IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of Resource Consents and Notices of Requirement for the Central Interceptor main project works under the Auckland Council District Plan (Auckland City Isthmus and Manukau Sections), the Auckland Council Regional Plans: Air, Land and Water; Sediment Control; and Coastal, and the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health

STATEMENT OF EVIDENCE OF JOHN QUENTIN COOPER ON BEHALF OF WATERCARE SERVICES LIMITED

PROJECT CONSTRUCTION

1. INTRODUCTION

1.1 My name is John Quentin Cooper. I am a Technical Director of the firm AECOM NZ Ltd. My qualifications include a Bachelor of Science (Hons) in Engineering Geology and Geotechnics. I am a chartered professional civil engineer and hold a Masters degree in Business Administration specializing in Construction and Real Estate.

1.2 I have over 30 years of civil engineering experience including work in the UK, Hong Kong and New Zealand with various assignments in over 15 other countries. I specialise in ground engineering, design and construction management, tunnelling and trenchless construction.

1.3 I also have specific experience in projects similar to the Central Interceptor Project ("**Project**"). For example, between 2005 and 2010 I was retained by North Shore City Council as Project Manager for the Rosedale tunnel and outfall project ("**Rosedale Project**"), which included

a similar, albeit shorter, tunnel to the Central Interceptor tunnel in Auckland. The Rosedale Project tunnel was successfully constructed in similar geological conditions beneath residential and commercial property typical of much of the Central Interceptor tunnel alignment.

1.4 The use of modern tunnelling techniques allowed the entire wastewater conduit to be built underground from the Rosedale Wastewater Treatment Plant ("**Rosedale WWTP**") to the sea virtually eliminating disruption to the public. This ability to avoid extensive works in residential streets is a key benefit of tunnelling. In the case of the Rosedale Project we were able to make use of the Rosedale WWTP land for the main construction shaft site, which involved the construction of deep shafts for drop structures and employed similar construction techniques. I also worked on the Hobson tunnel project ("**Project Hobson**") in its earlier stages.

1.5 These two projects provide excellent examples of how the Central Interceptor tunnel may be built, with an acceptable level of effects on the environment and the public. Significant long-term benefits can be achieved, with minimal disruption at surface level when compared to other options such as sewer separation.

Involvement in the Project

1.6 I have been involved with the Project intermittently since 2006. During this time, as part of the consultant team, I have worked on options for the Project's underground works and undertaken technical reviews of the concept design as it developed. I later advised on technical matters such as ground engineering and construction practice, including a review of parts of the Central Interceptor Main Project Works Assessment of Effects on the Environment submitted to the Council in August 2012 ("**AEE**"). Recently I have been involved in providing specialist advice on construction, tunnelling and general civil engineering practices.

Code of Conduct

1.7 I have been provided with a copy of the Code of Conduct for Expert Witnesses contained in the Environment Court's Updated Practice Note 2011 which took effect on 1 November 2011. I have read and agree to comply with that Code. This evidence is within my area of expertise, except where I state that I am relying upon the specified evidence of

another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Scope of evidence

1.8 The purpose of my evidence is to outline technical proposals for methods of construction of the Project as presented in the AEE. As this is a large and complex project by New Zealand and international standards, it has a number of components that must be designed and constructed at different times over a duration of 5 to 6 years for the main project works.

1.9 The concept design and construction methodology presented in the AEE, and discussed in this evidence, has been developed by engineers and planners who have considerable experience in this type of work and Auckland's geotechnical and construction conditions. The final design and construction methodologies will be developed further during the detailed design stage, and after a construction contractor(s) is appointed ("**Selected Contractor**"), within the "envelope" of Watercare's specifications, and in accordance with applicable international codes of practice, all applicable regulations, and the final designation and consent conditions.

1.10 Based on my experience of similar projects I am confident that the Project can be constructed in a way that does not create unacceptable adverse effects. A high standard of project controls are proposed, and will require ongoing management throughout the duration of construction.

1.11 My evidence is structured as follows:

(a) executive summary;

(b) construction methodology (tunnels);

(c) construction site types (primary and secondary);

(d) construction programme and staging;

(e) management of construction effects;

(f) Construction Management Plans;

(g) commissioning;

(h) response to submissions;

(i) response to the Council Pre-hearing Report; and

(j) conclusions.

1.12 I have illustrated my evidence with a number of photographs and diagrams from similar projects and reference should also be made to the Hearing Drawing Set as required. **Figure 1.1** on page 4 of the Hearing Drawing Set provides an overview of the Project alignment and its main components.

2. EXECUTIVE SUMMARY

2.1 The purpose of my evidence is to outline technical proposals for the methods of construction of the Project.

2.2 Modern mechanised tunnelling techniques will be used for the main tunnel, which will be located at depth within a consented envelope. Recent similar projects, such as the Rosedale Project and Project Hobson, have had considerable success installing similar tunnels without undue disruption or effects on surrounding residents. In this respect the deep tunnelling method, through the use of a tunnel boring machine ("**TBM**") and segmental lining, offers a significant advantage over surface trenching.

2.3 The link sewers are of a smaller diameter and are generally shallower than the main tunnels, making the use of a segmentally lined tunnel inappropriate. The only exception is Link Sewer 3, which will likely be constructed as an extension to the main tunnel using the same TBM. Micro tunnelling with pipejacking is the likely construction method for Link Sewers 1 and 2, with trenching proposed for Link Sewer 4.

2.4 Construction of the Project will be facilitated by 3 primary construction sites whose locations have been chosen to limit the lengths of main tunnel drives to manageable extents, to provide suitable access to the TBM drives and to support the construction activities without unacceptable effects on the surrounding environment.

2.5 Occupation of, and construction works at, these primary construction sites is expected over a period of approximately five to six years,

depending on the programming and construction sequencing agreed with the Selected Contractor.

2.6 The smaller secondary construction sites are located along the alignment of the main tunnel and link sewers. These are located where drop shafts and access shafts down to the tunnels are needed. The range of activities and construction at these sites will be similar to the activities at the primary sites; however, the scale of activities and the footprints of these sites will be much less. The secondary construction sites will experience construction activity typically over between six to 18 months, but may be occupied for a number of years depending on the phasing of construction.

2.7 The construction related effects of the Project will be managed and mitigated through the use of Construction Management Plans ("**CMP**"). Once the Selected Contractor is appointed, and prior to the start of the main construction programme, a CMP and other management plans will be prepared to ensure compliance with Watercare's proposed designation and consent conditions and minimise potential adverse effects.

2.8 A range of project-wide and site specific plans are also proposed to cover specific construction-related effects such as traffic, erosion and sediment, construction-related discharges, contamination, noise and vibration, and site reinstatement. I consider that these specific plans, together with the CMPs for each site, will adequately address and manage all standards to be complied with during the works and all construction related effects of the Project. I have discussed each of these plans in my evidence.

2.9 Following the completion of the Project, site reinstatement will be undertaken at all construction sites. I have read the submissions with particular regard to proposed construction methodologies. Many of the submissions raise concerns by local residents and affected parties about the construction impacts at the work sites for shafts as this is where the Project primarily interacts with the surrounding public.

2.10 These are justifiable and normal concerns for people adjacent to construction works in an urban area and for which the statutory regulations and specific Project consent conditions are well able to deal with. Watercare has already successfully demonstrated its capability to ensure its contractors manage and mitigate construction effects, including

Project Hobson and the Rosedale Project. The high standard of detailed works specifications, selecting highly experienced contractors, appropriate construction methods and implementing effective management plans under Watercare's supervision will be sufficient to mitigate the concerns of submitters on construction.

2.11 The evidence presented by Ms Petersen confirms Watercare's commitment to working closely with neighbours prior to and during construction to ensure that any concerns and effects can be appropriately addressed.

3. CONSTRUCTION METHODOLOGY (TUNNELS)

Main tunnel construction

3.1 The main tunnel and part of Link Sewer 3 are planned to be constructed using a TBM with segmented concrete lining.

3.2 Mr Cantrell has explained that tunnelling to construct the main tunnel will be undertaken within a 40 m wide corridor centred on the alignment shown on **AEE-MAIN-25** on page 9 of the Hearing Drawing Set. This will be done using one or, less likely, two TBMs. **Figure 1** shows an example of a TBM similar to the one that would be used for the Project. The cutting head and cutting tools are visible on the right. The body of the machine forms a "shield" to support the ground and protect workers until the segmental lining can be erected inside. As the machine cuts its way forward the lining is extruded from the rear (left) of the shield. A video will be screened at the hearing showing this process.

Figure 1 EPB Tunnel Boring Machine ready for use on Project Hobson

3.3 The vertical and horizontal parameters of the corridor proposed in the application provide some flexibility to adjust the alignment during detailed design development. The construction staging for the Project will be discussed in more detail below in Section 5, and will be determined in consultation with the Selected Contractor responsible for undertaking the tunnelling work.

3.4 The TBM will be launched from the bottom of one main construction shaft and then recovered from another. This is commonly called a "drive". Given the limitations on servicing a 13 km long tunnel drive with materials, air etc, the main tunnel is likely to be constructed in two separate drives, being:

(a) From Western Springs to May Road (5.5 km). This drive is likely to be constructed in a southerly direction then on to Haycock Avenue. The Selected Contractor may, however, elect to drive uphill in the opposite direction (ie from May Road to Western Springs).

(b) From Mangere Wastewater Treatment Plant ("**Mangere WWTP**") to May Road (7.8 km). The TBM is likely to be launched from the Mangere WWTP and driven uphill to May Road.

3.5 In the unlikely event that two TBMs are used, the timing of the tunnelling of the two drives could occur more or less at the same time with starting dates staggered by several months. Whilst using two machines offers programme advantages there are additional costs associated with a second machine. It is therefore more likely that only one TBM will be used, and therefore the two drives will not overlap.

3.6 A pressurised face TBM (either an Earth Pressure Balance ("**EPB**") or a Slurry TBM) is likely to be used for the main tunnel alignment to manage risks associated with the expected ground conditions:

(a) A Slurry TBM turns the spoil into a fluid by adding water and bentonite so that it can be pumped to the surface using a pipeline. A separation plant at the surface removes the spoil and the fluids are re-circulated back to the TBM for reuse.

(b) In an EPB TBM the spoil is kept solid and extracted by means of rail cars or a conveyor belt. An EPB TBM has recently been used very successfully in similar ground conditions on both Project Hobson and the Rosedale Project. It is also the type selected to construct the Waterview Connection tunnel.

3.7 At the front of the machine a cutterhead will excavate ground whilst a segmental precast concrete liner is installed immediately behind, in the shield. The tunnel liner segments are brought into the tunnel via the shaft and transported to the TBM where they are erected to form a load bearing and substantially watertight interlocking ring. **Figure 2** below shows the typical lining.

