as appropriate. This should be carried out in addition to and in combination with the installers own method statement, risk assessment and SOP's.SITE

- SITE SPECIFIC NOTES:**
1. A risk assessment to be done on site before the implementation of this traffic management plan
 2. Temporary pedestrian ramps to be used where footpath is closed and pedestrians are diverted on the other side of footpath.
 3. Residents to be notified in advance of the works and the tm system to be put in place.
 4. Site Access/Egress signs and locations will be positioned to suit progress of works.

- LEGEND:**
- Sign Symbol
 - Cone
 - Work Area
 - Pedestrian & Cyclist Route
 - Pedestrian Barriers



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Project
Title:
**CARRICKMINES SHANGANAGH RIVER
FLOOD RELIEF SCHEME
N11 OVERFLOW CULVERT**

Drawing
Title:
**Temporary Traffic Management
Layout For Lane Closure System
Zone 01**

Revision Details Box	
Rev. No	Comments

Detail Box		
Draft by: MV	Scale:	Drawing no.:
Designed by: PMC	not to scale	TMD.2025.2314.TMP.001
Approved by: PMC	Date: 15.09.2025	Rev: 00



DESIGNS PARAMETERS:

Table 3.2.1 Minimum Design Parameters for Level 3(a) Roads
Dual Carriageways and Motorways of 80km/h

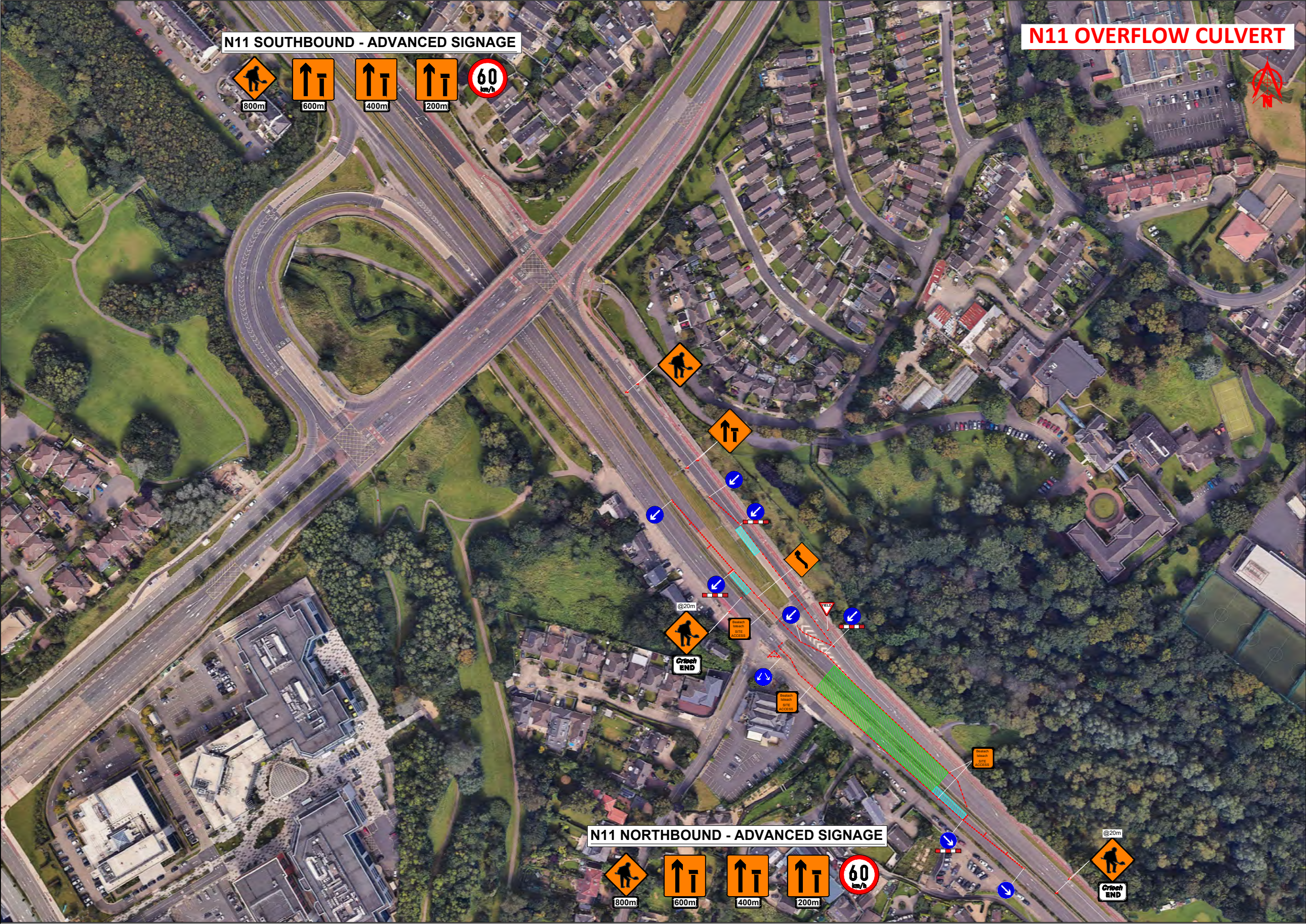
Design Parameter	Type A > 12 hours	Type B < 12 hours	Type C < 15 mins
Advance Warning Signage			
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Sign Visibility (m)	90	90	50
Number of Signs	4 (both sides)	3 (both sides) 4 (left side only)	...
Cumulative Distance (m)	480	360 ¹⁾ 480 ²⁾	...
Distance between advance warning signs (m)	120	120	...
Taper			
Lane Taper Length (m)	180	180	...
Hard Shoulder Taper Rate	1 in 20	1 in 20	...
Transition Length (m)	360	360	...
Cones			
Cone Height (mm)	750	750	...
Taper Spacing (m)	3	3	...
Longitudinal Spacing (m) ³⁾	12	12	...
Lamps (unit areas only)			
Taper Spacing (m)	6	6	...
Longitudinal Spacing (m)	24	24	...
Safety Zones			
Longitudinal (m)	45	45	...
Lateral (m)	1.2	1.2	...
Set Back (m)	0.4	0.4	...
Lanes			
Lane Width (m) ⁴⁾	3.3	3.3	...

