Memorandum

To	Technical Specialists
Copy	WSL and WSP Project Teams
From	Tony Sage
Office	c/- Auckland
Date	29 June 2023
Subject	Project Briefing and Request for Technical Assessments – Herne Bay Trunk Sewer, Watercare Services Limited

1 Construction Information

The following section provides details on the proposed construction method of the Herne Bay Trunk Sewer Line. It is broken down to work elements that are repeated along the alignment. The pipeline is constructed via a series of shafts from which a Tunnel boring machine (TBM) is launched (Thrust Shafts) and retrieved (Receiving shafts) as the TBM progresses along the alignment sections of pipe are placed in the thrust shaft and then jacked in behind the TBM as it progresses.

Figure 1: Proposed alignment of the Herne Bay Trunk Sewer

3.5m diameter interception shafts are required to allow for the construction of connecting pipes to the engineered overflow points.

1.1 Construction Hours

General construction works are proposed to occur between 7am and 6pm, Monday to Friday and 8am – 6pm on Saturdays. No works are proposed on Sundays or public holidays.

Site mobilisation and pack down works are proposed to occur 30 minutes before and after these windows.

The following works are operationally required to occur outside of these hours:

- TBM tunnelling works;
- Emergency works, or works due to unforeseen circumstances;
- Where work is specifically required to be planned to be carried out at certain times; or
- Deliveries of large equipment, or specialist deliveries required outside of this window due to traffic management requirements.

1.2 Duration

A start date of May 2024 is proposed for the project, with works targeting a completion date of May 2026. The programme is to be further co-ordinated with the proposed Central interceptor project to ensure alignment with this adjoining project.

Work is primarily intended to be carried out during the day although there are some cases where work will fall outside of this, as described above. Large plant will be delivered early in the morning or later in the evening to avoid peak traffic volumes and any live cut over work with service relocations and connections will be carried out at night to mitigate service disruptions and while flows are low.

As works are completed in each area the local site will be disestablished and returned to public use as soon as practical.

1.3 Traffic Management

Shafts are typically located in road intersections, during construction of these shafts the intersections will be closed to through traffic. During the tunnelling works, within the shafts it is envisaged these intersections can be partially reopened with at least one lane available to the public. It is expected that with the low traffic volumes and alternative routes being available that this will not cause undue traffic issues. Where residents have no alternative such as the North end of Wallace St (2 residents affected) residents' access will be managed with temporary driveways on the road berms and where necessary liaise with residents to close access within work hours to ensure safety.

The interception shafts and EOP connections (as described in Table 1 above) will only be constructed later when access is restored around the primary shafts to ensure continuous access for the local residents.

1.4 Construction staging, equipment, and activities

Overall, the tunnel will progress from Point Erin Park along the alignment to Marine Parade Shafts are required at the changes in direction to provide entry for the TBM (Thrust shafts) and retrieve the TBM (Receiving shafts) and will be constructed as the project progresses ensuring there is a receiving shaft as the TBM commences a drive towards it.

Following completion of the main drive the interception shafts can be constructed adjacent to the main tunnel and the connections to the EOP's either drilled with trenchless technology or laid in open trenches as feasible.

Interception lines and EOP connections are planned to be constructed as follows:

Table 1: Proposed construction method for interception lines and EOP connections

Shaft Name	Location	Methodology	Distance	Depth to Invert	End Depth
SE01	59 Hamilton Road	Steel Casing			**17.8m**
EP202	69 Hamilton Road	Horizontal Drill	85m	1.1m	11.5m
EP195	59 Hamilton Road	Open trench Excavation	6.4m	2.0m	2.3m
SE02	80 Sarsfield Street	Steel Casing			**13.4m**
EOP200	28 Sentinel Road	Open trench Excavation	184m	4.0m	4.7m
SE03	91 Sarsfield Street	Steel Casing			**9m**
EOP201	91 Sarsfield Street	Open trench Excavation	4.3m	4.1m	4.5m
Shaft 2		Secant Pile			14m
EOP1019	11 Cremorne Street	Open trench Excavation	55m	2m	5m
EOP1019 WWMH01	12 Stack Street	Horizontal Drill	85m	7.3m	8.7m
EOP1019 WWMH02	1 Wairangi Street	Horizontal Drill	80m	5m	7.3m
SE04	45 Argyle Street	Steel Casing			**7m**
EOP740A	45 Argyle Street	Open trench Excavation	7m	4.1m	5m
Shaft 4		Secant Pile			**17m**
EOP197	1 Marine Parade	Horizontal Drill	65m	3.6m	14.5m
Shaft 7		Trench box			**6m**
EOP198	22 Marine Parade	Open trench Excavation	3.5m	4.7m	4.9m
Shaft 8		Trench box			**2.5m**
EOP199A	Bella Vista Road x Marine Parade	Open trench Excavation	26.5m	1.8m	2.3m

The following table outlines the construction elements, with associated activities and plant required for the Project.