Figure 2 Typical lining using pre-cast gasketed segments (Rosedale Project)

3.8 In **Figure 2** above, looking back down the tunnel from the rear of the EPB TBM, you can see the assembled segments forming the circular lining of the tunnel. This will also be visible in the video to be presented at the hearing. Once erected and then grouted in place, the lining ring acts in compression like an arch to support ground and groundwater loads. Each segment is joined to the next using either a dowel or bolt. The lining is made substantially watertight by means of a rubber gasket on the jointed faces.

3.9 A stockpile of segments is stored on-site to keep pace with the advancing tunnel but the manufacture and bulk storage of segments will be at a

suitable facility off-site. Tunnel segments were stored in this way during the Rosedale Project, and a photo is included as **Figure 3** below.

Figure 3 Tunnel segments being stored ready for use at the Rosedale Project construction shaft.

3.10 It may be necessary to inject approved additives to make excavated material workable and easily removed. The additives are typically flocculants or foam to condition the spoil as it passes through the TBM. Similar conditioners were employed for the Rosedale Project and Project Hobson. The minor quantities that remain in the spoil are able to be approved for disposal as cleanfill. Water may also be added to form slurry to aid in cutting.

3.11 The excavated spoil will be transported from the TBM to the surface via one or more of the three primary construction shafts using spoil cars or a continuous conveyor belt. If a Slurry TBM is used, a mixture of spoil, bentonite and water will be pumped back to the surface.

3.12 Several cranes may be required at both the primary and secondary sites at any one time to service the shaft sinking and underground construction. However, the main tunnel spoil will only be removed from the primary construction sites.

3.13 The TBM moves forward by pushing off the newly erected liner ring and can apply a controlled pressure to the face to support the ground and

manage groundwater. I will use a video clip, courtesy of the manufacturer Herrenknecht, at the hearing to illustrate the typical TBM advance.

3.14 Typically an EPB TBM has the advantage of being able to be operated in "open" (without face pressure) or "closed" (with face pressure) mode depending on the ground conditions. In comparison, a Slurry TBM always operates in closed mode. Face pressure is typically applied to stabilise the excavation face in soft ground, or in cohesion-less ground that has the potential to flow due to the presence of groundwater. Face pressure can also be applied to balance or partially balance groundwater pressure to prevent or reduce groundwater flows into the excavated face.

3.15 The open mode is usually faster, less stressful on the machine and uses less conditioners. It does not, however, provide the same level of face pressure to weaker ground and groundwater. When ground conditions require full support, the EPB TBM can be put into "closed" mode, which allows it to advance more slowly and form a plug of soil to maintain support to the ground in front. Thus the EPB TBM offers the ability to deal with a range of ground conditions.

3.16 Tunnelling operations will occur 24 hours a day 7 days a week underground at the primary construction sites serving the drive. However, as I describe later in my evidence, the removal of spoil offsite and bringing material on site will be limited to day time hours. The actual tunnelling progress will vary from day to day and week to week but can be expected to advance in the order of approximately 10 m to 20 m per day. By way of comparison, I note that during Project Hobson the average progress was approximately 15 m per day and for the Rosedale Project, the very best tunnelling progress was 35 m in a single day, (although these tunnels are a somewhat smaller diameter). For this project, a conservative average of 12 m per day has been assumed in planning the works to take account of repair and maintenance activities and changing ground conditions.

3.17 At the end of the tunnel drive the TBM will either be retrieved from the shaft, or left in place at Haycock Avenue (at the end of the Link Sewer 3 drive). Leaving it in place would avoid the construction of an additional shaft to retrieve the TBM. If left in place all major internal components and lubricants etc. will be removed. This was done on the Rosedale Project without difficulty. The Haycock site is currently planned as a

secondary construction site in line with this approach and this is reflected in the AEE.

Link sewers (micro tunnelling) construction

3.18 The link sewers are of a smaller diameter and are generally shallower than the main tunnels, making the use of a segmentally lined tunnel inappropriate. The only exception is Link Sewer 3, which is appropriate to be constructed as an extension to the main tunnel using the same TBM. Micro tunnelling with pipejacking is the likely construction method for Link Sewers 1 and 2, with trenching proposed for Link Sewer 4.

3.19 The micro tunnelling / pipejacking method involves pushing forward a Micro Tunnel Boring Machine ("**MTBM**") from a launch shaft to a reception shaft. This method differs from that of the main tunnels in that the lining and advance of the MTBM is achieved using precast pipe units inserted from the launch shaft behind the machine. The MTBM is inserted first, and pushed forward by hydraulic rams that push off the shaft wall or a reaction pad. At the end of each ram stroke a new precast pipe unit is inserted and the process repeated until the cutting unit or shield is retrieved at the reception shaft. A video of this process will be shown at the hearing to illustrate advancing the pipe jack from a typical shaft. This method is very common for pipe sizes in the range 500 mm to about 2 m and has been used successfully for many years in Auckland's ground conditions, for example Trunk Sewer 4A passing under SH1 and Trunk Sewer 8 in Browns Bay on the North Shore.

3.20 The pipe stockpile, cranes, and any support equipment and stores are located at the launch shaft construction site. The reception shaft construction site is smaller and only needs to provide access for a crane to retrieve the MTBM.

3.21 MTBM's, like the main tunnel TBM, may be either EPB or slurry type. For EPB machines the excavated material is transported to the shaft using either spoil cars or a horizontal continuous conveyor belt. If slurry MTBM is undertaken, additional equipment will be required at the launch construction site, including a bentonite mixer and a separation plant. The separation plant separates the ground material from the slurry which is then recycled back to the tunnelling face. The separated soil is then deposited in muck bins and loaded onto trucks. The slurry separation

system is a "closed loop" and will not require any discharge of water at the construction sites. Unusable slurry will be disposed of to an appropriately authorised facility. To reduce the noise and environmental effects the micro tunnel works will normally be carried out only during daytime working hours, but in unusual circumstances work outside these hours may be necessary.

3.22 **Figure 4** shows a typical micro-tunnelling arrangement, the site setup, the pipe-jack launch site and the pipe segments waiting to be jacked into place. **Figure 5** shows the launch shaft site during construction of Watercare's South Western Interceptor extension which was successfully completed in 2012.

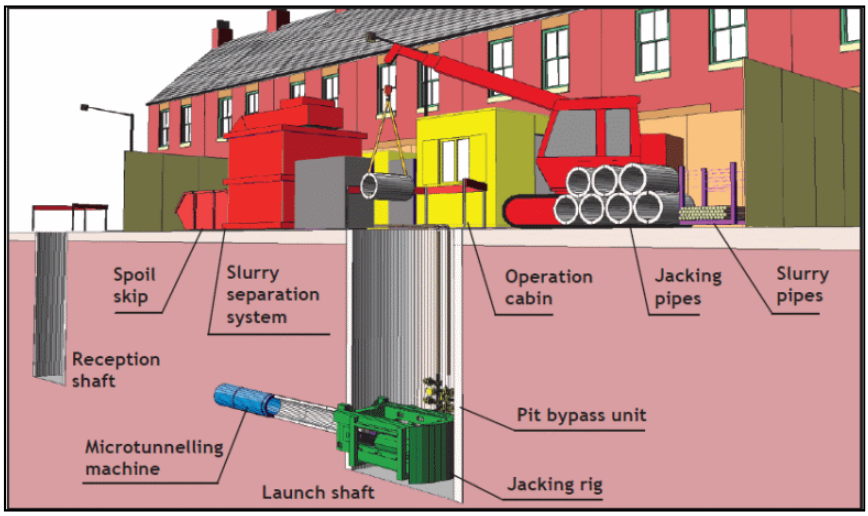

Figure 4 Typical micro tunnelling arrangement (source: Iseki Micro tunnelling http://www.isekimicro.com/micro.html)

Figure 5 Set up of pipejacking launch shaft for SW Interceptor

De-aeration tunnels

3.23 De-aeration tunnels are required to link the drop shafts to the main tunnel. An indicative arrangement of the access shaft, drop shaft and de-aeration tunnel is shown below in **Figure 6**.

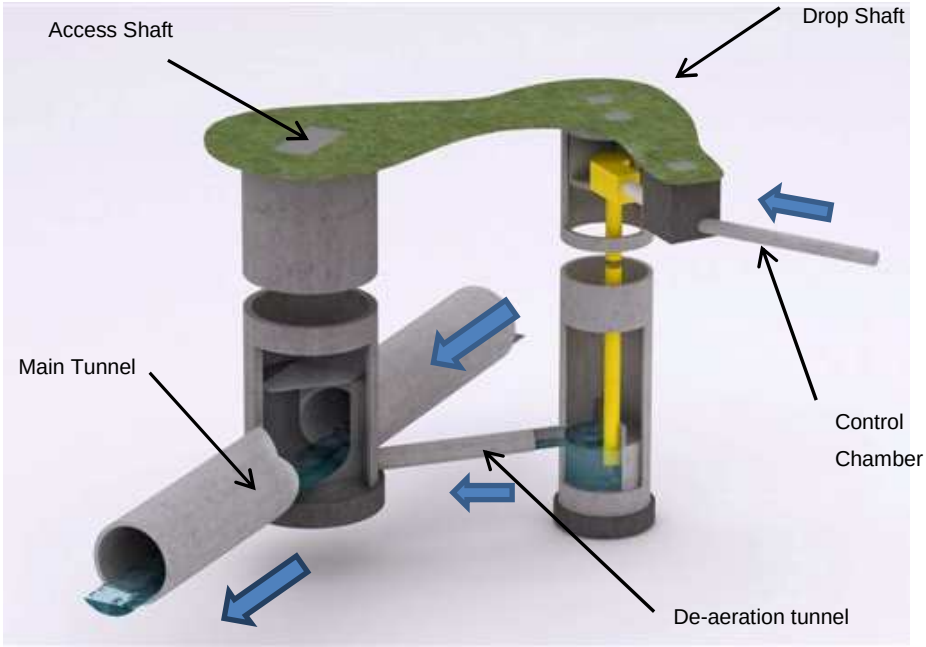

Figure 6 Indicative arrangement of access shaft, drop shaft, and de-aeration tunnel.

3.24 These tunnels have a diameter of 3 m to 4 m and will be constructed using the following possible methods:

(a) roadheader (unshielded, or shielded in poor ground);

(b) hydraulic excavator with rock mill attachment or similar;

(c) digger shield; or

(d) hand mining.

3.25 A similar short tunnel at Project Hobson was excavated using an hydraulic excavator. The typical excavation methods for de-aeration tunnels are shown as **Figure 7** below.

3.26 The short length and shape of these excavations make the use of a segmental lining impractical. Following excavation and temporary support they will then be lined with a concrete permanent lining. Temporary support of these de-aeration tunnels will likely consist of rockbolts or dowels with steel mesh and/or shotcrete. In areas of poor rock mass quality, the support measures may comprise closely spaced steel arches (sets) with timber lagging.

Figure 7 Typical excavation methods for the de-aeration tunnels. Installation of rock bolts and shotcrete lining are visible (Project Hobson)

3.27 These methods have been used routinely for many years and were employed in similar circumstances on both Project Hobson and the Rosedale Project.