- GENERAL NOTES:
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- LEGEND:
- Sign Symbol
 - Cone
 - Work Area
 - Pedestrian & Cyclist Route
 - Pedestrian Barriers
 - Safety Zone



DESIGNS PARAMETERS:

Table 3.2.1 Minimum Design Parameters for Level 3(0) Roads
Dual Carriageways and Motorways of 80km/h

Design Parameter	Type A > 12 hours	Type B < 12 hours	Type C < 15 mins
Advance Warning Signage			
Sign Size (mm)	750	750	500
Sign Visibility (m)	90	90	50
Number of Signs	4 (both sides)	3 (both sides) 4 (left side only)	---
Cumulative Distance (m)	480	360 ¹ 480 ¹	---
Distance between advance warning signs (m)	120	120	---
Taper			
Lane Taper Length (m)	180	180	---
Hard Shoulder Taper Rate	1 in 20	1 in 20	---
Transition Length (m)	360	360	---
Cones			
Cone Height (mm)	750	750	---
Taper Spacing (m)	3	3	---
Longitudinal Spacing (m) ^A	12	12	---
Lamps (unit areas only)			
Taper Spacing (m)	6	6	---
Longitudinal Spacing (m)	24	24	---
Safety Zones			
Longitudinal (m)	45	45	---
Lateral (m)	1.2	1.2	---
Set Back (m)	0.4	0.4	---
Lanes			
Lane Width (m) ^B	3.3	3.3	---

- GENERAL NOTES:**
1. All signs to be in accordance with Chapter 8 of TSM Guidance Document 2019.
 2. Signs to be placed so as not to cause a hazard to road users and pedestrians.
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- LEGEND:**
- Sign Symbol
 - Cone
 - Work Area
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 - Pedestrian Barriers
 - Safety Zone



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Client:  

Project Title:
**CARRICKMINES SHANGANAGH RIVER
FLOOD RELIEF SCHEME
N11 OVERFLOW CULVERT**

Drawing Title:
**Temporary Traffic Management
Layout For Lane Closure System
Zone 03**

Revision Details Box

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Detail Box

Draft by: MV	Scale: not to scale	Drawing no.: TMD.2025.2314.TMP.003
Designed by: PMC	Date: 15.09.2025	Rev: 00

N11 OVERFLOW CULVERT

N11 SOUTHBOUND - ADVANCED SIGNAGE

800m 600m 400m 200m 60 km/h

N11 NORTHBOUND - ADVANCED SIGNAGE

800m 600m 400m 200m 60 km/h

Diversion Route

Truck or Trailer SU DIVERTED TRAFFIC

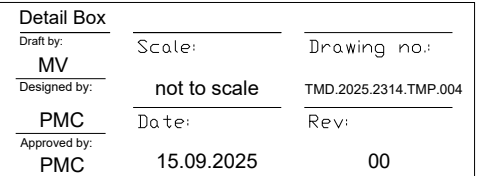
Crash END

Truck or Trailer SU DIVERTED TRAFFIC

Crash END

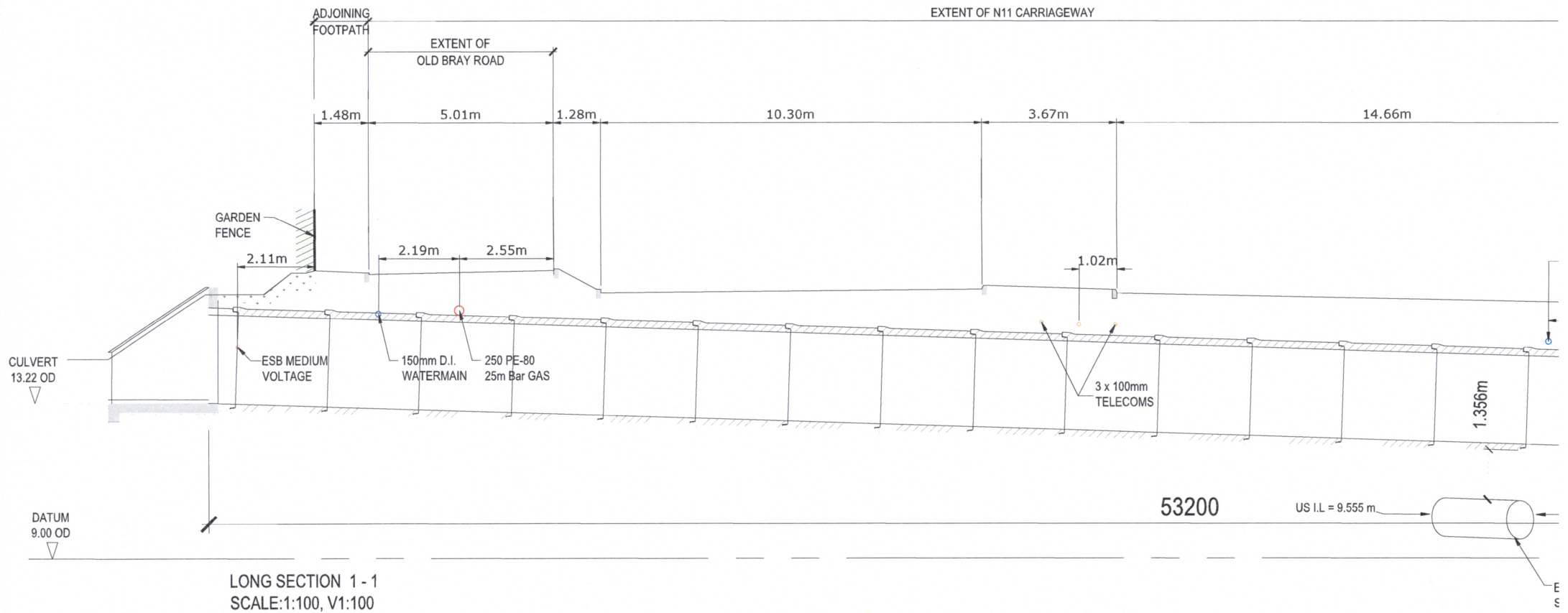
Design Parameter	Type A ≥ 12 hours	Type B ≥ 12 hours	Type C ≤ 15 mins
Advance Warning Signage			
Sign Size (mm)	750	750	—
Sign Visibility (m)	90	90	90
Number of Signs	4 (both sides)	3 (both sides) ¹⁾ 4 (left side only) ²⁾	—
Cumulative Distance (m)	480	360 ²⁾ 480 ¹⁾	—
Distance between advance warning signs (m)	120	120	—
Taper			
Lane Taper Length (m)	180	180	—
Head Shoulder Taper Rate	1 in 20	1 in 20	—
Transition Length (m)	360	360	—
Cones			
Cone Height (mm)	750	750	—
Taper Spacing (m) ^A	3	3	—
Longitudinal Spacing (m) ^A	12	12	—
Lamps (unit areas only)			
Taper Spacing (m)	6	6	—
Longitudinal Spacing (m)	24	24	—
Safety Zones			
Longitudinal (m)	45	45	—
Lateral (m)	1.2	1.2	—
Set Back (m)	0.4	0.4	—
Lanes			
Lane Width (m) ^B	3.3	3.3	—