Table 2: Construction Staging

Part 1 Construction Staging and Activities		
Construction Elements	Activities	Equipment/ vehicles/ materials
Establishment	Main Site established –Salisbury Park • Central Construction support compound set up • Worker welfare facilities established • Temporary traffic management set out	• Trucks • Fencing • Portacabin • Portaloo • Containers • 25kVA generator • Hardfill site area
Enabling	Enabling works • Pot hole services throughout the route • Service diversions	• 6 wheeler truck • Fencing • 5t Excavator

		• Hydrovac • Concrete saw
Satellite Site Establishment	• Traffic & Fencing Management • Environmental controls • Hardfill • Plant Delivery	• Traffic attenuators • Hiab • 4t Roller • Low loader • 12t Excavator • Spoil truck
Shaft Piling	Piling Shaft construction • Temporary excavation support – either Sheet Piling, Casing Shaft or Secant Piling. • Removal of spoil	• 45t Piling rig for secant shafts or steel casing shaft, • 75t tracked crane • Hiab • Tremmie Rack • 12t Excavator • Hydrovac/ sucker truck • Spoil & Concrete trucks • Diesel generator 10kVa
Shaft construction	Shaft Construction • Concrete breaking back • Excavation • De-water shafts • Concrete construction	• Spoil & Concrete trucks • Concrete Pump • 25 to 50t mobile crane • 200cfm Compressor & conc breakers • 2t & 23t excavators • Muck skips • Diesel generator 10KVa • Dewatering pumps
Interception Shafts	Interception shaft construction • Construct drilling platform • Drill 3.5m diam casing • Cut into main sewer	• 75t Piling rig • 75t tracked crane • 12 excavator • 6 wheeler truck • Diesel generator 10KVa
Tunnelling	Tunnelling • Set up tunnelling rig/ equipment • Tunnel boring • Removal of spoil • Install pipes	• Tunnel boring machine (TBM) • 300t crane TBM delivery • 20 foot TBM power pack container • Cooling and lubrication plant • 25t mobile crane • Flatbed truck for pipe deliveries • 6 wheeler truck for spoil removal • Pipe delivery • Ventilation fan • 850 (tbc) kVa Diesel generator • 8t Excavator • Muck skips
Manhole construction	Manhole Construction • Install manholes within shafts • Progress backfilling of shaft around manhole • Removal of sheet piling or casing shaft as required • Break down concrete of secant shaft 1m below ground • Reinstatement of surrounding Roadway	• Spoil & Concrete trucks • 23t Excavator & Breaker • 500kg Compactor • 20t mobile crane • Manholes • Generator 10KVa

Direction Drilling	Directional drill • Excavate drill pits with trench shields • Drill bore • Pull through drainage line	• 12t Excavator • HDD drilling rig • PE welding machine • 10kVa Generator
Open trenching	Open trench construction (limited section as needed) • Temporary excavation support – trench shields • Removal of spoil – to be loaded onto truck and removed from site • Install bedding and then new pipe, manhole backfill • Reinstatement works • Activities will be undertaken during daytime hours.	• Concrete saw • Spoil & Concrete trucks • 23t Excavator • Trench shield • Hydrovac/ sucker truck • 500kg Compactor • 8t Roller • Aggregate, pipes, manholes
Reinstatement	Road reconstruction • Concrete break out and excavation • Kerbing • Traffic Islands & footpaths • Asphalt • Line marking	• 23t excavator & breaker • Spoil & Concrete trucks • Road Miller • Paving plant

2 Construction elements

2.1 Construction Support Areas

Two construction support areas ('CSA's) will need to be established. These will act as hubs for the satellite sites at each shaft and enable short term storage of materials and plant. This will enable a reduction of materials and equipment stored at each shaft location and reduce the size of vehicles and truck movements on the local road network.