4. CONSTRUCTION SITES

4.1 In general, the Project will utilise two types of construction sites - primary and secondary. The nature of construction activities varies between the two types of sites, and also varies during the different phases of construction.

4.2 Mr Cantrell has explained the purpose of the two types of construction sites and the functionality of the sites. My evidence expands on his explanation, to explain how the main project works will be constructed.

4.3 As Mr Cantrell has explained, there will be:

(a) Three primary construction sites along the length of the main tunnel to provide the logistical support sites for the launch / retrieval of the main tunnel TBM drives. These primary construction sites will supply the tunnelling operation with plant, materials and labour and be the point of removal of tunnel spoil.

(b) Secondary construction sites along the main tunnel and link sewer alignments to form connections, drop shafts and access shafts. These sites also provide an opportunity for access to the TBM during construction for inspecting the cutterhead and essential maintenance before it moves forward onto the next leg of the main tunnel.

4.4 The following paragraphs describe the construction issues associated with the various construction sites.

Primary sites

4.5 As explained by Mr Cantrell, the three "primary" construction sites:

(a) Western Springs;

(b) May Road; and

(c) the proposed Mangere Pump Station.

4.6 The proposed Mangere Pump Station site is envisaged to operate as a launch site and the Western Springs and May Road sites may operate as either launch or retrieval sites depending on the direction of tunnelling ultimately chosen by the Selected Contractor. For the purpose of assessing effects, the technical experts have been instructed to assume that both Western Springs and May Road will operate as launch sites as this has the potential for greater construction effects beyond the Mangere WWTP designation.

4.7 Occupation of, and construction works at, these primary sites are expected over a period of approximately five to six years, depending on the programming and construction sequencing agreed with the Selected Contractor. Relatively long occupation of these sites is required to accommodate site preparation, enabling works such as the provision of a power supply, the long lengths of tunnel drives and construction of permanent facilities after the tunnel construction is complete, such as control chambers.

4.8 These sites will serve as construction bases where site facilities will include site offices, parking, lay down areas and workshops. Areas will also be required for the temporary storage of equipment and materials such as tunnel liner segments, and spoil, cranes or gantries, a wheel wash, water treatment facilities, standby power, and site lighting. **Figure 8** below illustrates a typical example of a primary site and shafts.

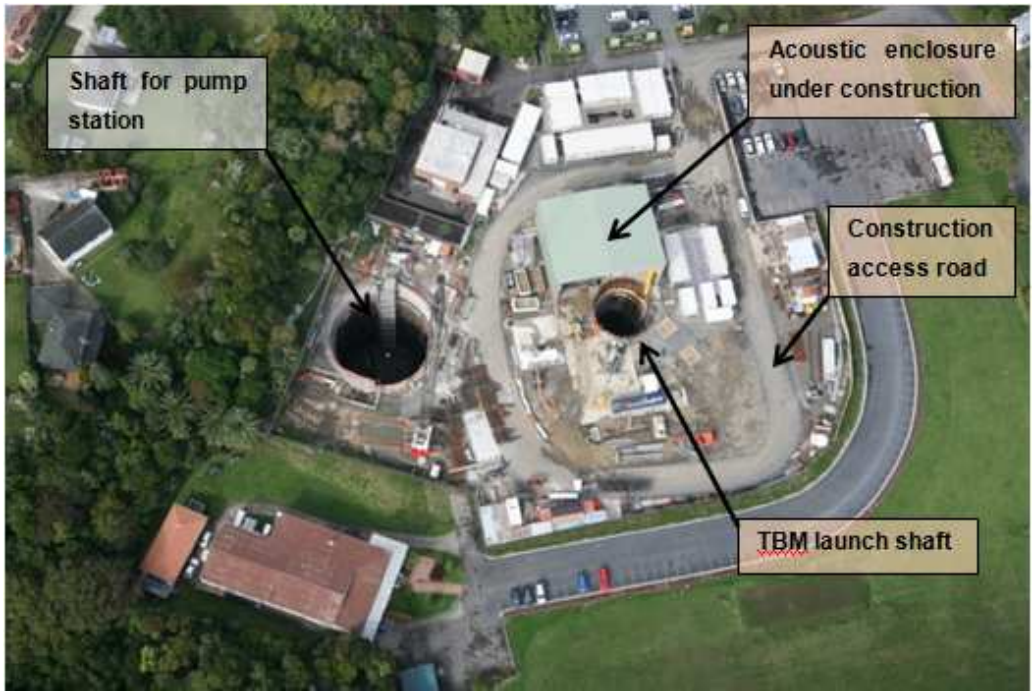

Figure 8 Typical Primary shaft site appearance (Project Hobson during construction with acoustic shed partially complete to allow 24/7 working in the tunnel)

4.9 Temporary acoustic enclosures will be constructed over the shafts at Western Springs and May Road (ie **Figure 8**). Spoil removal from the tunnel would be undertaken from inside these buildings. The enclosure buildings will reduce noise levels at these sites where tunnelling related surface activities will occur at night time relatively close to residential properties. Obviously some elements of the tunnelling operations will still emit noise, for example the cranes assisting with spoil removal. However, the Construction Noise and Vibration Management Plan ("**CNVMP**") will control noise levels at all sites, including from those activities not contained within acoustic enclosures.

4.10 The construction sequence at the primary sites will typically involve:

(a) site establishment;

(b) shaft piling using excavators, loaders and trucks;

(c) shaft excavations;

(d) TBM assembly and launch (or retrieval);

(e) tunnel excavations, liner placement and spoil removal;

(f) shaft permanent works construction; and

(g) other permanent construction works, such as grit chambers, control chambers, connection chambers, connecting pipelines, permanent access roads, provision of power supply, and stormwater drainage.

4.11 In addition, at the proposed Mangere Pump Station primary work site, the pump station wet well, building, and fit out will occur, along with construction of the air treatment facility, links into the Mangere WWTP and an emergency pressure relief structure. Air treatment facilities may also be constructed at the May Road and Western Springs sites at a later date if necessary. The proposed options have been discussed in the evidence of Mr Cantrell. The layout of the proposed Mangere Pump Station primary work site is illustrated on **AEE-MAIN-10.2** on page 128 of the Hearing Drawing set.

4.12 At the completion of works, site reinstatement will be undertaken which will involve removal of all construction plant and equipment, the removal of temporary structures, followed by reinstatement landscaping and planting.

4.13 **Figure 9** shows an example of reinstated shaft construction site from the Rosedale Project. This illustrates the types of finishes that can be achieved. For the Project, the final layouts and reinstatement arrangements within the site boundaries will be determined in consultation with relevant stakeholders such as Auckland Council Parks, Sports and Recreation Parks and the relevant Local Boards. The appearance of completed sites is discussed in more detail in the evidence of Mr Goodwin and visual simulations for some sites are included in the Hearing Drawing Set.

Figure 9 Indicative reinstatement (Rosedale Project main construction shaft site). The same site is shown during construction in Figure 10

4.14 Typical construction plant and equipment that will be employed at primary construction sites is expected to include (but not be limited to):

(a) site access road establishment machinery;

(b) TBM or MTBM with associated back up trains, conveyors and service pipelines;

(c) spoil handling conveyors, bins and sheds;

(d) temporary workshops and equipment storage;

(e) craneage;

(f) excavators and breakers;

(g) articulated trucks for delivery of materials including tunnel segments and pipe units;

(h) concrete trucks;

(i) bulk cement storage silo's for shotcrete and grouting underground;

(j) trucks for spoil and other materials;

(k) water treatment facilities;

(l) slurry separation facilities (where required);

(m) wheel wash;

(n) generators and transformers; and

(o) ventilation plant.

Secondary sites

Main Tunnel

4.15 The range of activities and construction sequencing at these sites will be similar to the activities at the primary sites. The scale of construction activities occurring at them will be less, as are the footprints of the sites. This is primarily because the TBM is not being launched or retrieved from any of these sites, so they will be active for shorter periods of time, ranging from six to 18 months, depending on the scale of works at the site.

4.16 **Figure 10** below shows how a typical secondary site for the main tunnel works might look. In the middle of the picture a shaft is being constructed, serviced by a track mounted crane and surrounded by equipment including offices, workshops, spoil handling equipment and material stores.

Figure 10 Typical secondary shaft site appearance (Rosedale Project).

4.17 Due to the phasing of construction, these sites will need to be available for between one and five years (six years at the proposed Mangere Pump Station site). For some periods, no active construction works will occur.

4.18 The relatively long periods of occupation are required to allow for the complex sequencing of different parts of the work. For example a typical secondary site will have to be timed to match the approach of the main tunnel but some of the surface connections can only be made once the tunnel is complete. Watercare will define detailed programmes for the occupation and construction activities at all the sites once design is complete and the Selected Contractor appointed. This will allow surrounding residents and other affected parties to have more certainty about the works at a particular site. It may then be possible to shorten the total occupancy period at some sites. Further details of the programme are discussed in Section 5 below and in Part B of the AEE.

4.19 The secondary sites on the main tunnel alignment are:

(a) Lyon Avenue;

(b) Haverstock Road;

(c) Mount Albert War Memorial Reserve;

(d) Keith Hay Park;

(e) Walmsley Park;

(f) Pump Station 23 (Frederick Street); and

(g) Kiwi Esplanade.

4.20 Construction work at these sites will largely be focussed on the construction of drop and access shafts, connection to the existing network and the other permanent works, such as connection chambers. At Mount Albert War Memorial Reserve and Keith Hay Park there will also be micro-tunnelled connections and associated activities. Spoil from the excavation of the shaft and related activities will be removed from each of these sites. Spoil from the main tunnel will not be removed from these sites.

Link Sewers

4.21 The secondary sites providing access to the link sewers are:

(a) Motions Road;

(b) Western Springs Depot;

(c) Rawalpindi Reserve;

(d) Norgrove Avenue;

(e) Pump Station 25 (Miranda Reserve);

(f) Miranda Reserve;

(g) Whitney Street;

(h) Dundale Avenue; and

(i) Haycock Avenue.

4.22 Smaller-scale spoil removal activities will occur at these secondary sites to support micro tunnelling, along with construction of shafts and the permanent works.

4.23 Typical construction plant and equipment that will be employed at the secondary construction sites along the link sewers is expected to include (but not be limited to):

(a) site access road establishment machinery;

(b) spoil handling cranes and bins;

(c) temporary workshops and equipment storage;

(d) craneage;

(e) excavators and breakers;

(f) trucks for delivery of materials;

(g) concrete trucks;

(h) cement storage for shotcrete application underground;

(i) trucks for spoil and other materials;

(j) water treatment facilities;

(k) slurry separation facilities (where required);

(l) wheel wash;

(m) generators and transformers; and

(n) ventilation plant.

All secondary sites

4.24 Site establishment will include the erection of fences, noise barriers where necessary, measures to provide a sound working platform for plant and truck movements, and measures to control and treat runoff and store materials appropriately.