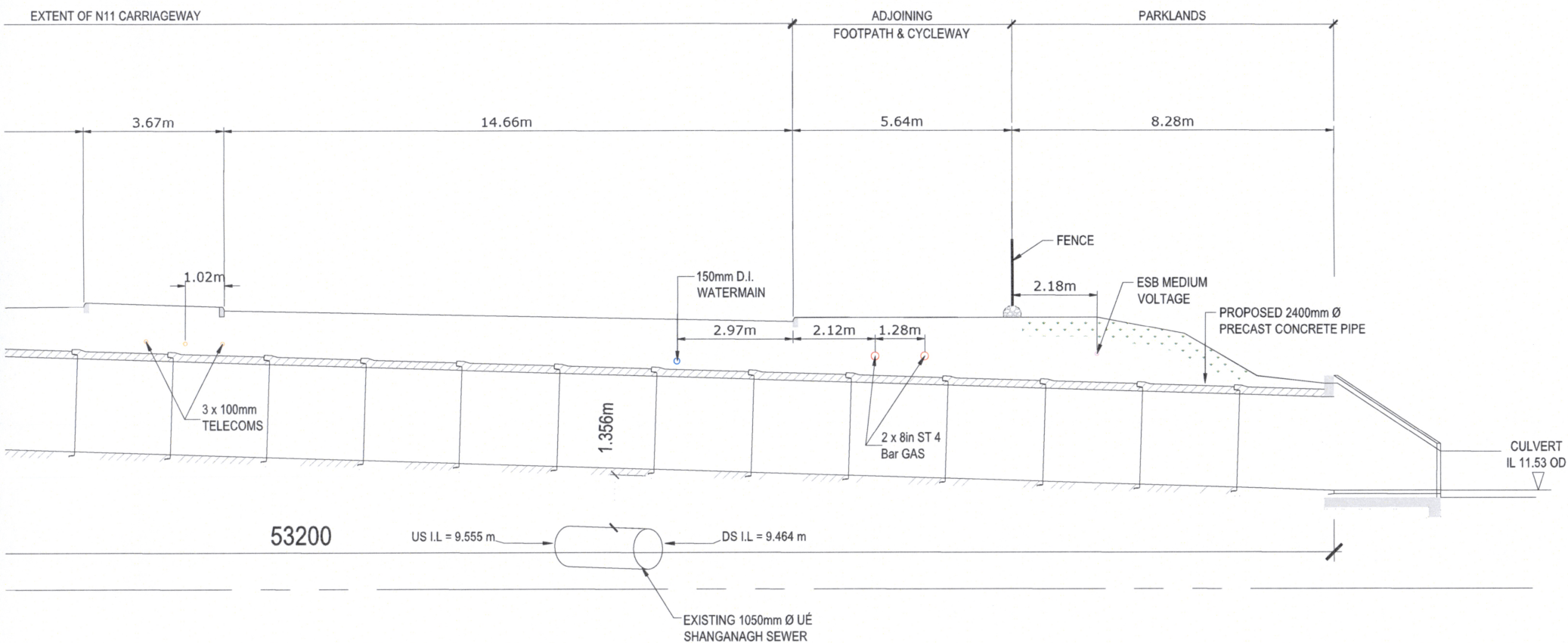
	-	Sign Symbol
	-	Cone
	-	Work Area
	-	Pedestrian & Cyclist Route
	-	Diversion Route
	-	Safety Zone



APPENDIX 3

Location of Utilities





APPENDIX 4

Komatsu-pc360-11 Excavator Specification



PC360LC-11 PC360NLC-11



Hydraulic excavator

Engine power

202 kW / 271 HP @ 1950 rpm

Operating weight

PC360LC-11: 35900 - 36850 kg

PC360NLC-11: 35800 - 36560 kg

Bucket capacity

max. 2.66 m³

PC360LC/NLC-11



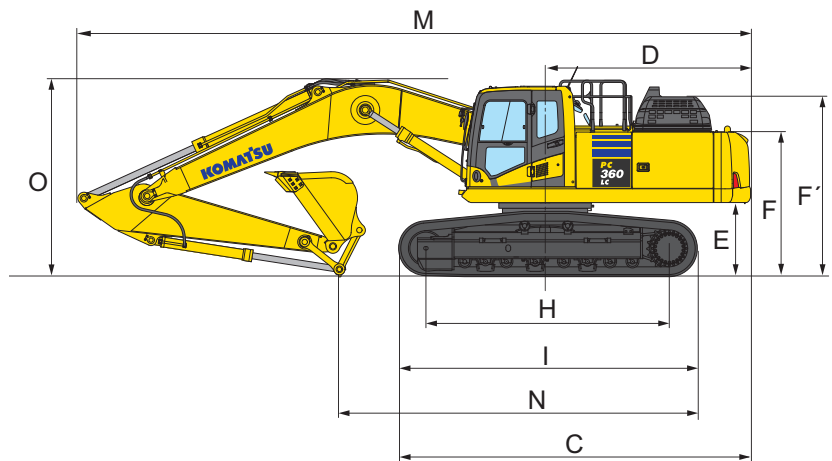
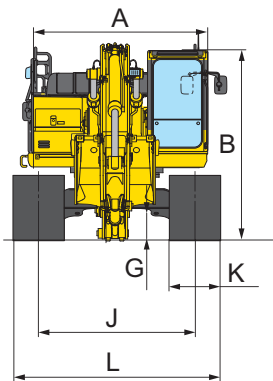
Engine power
202 kW / 271 HP @ 1950 rpm

Operating weight
PC360LC-11: 35900 - 36850 kg
PC360NLC-11: 35800 - 36560 kg

Bucket capacity
max. 2.66 m³

Dimensions and performance figures

Machine dimensions	PC360LC-11	PC360NLC-11
A Overall width of upper structure	2995 mm	2995 mm
B Overall height of cab	3160 mm	3160 mm
C Overall length of basic machine	5880 mm	5880 mm
D Tail length	3405 mm	3405 mm
Tail swing radius	3445 mm	3445 mm
E Clearance under counterweight	1185 mm	1185 mm
F Machine tail height	2350 mm	2350 mm
F' Machine tail height (top of engine cover)	2920 mm	2920 mm
G Ground clearance	498 mm	498 mm
H Tumbler centre distance	4030 mm	4030 mm
I Track length	4955 mm	4955 mm
J Track gauge	2590 mm	2390 mm
K Track shoe width	600, 700, 800, 850 mm	600, 700, 800 mm
L Overall track width with 600 mm shoes	3190 mm	2990 mm
Overall track width with 700 mm shoes	3290 mm	3090 mm
Overall track width with 800 mm shoes	3390 mm	3190 mm
Overall track width with 850 mm shoes	3440 mm	-