Salisbury Reserve is the proposed central hub ('CSA1'), with 94A - B Shelley Beach Road to be used as a secondary compound ('CSA2'). Salisbury Reserve will act as a central site providing immediate support to the work sites, central office compound and worker welfare facilities. The second site at either 94A-B Shelley Beach Rd will be able to provide for access to larger truck & trailers movements will enable better handling of bulk materials and to further reduce truck movements on the local network. These CSAs will be used for the following combined purposes:

- Bulk Delivery and removal of materials and
- Storage of materials (pipes and manholes, piling equipment)
- Storage of diesel (up to 2,000L at any one time)
- TBM spare parts and lubricants storage
- Crane parking
- Loading bay for truck loading and unloading
- Worker welfare facilities
- Main Site office

The proposed locations of the CSAs for the project is shown in Figure 2. The final layouts are to be determined pending availability and adjacent stakeholder requirements.

Each of these sites will be hardfilled to provide an all-weather surface and suitable environmental controls in place along with a security fence, gate controls and semi-

permanent traffic management. Where possible, services will be connected to the grid for the duration of the construction works.

Figure 2: Locality map of proposed CSAs and satellite sites

Figure 3: CSA-1 at Salisbury Reserve

Figure 4: CSA-2 at 94a – b Shelley Beach Road Establishment

The CSAs will be established with fixed hoardings and fencing to secure the site. Topsoil will be removed and replaced with hardfill, compacted to provide a secure, trafficable compound. Site offices will be set up with the intention of permanent local water, sewer and power

connections to reduce service vehicle movements and use of generators and tankers. A Wheel wash will be set up at the exit points and stockpile bins located.

The intention will be to centralise all management and planning staff at CSA-1 Salisbury Reserve with limited management personnel located away from the central location.

2.2 Enabling work and service investigations

At each shaft location service investigations and then service diversions will be undertaken. This will require small construction sites typically involving, a hydrovac, small tip trucks (4t) and 5t excavators unearthing and diverting the existing services at each of the shaft locations. These diversions require smaller site footprints than the shaft construction and will have minimal disruption on the local stakeholders, with typically only shoulder and footpath closures required. Dealing with multiple service providers and potential delays these are undertaken in advance of the main works to ensure there are no delays to the larger project works.

2.3 Satellite Construction Sites

At each shaft location a satellite construction site (CS) will be established with the footprint minimised by using the central compound for material & plant storage. These will be established as the site project progresses and dis established as soon as no longer required to minimise the number of CS's open at any one time.

Each CS will be established and set up for the activities as noted in Table 2. As activities change within each site and the type of plant replaced the traffic management will be revised to ensure traffic disruptions are minimised. That is, when is feasible and safe traffic management and site fencing will be retracted, reopening the road to traffic. When work is complete in an area the road and kerbing will be fully reinstated and a temporary paving surface laid. On completion of all the works the permanent paving will be reinstated across all the construction areas.

A typical CS set up (Shaft 4 in this instance) is shown below in Figure 3.