4.25 Site reinstatement will be undertaken at all construction sites, such as filling of shafts around permanent structures, removal of all construction plant and equipment, removal of temporary structures, landscaping and planting.

5. CONSTRUCTION PROGRAMME AND STAGING

5.1 The main construction programme for the Project is currently scheduled to occur between 2017 and 2023. An indicative construction programme

is set out in **Figure 11** attached as **Appendix A** (with year 1 being 2017) for construction utilising a single TBM.[1]

5.2 This is an indicative programme based on current knowledge. The timing and staging of works may change as the Project proceeds and will depend on the construction methodology adopted.

5.3 Construction of the main tunnel and link sewers will occur over a five to six period. The first year will be spent on general mobilisation activities (e.g. site preparation, main shafts). TBM commissioning and tunnel excavation will occur over the following three to four years. Construction of the proposed Mangere Pump Station will take place over a two year period. Testing and commissioning of the works will occur after this.

5.4 The anticipated duration of construction activities at the three primary sites are:

(a) the proposed Mangere Pump Station - the whole duration of the construction project; and

(b) May Road and Western Springs - between one and five years depending on the TBM drive direction selected.

5.5 The secondary sites, involving shafts and sewer connections, will experience construction activity over much shorter periods, typically ranging between six to 18 months, but may be occupied for a number of years without any active construction works occurring, due to phasing of construction.

6. PROPOSED CONSTRUCTION METHODOLOGY

6.1 The effects of construction, primarily on ground settlement, vibration, noise and traffic will be discussed by technical experts. I have provided those witnesses with the following details of the proposed construction methodology to enable them to undertake their assessments, and to the extent that is appropriate. I also discuss the proposed approach to managing the effects of the construction activities. I note that the proposed construction methodology explained below is indicative only,

[1] In the unlikely event that an additional TBM is used, the construction timeframes may be able to be shortened.

with the final methodology to be confirmed by the Selected Contractor in due course.

Site establishment

6.2 Site establishment works will generally involve the following activities:

(a) establishment of erosion and sediment control measures;

(b) vegetation removal;

(c) services relocations;

(d) site levelling and drainage works;

(e) formation of construction access and compacting of the site yard;

(f) establishment of site buildings, services (water, electricity etc); and

(g) construction of site perimeter fencing and noise mitigation barriers, where required.

6.3 Temporary roads will be required for access during construction and indicative locations are shown for each site in the Hearing Drawing Set. Alternative pedestrian access ways will also be provided at some sites where works will affect existing access. These are also shown on the indicative site layouts in the Hearing Drawing Set.

Shaft excavations

6.4 Construction shafts are required at each of the primary and secondary construction sites. On completion of the tunnel excavations, shafts will be fitted out to form the permanent lined shafts. In some cases, infilling around the permanent structures may be required to reduce the size of the temporary shaft down to the permanent shaft diameter.

6.5 Shafts of a range of depths and diameters are required and the ground conditions at individual shaft locations will dictate the methods used to construct the shafts. Typically, the Selected Contractor will elect to use sheet piles through the softer soils (like those in **Figure 12** below). The shape may either be round, elliptical or square depending on ground

conditions and depths, and the final shape will be determined during detail design and in consultation with the Selected Contractor(s). If the location and ground condition requires more support or greater prevention of groundwater ingress the option of bored piles can be used. Shaft sinking using precast segments is also common in poor ground although this is not expected to be required for this Project.

Figure 12 Typical circular construction shaft in soft ground before excavating down into underlying East Coast Bays Formation rock (Rosedale Project)

6.6 Once the rock is reached the shaft can be supported using rock bolts and mesh. **Figure 13** below shows one of the shafts excavated in East Coast Bays Formation ("**ECBF**") for Project Hobson. The walls of the shaft stand up very well using rock bolts and a light mesh.

Figure 13 Example of shaft excavation in ECBF (Project Hobson)

6.7 As explained by Mr Cantrell, shafts on the main tunnel alignment will range in depth depending on the final depth of the tunnel within the vertical envelope. If the tunnel is located along the top of the envelope, minimum shaft depths will range from around 27 m (Western Springs) to 79 m (Keith Hay Park).

6.8 The Mangere WWTP shaft will be constructed at 35 m diameter to accommodate the proposed Mangere Pump Station. The other primary construction sites at May Road and Western Springs will require shafts to be constructed at 25 m diameter.

6.9 At the secondary construction sites, where access and drop structures are proposed, the constructed diameters will vary between 6.5 m and 10 m in diameter. These sizes will be reduced to a permanent diameter in the range of 2.4 m to 8 m depending on the site requirements and once the works are complete.

6.10 The reason that the shaft at the proposed Mangere Pump Station site is larger than all others is because it needs to accommodate the terminal pump station. Given the nature of the ground in this area and the large diameter, it is proposed to use the diaphragm wall technique to form the main shaft walls. This involves excavation of a wall in the ground using a bentonite mud to support the sides of the hole until a reinforcement cage and concrete

can be located in place. The panels are constructed progressively to form a circular cofferdam in which the pump station can be built.

6.11 This process is illustrated in **Figure 14**. This completed ring of connected panels provides effective support to the ground whilst excluding the groundwater from the excavation inside. This method has previously been used very successfully to construct parts of the Victoria Park motorway tunnel in Auckland.

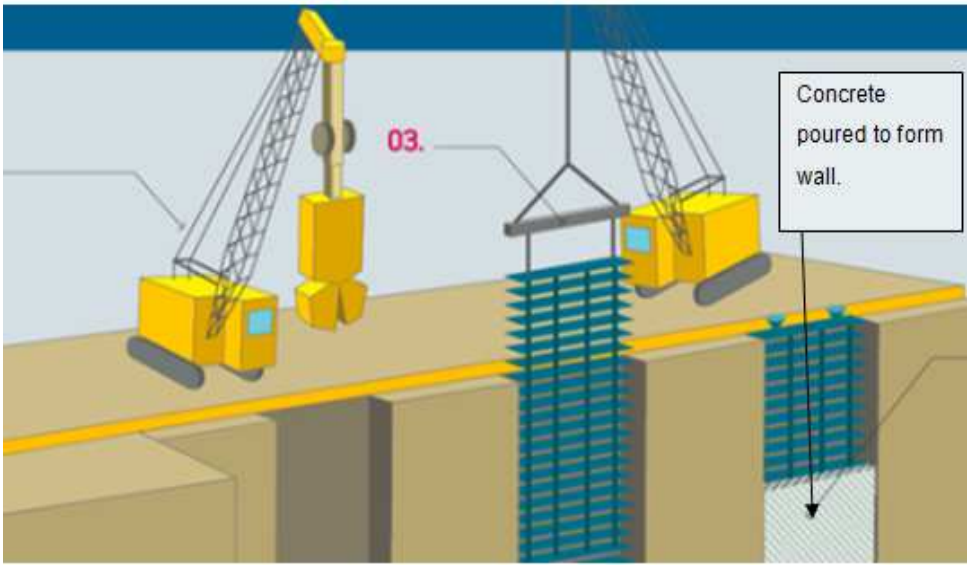

Figure 14 Diaphragm Walling process

6.12 **Figure 15** shows the partially completed Project Hobson pump station shaft. It gives a good idea of the scale of the structure that will be required to house the proposed Mangere Pump Station.

Figure 15 Construction of the shaft walls for Project Hobson pump station.

6.13 The other two primary site shafts, at Western Springs and May Road, have little soft ground present and are both expected to be constructed by a combination of grouting and rock bolting in basalt, and rock bolting in ECBF strata. Some form of mesh or shotcrete is likely to be required on the walls to protect the workers from small blocks ravelling and falling from the walls. Construction of the shafts at the secondary sites will use a combination of methods, including steel sheet piling, secant piling, rock bolting / anchoring with mesh / shotcrete, and soldier pile with timber lagging.

6.14 Smaller shafts on the micro tunnelled link sewers may include construction by precast caissons and bored pile casings. These methods are similar to the methods used for other Auckland projects in similar ground conditions, including Project Hobson. It may be necessary to construct some access shafts with bored piles or precast segments, which form the temporary works and also double as the permanent shaft structure. This technique is common in Europe and there are recent examples in Australia where it has performed well.

6.15 Blasting will not be widely used in construction, but it will be required where basalt is found in the shaft excavation and no other reasonable alternative exists. Blasting would then likely occur only during daylight hours and to an approved methodology such as using small charge weights and controlled blasting techniques which will control the rock breakage, vibration and noise generated. Blasting offers the benefit of a

shorter duration and overall less noise than using the alternative of rock breakers.

6.16 The following sites have been identified as potentially requiring blasting:

(a) Western Springs;

(b) Mount Albert War Memorial Reserve;

(c) Lyon Avenue;

(d) Haverstock Road;

(e) Walmsley Park;

(f) May Road;

(g) Kiwi Esplanade;

(h) Motions Road; and

(i) Western Springs Depot.

Dewatering

6.17 For all sites, special attention will be required to manage groundwater inflows and minimise the risk of ground settlement around the shafts by using appropriate construction methods.

6.18 Infiltration of groundwater into the shafts and tunnels is to be primarily controlled through the design and specification of relatively watertight excavation support systems. This reduces water inflows that would otherwise have to be pumped out of the shafts, treated, and disposed of. It also helps mitigate ground settlement, as Mr Twose will explain in more detail in his evidence. Some groundwater will need to be removed from the shafts and disposed of as described below.

6.19 Typical groundwater control measures for rock shafts include dewatering and groundwater cut-offs through chemical or permeation grouting and will be used as needed. Groundwater control for excavation through the basalt rock would be accomplished by grouting. The ECBF materials are not expected to require special groundwater controls. Groundwater control methods, if used, will likely be supplemented with other measures such as a sump system to remove groundwater inflows from the

excavations and concrete collars to control seepage along the soil / rock contact.

6.20 The proposed Mangere Pump Station shaft is in soft permeable soils and will require a watertight wall around its perimeter to prevent drawdown of water in the surrounding ground. This wall is expected to be a diaphragm wall. Once the surrounding ground is isolated by the wall deep wells inside the wall will then be used to dewater the alluvial sediments in the excavation. This method is designed to prevent drawdown of groundwater in the surrounding ground.

6.21 If the main tunnel drive begins at Western Springs (rather than at May Road), the tunnel will be driven downhill. Pumps and pipe work will need to be carried along with the TBM to keep the tunnel dewatered and avoid collection of water at the low end of the tunnel. If the main tunnel drive goes uphill from May Road to Western Springs then the advancing tunnel will be adequately drained back to May Road by gravity.

6.22 With the proposed construction method, involving a TBM with gasketed segmental lining installed, groundwater inflows during construction are expected to be low, of the order of 5 to 30 m^3 per day in the area of the advancing face.

6.23 The risk of groundwater inflows to the advancing tunnel face could increase where large zones of Parnell Grit or fractured ECBF are encountered for significant lengths of excavation. Careful operation of the EPB TBM in closed mode will prevent the high flows from ever entering the tunnel.