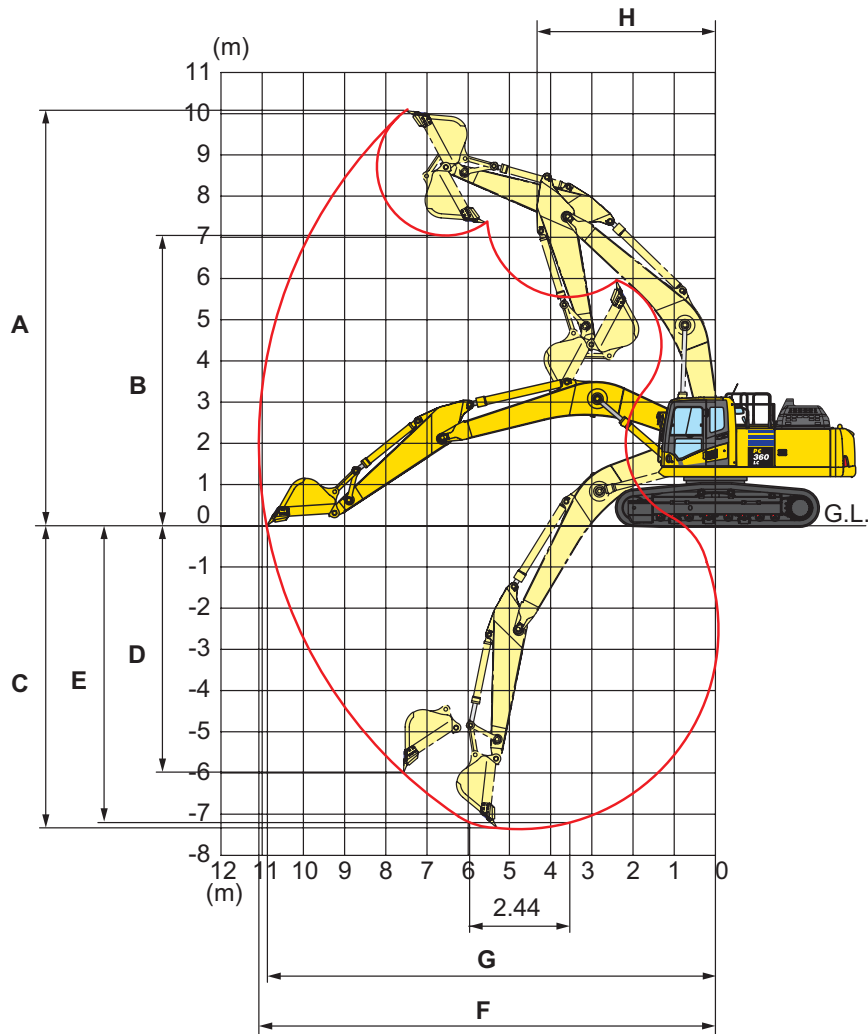
Transport dimensions

Mono boom

Arm length	2.2 m	2.6 m	3.2 m	4.0 m
M Transport length	11290 mm	11180 mm	11145 mm	11170 mm
N Length on ground (transport)	7155 mm	6760 mm	5935 mm	5475 mm
O Overall height (to top of boom)	3400 mm	3410 mm	3320 mm	3760 mm

Working range

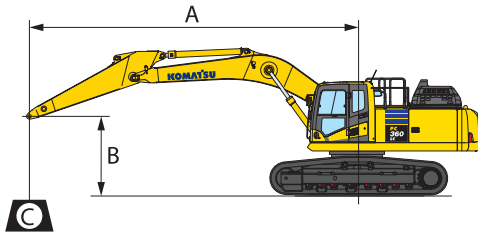
Mono boom



Working range

Arm length	2.2 m	2.6 m	3.2 m	4.0 m
A Max. digging height	9580 mm	9965 mm	10210 mm	10550 mm
B Max. dumping height	6595 mm	6895 mm	7110 mm	7490 mm
C Max. digging depth	6355 mm	6705 mm	7380 mm	8180 mm
D Max. vertical wall digging depth	5120 mm	5880 mm	6480 mm	7280 mm
E Max. digging depth of cut for 2.44 m level	6130 mm	6520 mm	7180 mm	8045 mm
F Max. digging reach	10155 mm	10550 mm	11100 mm	11900 mm
G Max. digging reach at ground level	9950 mm	10355 mm	10920 mm	11730 mm
H Min. swing radius	4390 mm	4400 mm	4310 mm	4320 mm

Lifting capacity



A – Reach from swing center

B – Bucket hook height

C – Lifting capacities

– Rating over front

– Rating over side

– Rating at maximum reach

Weights:

With 2.2 and 2.6 m arm:

bucket linkage and

bucket cylinder: 470 kg

With 3.2 and 4.0 m arm:

bucket linkage and

bucket cylinder: 435 kg

PC360LC-11 Mono boom

With 700 mm shoes

Arm length	A				9.0 m		7.5 m		6.0 m		4.5 m		3.0 m		1.5 m	
	B															
 4.0 m	6.0 m kg	*5470	5440	*7220	5870	*7960	7850									
	4.5 m kg	*5490	4930	*7870	5770	*8560	7610									
	3.0 m kg	*5660	4650	*8250	5610	*9340	7300	*11130	10030	*14560	*14560					
	1.5 m kg	*5970	4540	8200	5440	*10080	7000	*12480	9470	*17080	14080					
	0.0 m kg	*6490	4590	8040	5300	10390	6750	*13330	9060	*18230	13430	*8100	*8100			
	-1.5 m kg	7320	4830	7960	5230	10220	6600	*13500	8830	*18100	13180	*12160	*12160	*8170	*8170	
	-3.0 m kg	*7960	5330			*10130	6560	*12870	8780	*16900	13190	*17440	*17440	*12690	*12690	
	-4.5 m kg	*7780	6350			*8470	6690	*11210	8900	*14530	13400	*19380	*19380	*18050	*18050	
	-6.0 m kg	*6950	*6950						*7520	*7520	*10320	*10320	*13110	*13110		
 3.2 m	6.0 m kg	*6960	6240			*8760	7640									
	4.5 m kg	*7030	5570	*7650	5640	*9270	7440	*10700	10320							
	3.0 m kg	*7310	5220	8280	5530	*9950	7180	*12060	9800	*16280	14670					
	1.5 m kg	7660	5090	8150	5410	*10530	6930	*13170	9330	*18170	13790					
	0.0 m kg	7830	5180	8050	5320	10370	6740	*13660	9040	*18460	13420					
	-1.5 m kg	8390	5520			10280	6660	*13400	8920	*17600	13360	*13300	*13300			
	-3.0 m kg	*8630	6270			*9470	6710	*12240	8950	*15750	13480	*20330	*20330			
	-4.5 m kg	*8140	7920					*9690	9160	*12560	*12560	*15600	*15600			
	-6.0 m kg															
 2.6 m	6.0 m kg	*9390	6960			*9500	7590	*10450	*10450							
	4.5 m kg	9140	6140			*9880	7420	*11530	10220	*14810	*14810					
	3.0 m kg	8560	5730			*10440	7190	*12760	9730	*17560	14340					
	1.5 m kg	8400	5600			10610	6980	*13640	9330							
	0.0 m kg	8630	5730			10460	6840	*13820	9110	*18210	13520					
	-1.5 m kg	*9240	6170			*10390	6810	*13200	9060	*16870	13570	*12670	*12670			
	-3.0 m kg	*8940	7180					*11560	9160	*14570	13750	*17260	*17260			
	-4.5 m kg	*7850	*7850							*10630	*10630					
	-6.0 m kg															
 2.2 m	6.0 m kg	*9870	7590					*10830	10510							
	4.5 m kg	*9720	6590			*10110	7340	*11850	10090	*15470	15190					
	3.0 m kg	9160	6100			*10590	7120	*12990	9600							
	1.5 m kg	8970	5950			10560	6930	*13720	9230							
	0.0 m kg	9250	6100			10430	6810	*13710	9050	*17640	13470					
	-1.5 m kg	*9740	6640			*10070	6820	*12880	9040	*16140	13560					
	-3.0 m kg	*9380	7910					*10940	9190	*13650	*13650	*15120	*15120			
	-4.5 m kg	*7880	*7880							*9210	*9210					
	-6.0 m kg															

* Load is limited by hydraulic capacity rather than tipping. Ratings are based on SAE Standard No. J1097.