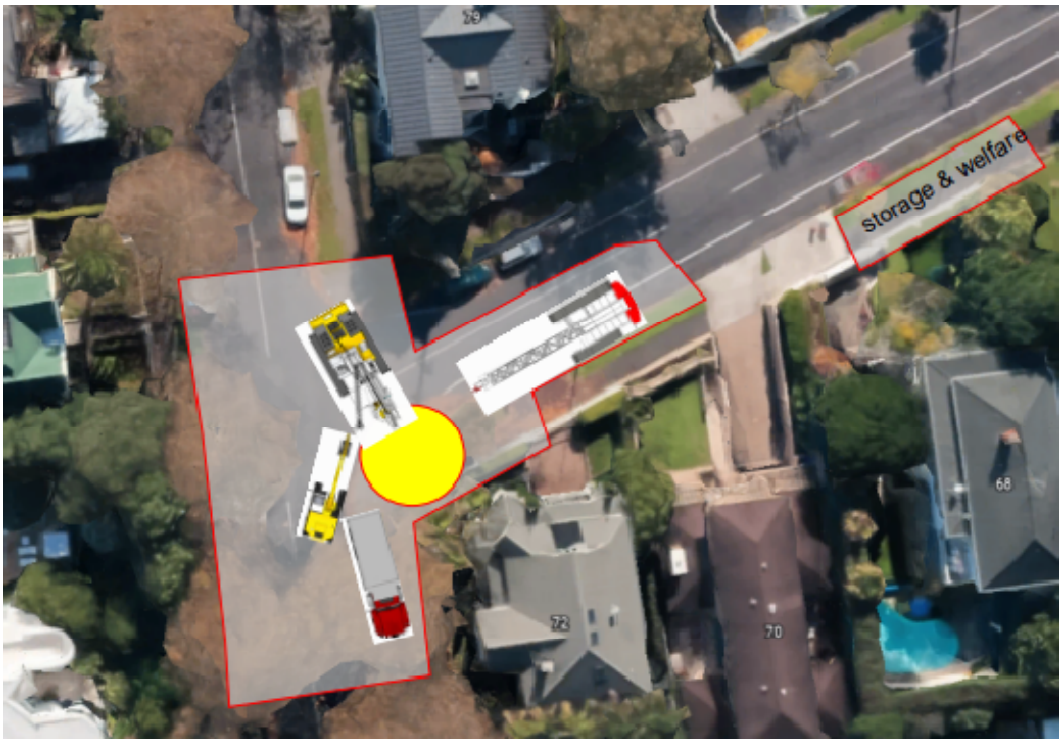

Figure 5: Typical CS set up (Shaft 4)

2.4 Piling shaft construction

Piling will be undertaken with the secant pile shaft being constructed with a bored pile rig and crane. Steel casings and tooling will be stored on site and reused while pile cages will be stored and prepared at CSA-2 to be brought to the site as and when ready to be lifted direct from the truck and into the pile bore. These will then be concreted, with the CSA being used as a marshalling yard for where there is no capacity onsite for waiting concrete trucks.

Figure 7 Typical Secant Pile construction

2.5 Shaft Construction

The piled shaft will then be excavated, breaking down the top of the piles and constructing a capping ring beam. The rest of the shaft will be dug out using a 23t excavator, a 2t excavator in the shaft with a muck bin being lowered and remove by a mobile 25t crane.

At the bottom of the shaft a concrete base will be poured and a thrust block (Thrust shafts) and soft eye poured on the shaft walls.

2.6 Tunnelling

Tunnelling will be carried out using a tunnel boring machine (TBM), this will be lowered into the shaft built up to then bore along the tunnel alignment. As it progresses Pipe sections will be lowered in and jacked behind the TBM. The Earth Pressure Balance (EPB) TBM will remove cuttings into a muck bin behind a locomotive and hauled back into the shaft where the

Figure 6 Typical Secant Pile shaft under Excavation

muck bin being lifted out and loaded on a truck to a spoil stockpile

2.7 Manhole construction

On completion of the tunnel through the shaft and removal of the TBM the shaft can be decommissioned with the installation of the permanent manhole. The annulus of the shaft and manhole can be backfilled with hardfill, and holes punched into the shaft walls to allow migration of ground water. The shaft walls will then be broken down to 1m below road surface and the road reinstated over.

2.8 Interception Shaft

On completion of the main drives the interception shafts will be installed. The drill rig will be remobilised to site and commence drilling the shaft, as it progresses, a 3.5m diam steel casing will be installed. This temporary casing is for securing the shaft while creating a connection to the main pipeline and constructing a manhole. On completion of the manhole the casing will be recovered, and the shaft annulus backfilled.

Figure 8 Interception shaft Casing installation

2.9 Directional drilling

Directional drilling will be used when feasible to limit disruption to the area. A drilling and receiving pit will be excavated and shored within trench shields. Once complete the Directional drill rig will be mobilised to site. The rig will drill a bore using a bentonite slurry recirculation then a PE line will be pulled back into the bore and the annulus grouted.

2.10 Open trenching

Open trench drainage will be traditional construction with the use of trench shields or shoring slide rail systems; 6-wheeler spoil trucks and a 23t excavator will be used. Work will be co-ordinated with the residents to ensure access to their properties as required, utilising road plates or temporary spot backfilling to do so.

2.11 Reinstatement

Final reinstatement of the carriageway will be carried out as work at each of the shafts is completed. The kerbing and footpaths reinstated along with speed humps and traffic islands reconstructed and a temporary paving surface laid.

Once all works are complete permanent repaving of all the sites will be carried out in one or two nights, or if traffic movements allow during the day.