6.24 All inflows will be pumped to the surface and treated prior to discharge. Groundwater that does not require treatment will be discharged directly to stormwater drains. Discharge of treated water will be to either stormwater or sewer, depending on quality as described below. The amount and quality of groundwater will vary from site to site and will depend on the nature of the ground and the method of shaft construction.

Water treatment

6.25 Water used or exposed to any construction process (e.g. wheel wash etc) will be directed to a water treatment facility located on the site. Groundwater pumped out of the tunnels may also require treatment prior

to discharge. Treatment requirements will be determined with consideration to the potential discharge receiving environment. The options for groundwater disposal are:

(a) discharge to a Watercare sewer; or

(b) discharge to watercourse or the reticulated stormwater system.

6.26 At all sites, if the discharge is to occur to a watercourse or reticulated stormwater system, treatment will be undertaken to reduce sediment to acceptable levels for discharge. This will be via settlement tanks and, if necessary, flocculation. Neutralisation treatment may be required to address pH levels and to achieve required discharge standards. Additional site specific measures have been described in the Draft Chemical Treatment Management Plan which has been previously provided to the Auckland Council as part of the Draft Construction Discharge Management Plan accompanying the AEE (and was updated in the recent section 92 response).[2]

Connection pipelines

6.27 Connection pipelines are required to make connections to the existing sewer network.

6.28 The connection to Branch 9 and 9B sewers to the north of Keith Hay Park will require micro tunnelling construction sites within Keith Hay Park and adjacent to the SH20 motorway. All other connections will involve minor trenching works. These works will use standard trenching practice, such as trench shields, shoring and battering.

6.29 The connection sites, at any one location, should be required for a relatively short duration. Connections to the existing network may require work at night during periods of low flow. Where connections are to be trenched in the road, traffic management measures will be implemented. Where trenching occurs in close proximity to residential dwellings, noise mitigation measures will be used where necessary to meet Watercare's proposed construction noise conditions.

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[4] Section 92 Response, 27 May 2013.

Artificial lighting

6.30 As 24 hour operations are proposed at the three primary construction sites, artificial lighting will be required. For Western Springs and May Road, the lighting will be in the acoustic sheds, with the exception of more subdued lighting for staff access, security and nearby offices. Lighting will be designed and located to minimise effects on nearby property, such as through consideration of placement and design of lighting, and whether screening is necessary.

Erosion and sediment control and stormwater management

6.31 The estimated areas and volume of earthworks associated with the main project works are summarised in **Table 1** below.

	Auckland Isthmus area	**Manukau area**	**Coastal Marine Area**	**Total**	**Total (%)**
Tunnel works					
Approximate volume of excavated material (m^3)	262,000	58,000	36,000	356,000	75%
Construction site works					
Approximate volume of excavated material (m^3)	53,000	68,000	-	121,000	25%
Sub Totals (m3)	**315,000**	**126,000**	**36,000**	**477,000**	
Approximate area of works (ha)	6.6	3.5	0.16	10.3	

Table 1: Approximate earthworks areas and volumes (AEE Part A Table 6.1)

6.32 The nature of earthworks required includes the stripping and preparation / contouring of construction sites, shaft and tunnel excavations, excavations for permanent works such as chambers, trenching for connection pipework, and site reinstatement.

6.33 Generally, tunnel and shaft spoil will be taken off-site as it is removed and would not be stored in large quantities on site. However, it may be necessary at times to temporarily stockpile spoil on site. At Western Springs and May Road, spoil excavated outside normal working hours would be stored within the acoustic enclosures for removal the following working day. As final construction site layouts have not yet been determined, the final stockpile locations on the construction sites have yet to be identified. Any stockpiles will be watered, covered or protected as necessary to prevent windblown dust or soil runoff. Management of any stockpiles will be included as part of the CMPs.

6.34 It is intended that earthworks will be undertaken throughout the calendar year and consent for earthworks is sought on this basis. Draft Erosion and Sediment Control Plans ("**ESCP**") and Construction Discharge Management Plans ("**CDMP**") have been prepared to manage works at the sites during construction (Initial draft ESCPs were contained in Part D, Technical Report K of the AEE and draft CDMPs were provided as part of the Section 92 Response submitted to the Council, dated December 2012 (Attachment 3, Appendix A to the draft CDMP and updated 22nd May 2013). A draft was also prepared for the Mount Albert War Memorial Reserve Car Park site in the Section 92 Response submitted to the Council dated 13 May 2013).

6.35 The earthworks will be executed in two phases for each site:

(a) The establishment phase, when most of the surface disturbance activities will occur, such as site grading and access road establishment; and

(b) During the active construction phase, when shaft sinking and tunnel construction works will occur at the sites, generating sediment from vehicle movements

6.36 Consideration has been given to Auckland Council Erosion and Sediment Control guideline (TP 90) and Design Guideline Manual for Stormwater treatment devises (TP 10), and appropriate treatment has been proposed

depending on the physical nature of the site, the duration of works, and the activities to be undertaken.

6.37 Dust control measures will be implemented should this be required and wheel wash facilities will be established to ensure truck wheels are cleaned before travelling on local roads.

Spoil disposal sites

6.38 Excavated material will not generally be reused and will be disposed of to an authorised site. The spoil disposal sites will be determined by Watercare or the Selected Contractor and do not form part of the current consent applications. Possible sites for spoil disposal may include other construction sites where cleanfill material is required, existing cleanfill sites, or to landfill for any contaminated material.

Works in the coastal marine area

6.39 Works will occur in the coastal marine area ("**CMA**") in three locations:

(a) the construction of the main tunnel under Manukau Harbour between Hillsborough on the northern side and Mangere Bridge on the southern side;

(b) the construction, use and subsequent removal of the temporary construction platform, the demolition of Pump Station 23 (**Figure 16** shows the foreshore in its present condition), and the placement of a permanent seawall as part of site reinstatement at Pump Station 23 (Frederick Street); and

(c) the construction of the emergency pressure relief ("**EPR**") structure at the proposed Mangere Pump Station.

Main tunnel

6.40 The main tunnel will pass at depth under the seabed of the Manukau Harbour.

Pump Station 23

6.41 At Pump Station 23, due to constraints in site size and layout, a temporary construction platform is needed in order to construct the main tunnel and permanent site works. The proposed site optimises the use of an existing Watercare facility and minimises the area of CMA occupation.

The works will not interfere with any existing public walkways and access will still be possible around the site at low tide. The extent of the permanent sea wall and temporary working platform is shown on **AEE-MAIN-8.3** and **AEE-MAIN-8.4** at pages 113 and 114 of the Hearing Drawing Set.

Figure 16 Existing foreshore area at Pump Station 23

6.42 Construction of the temporary platform will require placement of a separation membrane on the seabed before placement of suitable granular imported fill within a perimeter bund trucked into the site, likely coarse run of pit rock. During placement a substantial silt fence will be in place around the reclamation perimeter to minimise silt entering the sea. The footprint of the proposed temporary platform is approximately 1300 m^2 and it will extend approximately 25 m into the CMA. It will take 12 to 18 months to complete the works at PS23 within an occupation period of 5 years. The platform will then be removed and the area reinstated.

EPR structure at proposed Mangere Pump Station

6.43 The EPR structure will be constructed as a concrete box culvert set back under the existing roadway with an apron extending a short distance onto the foreshore. This will necessitate a temporary cofferdam to exclude water at high tide for one to two months during construction after which it can be completely removed. The cofferdam will also isolate the works from the marine environment during construction.

Conditions

6.44 Watercare has proposed a set of draft conditions to manage the effects of construction activities within the CMA (proposed Consent Conditions 9.2 - 9.6). In particular, proposed Consent Condition 9.4 requires the CMP to also include the details of all temporary structures (including their construction methodology and expected occupation) within the CMA and measures to be taken to minimise disturbance of the seabed during construction activities.

6.45 There may be occasions where it is necessary to continue construction activities in the CMA outside of usual hours to tie in with tidal cycles. At both Pump Station 23 and the EPR structure, erosion and sediment control measures will be employed to manage the effects of these works and these sites will be managed through within the main CMP.

6.46 Proposed Consent Condition 9.5 requires the Selected Contractor to prepare a Site Restoration and Landscape Plan ("**SRLP**") prior to commencement of works in the CMA at Pump Station 23 and the EPR structure. The SRLP will include methods for the removal of the temporary construction platform at Pump Station 23 and measures and methodology for reinstating disturbed areas of the CMA.

7. CONSTRUCTION OF PERMANENT STRUCTURES

Fitting out

7.1 Permanent works will include fitting out of the access shafts, drop shafts, manholes, grit traps, and control chambers. This may include partial filling of construction access shafts where required. Fitting out of permanent works will require activities very similar to general civil and building works routinely employed by Watercare and others, including:

(a) in situ concrete construction;

(b) precast concrete installation;

(c) mechanical installation – control gates, air vents;

(d) electrical installation – power and control systems; and

(e) installation of ladders, platforms, stairs, and access covers etc.

7.2 These routine construction activities will comply with the relevant regulations and building codes as well as Watercare's technical specifications, and will be subject to the usual level of supervision by Watercare and the Selected Contractor.

Air treatment facilities

7.3 As Mr Cantrell has explained, air treatment facilities will be constructed at the proposed Mangere Pump Station and Pump Station 23 (Frederick St) in the first instance, with additional facilities provided on a staged basis depending on whether they are required.

7.4 Construction activities will depend on the type of air treatment facilities to be constructed. Generally speaking, however, construction of any air treatment facility would involve:

(a) in situ concrete construction;

(b) steelwork installation;

(c) precast concrete installation;

(d) cladding, roofing and building finishing;

(e) mechanical and process installation – biotrickling filters, activated carbon units etc for BTF/AC and pipes, bark media etc for biofilter;

(f) electrical installation – power and control systems; and

(g) installation of doors, ladders, platforms, stairs, and access covers etc.

Site reinstatement

7.5 Reinstatement at all sites following construction will generally involve replacing what was at the site prior to construction in a like for like manner where appropriate and practicable. At most sites this is likely to involve a combination of re-grassing or repaving, replanting, and replacement of facilities that have been removed (e.g. footpaths, playground, and park furniture).

7.6 Construction access roads not required for inspection and maintenance access will also be removed, but provision will be retained for durable all-weather access for inspection and maintenance purposes.

7.7 **Figure 17** illustrates a high standard of reinstatement to an access shaft.

Figure 17 Completed cover to a control chamber and access shaft (Mairangi Bay, Rosedale Project)

7.8 The details of site reinstatement will be developed in discussion with the landowners of the sites. Reinstatement works in parks and reserves will be developed in conjunction with Auckland Council and local boards (or Regional Facilities Auckland at Western Springs).

7.9 Consideration will be given to Auckland Council aspirations and plans, including those identified in Local Board Plans and the potential for integration of sites to tie in with any stream naturalisation proposals of Auckland Council.