Rated loads do not exceed 87% of hydraulic lift capacity or 75% of tipping load. Lifting capacity stated is based on lifting with bare arm.

When lifting with additional equipment installed to the arm, please subtract the weight of all additional equipment from the values stated.

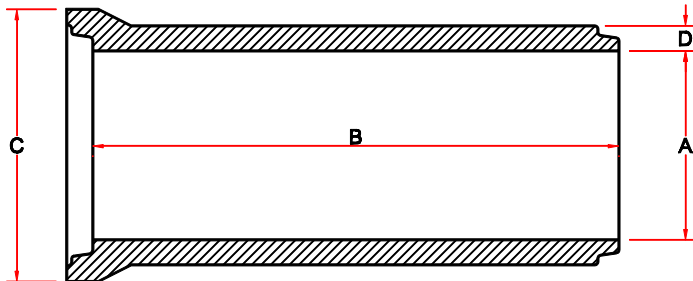
APPENDIX 5

Concrete Pipe Brochure

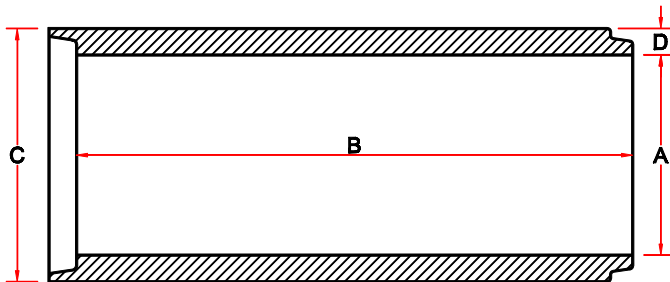


TECHNICAL SPECIFICATIONS

FLEXIBLE JOINTED PIPES



Spigot and Socket Type Pipe (S & S)



Rebated Type Pipe

OGEE PIPES

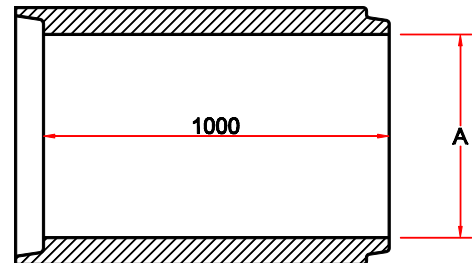


Table 4

"A" Internal Diameter	B Length	Approx. Wall Thickness (mm)	Approx. Weight in kgs
225mm	1 Metre	35	65
300mm	1 Metre	37	86
375mm	1 Metre	38	124
450mm	1 Metre	46	167
525mm	1 Metre	47	210
600mm	1 Metre	54	278
750mm	1 Metre	75	470
900mm	1 Metre	95	710
1050mm	1 Metre	100	870
1200mm	1 Metre	110	1110

Table 3

A Pipe -	B Length (m)	C Approx. Outside - (mm) O/D	D Approx. Wall Thickness (mm)	Approx. Weight in kgs	Pipe Type
150mm	1.25	290	33	80	S & S
225mm	1.25	392	38	122	S & S
300mm	2.0	505	60	358	S & S
375mm	2.5	606	65	565	S & S
450mm	2.5	707	69	730	S & S
525mm	2.5	808	77	980	S & S
600mm	2.5	909	91	1240	S & S
675mm	2.5	1008	97	1520	S & S
750mm	2.5	1016	111	1840	S & S
900mm	2.5	1183	122	2380	S & S
1050mm	2.5	1420	128	3040	S & S
1200mm	2.5	1605	138	3880	S & S
1350mm	2.5	1805	152	4640	S & S
1500mm	2.5	2012	150	5800	S & S
1650mm	2.5	2155	178	6900	S & S
1800mm	2.5	2310	203	8240	S & S
2100mm	2.5	2525	211	9560	Rebated
2400mm	2.5	2866	230	11600	Rebated

I.S. 6: 2004 is to be used in conjunction with ISEN 1916:

These pipes can also be manufactured to customers' own specification if so required.

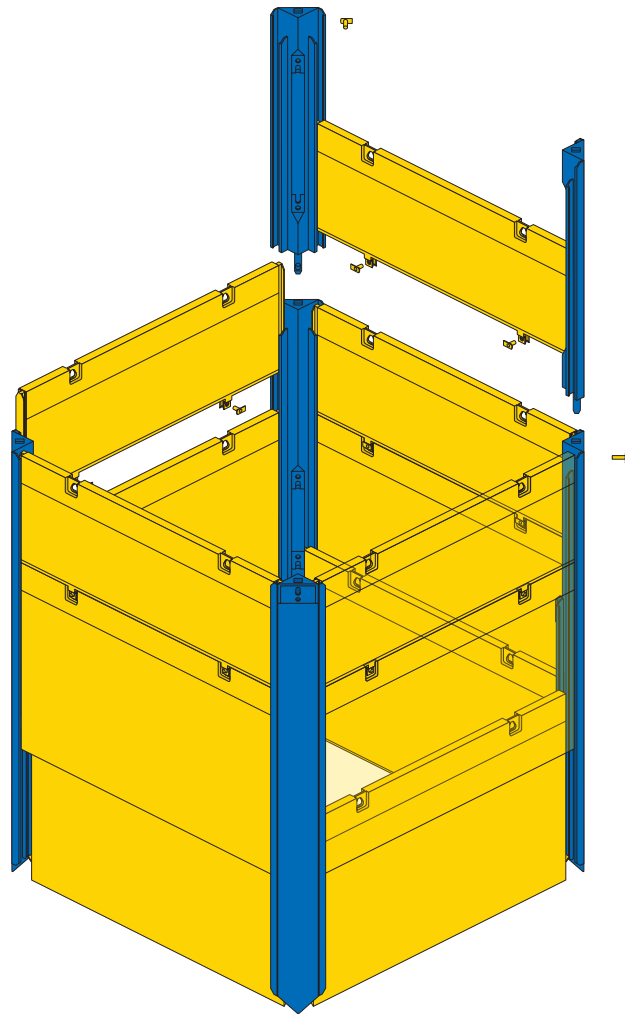
Rockers and Butt pipes are also available in 1-metre length in all sizes.

Ogee pipes are manufactured to I.S. 166: 1972 specification

APPENDIX 6

Trench Box _ Slide Rail System

Pits



SBH-Tiefbautechnik



ROLLING STRUT SHORING

Series 750/790

Fast

Safe

Economical

Rugged



SBH Tiefbautechnik GmbH
Ferdinand-Porsche Straße 8
D - 52525 Heinsberg

Tel. +49 (0) 24 52/91 04 0
Fax +49 (0) 24 52/91 04 50

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www.sbh-tiefbautechnik.com



ROLLING STRUT SHORING

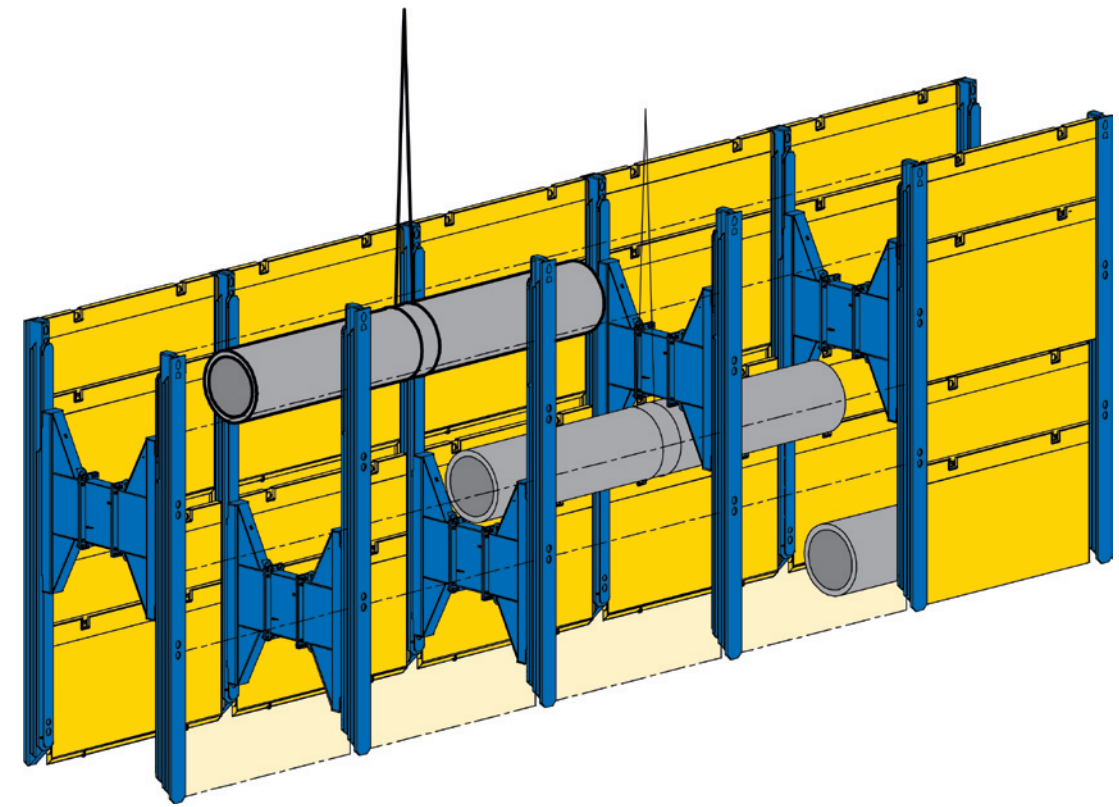
Series 750/790

The safe solution for hazardous jobs

The SBH Slide Rail System is perfect for projects with a combination of difficult conditions and can be used in most instances when conventional systems fail.

The SBH Slide Rail System is designed to handle deep trench excavations, close to existing buildings and adjacent to active roadways, without settlement.

The Inner Track of the Double Slide Rail System has been modified to accept the inner panels without loading them from the top as in older systems. This feature improves installation time.



The SBH Rolling strut shoring system allows a minimum pipe clearance of 3.00 metres and can be used for trench depths up to 9.00 metres which makes the system especially suited for typical inner city work.

If needed the Rolling Struts can be positioned in different heights and thus allow the laying of very long pipes.



Additional strength while providing more room for the excavator while digging or laying pipe

The compact size and center position of the "H" shaped rolling strut offers optimum working room during all operations. In every phase of the installation and removal process, the movable rolling strut is situated in such a low position that an excavator even with a short boom is always able to work free and unhindered. This feature makes this system much easier to use than any double strut slide rail system.

The unique rolling strut insures that opposing slide rails always remain parallel even when they are sliding past one another. Because of this, the slide rail panels can be installed easily even in deep cuts.

Soil movement outside the trench is minimized during the lining process. The horizontal soil movement which occurs when using conventional systems due to the shifting or tilting of slide rail panels during the lowering process is eliminated. The trench width remains constant during the entire excavation and back-fill operation.

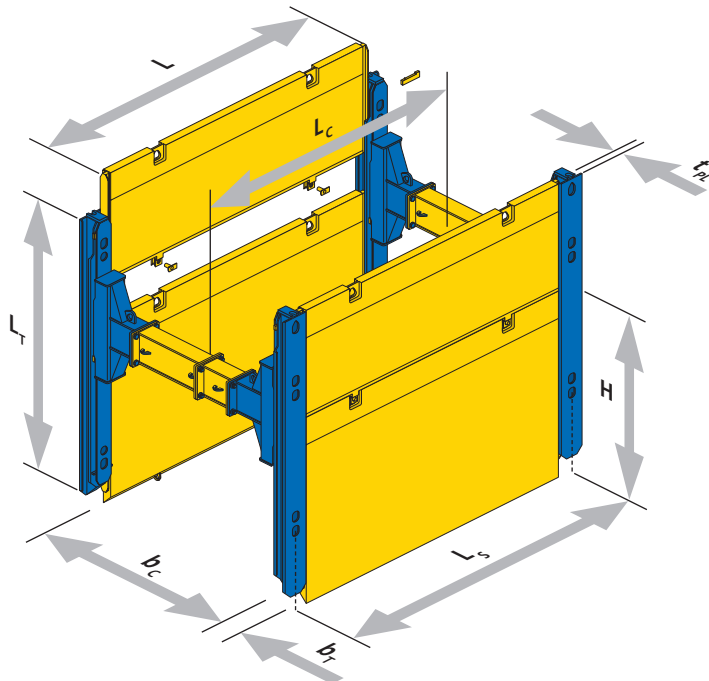
The removal process is improved as well, and is just as problem-free as the installation. Much less pulling force is required to remove panels as compared to old style slide rail systems. There is no horizontal movement of the shoring and thus no pressure against the soil.