7.10 The preparation of Site Reinstatement Plans post-construction has been proposed by Watercare as condition of the designation (Proposed Designation Condition SR.1). These conditions require SRPs to be prepared which detail the infrastructure that is to remain on the site and the proposed planting and reinstatement works to integrate that infrastructure into the surrounding environment. Watercare has also proposed particular conditions regarding site reinstatement and

restoration planting at Roy Clements Treeway (Proposed Designation Condition SR.1B and RC.1 - 5).

8. CONSTRUCTION MANAGEMENT PLANS

8.1 The intention is to address all construction related effects through the use of CMPs. Once the Selected Contractor is appointed, and prior to the start of the main construction programme, a CMP and other management plans will be prepared which set out the detail of the proposed construction methodology and programme, describe the mitigation measures to be taken to minimise potential adverse effects, and ensure compliance with Watercare's proposed designation and consent conditions (proposed Designation Conditions CM.1 - 3 and Consent Condition 1.7).

8.2 Management plans addressing specific topics will be incorporated in the main CMP where they have project-wide application. Specific topics or sites may require standalone plans depending on timing of works at various sites or where they have local characteristics that warrant a slightly different approach. Draft or outline management plans are contained in a number of the technical reports in Part D - Technical Reports of the AEE, or have been provided to Council subsequently.

8.3 The CMPs will address a range of construction issues, as summarised in **Table 2** below.

Construction Issue	**Likely Content of CMP**
Construction management	Sets out details of construction methodology.
Coastal works construction management	Sets out details of design, construction methodology and management of effects on the environment within the CMA.
Contaminated land management	Sets out details of the construction methodology for works and presents methods for managing and disposing of contaminated soils.
Traffic management	Sets out details of the proposed traffic management at the construction sites.

Construction Issue	Likely Content of CMP
Construction noise management	Sets out details of proposed construction noise management.
Noise & Vibration management	Sets our details of noise & vibration management and mitigation measures.
Tree protection	Sets out methods and procedures when undertaking works in close proximity to trees.
Accidental discovery protocols	Sets out procedures to follow in the event that archaeological remains, taonga or koiwi tangata (human remains) are exposed while project works are under way.
Erosion and sediment control	Sets out details of the proposed erosion and sediment control measures.
Dust management	Details methods for minimising and monitoring dust generated by construction activities.
Groundwater and settlement monitoring	Sets out measures for monitoring groundwater drawdown and settlement effects and responding to changes.
Hazardous substances management	Sets out measures for management of hazardous substances, including spill response procedures.
Communications management	Sets out details of the proposed internal and external communications during construction, including key internal and external contacts and lines of communication.

Table 2 Construction Management Plan contents

8.4 Through the use of these management plans, all construction related effects can be appropriately controlled.

Hours of operation

8.5 The site operations for different types of work and site have been discussed above in some detail. In this section of my evidence I summarise the hours of operation for construction work. Site operational arrangements will likely occur on the following general basis:

Tunnelling and associated surface activities at primary sites

(a) Operations will occur for all tunnelling activities related to the main tunnel works 24 hours a day, 7 days a week.

Micro-tunnelling, trenching and associated surface activities at secondary sites

(b) This work would occur during normal working hours, (7 am to 6 pm, Monday to Friday and 8 am to 6 pm Saturday). However, in particular circumstances, Watercare may need to undertake micro-tunnelling works 24 hours a day 7 days a week (or alternative extended hours) to meet construction demands, provided that construction work can be managed to meet construction traffic, noise, and vibration requirements.

Truck movements

(c) These will take place at secondary and primary construction sites during normal working hours, 7 am to 6 pm, Monday to Friday and 8 am to 6 pm Saturday. At times special deliveries may be required outside these times to address traffic management measures but this will be rare.

General primary and secondary site activities:

(d) These will take place during normal working hours, 7 am to 6 pm, Monday to Friday, and 8 am to 6 pm Saturday, and with provision to extend these hours during summer daylight savings periods as required. This would include any blasting for shaft excavations.

8.6 Watercare has proposed these construction hours as part of its proposed conditions (proposed Designation Condition CH.1 and Consent Condition 1.9).

8.7 There may be occasions where it is necessary to continue construction activities outside of usual hours, for example, where it is necessary to complete an activity that has commenced, to tie into the existing network, delivery of large plant or machinery, emergency works, or to tie in with tidal cycles for works in the CMA etc.

8.8 For works outside of normal hours, appropriate measures will be implemented to ensure construction noise and vibration standards are met where practicable and alternative management strategies are implemented where standards cannot be achieved. These measures will be set out in a CNVMP(s), as required under the proposed Designation Conditions CNV.1 - 7 and Consent Condition 1.10.

Traffic

8.9 Prior to construction commencing, a detailed Traffic Management Plan(s) ("**TMP**") will be prepared to address the detailed provisions for each site. The TMPs will address:

(a) signage and notification of the works;

(b) construction traffic routes; and

(c) measures to avoid or mitigate effects, such as restrictions on vehicle movements, stopping restrictions, parking limitations etc.

8.10 Watercare has proposed that a TMP will be prepared either as a stand-alone plan or part of the CMP (proposed Designation Conditions TM.1 and CM.2). Draft traffic management measures for those sites where the construction area extends into the road reserve (Whitney Street, Haycock Avenue, and Norgrove Avenue) have been prepared and are contained within the Traffic Impact Assessment at Technical Report E of Part D of the AEE. Works will be subject to Corridor Access Requests from Auckland Transport (for works in road reserve), the New Zealand Transport Agency (for works in state highways), and KiwiRail (for works under rail corridors).

Noise and Vibration

8.11 Vibration and noise management will be addressed in the CMP or in a standalone CNVMP as part of the wider CMP package. This will identify the standards to be complied with during the works and measures to minimise the effects on health and limit discomfort to people as well as ensure the risk of damage to structures is less than minor. Whilst vibration and noise from tunnelling activities is generally negligible other sources may require mitigation, for example vibration and noise from piling, blasting (if any), rock breaking or drilling, and from movement of large plant such as cranes.

8.12 Watercare has proposed draft conditions that require the Selected Contractor to prepare a CNVMP, either as a standalone plan, or included as part of the CMP (proposed Designation Condition CNV.1 and CM.1). A draft CNVMP has been prepared (refer Part D Technical Report F of the AEE). The CNVMP provides recommendations and processes to mitigate noise levels from construction activities in accordance with the Construction Noise Standard (NZS6803: 1999) and German Standard DIN4150-3: 1999 for vibration.

8.13 The CNVMP covers:

(a) communication and consultation protocols;

(b) construction noise and vibration mitigation measures;

(c) noise and vibration monitoring procedures;

(d) contingency measures to be implemented when works may exceed the Standards; and Complaints procedures;

(e) requirements for condition surveys of Existing Buildings and Structures ("**EBS**"); and

(f) procedures for storage, handling and use of explosives.

Contaminated sites

8.14 Watercare has proposed draft conditions which require a Contaminated Land Site Management Plan ("**CLSM**") to be prepared prior to commencement of construction (proposed Consent Condition 8.2). A draft CLSM has been prepared to address the management of contaminated soils and is found in Part D, Technical Report I of the AEE. Material requiring disposal off site will be disposed of at an appropriate facility based on the nature of the material.

8.15 Some sites have already been tested and found to have traces of contamination, and likely disposal sites and methods have been identified for these sites (Western Springs, May Road, the proposed Mangere Pump Station, and Motions Road). Additional confirmatory testing for contamination will be carried out at selected sites prior to construction, as described in the proposed conditions (Proposed Consent Condition 8.5).

Hazardous substances

8.16 Construction works will involve the use of some hazardous substances and refuelling and maintenance activities have the potential to release oil, diesel, degreasers and other contaminants into the environment. Management of hazardous substances will be detailed in the CMP. This will identify the standards to be complied with during the works and measures to minimise the potential effects on health and the environment. The CMP is likely to include the following:

(a) requirements for refuelling and maintenance areas;

(b) concreting methodology;

(c) spill response procedures;

(d) general procedures for storage, handling and use of hazardous substances; and

(e) contingency measures and complaints procedures.

8.17 All hazardous substances will be transported, stored, used and disposed of in a manner appropriate to their Hazardous Substances Classification. If a spill of a hazardous material occurs, the Project's spill procedures (to be detailed in the CMP) will be followed. Appropriate measures will be used to manage concrete pours and waste concrete and grout will be disposed of off-site.

9. COMMISSIONING

9.1 The commissioning of the main project works will be an important phase of the construction programme. Commissioning involves routine testing, flow testing and operational activities at the Project work sites, for example to test gates and flow control equipment. Sites will be accessed multiple times to ensure the facilities are operating properly.

9.2 The process will be undertaken in a series of stages and will likely require temporary works to enable flows to be diverted from the existing network into the Central Interceptor tunnel and back, to allow trialling of connections, support systems and the pump station. It is likely the process will take several months, with the final switch over only

happening when Watercare is confident that the new works are performing as intended.

9.3 The actual requirements of the commissioning phase will be known once detailed design work has been completed and construction methods finalised. The effects will be similar to routine maintenance access for each site with a limited number of vehicles movements and having minimal effect on the environment, public and surrounding properties.

10. RESPONSE TO SUBMISSIONS

10.1 I have read the submissions with particular regard to construction methodologies and the associated impacts and have assisted Watercare in the preparation of their responses prior to this hearing.

10.2 Many of the submissions raise concerns by local residents and affected parties about the construction impacts at the construction sites for shafts as this is where the Project primarily interacts with the surrounding public. My consideration of these submissions and the advice I have provided to Watercare focuses on the proposed methods of construction.

10.3 Submitters have queried the construction working hours, generation of fumes and dust at sites. These are normal concerns for people adjacent to construction works in an urban area and for which the statutory regulations and specific Project conditions are well able to deal with. The conditions place specific limits on the construction activities and apply a systematic checking and review process that is tried and tested on many sites. Watercare has demonstrated its capability to administer their contractors successfully in this regard through many projects, including Project Hobson and the Rosedale Project. In my opinion these relatively routine adverse effects can be minimised through good practice at each site.

10.4 It will, in my opinion, be impossible to construct a project of this type in dense residential and commercial areas without adjacent parties being inconvenienced in some way during the construction period. As with any project, it is necessary to trade off the relatively short lived disruption during construction for the much longer term benefits to the community of the completed Project. Having said that, it is vital that any residual adverse effects are carefully assessed and, where necessary, mitigated.

The development of the concept design and construction methodologies has been, and will continue to be, undertaken with this in mind.

10.5 The construction work methodologies are to be set out in a comprehensive CMP required to be submitted to the Council as part of the Outline Plan of Works ("**OPW**") as required by Watercare's Proposed Designation Conditions. The OPW, and more specifically the CMP, includes a defined monitoring regime and contingency planning. This should give submitters confidence that the impacts of the works will be properly controlled.