As you see - all along the line

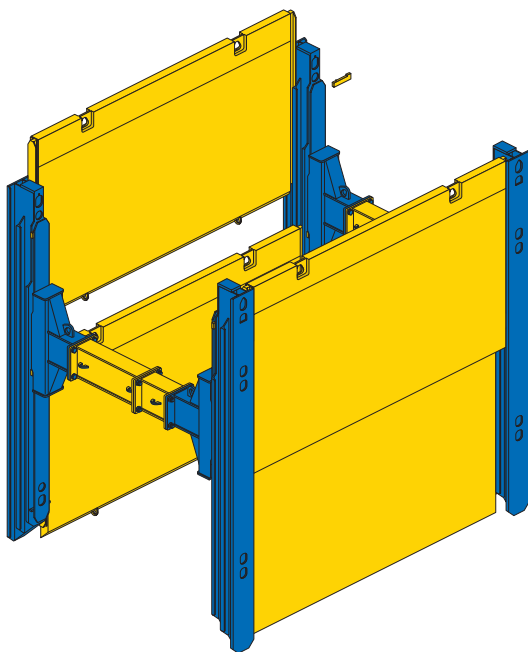
ROLLING STRUT SHORING

Series 750/790

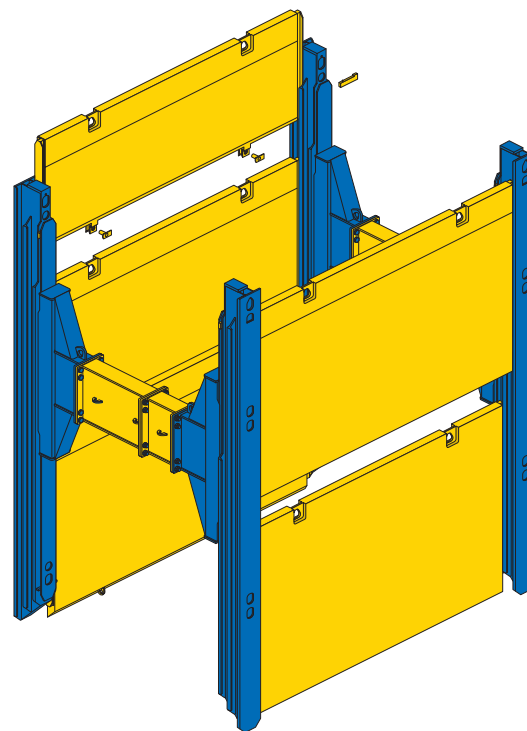
Single slide rail
Series 790



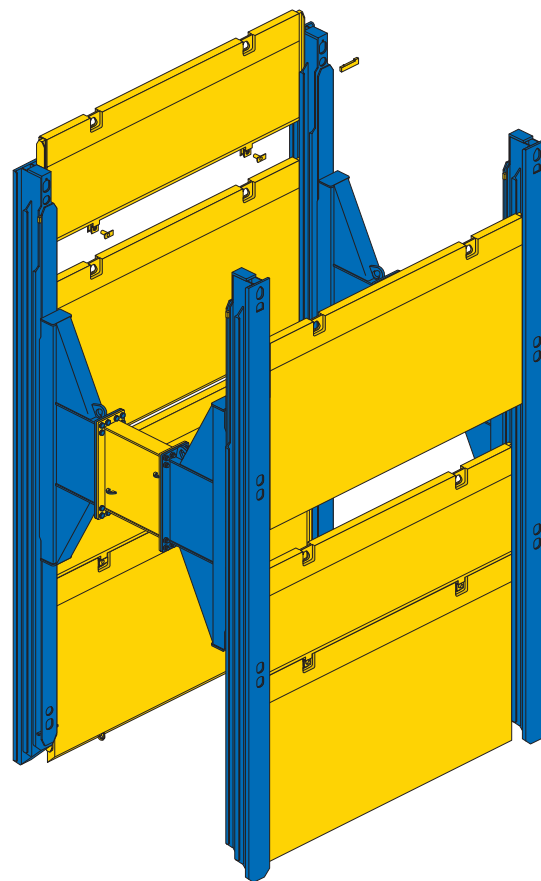
Mini double slide rail
Series 750/790



Standard double slide rail
Series 750



Mega double slide rail
Series 750



RS-Rail

Name	Rail length L_r [m]	Weight per rail [kg]	Rail height b_r [mm]	Permissible bending moment [kNm]
Single – Series 790	3.50	540	220	307
Standard – Series 750	4.50	960	375	672
Standard – Series 750	5.50	1170		
Top rail – Series 750	3.00	650	405	927
Mega – Series 750	6.50	1710		
Mega – Series 750	7.50	2000		
Top rail Mega – Series 750	3.00	760		

Corner slide rail

Name	Rail length L_r [m]	Weight per rail [kg]	Rail height b_r [mm]	Permissible bending moment [kNm]
Single – Series 790	3.50	390	275	132
Standard – Series 750	4.50	810	430	328
Standard – Series 750	5.50	950		
Standard – Series 750	6.50	1130		
Standard – Series 750	7.50	1305		
Corner top rail – Series 750	3.00	530		

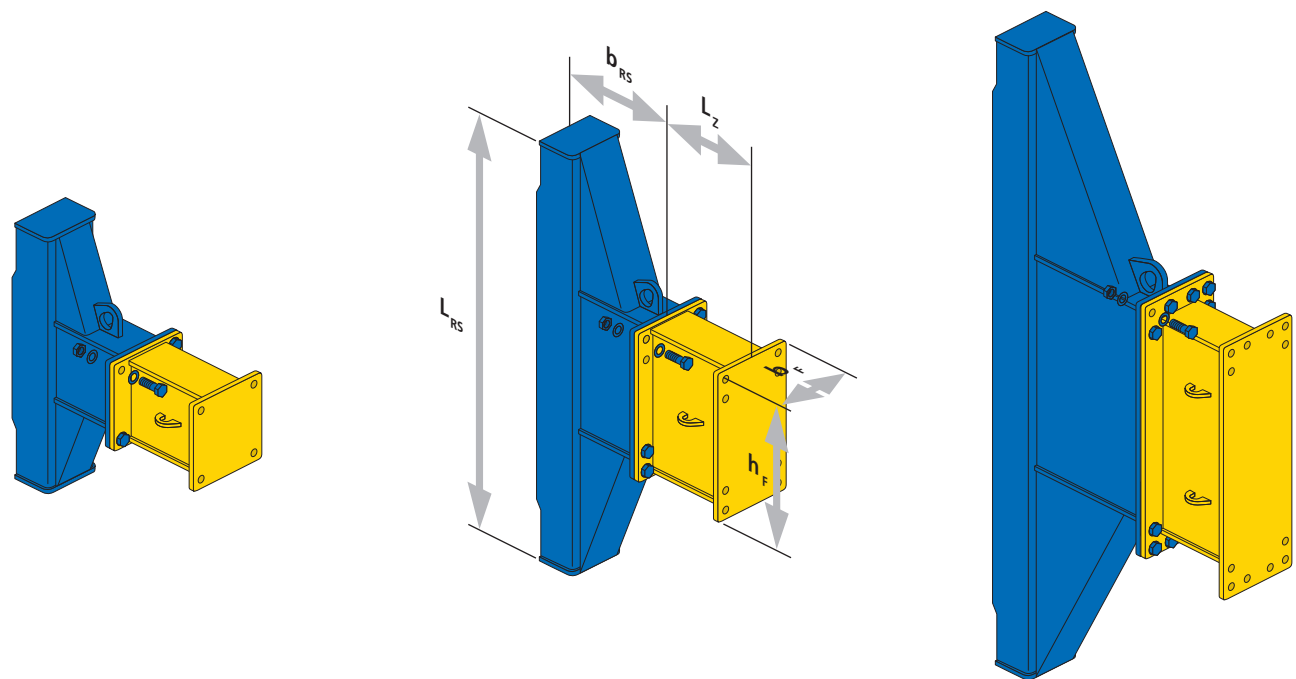
Slide rail plates

Plate length L [m]	Plate height H [m]	Thickness t_{PL} [m]	Pipe clearance length L_c [m]	Pipe clearance height h_c [m]	Permissible earth pressure [kN/m ²]	Weight [kg]
2.00	2.40 1.40	107	1.80	2.27	158.2	550 355
2.50	2.40 1.40		2.30	2.77	101.2	650 420
3.00	2.40 1.40		2.80	3.27	70.3	770 495
3.50	2.40 1.40		3.30	3.77	51.6	900 580
4.00	2.40 1.40		3.80	4.27	39.5	1010 650
4.00	2.40 1.40	130	3.80	4.27	82.1	1370 880
4.50	2.40 1.40		4.30	4.77	64.9	1530 980
5.00	2.40 1.40		4.80	5.27	52.6	1690 1070
5.50	2.40 1.40		5.30	5.77	43.4	1850 1170
6.00	2.40 1.40		5.80	6.27	36.5	2210 1370

ROLLING STRUT SHORING

Series 750/790

Rolling strut frame



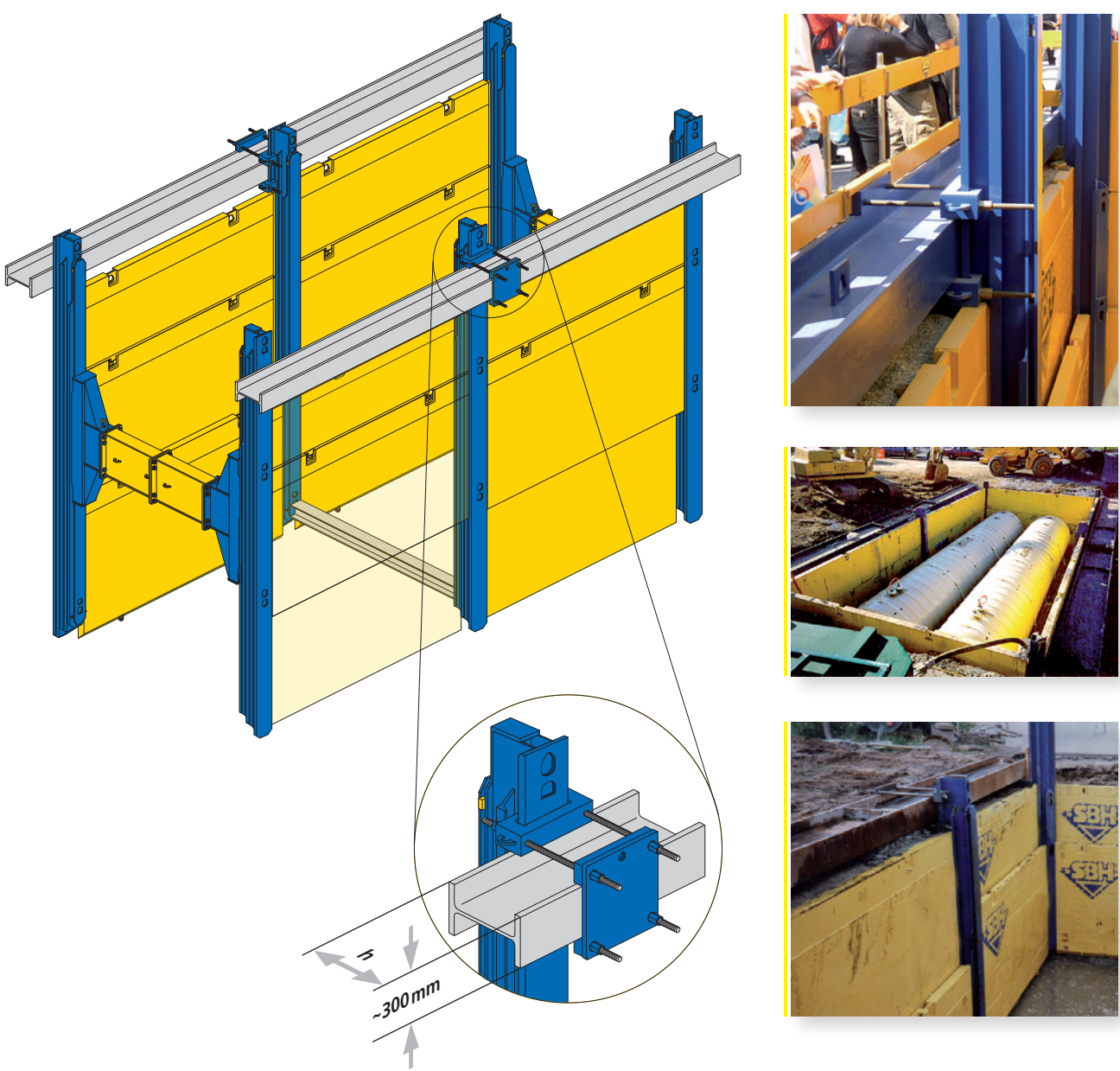
Rolling strut (RS)

Name	RS-length L_{RS} [m]	RS-width b_{RS} [m]	min. working width b_c [m]	Flange $b_F \times h_F$ [mm]	Permissible forces [kN]	Weight per RS-pair [kg]
Mini – RS	1.24	0.62	1.24	405 x 420	-100 bis 639	620
Standard – RS	2.04	0.62	1,24	405 x 720	-200 bis 780	980
Mega – RS	3.04	0.92	1.83	405 x 1220	-374 bis 973	1700
RS for top rail & SSR	1.24	0.62	1.24	405 x 420	-100 bis 639	620

Distance piece

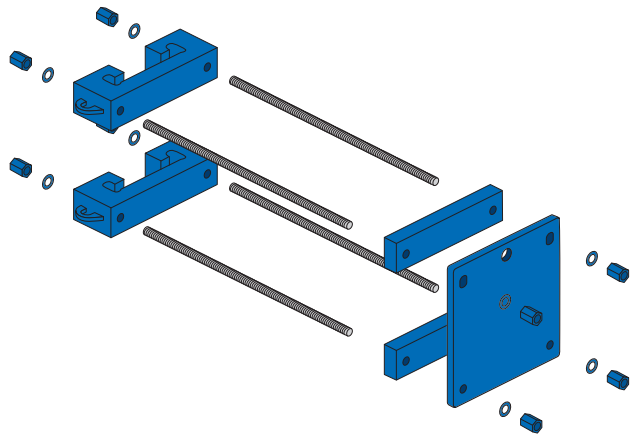
Length L_Z [m]	RS Mini / Top / SSR		Standard – RS		Mega – RS	
	Flange [mm]	Weight [kg]	Flange [mm]	Weight [kg]	Flange [mm]	Weight [kg]
0.25	405 x 420	99	405 x 720	163	405 x 1220	306
0.50		128		201		363
0.75		157		239		418
1.00	405 x 420	185	405 x 720	277	405 x 1220	474
2.00		303		437		714
3.00		421		597		960

Adjustable clamping device



Technical parameters

Name	Dimensions [mm]	Weight [kg]
Adjustable clamping device Width ~300mm, height adjustable	550 x 520 x h	275



APPENDIX 7

HIAB Specification