10.6 Generally the high standard of detailed works specifications, selecting experienced contractors, appropriate construction methods and using effective management plans under Watercare's supervision will be sufficient to mitigate the concerns of submitters on construction.

10.7 The following sections discuss my response to particular key submissions. Where possible, I have set these out according to the particular location to which they relate, commencing at the northern end of the works.

Mt Albert War Memorial Reserve

10.8 The original Mt Albert War Memorial Reserve site is located within the Park with access from Wairere Ave. The submissions received relating to this location include concerns about effects arising from noise, hours of operation, duration of works, construction traffic via Asquith and Wairere Ave, vibration and air pollution, all associated with the proximity of construction to residential properties.

10.9 Following on-going consultation with affected parties, Auckland Council Parks, and the Albert-Eden Local Board, Watercare now proposes an alternative location for the construction works, being in the existing car park, to reduce effects on the reserve and increase the distance from most residents. Subsequent submissions on this new notice of requirement have been mostly in support of the revised location.

10.10 For both the original Reserve site and the alternative Car Park site, mitigation measures will be required to ensure that noise and vibration limits are met. Mr Cottle and Mr Millar will discuss these effects in some detail in their evidence. I am satisfied that available construction

techniques and the implementation of the proposed mitigation measures will reduce effects to less than minor for the majority of surrounding properties.

10.11 Blasting is likely to be required to remove basalt present at shallow depths within the shafts and connecting sewers for both the Reserve and Car Park sites. The Selected Contractor will mitigate the resulting effects by using low charge weights, blasting at regular times set in consultation with affected parties and using rock breakers in some cases. Although it is my experience that the longer term noise generation of rock breakers may give rise to greater nuisance than regular short duration blasts.

10.12 The Community of Refuge Trust ("**CORT**") located at 9 Wairere Ave is of particular concern because it remains close to the revised site location and houses particularly sensitive occupants. The works at this location include construction of new manholes and connections pipes within 10m to 20m of the property. It is unlikely that the closest works can be conducted without having more than minor effects on these residents and I understand Watercare is discussing options for temporary alternative accommodation with CORT to remedy this issue.

10.13 Construction traffic movements will need to be managed carefully at all sites. Mr Hill assesses the traffic effects of this site in his evidence. I have considered his conclusions and can confirm that the construction methodology and planning can work efficiently within the constraints and mitigation measures Mr Hill recommends at this site.

Lyon Avenue

10.14 Submissions have been received from St Lukes Gardens Apartment Body Corporate, St Lukes Gardens Apartments Progressive Society Inc., Gordon Spittle, Dennis and Patricia Prescott, Saint Lukes Environmental Protection Society, Mt Albert Residents Association raising concerns about the construction effects at the Lyon Avenue site. These submissions suggest that the construction site should be within the Mount Albert Grammar School playing fields to avoid the loss of mature trees and significant vegetation in the Roy Clements Treeway.

10.15 The use of Morning Star Place raises concerns regarding access, noise and traffic. I have also reviewed the work done by the traffic, noise and vibration specialists in relation to this site, have visited the site several

times and have assisted Watercare in the evaluation of alternatives over recent months. This is one of Auckland's largest wastewater overflows and it is therefore important to balance the short term adverse effects experienced at this site with the longer term environmental benefits of intercepting these discharges.

10.16 I undertook a comparison of construction and access for the two sites as part of the Section 92 response of 27 May 2013. In terms of construction, it is my opinion that the playing fields have a number of disadvantages as compared with the proposed Lyon Avenue site:

(a) In order to connect to the existing overflow structure it would be necessary to trench through Meola Creek with associated temporary stream diversion to connect into the diversion chamber.

(b) The diversion chamber would still require work in the Treeway adjacent to Morning Star Place.

(c) Once constructed the hard surfaced shaft lids and hatches would be located in the middle of current playing fields.

(d) The playing fields have a history of flooding from the Meola Creek requiring the site levels to be lifted to protect the construction activities.

(e) Relocating the site to the playing fields would not avoid adverse effects on vegetation or ecological values as vegetation will still need to be removed from both sides of Meola Creek to establish connections to the Edendale Branch Sewer and provide a new overflow culvert (although this loss will be lesser).

10.17 For these reasons, I remain of the view that the proposed Lyon Avenue site is the most feasible option in terms of construction considerations.

10.18 For completeness, I note that:

(a) Mr Hills will also discuss the comparison of traffic effects and alternative access routes in more detail in his evidence. I support his conclusion that the use of Morning Star Place is the best practical option for accessing the proposed Lyon Avenue site from both a traffic and construction access point of view.

(b) Ms Petersen includes a comparative summary of the two options in her evidence and confirms Watercare's preference for the proposed Lyon Avenue site. I support that conclusion.

Haverstock Road

10.19 The Project requires structures at this site to allow for an existing overflow and existing sewers to be diverted into the main tunnel. It is a secondary construction site. The New Zealand Institute for Plant and Food Research ("**PFR**") and the Institute of Environmental and Industrial Research have lodged submissions raising concerns in relation to vehicle access, noise and vibration (including effects on sensitive laboratories), odour, and cumulative effects. These matters have been addressed by a number of witnesses, and I only briefly comment on those that relate to site layout and construction methodology:

(a) PFR requests a survey of the proposed alignment and future potential exclusion width. As-built surveys will be made available after construction completion. Future development and works in the area of the new infrastructure will be subject to the usual notification and third party approval processes that apply to the rest of Watercare's wastewater network, and there is no "future potential exclusion width" as suggested.

(b) PFR requests further details of proposed mitigation. The AEE generally covered the mitigation measures appropriate for this site and further detail will be available when design is completed, the Selected Contractor develops its methodology for this site and will likely form part of the overall CMPs and TMPs to be prepared.

(c) PFR has raised proposed onsite security. Given the proximity to PFR this site will be protected with a security fence. When construction is underway measures will be implemented to secure the site both during working hours and at night. This will also protect the plant equipment located on site. These measures would normally include, lighting, alarmed buildings and may include security guards in some circumstances.

(d) PFR raised the matter of identified and assessed potential constraints for future campus redevelopment and growth. The

Central Interceptor tunnel is located well below ground and therefore will not impact on PFR's future development plans. The drop and access shafts are located in the corner of the PFR land close to the existing sewer. The CSO collector sewer has been located close to the site boundary and the permanent footprint of the control chamber has been kept as small as practicable.

May Road

10.20 May Road is one of the three primary construction sites for the main tunnel drive. It will require a high level of site preparation and extensive facilities. It is likely that the main tunnel will be driven down-hill from Western Springs through the May Road shaft and on to construct Link Sewer 3 to Haycock Ave. However the Selected Contractor may elect to launch the TBM from May Road for this drive. A noise attenuation building is proposed to house the main shaft works to allow tunnelling to proceed 24 hours a day, 7 days a week (as proposed by Watercare's Proposed Consent Conditions).

10.21 Foodstuffs Limited is a major user of Roma Road and has lodged a submission. Whilst its submission is supportive of the overall outcomes of the Project, Foodstuffs is opposed to:

(a) any adverse effects that may occur due to the construction and operation of the main tunnel as it crosses Foodstuffs properties along the tunnel alignment;

(b) those parts of the NOR and of the associated resource consents which are proposed to apply to 105 May Road and access from Roma Road; and

(c) use of 105 May Road as a primary construction site which will impact on Roma Road, a strategically significant node for Foodstuffs and Foodstuffs' supply chain. Impacts of concern include traffic, construction site access, noise, vibration, odour, construction management, and stormwater effects.

10.22 The main tunnel passes under Foodstuffs' property at a depth of at least 70m in the ECBF formation. As described in some detail by Mr Twose in his evidence, the expected settlement will be barely detectable (<25mm

and 1 in 2000), and well within the tolerance of Foodstuffs' large commercial building and its services. Monitoring and setting of trigger levels for contingency actions is a key requirement of the CMP and a requirement of Watercare's Proposed Conditions.

10.23 Mr Hill has discussed the traffic implications of this primary construction site on Roma Road and its junction with May Road. The accessway will be formed to the usual road standards for a 5 to 10 year life so I have no concerns that it will be adequate for the traffic loads envisaged. It is also relevant that the access avoids adverse effects on the adjacent buildings. This will be achieved by ensuring the road is built to appropriate standards and effects from increased loads are not experienced by the adjacent buildings as the access is formed; probably using a small timber cantilever retaining wall. Curbs and road drainage will also be required.

10.24 Watercare has recently purchased the land required for the May Road site. The agreement with the former owner includes provision for an additional access direct to May Road. The way in which this additional access would be used is yet to be defined, but could allow the access off Roma Road to be used for one way traffic only, with an associated reduction in construction traffic volumes on Roma Road.

Keith Hay Park

10.25 The secondary construction site at Keith Hay Park occupies two former residential properties, one now owned by Auckland Council and the other purchased by Watercare. As such, it remains close to a number of residential properties. Mr and Mrs Whitehead of 18 Gregory Place have submitted with concerns about noise, vibration, dust and traffic and the risk of damage to their property. I have visited this particular house because of its proximity to the works and because their first floor main living area overlooks the site.

10.26 Best practice construction management will be applied at all the Project sites to protect residents. Blasting is not required at this site but the shafts will require support to the upper soils, which will probably be in the form of driven sheet piles. Vibration and noise generated by these operations are discussed by Mr Millar and Mr Cottle in their evidence.

10.27 I agree with their conclusions that special measures will be required at 18 Gregory Place to keep noise and vibration levels within appropriate

parameters. Concern has also been expressed by residents of 47A Arundel Street (the Puertollanos) adjacent to the work site. This property is located further from the access and drop shafts at Keith Hay Park so that the effects are reduced. Nonetheless careful monitoring of generated noise, vibration and settlement will be required and will be undertaken at this site, as well as at others, and will be managed by the CNVMP. Further assessment of the effects at this site will need to be carried out during detailed design. The use of alternative excavation techniques which do not using driven sheet piles should be retained as an option for the construction in this area.

Transpower

10.28 Transpower has submitted on the application with concerns regarding impacts on their regionally important power supply infrastructure near the alignment during construction, in particular the potential impact on the sub-station at Mt Roskill. The Transpower submission specifically mentioned the construction sites for the shafts located at Whitney Street, Dundale Avenue, and Pump Station 23 (Frederick Street), as they are located close to three of Transpower's existing 110kV transmission structures.

10.29 Particular concerns identified relevant to construction activities include:

(a) the need for appropriate management during construction;

(b) earthworks and potential effects on the structural integrity of the support structures resulting from excavations (particular where tunnels are located below transmission line towers);

(c) potential for reduced vertical clearances between the ground and conductors caused by filling (and the need for an electrical assessment where filling is proposed); and

(d) vibration and dust effects.

10.30 Mr Twose and I have undertaken more detailed additional assessments of the potential impacts on these specific assets, establishing the proximity of the works to the Transpower assets, the local geology, types of foundations and making reference to Transpower' s own guidelines for deformation of the structures, with particular attention given to settlement and clearance. We concluded that the works can be constructed without

unacceptable impact on Transpower facilities given Watercare's proposed works management regime. Watercare has prepared detailed conditions to address any potential adverse effects on Transpower's assets and how these can be avoided, remedied or mitigated. Watercare's Proposed Conditions have been provided to Transpower who has proposed minor amendments to satisfy its concerns. These amendments have been accepted by Watercare and included in Watercare's Proposed Designation and Consent Conditions.

10.31 It is my understanding that Transpower is also particularly concerned to ensure that Watercare's works will be undertaken in accordance with NZECP 34:2001 New Zealand Code of Practice for Electrical Safe Distances and the National Policy Statement on Electrical Transmission. I have confirmed that these will be able to be complied with during construction. I understand that Transpower is now satisfied that the works will be constructed without risk to its assets and the detailed design will take account of their concerns and the works will be appropriately managed and controlled through the CMPs. Watercare's Proposed Conditions have also been modified in response to Transpower's concerns.

10.32 It will be important that Watercare and the Selected Contractor continue to consult with Transpower on an ongoing basis as the detailed design progresses.

11. RESPONSE TO COUNCIL PRE-HEARING REPORT

11.1 The Council Pre-hearing Report includes detailed consideration of the construction aspects of the Project. I agree with the Report's conclusion on the potential effects at the proposed construction sites:[3]

> During work at the various construction sites there will be a range of adverse effects likely to impact on the areas surrounding the work sites, but as noted in the AEE these will be temporary and are proposed to be mitigated to an appropriate level through various construction management techniques. Once completed, the Central Interceptor and associated features will be located predominantly underground, and temporary work areas will be reinstated.

[3] Pre-hearing Report Section 9.3.20.

11.2 I would like to comment on a number of specific conclusions and new conditions to Watercare's Proposed Conditions in the Report concerning:

(a) stability effects;

(b) earthworks and stormwater effects;

(c) noise effects;

(d) contamination; and

(e) the assessment of alternative locations and layouts for the construction site at Lyon Avenue.

Stability effects

11.3 Mr Nelson (advising Auckland Council) has recommended monitoring and reporting requirements in addition to those originally proposed by Watercare in respect of the structural stability of sensitive buildings so that any adverse effects can be detected at an early stage.

11.4 In addition to the conditions that Watercare had proposed which require Watercare to undertake risk assessments to identify buildings that are at risk of damage (proposed Consent Condition 4.9) and to consult with landowners to undertake a detailed pre-construction survey (Proposed Consent Condition 4.11), Mr Nelson proposes an additional condition which states:[4]

> Where neighbouring building/property owners indicate the presence of particularly sensitive structures (examples include old or brittle structures, vibration sensitive equipment, unusually heavy loads or settlement sensitive machinery) a full engineering assessment shall be undertaken to determine what, if any, additional avoidance, design, remedial or monitoring works are required in this vicinity. The Consent Holder shall use best endeavours to complete work to the satisfaction of the building owner.

11.5 Watercare has sought that this additional requirement in Proposed Consent Condition 4.11 is deleted. I support Watercare's request to delete this condition as it is unnecessary given that Proposed Consent Conditions 4.9 and 4.11 already require extensive pre-construction

[4] Council Pre-hearing Report at pages 301 - 302.

surveys of identified "at risk" buildings. Mr Twose also addresses this condition in his evidence and I support his conclusions.

11.6 The Council has proposed a new Condition 4.25 as follows:

> Construction methodology shall ensure that following the Completion of Dewatering groundwater levels will not significantly change from pre-construction groundwater levels or exceed trigger levels established as part of this consent.

11.7 I do not agree that this condition is necessary as I consider this is already covered by Watercare's Proposed Consent Condition 4.2. Mr Twose also addresses this condition in his evidence and I support his conclusions. I support Watercare's request that Consent Condition 4.25 is deleted.

Earthworks and Stormwater Effects

11.8 Following exchange of further information through the section 92 process, Mr Stewart has proposed changes to the draft CDMP (3 Earthworks) within proposed conditions, for discharge standards and monitoring of tunnel dewatering activities, wheel washes and other construction site related discharges (3.3). Mr Stewart recommends a new Consent Condition 3.5 which provides:[5]

> "The Construction Discharges Management Plan (CDMP) shall include a monitoring programme which shall include but not be limited to:
>
> • The monitoring to be undertaken to ensure that the discharges from all devices are complying with the discharge standards detailed in Condition (,,);
>
> • The erosion and sediment control and water management devices that require maintenance;
>
> • The time when the maintenance was completed;
>
> • Areas or incidents of non compliance with the discharge standards and monitoring plan (if any) and the reasons for the non compliance.
>
> The information is to be submitted to the Auckland Council on a monthly Basis".

11.9 I concur with Mr Stewart that the revised treatment standards and inclusion of this condition as it will effectively control construction discharges.

11.10 I also agree with the further conditions (Consent Conditions 3.3, 3.4 and 3.6) recommended by Mr Styles relating to the standards and treatment of discharges prior to their discharge to the receiving environment,

[5] Pre-hearing Report at page 113.

including the application of a turbidity standard of 50 NTU which was proffered by Watercare during consultation with the Council.

11.11 Ms Chuah recommends that attenuation rain tanks for the runoff of the acoustic enclosures be provided on the basis of Extended Detention Volume to protect receiving environments.[6] I concur that this is a reasonable approach to be carried forward into the contract specifications.

11.12 In respect of stormwater works, Ms Chuah also recommends that an Operational and Maintenance Plan is required for the operation and maintenance of permanent stormwater management systems (Consent Conditions 6.9 and 6.10). I support this recommendation as it will ensure that the adverse effects of stormwater management systems will be minimised.

Noise Effects

11.13 The Pre-hearing Report concludes that:[7]

> The noise effects from construction activities can be appropriately managed through the implementation of site specific CNVMPs involving consultation with affected landowners.

11.14 This conclusion is based on Mr Styles' recommendation that Watercare's proposed Designation Conditions CNV.4 and CNV.5 include an additional requirement that requires: [8]

> The measures that will be undertaken by the Requiring Authority to communicate and obtain feedback from affected landowners on noise management measures.

11.15 Mr Styles also recommends that the CNVMP should set out the Best Practicable Option for the mitigation of the noise levels specific to each activity for each site, including physical mitigation, restrictions on hours for the noisy work, consultation and monitoring (Proposed Designation Condition CNV.4(h)).

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6 Pre-hearing report at page 115

7 Pre-hearing Report at page 123.

8 Refer to Proposed Designation Conditions CNV.4(g) and CNV.5(g).

11.16 I support the emphasis on consultation with affected stakeholders during development of the CNVMP and the adoption of the Best Practical Option for mitigating noise effects. Mr Cottle comments on the other proposed noise conditions in his evidence.

Assessment of alternative locations and layouts for the Lyon Avenue Site

11.17 The Pre-hearing Report requests that Watercare should provide further evidence on the viability of the alternative site on Mount Albert Grammar School playing fields. I have already set out the reasons why the playing fields were not considered a viable alternative to the proposed Lyon Avenue site from paragraph 10.14 above. I consider that the information provided as part of the section 92 responses is sufficient to illustrate why the proposed Lyon Avenue site is considered more feasible than the playing fields.

11.18 For all the reasons given, I consider that the proposed Lyon Avenue site is the most feasible construction site. I agree with the Pre-hearing Report conclusion that the proposed site "provides the best practical location for construction due to potential impacts on the operation of the Mount Albert Grammar School sports field, and the need to reinstate the sports field following construction" and that the unavoidable loss of vegetation can be adequately addressed through the proposed reinstatement conditions.[9]

Retention of the existing pohutukawa tree at Pump Station 23

11.19 The Pre-hearing Report requests further information regarding the feasibility of retaining the existing pohutukawa tree on the north-west corner of the Pump Station 23 site. We have assessed whether or not this tree could be retained within the construction site area from an engineering perspective. It has been determined that the tree cannot be retained with the current site layout.

11.20 The detailed design process and development of the CMP may allow a revised layout to be developed resulting in saving the tree, possibly through hard pruning, although this is unlikely given the very confined nature of the site.

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9 Pre-Hearing Report at page 196.

12. CONCLUSION

12.1 I have outlined the primary construction methodologies expected to be used for the Project.

12.2 The Project is a major addition to Auckland's wastewater network. The use of modern tunnelling techniques allows much of the Project to be built underground between Western Springs and the Mangere WWTP, some 13 km, virtually eliminating disruption to the public except at the surface construction sites. This ability to avoid extensive works in streets close to houses is a key benefit of the concept design.

12.3 Consolidating the support sites for the main tunnel into three carefully selected primary sites further reduces disruption:

(a) Locating the terminal pump station within the existing Mangere WWTP designation minimises the impact on residents and the public. It also enables the TBM to be driven from this site, with all spoil removed from this drive at Mangere WWTP.

(b) The May Road site is located in one of the few remaining undeveloped sites large enough to accommodate major tunnelling works.

(c) In the case of Western Springs, it is necessary to designate a public reserve to find the space needed and minimise the works close to residents.

12.4 In order to deliver the desired outcomes, the Project must link to the Western Interceptor and the existing local network and collect some of the largest combined sewer overflows in the city. Examination of the network in detail has kept the number of drop structures, and the work sites that support their construction, to a minimum and at locations that, whilst intrusive for the immediate neighbours during construction, offer manageable impacts.

12.5 I have placed particular emphasis on issues relating to the construction shaft sites as these have the potential to cause adverse effects on the immediate neighbours.

12.6 The construction sites are above ground facilities which are located in relatively dense urban environments that will be present for many months

or years. It is the activities at these sites that have the potential to have a significant impact on the surrounding communities if not carefully planned and managed. The nature and selection of construction techniques for these sites has been developed in parallel with the concept design, to take proper account of these considerations and to take account of the successful experience of similar projects such as the Rosedale Project and Project Hobson.

12.7 Watercare infrastructure projects occur regularly in urban settings, and the contractors engaged by Watercare on major projects are skilled in managing the effects of their work to minimise disturbance to neighbours. This process includes Watercare, the designers and the contractor working closely with neighbours to keep them informed of the proposed work and discussing the range of options available to minimise disturbance.

12.8 The size and complexity of this Project means that it will be designed, constructed and controlled by highly skilled and experienced personnel working under specifications and contracts to the highest industry standards. Watercare has demonstrated its ability to deliver similar infrastructure projects to very high safety and environmental standards through such award winning projects as Project Hobson and the Rosedale Project.

12.9 Based upon my experience of similar works, and having reviewed the submissions and Council Pre-hearing Report, it is my opinion that the Project as outlined in the concept design and AEE can be constructed by a competent contractor, employing modern construction techniques within a framework of properly executed CMPs in a way that appropriately manages any potential adverse effects. In this way the panel can be confident that there are adequate checks / protections in place for a project of this nature.

John Quentin Cooper

12 July 2013